# The Influence of Accounting Standards on Valuation Models: An Application to the Fama-French Model


## ABSTRACT

In this paper we analyze the effect of cross-country differences in accounting standards on the performance of valuation models from a theoretical and empirical point of view. We show how the lack of uniform accounting standards in the world generates misleading international comparisons of firm level data. A unified framework of accounting reporting would facilitate these comparisons and improve the efficiency of the global financial market. As an empirical application, we analyze how differences in accounting standards affect the performance of the Fama-French (1993) three-factor valuation model. We show that the F-F model is not only country-specific (Griffin, 2002) but also accounting-specific. In other words, the model works if the data are homogeneous in terms of accounting standards. This result has a very important empirical corollary in that the three factor model accounts extremely well for the cross-country returns of firms following IASB standards.



**Keywords:** Accounting systems, international valuation and comparisons, IASB accounting system, Fama-French three factor model.

**JEL Classification:** M41, G12.

## 1. INTRODUCTION

Given the continuous trend toward increased integration of capital markets, valuation models that can be applied at the international or global level are becoming more and more important. The correct allocation of international investment hinges directly on correct cross-country comparisons of returns of financial assets.

However, so far the performance of valuation models at the international level has not been stellar. In particular, models that work quite well at the domestic level –the CAPM, or multifactor extensions such as the three-factor model of Fama and French (F-F, 1993)- have failed to provide a good explanation of the cross-country structure of returns. In this paper we look at the latter model as one of the main examples of this failure of international valuation models. There is quite strong evidence that the F-F model can be applied domestically for widely different countries: apart from the original paper that looked at the cross-section of returns of US firms, other authors have applied the model to Japan (Chan et al., 1991), countries in the Euro Area (Moerman, 2005), the Pacific Basin countries (Chui and Wei, 1998), Australia (Faff, 2004; Gaunt, 2004), China (Cao et al., 2005) and wider sets of countries (Fama and French, 1998). However, when it is applied at a cross-country level, the model loses explanatory power and it does not seem able to explain the international cross-section of expected returns. For example, the comprehensive analyses in Griffin (2002) or Moerman (2005) convincingly suggest that the F-F model has validity only at the domestic level.

The failure of these international valuation models may be due to several reasons. We focus the analysis in this paper on reasons related to the way the accounting measures used in valuation –normally some measure of earnings- are calculated. There are appreciable differences in accounting standards across the world. These differences affect the way accounting measures of earnings behave over time, and how they may be related to risk factors or to firm characteristics. If these measurement-induced differences in behavior are not taken into account when comparing, for example, earnings of firms quoting in different capital markets, the comparisons could be quite misleading, if not outright incorrect.[1]

As a consequence, differences in accounting standards could prevent analysts from meaningful cross-country analyses and valuation exercises. Taking the F-F model as an example, again, it is reasonable that a world version of the model would perform worse than a country-specific version just because of the heterogeneity in accounting measures introduced by the different accounting standards. It has to be remembered that F-F justify their risk factors (book-to-market and size) on the basis of the relationship of these factors to companies' earnings, which are, after all, an accounting measure. Differences in accounting practices may lead to distorted international comparisons, especially if the countries to which the firms belong have quite differing ways of computing or reporting earnings over time.

In this paper we briefly show how the different degree of conservatism of two accounting systems distorts raw cross-country comparisons of accounting measures, and we suggest that international valuation models should be applied considering the

[1] Just to offer an example, Telefonica, one of the biggest companies in Spain, posted in 2001 a profit of 2160 million euros, computed using the Spanish accounting standards. The same figure became a loss of 7180 million euros when the US GAAP were used instead.

financial accounting dimension explicitly. In the limit, of course, the implication is that domestic versions of the valuation models are based on the most homogeneous accounting data, and it is no surprise that these domestic versions perform quite well.

We provide empirical evidence with regards to the importance of homogeneity of accounting measures by examining the performance of different versions of the F-F three-factor model. We show –in line with previous literature- how domestic versions clearly outperform the global version of the model, as should be the case given the high homogeneity of domestic data, but also that an international version of the model based on countries that share the accounting system –and therefore use similar accounting standards- improves on the simple global version that pools together firms in different accounting systems. More relevant evidence comes from the application of the F-F model to companies that use the IASB system. These companies come from different countries but are by definition subject to the same reporting standards. We show how the F-F model applied to these companies, whose data are homogeneous in the accounting sense, does an excellent job explaining the cross-section of expected returns of the IASB companies. In fact, the performance in terms of goodness-of-fit of the IASB-version of the F-F model is comparable, if not better, than the performance of single-country domestic versions. We believe this to be quite strong evidence in favor of the use of homogeneous accounting measures, and therefore of explicitly including the accounting-standards dimension, when carrying out international valuation exercises.

The rest of the paper proceeds as follows. Section 2 comments on the differences on accounting measures induced by different accounting standards across countries: the section contains a brief review of the literature that has looked at the cross-country behavior of accounting measures and its relationship to the accounting environment and regulation. The section also contains a simple model that shows how these differences in accounting practices may affect valuation. Sections 3 and 4 carry out a comprehensive test of the three-factor model of Fama and French (1993) and show how homogeneity of accounting measures improves quite significantly the performance of international versions of the model. In particular, we show how the model performs extremely well for a group of companies that share the same accounting standards –the IASB system– despite these companies coming from different countries. Section 5 concludes.

## 2. THE COMPARISON OF ACCOUNTING MEASURES ACROSS COUNTRIES

We present in this section a brief review of recent literature on cross-country comparisons of accounting measures, and a very simple theoretical argument for the impact of accounting standards on international valuation.

### 2.1. A LOOK AT SOME RECENT LITERATURE

The behavior of accounting measures across countries may differ significantly because of differing accounting standards or other institutional features such as commercial regulations, litigation risk, the structure of providers of capital funds, investor protection or the tax system. These differences should be taken into account

when comparing earnings of firms that quote in different capital markets. Otherwise, comparative valuation across countries could be highly misleading.

Among these factors that generate heterogeneity of accounting measures, differences in accounting systems should be given special attention. The literature has found that countries that follow the same accounting system, for example, common-law or code-law countries, also share a similar accounting and legal environment. This generates that accounting variables, such as earnings, behave quite similarly across countries that share the same accounting system. Alternatively, the cross-section behavior of accounting measures may be substantially distorted when information from countries with different accounting systems is pooled.

For example, Ball et al. (2000) find that earnings of firms in common-law countries (US, UK, Australia and Canada) are much more asymmetric than earnings in code-law countries. Similarly, Giner and Rees (2001), Raonic et al. (2004), García Lara and Mora (2004), García Lara et al. (2005) and Bushman and Piotroski (2005) show that the demand for timely information in the financial statements is different in code-law and common-law countries, given that the structure of providers of capital funds differs significantly between the two accounting systems.

Furthermore, Ball et al. (2000) find that smoothing of earnings is more intense in code-law based countries because banks tend to hold large direct or indirect ownership blocks and therefore dominate voting rights. Since bank leverage regulations penalize volatility in bank net income, these banks have incentives to reduce this volatility and pressure firms to generate smooth earnings. In this line, Bao and Bao (2004), Gassen et al. (2005) and García Lara et al. (2006) also find evidence consistent with the existence of smoothing of earnings in Germany.

Differences in tax systems are other factors that could affect cross-country similarities in the behavior of earnings. Harris et al. (1994), Kasanen et al. (1996), Lamb et al. (1998) and Seckler (1998) point out that earnings reported by code-law based firms are quite influenced by taxation: a more intense link between earnings and the tax system creates incentives for earnings manipulation, which tends to result in delayed taxation.

Even within the same accounting system, there may be appreciable differences in the behavior of accounting measures across countries. For example, Beaver and Ryan (2005) and Pope and Walker (2003) find that conservatism in the balance sheet significantly affects the timeliness of earnings to news. If an asset is not recognized, then the news affecting this asset will not be captured in earnings. If revaluation of assets is not generally allowed, good news will not be captured in earnings. Significant differences in conservatism in balance sheet around the world exist. For example, revaluation of assets is allowed in the UK, Ireland and the Netherlands but not in the US. In code-law based countries, revaluation is allowed but taxed in France, and therefore not used at all; revaluation is also allowed in Italy and Spain but only under very stringent regulations that limit the usefulness of its practice; revaluation in Germany is forbidden. The regulation of capitalization of internally generated intangible assets also varies significantly from country to country.

Not only accounting standards can be different between countries in the same accounting system, but also regulations could differ. This could also have a significant impact in earnings. For example, the German Stock Law allows managers to retain a maximum of 50% of the reported earnings, leaving the rest to the shareholders' discretion.[2] In this situation managers have incentives to reduce earnings and thus increase the capacity to finance their investment strategies using internal funds.[3] Pope and Walker (1999) provide another example, and show that managers of UK firms use extraordinary items to recognize bad news, thus affecting the quality of ordinary measures of earnings: unless earnings data are calculated after extraordinary items, the measures could be quite distorted and prevent the analyst from meaningful comparisons with firms from other countries.

The above discussion should suffice to demonstrate the importance of comparability of accounting measures when any type of valuation analysis needs to be carried out at a cross-country level. In this paper we focus our attention on the effects of comparability of data from countries with different accounting standards. This is in line with the discussion in the last paragraphs, which showed that, even within the same accounting system, differences in institutional features could lead to significant differences in the behavior of accounting measures, and thus make international comparisons more involved.

For the sake of illustration, we show in the next subsection a simple model that shows how different accounting standards, or differences in factors that affect the way earnings are accounted for, may have an influence on the validity of cross-country valuation models. This allows us to point out some limitations of these models and suggest that international valuation models should be applied at the accounting-standards level.

### 2.2. THE INFLUENCE OF ACCOUNTING STANDARDS IN VALUATION

Differences in accounting standards could result in misleading cross-country comparisons of accounting measures, and therefore lead to errors in valuation. This could partly explain the poor performance of valuation models such as the Fama-French (FF) three-factor model when applied in international settings: if the data used come from firms in countries that follow different accounting standards, the heterogeneity of accounting measures would impede meaningful comparisons and therefore distort the results.

A simple model of dividends may be useful to clarify this relationship between the accounting system and expected stock returns.[4] Consider a firm that finances its investments with retained earnings. Dividends in period $t$ ($D(t)$) are equal to equity income ($EI(t)$[5]) plus depreciation ($DP(t)$) minus investment outlays ($I(t)$),

[2] In Chile profitable firms must distribute at least 30% of their net income in the form of dividends.

[3] This is related to the pecking order theory developed by Myers (1984) and Myers and Majluf (1984). The theory argues that managers prefer internal to external funds to finance their investments. Ehrhardt and Schmidt (2003) analyze the behavior of German managers and show that these managers behave according to the pecking order theory.

[4] Fama and French (1995) used this simple model to establish the relation between book-to-market-equity and expected stock return, and between book-to-market-equity and earnings on book equity.

[5] $EI(t)$ is earning after depreciation, interest, taxes and preferred dividends but before extraordinary items.

$$D(t) = EI(t) + DP(t) - I(t)$$

Suppose that at time *t*, expected depreciation and investment for any future period *t+i* are proportional to expected equity income

$$E_t D(t+i) = E_t\left[EI(t+i) + DP(t+i) - I(t+i)\right] = E_t EI(t+i)\left(1 + a_1 - a_2\right)$$

where $a_1$ and $a_2$ are the constant proportionality factors. Assuming a constant discount rate *r* for expected dividends, the market value of equity at time $t$ should be:

$$ME(t) = \left(1 + a_1 - a_2\right)\sum_{i=1}^{\infty} \frac{E_t EI(t+i)}{(1+r)^i}$$

Now we introduce the differences that may be due to accounting standards. Let "A" be a firm in a market where the accounting standards are aggressive or, alternatively, where the earning is the firm's economic rent of year *t*. Let "B" be the same firm quoting in a capital market where the accounting standards are more conservative. We assume that period 1 is the first period in the life of both firms. The estimated flows of earnings would correspond to:

| | 1 | 2 | 3 | …. | ∞ |
|---|---|---|---|---|---|
| **A** | $K$ | $K$ | $K$ | …. | $K$ |
| **B** | $K - \delta_1$ | $K - \delta_2 + \delta_1$ | $K - \delta_3 + \delta_2$ | …. | $K - \delta_\infty + \delta_{\infty-1}$ |

where *K* is firm A's economic rent (aggressive accounting system). $\delta_i$ is therefore the sum of *deferred income* and *anticipated expenses* by the conservative accounting system at time *i*.[6] This term could be understood as the global impact of a conservative accounting environment (accounting standards, commercial regulation, litigation risk…). We assume, for simplicity, that $\delta_1 = \delta_2 = \delta_3 = .... = \delta_\infty$. Straightforward application of the above formula would yield different market values for A and B:[7]

$$ME_0(A) = (1 + a_1 - a_2)\sum_{i=1}^{\infty} \frac{K}{(1+r)^i} = (1 + a_1 - a_2)\frac{K}{r}$$

$$ME_0(B) = (1 + a_1 - a_2)\sum_{i=2}^{\infty} \frac{K}{(1+r)^i} + (1 + a_1 - a_2)\frac{K - \delta_1}{(1+r)} =$$

$$= ME_0(A) - (1 + a_1 - a_2)\frac{\delta_1}{(1+r)}$$

[6] These results would be the same if we split $\delta_i$, the *global* effect of a conservative accounting system, into the part of anticipated expenses ($\rho_i$) and the part of deferred income ($\delta_i$), as we do in the next subsection.

[7] Derivation of all the formulas in this subsection is quite straightforward.

In other words, the market value of B would depend on $\delta_1$ and, consequently, two identical firms in countries with different accounting standards would be priced differently. This goes against the efficiency of a global capital market which should price equally two identical firms. We assume, therefore, that rational investors do take into account these differences in accounting standards for the valuation of firms, and adjust the market value of B by estimating $\hat{\delta}_1$, so that:

$$ME_0(B) = (1+a_1-a_2)\sum_{i=2}^{\infty}\frac{K}{(1+r)^i} + (1+a_1-a_2)\frac{K+\hat{\delta}_1-\delta_1}{(1+r)} = ME_0(A)$$

On the other hand, the accounting system indeed will affect the market-to-book ratio of a firm, given that book values in empirical analyses cannot be explicitly taken to be adjusted the way market values are.

Letting $C_0$ be the initial and unique contribution of shareholders, we can compute the current book values of A and B as:

$$BE_t(A) = C_0 + \sum_{i=1}^{t}\left(EI_A(i) - D_A(i)\right) = C_0 + \sum_{i=1}^{t}\left(EI_A(i) - EI_A(i) - DP_A(i) + I_A(i)\right) =$$

$$= C_0 + \sum_{i=1}^{t}\left(I_A(i) - DP_A(i)\right) = C_0 + \sum_{i=1}^{t}K(a_2-a_1) = C_0 + tK(a_2-a_1)$$

$$BE_t(B) = C_0 + \sum_{i=1}^{t}\left(EI_B(i) - D_B(i)\right) = C_0 + \sum_{i=1}^{t}\left(I_B(i) - DP_B(i)\right) =$$

$$= C_0 + \sum_{i=1}^{t}EI_B(i)(a_2-a_1) = C_0 + (a_2-a_1)\left[(K-\delta_1) + (t-1)K\right] =$$

$$= C_0 + (a_2-a_1)\left[tK - \delta_1\right] = BE_t(A) - \delta_1(a_2-a_1)$$

We see that $BE_t(A)$ will usually be higher than $BE_t(B)$ since dividends will generally be lower than equity income:

$$(a_2-a_1) = \frac{I}{EI} - \frac{DP}{EI} = \frac{EI}{EI} - \frac{D}{EI}$$

If dividends were bigger than equity income, then $BE_t(B) > BE_t(A)$: the conservative accounting system forces the retaining of funds, thus limiting the capacity to pay higher dividends.

We suppose now, for simplicity, that the annualized mean return is $l$ in both contexts:

$$ME_t(A) = ME_0(A)(1+l)^t$$

$$ME_t(B) = ME_0(B)(1+l)^t$$

Consequently, the market-to-book ratio ($MB_t$) for firm B is:

$$MB_t(B) = \frac{ME_t(B)}{BE_t(B)} = \frac{MB_t(A)}{1-\psi}$$

Where $\psi = \frac{\delta_1(a_2 - a_1)}{BE_t(A)}$. Note that $MB_t(B)$ differs in general from $MB_t(A)$. In fact, it will usually be larger than that of A. The two ratios would only be equal:

a) If $\delta_1 = 0$, that is, in the case of both companies being in the same accounting system
b) If $a_2 = a_1$, that is, when pay-out is equal to equity income of the company.[8]

It is clear, then, that MTB ratios for identical firms across accounting systems will usually not be the same: the MTB ratio of the company in the more conservative system will usually be larger.
The differences induced by the accounting standards could be adjusted in order to obtain cross-country comparable market-to-book ratios. In our example, we would need to find an estimate of $+\delta_1(a_2 - a_1)$ in order to adjust the book value of B. This type of adjustment requires thorough knowledge of the operations and procedures of firm B, and it is likely to be much more difficult to implement than the adjustment of market values –which is, at the end, done by the market's assessment of the values of the two companies.

The above result has important implications:

1) International investors or global analysts should consider the differences in accounting standards when carrying out cross-country valuation or should at least acknowledge the need for adjustments in the accounting measures used in the analysis.
2) International standards setters should take into account that higher differences in accounting standards lead to larger differences in MTB and other accounting-based ratios.

Additionally, a related implication is that firms with the same MTB ratio belonging to countries with different accounting standards should probably not be directly compared, and therefore, international valuation models or models that try to explain cross-country returns should not mix heterogeneous –i.e. coming from different standards- accounting information. This has a direct application when using valuation models, such as the F-F three-factor model.

### 2.3. ACCOUNTING FOR INFLATION

Given the structure of the above analysis, it seems more realistic to allow for differing values of $\delta_i$, and, in particular, to explore the possible effect of inflation. We now introduce inflation and analyze separately anticipated expenses and deferred incomes of a conservative accounting system. Just as before, let "A" be a firm that

[8] We are working with firms that finance their investments with retained earnings as we defined in 2.2, so a2≠a1.

quotes in a market where the accounting standards are aggressive and let "B" be an identical firm quoting in a capital market where the accounting standards are more conservative. The estimated future flows of earnings are:

| | 1 | 2 | 3 | …. |
|---|---|---|---|---|
| **A** | $K$ | $K(1+g)$ | $K(1+g)^2$ | .... |
| **B** | $K-\delta_1-\rho_1$ | $[K-\delta_1-\rho_1](1+g)+\delta_1+\rho_1$ | $[K-\delta_1-\rho_1](1+g)^2+[\delta_1+\rho_1](1+g)$ | …. |

Where $K$ is the economic rent of firm A, $\delta_i$ is the amount of deferred income and $\rho_i$ is the level of anticipated expenses by the conservative accounting system at time $i$. These last two terms can be understood as the global impact of a conservative environment. $K$, $\delta_1$ and $\rho_1$ grow at rate $g$, the (constant) inflation rate. In a global market the market values of A and B again will be the same, so an adjustment for $\delta_1$ and $\rho_1$ will be needed:

$$ME_0(A)=(1+a_1-a_2)\sum_{i=1}^{\infty}\frac{K(1+g)^{i-1}}{(1+r)^i}$$

$$ME_0(B)=(1+a_1-a_2)\left[\sum_{i=1}^{\infty}\frac{\left(K+\hat{\delta}_1+\hat{\rho}_1-\delta_1-\rho_1\right)(1+g)^{i-1}}{(1+r)^i}+\sum_{i=2}^{\infty}\frac{(\delta_1+\rho_1)(1+g)^{i-2}}{(1+r)^i}-\sum_{i=2}^{\infty}\frac{\left(\hat{\delta}_1+\hat{\rho}_1\right)(1+g)^{i-2}}{(1+r)^i}\right]=ME_0(A)$$

However, just as before, the differences in MTB ratios will be affected, and most likely amplified, by inflation. Let $C_0$ be the initial and unique contribution of shareholders (see Appendix for derivation):

$$BE_t(A)=C_0+\sum_{i=1}^{t}\left(EI_A(i)-D_A(i)\right)=C_0+\sum_{i=1}^{t}K(a_2-a_1)(1+g)^{i-1}$$

$$BE_t(B)=C_0+\sum_{i=1}^{t}\left(EI_B(i)-D_B(i)\right)=BE_t(A)-(\delta_1+\rho_1)(a_2-a_1)\left[(1+g)^{t-1}\right]$$

Again one can see that $BE_t(A)$ will usually be higher than $BE_t(B)$ –dividends being lower than equity income. Assuming, as before, that the annualized mean return of both identical firms is $l$, the relationship between the market-to-book ratio in A and B will be:

$$MB_t(B)=\frac{ME_t(B)}{BE_t(B)}=\frac{MB_t(A)}{1-\psi'}\text{, where }\psi'=\frac{(\delta_1+\rho_1)(a_2-a_1)\left[(1+g)^{t-1}\right]}{BE_t(A)}$$

And the conclusions from 2.2 still hold: $MB_t(B)$ is greater than $MB_t(A)$ and, in this case, the difference induced by the accounting standard will be even larger. Consequently, the same comment about adjustment in the MTB ratios that we did in the previous

subsection applies here. Now the necessary adjustment should require knowledge of $+(\delta_1+\rho_1)(a_2-a_1)\left[(1+g)^{t-1}\right]$.

Thus, our simple analysis has important implications for valuation models that use accounting ratios. The conservativeness of accounting standards will normally affect ratios based on accounting measures and, as a consequence, valuation models should perform poorly when using unadjusted cross-country accounting measures. A related consequence is, then, that differences in accounting standards would distort the process of international selection of assets, possibly leading to substantial misallocations in the absence of the necessary adjustments.

An alternative way of expressing this main conclusion is that the use of global measures could work out well only in integrated financial markets with similar accounting standards. If firms from markets with appreciable differences between accounting standards are pooled in the analysis, then the performance of valuation models could be quite poor or, even, misleading.

## 3. AN EMPIRICAL APPLICATION: WHY DO GLOBAL VERSIONS OF THE F-F THREE FACTOR MODEL PERFORM POORLY?

The conclusions of the above analysis have important implications for a particular, and popular, model of stock valuation: the Fama-French (F-F, 1993) three-factor model. This model is an ideal setting for testing the relevance of our main conclusion, given that the F-F risk factors are directly related to an accounting measure, specifically earnings: F-F relate their *BTM* and *Size* risk factors to firm profits. Firms that have high BTM ratio tend to present low earnings on assets and firms with low BTM have persistently high earnings; controlling for BTM, small firms have lower earnings on assets than large ones.

We have showed theoretically that accounting standards differences affect BTM ratios, therefore if we do not take into account this for constructing *BTM* factor, we will not be able to compare firms' retuns in an efficient way.

Empirical analyses of the F-F model have shown that the model performs poorly when applied at the global level, thus concluding that its validity is only at the country level (Griffin, 2002). Our discussion qualifies this conclusion: it is clear that a global version of the F-F model should perform worse than a version using more integrated accounting data or, in the limit, a version that uses data from one single country, for which the accounting standards are unified by definition.

The conclusion then would be that an accounting-standards-specific version of the F-F model should be the correct way for evaluating the risk-return relationship. This implies that data should be pooled only from firms in the same country or in countries that used the same accounting standards. A corollary to this conclusion is that one could pool data from firms that, despite being in different countries, were subject to the same accounting standards, as it is the case with firms using the IASB system.

Note that this conclusion does not necessarily depend on the meaning of the F-F factors. Whether the F-F factors are proxying for global risk factors (as F-F initially postulated or the analyses in Liew and Vassalou, 1991, or Kelly, 2006, suggest) or for firm characteristics (Daniel and Titman, 1997; Lakonishok et al., 1998; Daniel et al., 2001) the inclusion of data for firms with different accounting standards will lead to distorted results, given the time inconsistency of the different measures. Thus, we would expect the performance of international versions of F-F-based valuation analyses to improve significantly when the data are unified by accounting standards.

We attempt to carry out now an empirical test of this implication, by estimating F-F models at the country, international, world and accounting-system levels, including a separate analysis of the IASB firms. Firms that use the IASB system are located in different countries but report with the same accounting standards. The performance of the F-F factors for this subset of firms should be comparable to that of country-specific applications if indeed the homogeneity of accounting measures is, at least partly, the cause for the underperformance of international valuation exercises.

Our sample consists of data for firms in Australia, Canada, UK, USA, Germany, France, Japan, Malaysia, Singapore and all firms following IASB standards over the period 1995-2004. Thus, we cover three different accounting systems (Continental, Common and Asian) plus the IASB firms. The data come from the Global Vantage Compustat database. Fiscal years end in June for Australian firms, March for Japanese firms and December for firms in the rest of the countries. The total number of firms is 313 for Australia, 337 for Canada, 526 for the UK, 1,949 for USA, 352 for Germany, 532 for France, 2,777 for Japan, 466 for Malaysia, 298 for Singapore and 810 firms following IASB standards around the world.

We collect the following data for each firm: Market value, ordinary common equity and return (adjusted for dividends, capital increases, splits and reverse splits). Size, common equity and returns are measured in local currency. In the IASB sample the size and common equity are measured in US dollars. Moreover, as it is usual, we only consider firms with positive common equity.

The return of the MSCI index for each country has been used as a proxy for market return and the level of the three-month interest rate of Treasury bills of each country has been taken as a proxy for the return of the risk-free asset. For firms following IASB standards, we have calculated a weighted average of the return of the MSCI indices and the three-month interest rates of the countries represented. All these calculations have been based on data from Factset-JCF database.[9]

We follow exactly the procedure described by F-F (1993) to construct the size and book-to-market portfolios. In order to account for the different fiscal years of Japan and Australia, we take, respectively, portfolios constructed at the end of September and at the end of December. For the rest of the countries we construct portfolios at the end of June. The portfolios are reformed after twelve months. *Book-to-market* at the end of the fiscal year is, then, book common equity divided by market equity for the fiscal year ending in calendar year t-1, and *Size* is the market value at the moment the portfolio is constructed. Thus, the results correspond to the periods January 1996-December 2004

[9] We have obtained similar results using an average of the mean returns of firms in the sample of each country as a proxy of market return.

(Australia), October 1996-September 2004 (Japan) and July 1996-June 2004 (rest of the countries).

### 3.1. FOUR VERSIONS OF THE F-F MODEL

In a global efficient capital market there should be a unique set of risk factors that describe expected returns in all countries. However, we have shown that if capital markets are not integrated in the "accounting sense" the performance of world versions of valuation models could be seriously affected. In order to show evidence in this regard, we evaluate four different versions of the F-F model: a *domestic* version (*Domestic Accounting System*), an extension of the domestic setting that we call *International*, a simple *World* version and a version based on countries that follow the same accounting system (*Global Accounting System*).

The *Domestic Accounting System* version is the traditional F-F (1993) model that uses country-specific factors for a country-by-country valuation analysis. This implies that the data used are perfectly homogeneous in their accounting standards and therefore the valuation model should perform well. The model is:

$$R_{pt} - r_{ft} = \alpha_p + \beta_{pM} MKT_t + \beta_{pSMB} SMB_t + \beta_{pHML} HML_t + e_{pt} \qquad [1]$$

Where $R_{pt}$ is the return on portfolio $p$ in month $t$, $r_{ft}$ is the return on the risk-free asset in month $t$ and $e_{pt}$ is the error term. $MKT_t$ is the market factor, $SMB_t$ is the difference between the average returns on the three portfolios containing the smallest-cap stocks (value, neutral and growth) and the returns on the three portfolios containing the largest-cap stocks (value, neutral and growth), and $HML_t$ is the difference between the average returns on the two stock portfolios with a high Book-to-Market ratio (big-value and small-value) and the average returns of the stock portfolios with a low Book-to-Market ratio (small-growth and big-growth). The subscript $p$ in the parameters indicates that the effect of the factors may vary between portfolios.

We construct the *International* version (Griffin, 2002) by adding to the *Domestic* model a set of foreign factors. We use the market value of each country in US dollars for weighting the factors of the model:

$$\begin{aligned} R_{pt} - r_{ft} = {} & \alpha_p + \beta_{DpMKT}\left(W_{Dt-1} DMKT_t\right) + \beta_{DpSMB}\left(W_{Dt-1} DSMB_t\right) + \beta_{DpHML}\left(W_{Dt-1} DHML_t\right) + \\ & \beta_{FpMKT}\left(\sum_{F=1}^{8} W_{Ft-1} FMKT_{Ft}\right) + \beta_{FpSMB}\left(\sum_{F=1}^{8} W_{Ft-1} FSMB_{Ft}\right) + \beta_{FpHML}\left(\sum_{F=1}^{8} W_{Ft-1} FHML_{Ft}\right) + e_{pt} \end{aligned} \qquad [2]$$

where $W_{Dt-1}$ is the fraction of the total US dollar-denominated market capitalization of the analyzed country in the previous month and $W_{Ft-1}$ is the fraction of the total market capitalization of the remaining countries. $DMKT_t$, $DSMB_t$ and $DHML_t$ are the domestic factors in month $t$ and $FMKT_t$, $FSMB_t$ and $FHML_t$ are the foreign factors in month $t$.

The *World* version of the model is:

$$R_{pt} - r_{ft} = \alpha_p + \beta_{pMKT}\left(\sum_{i=1}^{9} W_{it-1} MKT_{it}\right) + \beta_{pSMB}\left(\sum_{i=1}^{9} W_{it-1} SMB_{it}\right) + \beta_{pHML}\left(\sum_{i=1}^{9} W_{it-1} HML_{it}\right) + e_{pt} \quad [3]$$

where $W_{it-1}$ is the fraction of the total US dollar-denominated market capitalization of country *i* in the previous month and $MKT_{it}$, $SMB_{it}$ and $HML_{it}$ are the factors of country *i* in month *t*. Notice that this setup assumes that a single set of world factors should explain the expected returns of companies in different countries.

Finally, the *Global Accounting System* is a modification of the *Global* model: only firms from countries in the same accounting system are considered. We have aggregated countries into three different accounting systems: the *Common Law* group consists of Australia, Canada, UK an the USA; the *Code Law* group includes Germany, France and Japan; finally, the *Asian* sample consists of Malaysia and Singapore.

The differentiation between common-law and code-law countries is by now quite well accepted (Ball et al., 2000; Ball et al., 2003; García Lara and Mora, 2004). The Asian sample is motivated by the conclusion in Ball et al. (2003) that financial reporting in East Asian countries presents some similarities with the common-law system, but it also exhibits distinct regional features.

The *Global Accounting System* model is then:

$$R_{pt} - r_{ft} = \alpha_p + \beta_{pMKT}\left(\sum_{i=1}^{n} W_{it-1} MKT_{it}\right) + \beta_{pSMB}\left(\sum_{i=1}^{n} W_{it-1} SMB_{it}\right) + \beta_{pHML}\left(\sum_{i=1}^{n} W_{it-1} HML_{it}\right) + e_{pt} \quad [4]$$

where $W_{it-1}$ is the fraction of the total US dollar-denominated market capitalization of country *i* in the previous month, and $MKT_{it}$, $SMB_{it}$ and $HML_{it}$ are the factors for country *i* in month *t*. Subscript *i* indexes the *n* countries in each accounting system group (four *common-law* countries, three *code-law* countries and two *Asian* countries).

The prediction of our discussion in Section 2 is that versions with homogeneous accounting data will perform better than other versions: the *Domestic* version should be the best performer –domestic firms are subject to the same accounting standards- and the *World* version should perform worse than the *Global Accounting System* model. Additionally, a *World-IASB* model that is applied exclusively to firms in the IASB sample should perform similarly to *Domestic* models despite its international character.

## 4. RESULTS

Panel A of Table 1 shows some descriptive statistics of the countries considered in this study. The monthly average number of firms varies between 179 in Singapore and 2,429 in the USA. The average market value per firm varies between 196 million US dollars in the Malaysian capital market and 4,201 in the US market. The country

with a highest BTM ratio is Japan and that with a lowest ratio is the USA. Significant differences can be found in BTM ratios across countries, differences that could be explained partially by the differences in accounting standards underlined in Section 2. In this line, we could say that the country with the lowest BTM ratio (highest MTB) would be the country with a more conservative accounting system in earnings terms, this country would be USA and this is in line with accounting literature about conservatism in earnings.

Panel B reports the weights of the countries in terms of market value, using values in US dollars for the weighting. The US factors weight 63% in the construction of world factors, which is reasonable given that the US market is by far the largest in terms of market value. When common-law factors are constructed, this weight increases to 84%. In code-law (continental) factors, Japan weights a 79%, so the continental factors are quite influenced by the Japanese market. Asian factors are more balanced.[10]

Table 2 reports simple correlations between the factors used in this study. It is important to note that the *World*, *Continental*, *Common* and *Asian* market factors are significantly correlated. This is not exactly the same for the *Size* and *BTM* factors. The *World* factors are highly correlated with the *Common* factors, given the high weight of the US market. It is also important to observe in a country-level analysis that the *World*, *Continental*, *Common* and *Asian* market factors are correlated with all countries belonging to the factor. Again, this result is not obtained in the case of the *Size* and *BTM* factors.[11]

Regarding *Asian* countries, we see that Malaysia and Singapore have high correlations with the *Asian Size* and *BTM* factors. This result can be explained by the similar weight of these countries in Asian factors and by the similarities of their accounting standards. As Ball et al. (2003) point out, these countries have had strong British influence and by 1996 most IASB standards had already been adopted in both countries.[12] However, these countries adapt the accounting standards issued by the IASB to their specific local needs, which makes them especially interesting subjects of separate analysis. This homogeneity in accounting standards can be an important factor determining the high correlations between Country factors and Asian factors.

Table 3 shows descriptive statistics on the factors. Curiously, the return of *BTM* factors is always positive in *Country*, *World* and accounting systems factors. The same result is obtained by Fama-French (1998) and Griffin (2002).

[10] We have also calculated equally weighted factors in order to test for robustness of the results to the predominance of a single country.

[11] Note that the German and French *Size* factors are not highly correlated with the *Continental* size factor. A similar result holds for the Australian and the Common *Size* factors. In the case of *BTM*, we see no correlation between the German factor and the Continental factor, and a low correlation between the Australian and Canadian factors and the Common factor. In other words, even within the same accounting system there may be differences in reporting practices –as we mentioned in Section 2.1- which would affect the correlation of the country factors with the common accounting-system factor. This would explain the differences in *BTM* factor and the differences of *Size* factors could be consequence of this factor could not be capturing the same level of differences in Return on Assets as in USA.

[12] The British influence is easy to detect in the Companies Act of 1965 for Malaysian accounting regulation; and in the Companies Act for Singapore.

4.1. ACCOUNTING AND THE F-F MODEL

Griffin (2002) points out that country-specific versions of the F-F model perform better than a world version. His world version includes data from the USA, Canada, the UK and Japan. He mentions that these markets are likely to be integrated, but he does not take into account the fact that Japanese accounting standards are very different from those of the other countries in the sample. Hence, from the accounting perspective this country is not integrated with the others. It is not surprising, then, to find a poor performance of the world version of the model.

Similarly to F-F (1993) and Griffin (2002), we construct three value weighted portfolios based on BTM ratios. The portfolio with assets in the highest 30% BTM ratio is called *High* whereas the portfolio with assets in the bottom 30% is called *Low*. These portfolios are recalculated monthly.

Table 4 reports the results of the pricing analysis obtained using the four versions of the F-F model that account for the accounting homogeneity in the data.

In the case of the value-weighted factors and portfolios we see, in general, that the *International* version of the model does not add value in terms of α and $R^2$ -this version is just an extension of the *Domestic* setup. This result is by itself important, since it suggests that the international factors may be redundant.

However, an important result is that a *Domestic Accounting System* version performs quite well when explaining the vast majority of portfolio returns, except in the cases of the *High* portfolio in France and the *Low* portfolio in Australia. This result is in line with our discussion and confirms the hypotheses linking the performance of the pricing model with the accounting homogeneity of the data. On the other hand the table does not present evidence in favor of the *Global Accounting System* versus the *World* version. This result could be due to the use of value-weighted portfolios: the results could be affected by the largest firms.

Table 5 shows the results of the analysis that uses equally-weighted factors and portfolios. Again the best version is *Domestic -International* does not add significant explanatory power to *Domestic*. More importantly, in this case of equally-weighted factors and portfolios, the *Global Accounting System* outperforms the *World* version. In other words, a global version of F-F with certain accounting homogeneity is better than a simple aggregate World version, thus suggesting that homogeneity in accounting data is important for the validity of the model

Finally, Table 6 reports the results of *Size* and *BTM* portfolios. We have constructed 25 stock portfolios formed on size and BTM: *SH-BL* is a portfolio long in the smallest 20% assets and the 20% assets with highest BTM ratio and short in the largest 20% assets and the 20% assets with lowest BTM ratio.[13] We can see that the results of the previous tables are consistent with those of Table 6: the best pricing model is a *Domestic* version. Additionally, with value-weighted portfolios we can not confirm whether the *Global Accounting System* or the *World* version dominates, but when we

[13] Results in this table for Malaysia could be influenced by the lack of stocks in the SH portfolio. This portfolio is empty in five months of the sample period. This problem does not appear for other countries.

eliminate the possible size effect by creating equally-weighted portfolios it becomes clear that *Global Accounting System* outperforms *World*.

So far the results confirm our discussion that, given the higher accounting homogeneity, a *Domestic* version of a valuation model should perform the best and the *Global Accounting System* version should outperform the *World* model. More confirming evidence of our main point could be obtained from the analysis of data from a group of firms from different countries that were subject to the same accounting standards. We do this in next subsection.

### *4.2 Different countries with the same accounting standards: the IASB case.*

The analysis of firms that follow the IASB accounting standards could give very strong evidence in favor of accounting homogeneity as one of the main issues that should be considered when using valuation models. If the F-F model performed well for the IASB firms –that are subject to the same accounting system but belong to different countries- the result would strengthen the conclusion that the accounting system matters, and that the excellent performance of domestic versions of the model is in part due to the relatively higher homogeneity in accounting data.

Table 7 reports the results of the pricing equations for firms following the IASB standards. It can be seen now that the *IASB Accounting System* version outperforms quite significantly the *World* version both in terms of α and $R^2$. In particular, the difference between both versions of the model in terms of $R^2$ is much higher than in the previous analyses. Furthermore, the value of $R^2$ of the *IASB* model is comparable –and sometimes even higher- to those obtained from the *Domestic* versions of the model that we used in the previous subsection.

We believe this last set of results to be very strong evidence in favor of homogeneity of accounting standards as one of the main determinants of the correct performance of international valuation models. The results also suggest that the F-F factors may be related to risk factors that are priced in the market rather than to firm characteristics. This last conclusion is still tentative -a formal analysis is outside of the scope of this paper- but it suggests some potentially fruitful avenues for future research.

## 5. CONCLUSIONS

Accounting standards differ quite significantly across countries. These differences, in turn, affect accounting measures of earnings or profitability and should therefore be taken into account when considering allocation of resources at the international level. Even within the same accounting system, there are noticeable differences in the reporting of earnings –see our discussion in Section 2.1- which reinforce the problem of cross-country comparisons of firm returns.

We have provided some simple intuition about the impact of accounting system differences on the performance and validity of international valuation models. When the reporting systems differ significantly across countries in terms of conservatism, the raw

comparison of accounting measures may be misleading or, at least, may reduce the accuracy of the pricing exercises.

We focused our empirical exercise on analyzing the performance of international versions of the Fama and French (1993) three factor model. This model is an ideal setting for testing the relevance of the main implications of the theoretical discussion, since the *BTM* factor is affected by differences in financial accounting standards. Given the significant differences in these standards around the world, the performance of alternative international versions of a model such as F-F should be quite informative about the relevance of the accounting system.

Our empirical results demonstrate that the F-F model is not only country-specific but also accounting-specific, that is, its performance depends on the accounting homogeneity in the data. The fact that the domestic versions of the F-F model have traditionally performed well is in line with the importance of the accounting system – which, by definition, is uniform within a country. However, the strongest evidence comes from the excellent performance of the F-F model for the multi-country group of IASB firms. This result suggests that indeed accounting heterogeneity may be behind the poor performance of international valuation models or, more positively, that harmonization of accounting standards should improve the accuracy of valuation models and, therefore, should contribute greatly to a more efficient allocation of resources at the international level.

Our results open several avenues for future research. First, and mentioned before, is the question of whether the use of correct –i.e. homogeneous in the accounting standards- international versions of the F-F model may help study the source of its explanatory power (risk factors versus firm characteristics). Second, our work could be used from a more practical point of view, by looking at the implications of our results for global asset management and estimating the necessary adjustment for constructing portfolios in the international context. Third, changes in accounting systems could be used as natural experiments to give improved evidence for our conclusion. Finally, the trend towards further accounting homogeneity provides with better testing grounds –that allow for time series analysis- for the impact of homogeneity on international investment allocation, performance of valuation models, etc.

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**Appendix: Derivation of Book Value for firm B (taking into account inflation)**

$$BE_t(B) = C_0 + \sum_{i=1}^{t}\left(EI_B(i) - D_B(i)\right) = C_0 + \sum_{i=1}^{t}\left(I_B(i) - DP_B(i)\right) =$$

$$= C_0 + \sum_{i=1}^{t}(K - \delta_1 - \rho_1)(a_2 - a_1)(1+g)^{i-1} + \sum_{i=2}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-2} =$$

$$= BE_t(A) - \sum_{i=1}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-1} + \sum_{i=2}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-2} =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1) - \sum_{i=2}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-1}$$

$$+ \frac{1}{(1+g)}\sum_{i=2}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-1} =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1) + \sum_{i=2}^{t}(\delta_1 + \rho_1)(a_2 - a_1)(1+g)^{i-1}\left[\frac{1}{(1+g)} - 1\right] =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1) - \frac{g(\delta_1 + \rho_1)(a_2 - a_1)}{(1+g)}\sum_{i=2}^{t}(1+g)^{i-1} =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1) - \frac{g(\delta_1 + \rho_1)(a_2 - a_1)}{(1+g)}\left[\frac{(1+g)^t - (1+g)}{g}\right] =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1) - (\delta_1 + \rho_1)(a_2 - a_1)\left[(1+g)^{t-1} - 1\right] =$$

$$= BE_t(A) - (\delta_1 + \rho_1)(a_2 - a_1)\left[(1+g)^{t-1}\right]$$

## Table 1. Descriptive statistics and weights.

Panel A reports some characteristics of the firms in the sample. *Firms*: Monthly average number of firms in the sample; *Size*: Mean market value per firm in million US dollars; *BM*: Mean Book-to-Market per firm; AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore. Panel B reports weights of countries in factors construction. The weights are expressed in percentage of market value and they are monthly averages values. *WL*: Weights of each country in world factors (all countries); *CN*: Weights of each country in continental factors. Continental countries in the sample are Germany, France and Japan; *CM*: Weights of each country in common factors. Common countries in the sample are Australia, Canada, Great Britain and USA; *AS*: Weights of each country in Asian factors. Asian countries in the sample are Malaysia and Singapore.

**Panel A: Descriptive statistics**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG |
|---|---|---|---|---|---|---|---|---|---|
| **Firms** | 227.83 | 279.48 | 435.27 | 1,710.62 | 252.62 | 378.05 | 2,429.09 | 311.27 | 178.92 |
| **Size** | 628.32 | 1,245.44 | 1,954.03 | 4,200.98 | 575.28 | 1,044.71 | 979.21 | 196.11 | 371.44 |
| **BM** | 0.89 | 0.91 | 0.84 | 0.66 | 0.88 | 0.99 | 1.27 | 1.11 | 1.26 |

**Panel B: Weights of countries**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG |
|---|---|---|---|---|---|---|---|---|---|
| **WL** | 1.19% | 3.05% | 7.45% | 63.24% | 1.25% | 3.35% | 19.47% | 0.46% | 0.54% |
| **CN** | - | - | - | - | 5.62% | 15.26% | 79.12% | - | - |
| **CM** | 1.60% | 4.06% | 9.97% | 84.36% | - | - | - | - | - |
| **AS** | - | - | - | - | - | - | - | 44.12% | 55.88% |

## Table 2. Factor Correlations.

Factor correlations by country and accounting system. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore; *WL*: World (all countries); *CN*: Continental accounting system (Germany, France and Japan); *CM*: Common accounting system (Australia, Canada, Great Britain and USA); *AS*: Asian accounting system (Malaysia and Singapore).

**MARKET FACTOR**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AU** | 1.00 | | | | | | | | | | | | |
| **CA** | 0.69 | 1.00 | | | | | | | | | | | |
| **UK** | 0.62 | 0.64 | 1.00 | | | | | | | | | | |
| **US** | 0.64 | 0.81 | 0.76 | 1.00 | | | | | | | | | |
| **DEU** | 0.59 | 0.65 | 0.75 | 0.73 | 1.00 | | | | | | | | |
| **FR** | 0.60 | 0.69 | 0.80 | 0.72 | 0.90 | 1.00 | | | | | | | |
| **JP** | 0.58 | 0.52 | 0.41 | 0.45 | 0.30 | 0.36 | 1.00 | | | | | | |
| **MY** | 0.29 | 0.40 | 0.26 | 0.30 | 0.29 | 0.29 | 0.22 | 1.00 | | | | | |
| **SG** | 0.60 | 0.57 | 0.48 | 0.56 | 0.41 | 0.41 | 0.41 | 0.59 | 1.00 | | | | |
| **WL** | 0.73 | 0.84 | 0.81 | 0.95 | 0.75 | 0.77 | 0.67 | 0.34 | 0.59 | 1.00 | | | |
| **CN** | 0.66 | 0.62 | 0.56 | 0.57 | 0.50 | 0.56 | 0.97 | 0.27 | 0.45 | 0.78 | 1.00 | | |
| **CM** | 0.67 | 0.83 | 0.80 | 1.00 | 0.75 | 0.75 | 0.47 | 0.31 | 0.58 | 0.96 | 0.59 | 1.00 | |
| **AS** | 0.51 | 0.54 | 0.42 | 0.48 | 0.39 | 0.40 | 0.36 | 0.89 | 0.89 | 0.52 | 0.41 | 0.49 | 1.00 |

**SIZE FACTOR**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AU** | 1.00 | | | | | | | | | | | | |
| **CA** | 0.24 | 1.00 | | | | | | | | | | | |
| **UK** | 0.28 | 0.51 | 1.00 | | | | | | | | | | |
| **US** | 0.11 | 0.61 | 0.49 | 1.00 | | | | | | | | | |
| **DEU** | 0.09 | 0.17 | 0.16 | 0.11 | 1.00 | | | | | | | | |
| **FR** | 0.21 | 0.51 | 0.36 | 0.32 | 0.23 | 1.00 | | | | | | | |
| **JP** | -0.01 | 0.16 | 0.17 | 0.12 | 0.07 | 0.12 | 1.00 | | | | | | |
| **MY** | 0.01 | 0.25 | 0.06 | 0.14 | 0.02 | 0.02 | 0.30 | 1.00 | | | | | |
| **SG** | -0.01 | 0.09 | 0.18 | 0.07 | 0.13 | 0.11 | 0.38 | 0.08 | 1.00 | | | | |
| **WL** | 0.15 | 0.66 | 0.57 | 0.97 | 0.14 | 0.39 | 0.31 | 0.20 | 0.16 | 1.00 | | | |
| **CN** | 0.02 | 0.23 | 0.21 | 0.17 | 0.14 | 0.27 | 0.98 | 0.29 | 0.39 | 0.36 | 1.00 | | |
| **CM** | 0.16 | 0.65 | 0.56 | 1.00 | 0.12 | 0.35 | 0.13 | 0.15 | 0.09 | 0.98 | 0.18 | 1.00 | |
| **AS** | -0.01 | 0.20 | 0.16 | 0.13 | 0.11 | 0.10 | 0.46 | 0.58 | 0.85 | 0.23 | 0.46 | 0.15 | 1.00 |

**BOOK-TO-MARKET**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AU** | 1.00 | | | | | | | | | | | | |
| **CA** | 0.16 | 1.00 | | | | | | | | | | | |
| **UK** | 0.24 | 0.39 | 1.00 | | | | | | | | | | |
| **US** | 0.26 | 0.31 | 0.40 | 1.00 | | | | | | | | | |
| **DEU** | 0.03 | 0.23 | 0.05 | 0.08 | 1.00 | | | | | | | | |
| **FR** | 0.01 | 0.24 | 0.20 | 0.42 | -0.16 | 1.00 | | | | | | | |
| **JP** | 0.22 | 0.12 | 0.27 | 0.30 | -0.03 | 0.33 | 1.00 | | | | | | |
| **MY** | -0.02 | 0.00 | 0.08 | -0.11 | 0.12 | -0.10 | -0.08 | 1.00 | | | | | |
| **SG** | 0.16 | 0.15 | 0.26 | 0.30 | 0.10 | 0.09 | 0.12 | 0.20 | 1.00 | | | | |
| **WL** | 0.29 | 0.34 | 0.48 | 0.97 | 0.09 | 0.48 | 0.47 | -0.11 | 0.32 | 1.00 | | | |
| **CN** | 0.20 | 0.18 | 0.29 | 0.40 | 0.00 | 0.56 | 0.96 | -0.08 | 0.13 | 0.57 | 1.00 | | |
| **CM** | 0.29 | 0.38 | 0.48 | 0.99 | 0.09 | 0.43 | 0.31 | -0.10 | 0.32 | 0.98 | 0.41 | 1.00 | |
| **AS** | 0.10 | 0.14 | 0.25 | 0.20 | 0.15 | 0.04 | 0.07 | 0.65 | 0.87 | 0.22 | 0.07 | 0.22 | 1.00 |

**Table 3. Descriptive statistics on factors.**

Mean and standard deviation of factor returns. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore; *WL*: World (all countries); *CN*: Continental accounting system (Germany, France and Japan); *CM*: Common accounting system (Australia, Canada, Great Britain and USA); *AS*: Asian accounting system (Malaysia and Singapore).

**MARKET FACTOR**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 0.0004 | 0.0054 | -0.0007 | 0.0032 | 0.0027 | 0.0047 | -0.0016 | -0.0047 | -0.0010 | 0.0010 | -0.0015 | 0.0028 | -0.0050 |
| **Std. Dev.** | 0.0532 | 0.0622 | 0.0424 | 0.0500 | 0.0725 | 0.0588 | 0.0626 | 0.1185 | 0.0900 | 0.0459 | 0.0558 | 0.0481 | 0.0926 |

**SIZE FACTOR**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 0.0088 | 0.0086 | 0.0022 | 0.0095 | 0.0013 | -0.0036 | 0.0001 | -0.0012 | -0.0006 | 0.0060 | -0.0008 | 0.0088 | -0.0008 |
| **Std. Dev.** | 0.0576 | 0.0488 | 0.0422 | 0.0543 | 0.0280 | 0.0279 | 0.0369 | 0.0680 | 0.0699 | 0.0390 | 0.0306 | 0.0496 | 0.0528 |

**BOOK-TO-MARKET FACTOR**

| | AU | CA | UK | US | DEU | FR | JP | MY | SG | WL | CN | CM | AS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 0.0075 | 0.0146 | 0.0042 | 0.0042 | 0.0034 | 0.0087 | 0.0070 | 0.0056 | 0.0119 | 0.0047 | 0.0063 | 0.0046 | 0.0096 |
| **Std. Dev.** | 0.0394 | 0.0615 | 0.0339 | 0.0475 | 0.0332 | 0.0451 | 0.0291 | 0.0494 | 0.0573 | 0.0355 | 0.0265 | 0.0427 | 0.0442 |

**Table 4. Value weighted Book-to-Market portfolios.**

Results obtained using value weighted factors and value weighted portfolios. *High* is the portfolio with assets in the highest 30% book-to-market ratio. *Low* is the portfolio with assets in the bottom 30% book-to-market ratio. Regressions of *High* and *Low* on domestic, international, world and accounting system versions of Fama and French (1993) three-factor model. *Average return* is mean raw return, α is the intercept of the Fama-French regression and *Adj.* $R^2$ is the adjusted R-Square coefficient. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore. *Domestic Accounting System*: National version of Fama-French model; *International*: International version of Fama-French model; *World*: World version of Fama-French model; *Global Accounting System*: Fama-French model taking into account only countries in the same accounting system. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

| | | | **Domestic Accounting System** | | **International** | | **World** | | **Global Accounting System** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Average Return (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) |
| High | **AU** | 1.37*** | 0.57 | 32.20 | 0.58 | 31.71 | 0.70 | 22.05 | 0.64 | 20.22 |
| High | **CA** | 1.74** | 0.83 | 36.48 | 0.53 | 45.56 | 0.75 | 42.31 | 0.58 | 44.96 |
| High | **UK** | 1.02* | 0.21 | 59.86 | -0.12 | 64.79 | -0.22 | 56.91 | -0.33 | 54.43 |
| High | **US** | 0.81 | -0.34 | 84.19 | -0.35 | 83.28 | -0.13 | 70.50 | -0.33 | 81.42 |
| High | **DEU** | 1.03* | 0.40 | 30.08 | 0.64 | 30.11 | 0.49 | 21.69 | 0.89* | 9.96 |
| High | **FR** | 1.94*** | 1.17** | 39.95 | 0.85* | 43.65 | 1.04** | 38.74 | 1.68*** | 11.36 |
| High | **JP** | 0.70 | 0.07 | 72.29 | 0.61 | 58.53 | 0.07 | 14.87 | 0.16 | 69.47 |
| High | **MY** | 0.84 | 0.21 | 85.94 | 0.70 | 67.51 | -0.74 | 21.79 | 0.32 | 69.69 |
| High | **SG** | 0.99 | -0.03 | 80.90 | 0.22 | 68.89 | -0.14 | 26.07 | 0.33 | 67.44 |
| Low | **AU** | 0.95** | 0.56** | 58.32 | 0.64** | 54.39 | 0.39 | 32.55 | 0.20 | 25.72 |
| Low | **CA** | 0.04 | -0.52 | 70.76 | -0.02 | 79.43 | -0.07 | 61.62 | -0.44 | 58.95 |
| Low | **UK** | 0.55 | 0.20 | 62.02 | 0.05 | 68.35 | -0.04 | 60.99 | -0.18 | 60.58 |
| Low | **US** | 0.66 | 0.17 | 93.81 | 0.12 | 93.32 | 0.48** | 85.79 | 0.25 | 93.21 |
| Low | **DEU** | 1.75** | 1.33 | 7.29 | 1.62* | 16.60 | 1.41* | 14.91 | 1.72* | 1.11 |
| Low | **FR** | 0.54 | 0.08 | 63.73 | 0.37 | 63.68 | 0.31 | 45.86 | 0.75 | 20.60 |
| Low | **JP** | -0.18 | 0.20 | 57.46 | 0.07 | 53.80 | -0.41 | 21.88 | 0.18 | 54.55 |
| Low | **MY** | -0.09 | -0.18 | 81.11 | 0.15 | 68.91 | -1.41 | 23.23 | -0.02 | 74.62 |
| Low | **SG** | 0.40 | 0.58 | 88.65 | 0.82 | 78.12 | -0.20 | 35.66 | 0.89* | 76.98 |

**Table 5. Equally weighted Book-to-Market portfolios.**

Results obtained using equally weighted factors and equally weighted portfolios. *High* is the portfolio with assets in the highest 30% book-to-market ratio. *Low* is the portfolio with assets in the bottom 30% book-to-market ratio. Regressions of *High* and *Low* on domestic, international, world and accounting system versions of of Fama and French (1993) three-factor model. *Average return* is mean raw return, α is the intercept of Fama-French model and *Adj.* $R^2$ is the adjusted R-Square coefficient. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore. *Domestic Accounting System*: National version of Fama-French model; *International*: International version of Fama-French model; *World*: World version of Fama-French model; *Global Accounting System*: Fama-French model taking into account only countries in the same accounting system. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

| | | | **Domestic Accounting System** | | **International** | | **World** | | **Global Accounting System** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Average Return (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) |
| High | **AU** | 2.24*** | 0.64** | 77.60 | 0.45 | 79.02 | 1.60** | 3.08 | 0.34 | 36.95 |
| High | **CA** | 2.58*** | 0.32 | 77.55 | 0.42 | 78.00 | 1.65** | 29.03 | 0.65 | 37.40 |
| High | **UK** | 1.38*** | 0.43 | 39.44 | 0.33 | 52.90 | 0.65 | 42.49 | 0.04 | 41.92 |
| High | **US** | 3.10*** | -0.14 | 94.44 | 0.13 | 94.70 | -0.11 | 80.54 | -0.80 | 63.35 |
| High | **DEU** | 0.98* | 0.21 | 74.09 | 0.43 | 76.94 | 0.47 | 24.08 | 0.36 | 39.47 |
| High | **FR** | 1.75*** | 1.22*** | 47.40 | 1.05*** | 50.79 | 1.47*** | 25.54 | 1.20*** | 44.23 |
| High | **JP** | 0.58 | -0.08 | 61.19 | -0.35 | 62.70 | -0.14 | 11.01 | 0.12 | 20.71 |
| High | **MY** | 0.71 | -0.09 | 85.38 | -0.38 | 86.92 | -1.78 | 41.69 | -0.16 | 72.06 |
| High | **SG** | 1.15 | 0.20 | 83.74 | 0.29 | 84.04 | -0.93 | 52.69 | 0.37 | 68.44 |
| Low | **AU** | 1.22* | 0.35 | 85.43 | 0.29 | 85.82 | 1.21* | 18.74 | 0.00 | 40.31 |
| Low | **CA** | 0.59 | 0.18 | 76.85 | 0.20 | 77.44 | 0.31 | 64.14 | -0.27 | 55.27 |
| Low | **UK** | 0.75 | 0.42 | 66.23 | 0.33 | 73.13 | 0.51 | 62.70 | -0.11 | 55.04 |
| Low | **US** | 1.12 | -0.17 | 90.05 | 0.05 | 90.11 | 0.92** | 76.61 | 0.13 | 77.80 |
| Low | **DEU** | 0.41 | 0.10 | 44.54 | 0.34 | 50.61 | 0.31 | 30.28 | 0.37 | 36.31 |
| Low | **FR** | 0.84 | 1.27*** | 76.84 | 1.08*** | 78.45 | 0.89 | 54.34 | 1.45*** | 66.53 |
| Low | **JP** | -0.16 | -0.14 | 55.12 | -0.40 | 56.72 | -0.48 | 12.48 | -0.17 | 22.44 |
| Low | **MY** | 0.22 | -0.18 | 82.71 | -0.38 | 84.31 | -1.77 | 41.13 | -0.04 | 74.77 |
| Low | **SG** | 0.31 | 0.24 | 80.70 | 0.29 | 81.13 | -0.71 | 51.72 | 0.19 | 64.16 |

**Table 6. Size and Book-to-Market portfolios.**

Results obtained using value and equally weighted factors and value and equally weighted portfolios of 25 stocks formed on size and book-to-market respectively. *SH-BL* is a portfolio long in small and high BTM assets (smallest 20% and highest 20% BTM ratio) and short in large and low BTM assets (largest 20% and lowest 20% BTM ratio). Regressions of *Size* and *book-to-market* portfolios on domestic, world, international and accounting system versions of Fama and French (1993) three-factor model. *Average return* is mean raw return, α is the intercept of Fama-French model and *Adj.* $R^2$ is the adjusted R-Square coefficient. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapore. *Domestic Accounting System*: National version of Fama-French model; *International*: International version of Fama-French model; *World*: World version of Fama-French model; *Global Accounting System*: Fama-French model taking into account only countries in the same accounting system. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

| | | | **Domestic Accounting System** | | **International** | | **World** | | **Global Accounting System** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Value weighted factors and portfolios** | | Average Return (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) |
| SH-BL | **AU** | 1.82 | -0.29 | 33.37 | -0.16 | 22.10 | 1.26 | 1.96 | 1.70 | 4.60 |
| SH-BL | **CA** | 2.73*** | 0.71 | 51.62 | 0.09 | 57.82 | 1.56 | 21.85 | 1.61 | 22.85 |
| SH-BL | **UK** | 0.64 | 0.00 | 55.42 | -0.01 | 54.00 | 0.05 | 25.05 | 0.10 | 23.25 |
| SH-BL | **US** | 2.62*** | 1.00** | 72.96 | -1.08** | 74.05 | 1.02** | 70.86 | 0.85** | 76.41 |
| SH-BL | **DEU** | -0.99 | -1.54 | 12.89 | -1.44 | 17.62 | -1.47 | 6.57 | -1.42 | 0.00 |
| SH-BL | **FR** | 0.14 | 0.26 | 45.80 | -0.33 | 55.94 | -0.39 | 34.13 | -0.34 | 19.42 |
| SH-BL | **JP** | 0.78 | 0.00 | 80.17 | 0.58 | 74.55 | 0.17 | 13.55 | 0.08 | 80.89 |
| SH-BL | **MY** | 4.50** | 3.90*** | 63.32 | 4.90*** | 34.80 | 4.09 | 1.36 | 5.35*** | 22.76 |
| SH-BL | **SG** | 1.49 | 0.28 | 36.85 | 0.27 | 29.67 | 0.35 | 5.04 | -0.04 | 35.76 |
| **Equally weighted factors and portfolios** | | | | | | | | | | |
| SH-BL | **AU** | 2.33* | 0.05 | 74.61 | -0.75 | 76.53 | 1.68 | 5.43 | -0.46 | 40.20 |
| SH-BL | **CA** | 3.80*** | -0.48 | 76.54 | -0.31 | 76.73 | 2.45 | 5.39 | 1.13 | 19.62 |
| SH-BL | **UK** | 0.88 | -0.14 | 57.20 | -0.41 | 57.65 | -0.09 | 32.21 | 0.03 | 33.02 |
| SH-BL | **US** | 5.41* | -2.59*** | 92.78 | -2.62*** | 93.09 | -4.97*** | 76.05 | -4.96** | 54.84 |
| SH-BL | **DEU** | 0.88 | 0.13 | 54.84 | 0.61 | 57.78 | 0.63 | 1.61 | 0.44 | 11.61 |
| SH-BL | **FR** | 0.62 | 0.33 | 47.27 | 0.27 | 48.51 | 0.25 | 33.65 | -0.28 | 52.17 |
| SH-BL | **JP** | 1.14* | -0.01 | 87.29 | -0.07 | 88.18 | 0.19 | 17.48 | 0.42 | 30.04 |
| SH-BL | **MY** | 4.38** | 2.98*** | 75.63 | 4.43*** | 78.22 | 3.77* | 10.61 | 4.02*** | 45.13 |
| SH-BL | **SG** | 1.51 | 0.17 | 32.17 | 0.66 | 31.13 | -0.78 | 14.94 | 0.12 | 25.83 |

## Table 7. Firms following IASB standards.

Results obtained for firms around the world that use IASB standards. *Value weighted*: Results using value weighted factors and value weighted portfolios; *Equally weighted*: Results using equally weighted factors and equally weighted portfolios; *High*: Portfolio with assets in the highest 30% book-to-market ratio; *Low*: Portfolio with assets in the bottom 30% book-to-market ratio; *SH-BL* is a portfolio long in small and high BTM assets (smallest 20% and highest 20% BTM ratio) and short in large and low BTM assets (largest 20% and lowest 20% BTM ratio). *World*: World version of Fama-French model; *IASB Accounting System*: Fama-French considering only firms following the IAS/IFRS standards. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

| | | | **World** | | **IASB Accounting System** | |
|---|---|---|---|---|---|---|
| | | Average Return (%) | $\alpha$ (%) | Adj. $R^2$ (%) | $\alpha$ (%) | Adj. $R^2$ (%) |
| Value weighted | High | 1.21 | 0.19 | 31.40 | 0.25 | 79.73 |
| | Low | 0.46 | -0.22 | 34.23 | -0.02 | 87.44 |
| Equally weighted | High | 1.50** | 0.57 | 17.67 | -0.11 | 94.15 |
| | Low | 0.54 | 0.13 | 42.79 | -0.24 | 94.18 |
| Value weighted | SH-BL | 1.36 | 0.57 | 14.28 | 0.20 | 41.83 |
| Equally weighted | SH-BL | 1.29* | 0.41 | 17.37 | 0.33 | 66.46 |