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The influence of differences in accounting standards on empirical pricing models: An application to the Fama-French model

Javier Gomez Biscarri
IESE Business School
Universidad de Navarra
Spain

Germán Lopez Espinosa
Department of Business
Universidad de Navarra
Pamplona, Spain

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We analyze the effect of cross-country differences in accounting standards on the empirical performance of financial pricing models. We show how the lack of uniform accounting standards across countries generates inconsistent estimates of the model parameters, and leads to rejection of the validity of the model. As an empirical application, we analyze how differences in accounting standards affect the performance of the Fama-French (1993) three-factor pricing model. We show that the F-F model is accounting-specific: it works better the more homogeneous the data are in terms of accounting standards. This result has an important empirical corollary: the model accounts extremely well for the cross-country returns of firms following IASB standards.

Javier Gómez Biscarri
IESE Business School
Universidad de Navarra
Avda. Pearson, 21
08034 Barcelona – SPAIN
jgbiscarri@iese.edu

Germán López Espinosa
Universidad de Navarra
Dpto. Empresa
Campus Universitario
31080 Pamplona
glespinosa@unav.es

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Javier Gomez Biscarri
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Germán Lopez Espinosa*
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Keywords: Accounting systems, international valuation and comparisons, IASB accounting standards, Fama-French three-factor model.

JEL Classification: M41, G12.

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1. INTRODUCTION

Given the continuous trend toward further integration of capital markets, pricing models that can be applied at the international or global level are receiving increased attention. The correct allocation of international investment hinges directly on correct cross-country comparisons of returns of financial assets. However, so far the empirical performance of the international pricing models most commonly used by investors has been far from stellar. In particular, models that work well at the domestic level –the CAPM, or multifactor extensions– have failed to provide a good explanation of the cross-country structure of returns.

The failure of these international pricing models may be due to several reasons. One of these reasons, and the main object of our analysis, relates to the way the accounting measures used in the empirical estimation of these models –normally earnings or book values– are calculated. There are appreciable differences in accounting standards across countries in the world. These differences affect the way accounting measures behave over time, and how they may be related to global risk factors or to firm characteristics. If these measurement-induced differences in behavior are not taken into account when comparing, for example, earnings or book values of firms quoting in different capital markets, cross-country analyses and pricing exercises could be misleading, if not outright incorrect.[1]

In this paper we briefly show how differences in accounting standards distort raw cross-country comparisons of accounting measures, and we suggest that international pricing models should be applied considering the financial accounting dimension explicitly. In the limit, of course, the implication is that domestic versions of these pricing models are based on the most homogeneous accounting data, and it is no surprise that these domestic versions perform quite well. We give some statistical arguments that show the effects of the use of non-homogeneous accounting measures in two-pass estimation procedures, which have become the traditional method for empirical estimation of simple factor pricing models.

We provide empirical evidence in line with these statistical results that confirms the importance of homogeneity of accounting measures. For that purpose, we examine different versions of one of the most widely used pricing models, the Fama and French (F-F, 1993) three-factor model. There is quite strong evidence that this model explains expected returns in widely different countries: besides 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 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. We show how domestic versions clearly outperform the global version of the model but also that an international version of the model based on firms from 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. Additional evidence comes from the application of the F-F model to companies that use the IASB system. These companies come from different countries but apply the same reporting standards. The F-F model does an excellent job explaining the cross-section of expected returns of these companies, whose data are

[1] Just to offer an example, Telefonica, one of the biggest companies in Spain, posted in 2001 a profit of 2,160 million euros, computed using the Spanish accounting standards. The same figure became a loss of 7,180 million euros when the US GAAP standards were used instead.

homogeneous in the accounting sense. In fact, the performance of the IASB-version of the F-F model is comparable to that 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 pricing exercises.

The rest of the paper proceeds as follows. Section 2 summarizes the literature on the differences on accounting measures induced by different accounting standards across countries. Section 3 presents a brief literature review on the relationship between accounting standards and the estimation of pricing models and some statistical results of two-pass estimation of pricing models with accounting-based variables. Section 4 describes the hypotheses, setup and results of the empirical analysis. Section 5 contains a discussion of the contributions, implications and limitations of the study. Section 6 concludes.

2. THE COMPARABILITY OF ACCOUNTING MEASURES ACROSS COUNTRIES

Even though the trend (and need) toward international accounting homogenization has been increasingly recognized (see, for example, Ball, 1995, Danaher and Hunt, 2001, and Goldberg et al., 2006), the behavior of accounting measures across countries is still quite dissimilar because of differences in business or tax regulations. Among these, differences in accounting systems deserve 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. Hence, accounting variables, such as earnings, behave similarly across countries that share the same accounting system and, alternatively, the behavior of these measures differs substantially across countries with different accounting systems.

For example, Ball et al. (2000) find that earnings of firms in common-law countries (e.g. US, UK, Australia or Canada) are much more asymmetric than earnings in code-law countries (e.g. Germany or France). Similarly, Giner and Rees (2001), Raonic et al. (2004), García Lara and Mora (2004), García Lara et al. (2005) and Bushman and Piotroski (2006) 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.

Ball et al. (2000) also report that smoothing of earnings is more intense in code-law 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. Bao and Bao (2004), Gassen et al. (2006) and García Lara et al. (2006) also find evidence consistent with the existence of smoothing of earnings in Germany. The regulation of capitalization of internally generated intangible assets or the opacity induced by accounting systems also varies significantly from country to country (Bhattacharya et al., 2003).

Differences in tax systems are another factor 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 aimed at delayed taxation.

Even within the same accounting system, there may be appreciable differences in the behavior of accounting measures across countries. For example, Pope and Walker (2003) and Beaver and Ryan (2005) find that conservatism in the balance sheet significantly affects the timeliness of earnings to news. If an asset is not recognized or revaluation of assets is not allowed, good news related to this asset will not be captured in earnings. 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 coefficients that limit its usefulness in practice; revaluation in Germany is forbidden (see Barlev et al., 2007, for a recent analysis of revaluation).

Not only accounting standards but also regulations may differ across countries in the same accounting system. This could 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. In this situation managers have incentives to reduce earnings and thus increase the capacity to finance their investment strategies using internal funds. 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 pricing analysis is carried out at a cross-country level.

For the sake of illustration, Appendix I develops a simple framework that considers two identical firms, A and B, which are different only because of the accounting standards to which they are subject. Firm A quotes in a market where the accounting standards are aggressive and B is exactly the same firm in a capital market where the accounting standards are more conservative. Under rational international financial markets, the market values of both companies should be the same, but the book values would differ, given the differing degree of accounting conservatism. Appendix I shows that, under certain assumptions, the market-to-book ratios (MTB, MB_t) of the two companies would be related by

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

where the form of ψ can be seen in the Appendix. Thus, MTB ratios for identical firms across accounting systems will usually not be directly comparable (see also Pae et al., 2005).

Our discussion has several implications:

1) Firms that have the same value of an accounting-based ratio such as the MTB but that belong to countries with different accounting standards are not directly comparable. Also, identical firms across accounting systems will present different values of accounting-based ratios.
2) More generally, firms from countries with different accounting standards should not be pooled together in international empirical analyses that necessitate the use of accounting information.
3) 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: differences in accounting standards may distort the process of international selection of assets, possibly leading to substantial misallocations in the absence of the necessary adjustments.

4) International standards setters should consider that higher differences in accounting standards lead to larger differences in MTB and other accounting-based ratios.

The first two implications are relevant in the context of our research, since they suggest that empirical factor pricing models, such as the F-F model, should be applied with the accounting dimension specifically in mind. The F-F model is especially interesting given that it uses an accounting variable (book value) to compute one of the risk factors. Additionally, this model is usually estimated following a two-pass procedure. We show now statistical results that suggest that in this estimation procedure –also used for other pricing models- the distortion induced by heterogeneous accounting information can lead to inconsistencies of parameter estimates and rejection of the full model.

3. ACCOUNTING DATA AND THE ESTIMATION OF PRICING MODELS

3.1 A REVIEW OF THE MAIN ISSUES

The issue of the value relevance of different accounting standards has probably been the main point of interest of recent literature in comparative accounting systems (Barth et al., 2001). Behind this literature there is usually the consensus about the convenience, from the point of view of investment efficiency, of high-disclosure standards of value-relevant information. Financial accounting environments that lead to greater disclosure of value-relevant accounting information are associated with better forecasting, higher capital mobility and lower cost of capital, thus leading to better allocation of investment resources (see Bandyopadhyay et al., 1994, Ashbaugh and Pincus, 2001, Young and Guenther, 2003, Hail and Leuz, 2006, Eaton et al., 2007, among others). In this sense, both US GAAP and IAS tend to be preferred to local domestic standards (see Cuijpers and Buijink, 2005, Samia and Zhou, 2004, Hung and Subramanyam, 2007, and Platikanova, 2007), although which of the former two should be preferred is still subject to some debate.[2]

Given the increased levels of international financial flows, the issue of the effect of the cross-country comparability of accounting information in the context of asset pricing becomes of special relevance. If analysts or researchers are to carry out international pricing exercises that require the use of accounting information, one would like to know whether the use of accounting information coming from different standards will have a significant impact on the results of the analysis. Indeed, the fact that the information may not be directly comparable should make us wary of possible distortions in the outcome of the analysis. The literature regarding the effect on international asset pricing of combining accounting information derived from different accounting standards so far has been very scarce. The accounting literature has looked at the effects of differences in accounting systems on accounting valuation (Ashbaugh and Olsson, 2002; Lin and Chen 2005; Platikanova, 2007) and Kallunki (1997) shows that the power of tests in pricing models that use accounting-based methods is similar to that of tests which use market-based methods. However, we are not aware so far of any study that looks at the impact on international asset pricing models of differences in accounting systems among the firms or countries included in the analysis. It is indeed the case that some of the main

[2] See, for example, Amir et al. (1993), Leuz (2003) or the comment to the SEC addressed by T.S. Harris in http://sec.gov/rules/concept/s70400/harris1.htm.

financial models do not require the use of accounting-based information.[3] However, we believe it is important to study whether, in those models that require the use of such information, the issue of the (lack of) comparability can lead to distortions in the output of the pricing analysis.

The F-F model is one of those pricing models that require accounting-based measures of book value in one of the risk factors (Book to Market). We briefly review the model in Sections 4.1 and 4.2. We now offer some general statistical results on the possible effect of combining heterogeneous accounting information in the cross-country application of a factor-pricing model.

3.2 SOME STATISTICAL RESULTS ON TWO-PASS ESTIMATORS OF ASSET PRICING MODELS

The use of accounting measures from firms that are subject to different accounting standards may distort the results of the empirical tests of pricing models in ways parallel to those detected by the literature (Griffin, 2002). In particular, we show now that international versions of these models may be rejected because of an inconsistency in the parameter estimates introduced by the differing accounting regulations. Corollaries of this result are that domestic versions of the pricing models should perform the best, but also that the pooling of companies from similar accounting standards should alleviate the poor performance of the international models.

We use the classical two-pass estimation procedure of a factor pricing model. We assume that the returns of a certain company i that uses accounting system j can be expressed as dependent on realizations of a risk factor f_t:

$$r_{it}^{j} = E\left[r_{it}^{j}\right] + \beta_i f_t + e_{it} \tag{2}$$

where $E[f_t]=E[e_{it}]=0$, $E[f_t e_{it}]=0$ and all expectations are conditional on information up to time t-1. Assume also, for completeness, that

$$f_t \rightarrow iid(0,1) \tag{3}$$

so that the risk factor is normalized to having unit unconditional variance. The expected excess return of stock i can be expressed as:

$$E\left[r_{i}^{j}\right] - r_f = \alpha + \beta_i \lambda \tag{4}$$

Where λ is the risk premium associated with the factor and α=0 if all the relevant risk factors that are priced are included in the model.[4]

We assume that r_{it}^{j} is measured by the market, or, at least, that if it is based on accounting information it has been adjusted for differences in accounting systems: in an integrated international financial market identical companies across countries should have

[3] Neither the CAPM, which uses the market return as the risk factor to be priced (directly or decomposed as in Campbell and Vuolteenaho, 2004 or Khan, 2007), nor factor-pricing models that include additional risk factors such as momentum (measured using the return history), size (that uses market capitalization), liquidity (measured via trading data: Liu, 2006) or exchange rate risk (Kolari et al., 2007) require the use of accounting information.

[4] We limit our analysis to the one-factor case for simplicity of the proofs. The results immediately apply to the multiple-factor case.

identical expected returns. In other words, we assume that returns are comparable across countries but accounting measures are not, because of cross-country differences in accounting standards.

Given that the factor f_t is unobservable, we assume that we have a proxy available, which we denote by X_t. One example of this proxy is the return on the HML portfolio (Book-to-market "factor") used in the F-F three-factor model. This variable is the return on a portfolio formed on the basis of book values. This proxy is constructed from accounting information, and it is therefore influenced by the accounting standards of the system j to which company i is subject. We can simply express this relationship, including the possibility of some measurement error u_t independent of f_t, as:

$$X_t = \varphi_j f_t + u_{jt} \tag{5}$$

where φ_j measures the strength of the relationship between the accounting proxy X_t and the risk factor f_t for accounting system j. We assume u_{jt} to have variance $V[u_{jt}]$.

Given the above structure, we estimate the pricing model following the traditional two-pass procedure. This would require first to estimate the sensitivities β_i of the companies' returns to the factor via a time-series procedure and then to use those estimated sensitivities in a cross-section regression of expected returns for a sample of different firms.

In the first pass, a set of time-series regressions is estimated, where the proxy X_t is used instead of the unobserved factor f_t. This implies regressing the time series of returns r_{it} of company i on the proxies X_t.

We only have a proxy for the factor f_t available, so the sensitivities are estimated as:

$$\beta_{i,X} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{r}_i \tag{6}$$

where $\mathbf{X}$ is the vector of time-series data of X_t and $\mathbf{r}_i$ is the vector of returns of company i. These $\beta_{i,X}$ coefficients will not necessarily be consistent estimates of the true sensitivities β_i. In fact, it is easy to show (see Appendix II) that, given the setup in equations (2) to (4),

$$p\lim \beta_{i,X} = \beta_i \frac{\varphi_j}{\varphi_j^2 + V[u_{jt}]} \tag{7}$$

It is clear from the expression that the estimated factor sensitivities $\beta_{i,X}$ are estimating a function of β_i and φ_j. Even if $V[u_{jt}]=0$, the difference (*plim* $\beta_{i,X} - \beta_i$) of the coefficient is zero only if $\varphi_j=1$ (X is a good proxy for the risk factor). In other words, if we use an imperfect proxy for f_t, $\beta_{i,X}$ will be an inconsistent estimate of β_i.

We then move into the second pass, where we use the estimated factor sensitivities $\beta_{i,X}$ in order to infer the risk premiums associated with the factors. This second-pass implies the regression of the excess returns ($E[r_i^j] - r_f$) of a set of portfolios or companies on the estimated factor sensitivities $\beta_{i,X}$ in order to obtain estimates of α and λ. There are two possible cases for the results of the second-pass cross-sectional regression:

1) (*plim* $\beta_{i,X} - \beta_i$) is the same for all i. Given the expression for the inconsistency, and the fact that we are assuming that all companies are subject to the same risk factor, this

requires that φ_j be the same for all companies –same accounting system– so that in all cases the accounting-based proxy is related to the risk factor in the same way. In this case (see Appendix II), the risk premium will be inconsistently estimated –the difference ($\text{plim}\lambda_X - \lambda$) being the reciprocal of ($plim\ \beta_{i,X} - \beta_i$)– but the intercept would still be a consistent estimate of the true intercept α (zero if the valuation model correctly accounts for expected returns). Thus, traditional analyses that use cross-sectional consistent proxies of the risk factor would yield inconsistent risk premiums and factor betas but correct inferences on the intercepts. Therefore, Wald-type tests of zero intercepts should not lead to rejection of the pricing model.

2) If ($plim\ \beta_{i,X} - \beta_i$) differs across i, because of different accounting systems (so that φ_j changes across companies), then (see Appendix II):
2.1) the risk premium λ is again inconsistent, but now ($\text{plim}\lambda_X - \lambda$) is a complicated function of the φ_j and of the proportion of companies that come from the different accounting systems j.
2.2) the intercept is also inconsistent: the probability limit of the intercept depends on ($\text{plim}\lambda_X - \lambda$), but under reasonable values of φ_j and considering a positive risk premium, it can be shown that the intercepts will be positive and therefore lead to rejections in the traditional Wald-type tests.

To sum up, when accounting measures are used to proxy for the risk factors, a difference in accounting standards leads to an inconsistent estimation of risk premiums –the difference with respect to the true value being a function of the parameters, which is difficult to adjust– and to rejection of the valuation model. This rejection stems from the inconsistent estimation of the zero intercepts *even though all the relevant risk factors may have been included or proxied by in the pricing equation*. The use of data from firms that are subject to the same accounting standards solves the second problem –so that the valuation model may not be rejected if it correctly specifies all the relevant risk factors– and alleviates the first in the sense that the adjustment of the risk premiums is, theoretically, much simpler.

4. TWO-PASS ESTIMATION AND ACCOUNTING MEASURES: FINDING THE REASONS FOR THE POOR PERFORMANCE OF GLOBAL VERSIONS OF THE F-F THREE FACTOR MODEL

4.1 THE F-F THREE FACTOR MODEL

The Fama-French pricing model is based on augmenting the traditional CAPM –where the only factor that explains differences in expected returns is the return of the market portfolio- with two additional risk factors, *Size* and *Book-to-Market* (BTM). Thus, the expected excess return of a stock is described by

$$E[r_i - r_f] = \beta_{1i}MKT + \beta_{2i}SMB + \beta_{3i}HML \qquad (8)$$

where *MKT* is the excess return on the market portfolio, SMB is the return of a portfolio constructed from a ranking of companies by *Size,* HML is the return of a portfolio constructed from a ranking of companies by the *Book-to-Market* ratio and β_{1i}, β_{2i} and β_{3i} are the sensitivities of stock i to the three risk factors.[5] If these three factors capture all relevant risks that are priced at the international level, this simple model should explain the international

[5] We explain the construction of the latter two portfolios in greater detail in the next subsection.

cross-section of returns: in a global efficient capital market a unique set of risk factors should describe expected returns across countries. However, if world capital markets are not integrated in some sense the empirical validity of international versions of this pricing model could be seriously affected. After a large number of analyses that show the validity of the F-F setup at the domestic level -i.e. the above three factors correctly account for the variation in expected returns-, Griffin (2002) and Moerman (2005) showed that domestic versions outperform international versions. This evidence seemed to restrict the validity of the model to domestic settings.

Two reasons could be behind this failure. One is model mispecification -there are international risk factors not accounted for by the three factors in (8)- but another could be the lack of comparability of international accounting data. We plan to focus on this second possible source of failure.[6] The studies mentioned above use data from countries that follow different accounting standards, a fact that is likely to distort the cross-country comparisons of accounting measures and should affect the validity of the empirical implementation of the international versions of the model. In other words, financial markets might not be integrated in the "accounting sense." In particular, the BTM factor is a proxy constructed from the return of a portfolio formed on the basis of book values of firms.[7] This measure is directly affected by accounting reporting standards. Thus, the use of non-homogeneous book values affects the composition of the BTM portfolio and, consequently, it should affect the explanatory power of the BTM factor over the cross-section of expected returns.

The F-F model is an empirical model whose theoretical foundation is still subject to research. Fama and French (1993) mentioned that the Size (SMB) factor may be correcting or proxying for size or trading-related biases (Dimson, 1979, Dimson and Marsh, 1986) and that the Book-to-market (HML) factor could be related to measures of leverage or financial distress. Other, more recent contributions, are looking for more aggregate sources of risk that the two factors may be proxying for, such as future GDP growth (Vassalou, 2003), long-run investment alternatives (Liew and Vassalou, 2000; Li et al., 2006; Petkova, 2006; In and Kim, 2007) or productivity (Balvers and Huang, 2007). Despite the pending task of providing it with a solid theoretical foundation, the model is widely used by practitioners and researchers. Given that it relies on an accounting measure, the issue of possible distortions in international pricing analyses induced by accounting differences becomes a relevant research question.

4.2 EMPIRICAL ANALYSIS: FOUR VERSIONS OF THE F-F MODEL AND THE IASB CONTEXT

If capital markets are not integrated in the "accounting sense" the performance of world versions of pricing models could be seriously affected. In order to show evidence in this regard, we carry out two different analyses. First, we estimate four different versions of the F-F model for an international set of firms: 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*). Second, we apply the model to a cross-country set of firms that follow the same accounting system (IASB firms) and show that the performance of the model in this setting is comparable to that of accounting-homogeneous domestic versions.

[6] The model might still have some missing international risk factor. We show that the fit of the model *improves* when the data comparability issue is solved, but inclusion of a missing factor would also lead to better model fit.

[7] The book-to-market ratio is used to construct the proxy in the following way: portfolios of companies are formed based on their BTM ratios. The return of a portfolio that contains the companies with the highest BTM ratio is subtracted from the return of the portfolio that contains the companies with the lowest BTM ratio. Thus, differences in accounting systems distort the composition of the *High* and *Low* portfolios.

In our first analysis, we use a world sample of firms coming from nine different countries. Following Griffin (2002), we fit four different versions of the F-F model to this set of firms. The *Domestic* version is the traditional F-F (1993) model that uses country-specific factors for a separate country-by-country pricing analysis. This implies that the data used are homogeneous in their accounting standards and therefore the pricing model should perform well. The model is:

$$R_{pt} - r_{ft} = \alpha_p + \beta_{pM} MKT_t + \beta_{pSMB} SMB_t + \beta_{pHML} HML_t + e_{pt} \tag{9}$$

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 an error term which we assume independent of the risk factors. 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 sensitivity to the factors varies across 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:

$$\begin{aligned} R_{pt} - r_{ft} = {} & \alpha_p + \beta_{DpMKT}\left(W_{Dt-1} DMKT_t\right) + \beta_{DpSMB}\left(W_{Dt-1} DSMB_t\right) + \beta_{DpHML}\left(W_{Dt-1} DHML_t\right) + \\ & \beta_{FpMKT}\left(\sum_{F=1}^{8} W_{Ft-1} FMKT_{Ft}\right) + \beta_{FpSMB}\left(\sum_{F=1}^{8} W_{Ft-1} FSMB_{Ft}\right) + \beta_{FpHML}\left(\sum_{F=1}^{8} W_{Ft-1} FHML_{Ft}\right) + e_{pt} \end{aligned} \tag{10}$$

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:

$$\begin{aligned} R_{pt} - r_{ft} = {} & \alpha_p + \beta_{pMKT}\left(\sum_{i=1}^{9} W_{it-1} MKT_{it}\right) + \beta_{pSMB}\left(\sum_{i=1}^{9} W_{it-1} SMB_{it}\right) \\ & + \beta_{pHML}\left(\sum_{i=1}^{9} W_{it-1} HML_{it}\right) + e_{pt} \end{aligned} \tag{11}$$

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 where 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, the UK and the USA; the *Code Law* group includes Germany, France and Japan; finally, the *Asian* sample consists of Malaysia and Singapore.[8] The *Global Accounting System* model is then:

$$R_{pt} - r_{ft} = \alpha_p + \beta_{pMKT}\left(\sum_{i=1}^{n} W_{it-1} MKT_{it}\right) + \beta_{pSMB}\left(\sum_{i=1}^{n} W_{it-1} SMB_{it}\right) + \beta_{pHML}\left(\sum_{i=1}^{n} W_{it-1} HML_{it}\right) + e_{pt} \tag{12}$$

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* and *International* versions should be the best performers –domestic firms are subject to the same accounting standards-. For the same argument, the *Global Accounting System* model should perform -probably- worse than the *Domestic* and *International*, but better than the *World* version.

Regarding our second analysis, we apply a version of the F-F model similar to the *World* version to the cross-section of *IASB* firms, which, despite coming from different countries, share the accounting system and report using the same accounting standards. If the accounting dimension is relevant, despite its international character the fit of this model should be similar to that of *Domestic* models. We call this the *IASB Accounting System* model.

4.3 THE MAIN HYPOTHESES

Our main hypotheses can now be stated. First, the estimation of factor sensitivities is sensitive to the accounting information -the quality of the proxy X-, and therefore different pooling of firms should lead to different estimates of the sensitivity. Second, the performance of applications of the F-F model should improve when the model is applied to accounting homogeneous settings. Thus, when we estimate model (12), where we pool together firms from countries in the same accounting system, or when we apply the model to the *IASB* firms, its performance should be better than that of international heterogeneous versions but comparable -although maybe worse- to that of domestic versions.[9] Third, the model should be more frequently rejected in the accounting-heterogeneous than in the accounting-homogeneous applications.

4.4 DESCRIPTION OF THE DATA

[8] The distinction between common-law and code-law countries is by now well accepted (Ball et al., 2000; Ball et al., 2003). The Asian sample is motivated by Ball et al. (2003), who find that financial reporting in East Asia presents some similarities with the common-law system, but it also exhibits some distinct regional features.

[9] Note that these conclusions do 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, 2000, 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 inconsistency of the different measures.

We carry out now an empirical test of the above hypotheses, by estimating F-F models at the country, international, world and accounting-system levels, including a separate analysis for data of the sample of *the IASB firms*.

Unless we mention otherwise, our data come from the Global Vantage Compustat database.We collect data for a large sample of firms in which we include firms from Australia, Canada, the UK, USA, Germany, France, Japan, Malaysia and Singapore.[10] This first sample covers 7,550 firms from nine countries in three accounting systems with quite different accounting regulations (Continental, Common and Asian). Therefore, it has both more firms and countries than either Griffin (2002) or Moerman (2005). The total number of firms in this *World sample* 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.

The *IASB sample* contains 810 firms coming from fifty four countries. This is the universe of firms that had adopted the IASB accounting standards over the period 1995-2004. The Compustat item number "GF66" has been used for this purpose. All firms that follow IASB standards are taken into account in this study: we do not exclude any firm if they are reporting under IAS/IFRS standards. If a firm reports under domestic standards in the first years of the sample period, this firm will be included in the IASB sample from the first year that it adopted the IAS/IFRS standards. This could lead to a sample selection problem (see Section 5) but we believe this should not invalidate our exercise: even though the companies may share some common characteristic -given some of the descriptive statistics, there is not much evidence of similarities- it is indeed the case that the firms come from countries with different domestic accounting systems. The fact that the F-F model correctly explains the cross-section of their returns is precisely the evidence we are looking for.

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 include firms with positive common equity. For each country, the return of the MSCI index and the level of the three-month interest rate of Treasury bills have been used as proxies for market return and for the return of the risk-free asset, respectively. 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.[11]

We follow exactly the procedure described by F-F (1993) to construct the size and book-to-market portfolios. Fiscal years end in June for Australian firms, March for Japanese firms and December for firms in the rest of the countries. 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 measured as 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

[10] These are the countries for which we have both financial and accounting data in Factset-JCF and Compustat. The firms selected are all those for which the necessary information for our analysis is available in Global Vantage Compustat.

[11] 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.

constructed. Thus, the results correspond to January 1996-December 2004 (Australia), October 1996-September 2004 (Japan) and July 1996-June 2004 (rest of the countries).

4.5 RESULTS

4.5.1 Some Descriptive Statistics

Panel A of Table 1 shows some descriptive statistics of the firms from the countries considered in this study and for the IASB firms. The monthly average number of firms varies between 179 in Singapore and 2,429 in Japan. The average market value per firm varies between 196 million US dollars in the Malaysian capital market and 4,201 in the US market. IASB firms tend to be of medium size, with an average market value of 2,068.82 million US dollars. 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 the US, a fact in line with the accounting literature on conservatism in earnings.

Panel B reports the weights of the countries for the *World sample* 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.[12]

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 case 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.[13]

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.[14] 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

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

[13] 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- which would affect the correlation of the country factors with the common accounting-system factor.

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

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).

4.5.2 Estimation of factor sensitivities

The first pass of the estimation procedure implies estimating the factor sensitivities β_i from the time-series regressions (6). As we mention in Section 3, these estimates of the factor sensitivities are subject to the quality of the proxy. In the case of the model, the proxies for the risk factors are returns of portfolios constructed on the basis of Size and Book-to-market measures. Consequently, the more general the version of the model, the poorer the proxy for f_t and the more inaccurate the estimates will be. It is not easy, however, to figure out the direction of the distortion, since both φ_i and $V[u_{it}]$ enter the term in (7).

Tables 4, 5 and 6 show the results of the estimates of the factor sensitivities for the different countries and versions of the model. We show both the point estimates (Table 4 and columns two and three of Table 6) and significance tests of the differences between the *Domestic* and the *World* estimates for the cross-country sample (Table 5) and between the *IASB* and the *World* estimates for the IASB sample (columns five and six of Table 6). We do not want to be too detailed in the comments, so we mention two stylized facts:

1) The estimates of the factor sensitivities differ significantly across versions of the model, although those for the MKT factor seem to be more stable than those for the Size and BTM factors.

2) For the BTM factor a regularity arises, in that the factor sensitivities are larger the more general the version of the model. This result is extremely regular –for the other two factors the differences, though sometimes large, appear in both directions- and might be justified in terms of our discussion: when φ_i is close to one, the term in (7) is close to one for small $V[u_{jt}]$, but then as φ_i decreases (so as the model includes more heterogeneous information and therefore the proxies are increasingly poorer) the value of (7) increases, yielding larger estimates of the factor sensitivity. This result is, though, very tentative so we just mention it as an empirical regularity that may warrant further attention.

4.5.3 Goodness-of-fit and validity of the model: *α's and adj.R²*

Once the factor sensitivities have been estimated, we use them in the second-pass, where we estimate the risk premiums and intercept of the pricing equation (4) and find the goodness-of-fit measures of the model. We focus only on the latter, which are the subject of the main discussion in the literature (Griffin, 2002). Specifically, we use the estimated values of the α-intercepts and the adjusted R^2's of the pricing equations. We believe this set of results deserves more attention, so our comments are more detailed.

Table 7 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 suggests that the international factors may be redundant once the domestic factors are included.

A first important result is that a *Domestic* 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. 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 8 shows the results of the analysis that uses equally-weighted factors and portfolios. Again the best version is *Domestic* and the *International* version does not add significant explanatory power. 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, suggesting that homogeneity in accounting data may be important for the validity of the model.

Finally, Table 9 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.[15] We can see that the results of the previous tables are consistent with those of Table 9: 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 eliminate the possible size effect by creating equally-weighted portfolios it becomes clear that *Global Accounting System* outperforms *World*.

Table 10 shows the results of Wald-type tests for joint nullity of the intercepts of the pricing equations (Campbell et al., 1996). These tests have traditionally been used to assess the validity of pricing models: the estimated intercepts for the different expected return equations should be zero if the risk factors correctly account for variation in returns. In the context of our discussion in Section 3, the tests could also be detecting inconsistencies in the estimation of the risk premiums, so it may be difficult to disentangle whether rejection is due to having the wrong model or to having mixed heterogeneous accounting data. However, failure to reject the nullity of the intercepts does imply that the model is correctly accounting for expected returns and that there does not seem to be a problem with the homogeneity of the data. The results that are shown in Table 10 are quite encouraging: the *Accounting System* version of the F-F model is the one that leads to fewer rejections at conventional significance levels, suggesting that the intercepts are indeed estimated at zero when uniform accounting data are pooled together.[16] The other versions behave similarly –after all, both the Domestic and the International versions should perform better-, although they would all lead to more frequent rejections of the null hypothesis, thus hinting that accounting homogeneity may be an important consideration in the application of the model.

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

[16] At the 10% significance level the Global Accounting System leads to fewer rejections than the other versions. At the 5% level it is the World model that dominates. At the 1% level, both the Domestic and Global Accounting System lead to no rejections.

So far the results confirm our hypothesis 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 can be obtained from the analysis of the *IASB sample*.

The analysis of firms that follow the IASB accounting standards gives additional 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 11 reports the results of the pricing equations estimated for firms that have adopted 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 values of R^2 of the IASB model are comparable –and sometimes even higher- to those obtained from the Domestic versions of the model that we used in the previous subsection.

4.5.4 Robustness Analyses

Several additional analyses were performed in order to analyze the robustness of the results. We include in Appendix III five tables with some of these results for the sake of completeness.

1. We deleted the 0.5% of extreme returns on each side by country-month in order to check whether outliers could affect the results. The main tenor of our results remains the same.
2. We took into account in our *IASB sample* only those firms from the nine countries in the world sample of the first analysis (Australia, Canada, the UK, the US, Germany, France, Japan, Malaysia and Singapur). The main results of our study continue to hold.
3. We analyzed the implication of international accounting differences on an accounting valuation model, Ohlson (1995). The results show big differences on estimated coefficients across countries for this model, a fact which is in line with our findings for the F-F empirical pricing model.
4. We controlled for possible biases induced by profitability, growth, leverage and liquidity by adding these variables into the F-F regressions. The results become distorted for some countries in the first analysis -the statistical behavior of some of these variables may be behind this effect- but they remain the same for the IASB analysis.

5. DISCUSSION, IMPLICATIONS AND LIMITATIONS OF THE ANALYSIS

Our paper is, to our knowledge, the first to attempt to look at the possible implications of homogeneity of accounting information in financial asset pricing. We believe our results, especially those in Tables 9 and 11, to be very strong evidence in favor of homogeneity of accounting standards as one of the determinants of the correct performance of international pricing models. These results are quite relevant for accounting and finance researchers, given the increasing importance of the literature on harmonization of accounting information, and for policymakers and practitioners: our results suggest the convenience of moving towards internationally homogeneous or comparable accounting procedures, and give support to either homogenization efforts such as the “Liabilities & Equity” project –undertaken by the FASB and IASB– or to the recommendation of unilateral adoption at an international level of a single set of accounting standards, such as the IAS or the US GAAP.

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 sense- 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 for 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. Fourth, consideration of the accounting dimension may allow for better discrimination among pricing models, in that it may eliminate a source of inconsistency that may be behind empirical rejections of some models. 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.

We are aware of some limitations of our analysis. On the one hand, the sampling of IASB firms might have a selection bias. Firms that have adopted the IAS tend to be multinationals with intense international presence, and so the fact of adopting IAS may be an endogenous decision. We mentioned that the IASB firms are quite dissimilar, but the issue of selection into IAS rules should be kept in mind.[17] Additionally, we could be subject to other more traditional biases, such as those stemming from size effects, thin trading, etc. As mentioned above, the F-F factors may in fact be proxying for some of those effects. We have carried out the robustness analyses mentioned in subsection 4.5.4, where we included measures of liquidity, profitablity, growth and leverage of the different portfolios in a “firm characteristics” analysis. None of these analyses changed the general conclusion, although the differing statistical behavior of some of these variables -which exhibit much more persistence than the returns that constitute the dependent and independent variables in the F-F model- distorted some of the estimation results.[18] Finally, carrying out our analysis for alternative pricing models would further strengthen our results. However, there are no other widely used factor-pricing models that use accounting-based variables, and the estimation of alternative accounting valuation methods would imply a strong departure from our main analysis in Section 3.[19] We leave an investigation of other accounting-based pricing models or of more traditional accounting valuation models for further research.

6. CONCLUSION

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

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[17] Alternative analyses underway (Gomez Biscarri and Lopez Espinosa, 2007) show that the results in this paper are robust, and the issue of sampling for IASB firms is not likely to be behind the good performance of the F-F model for that set of firms.

[18] The results of all the additional analyses mentioned in this paragraph that are not shown in Appendix III are available from the authors. They offer no new additional insight so we omit them for the sake of brevity.

[19] An application to Ohlson’s valuation model has been carried out, the results of which are shown in Appendix III.

We have given some intuition about the impact of accounting system differences on the performance and validity of international valuation models. We focused our statistical discussion and empirical exercise on analyzing the estimation of international versions of the F-F 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.

We provided some statistical results that show how the lack of accounting uniformity may induce inconsistencies in the two-pass estimation of the parameters of the model. Specifically, we show that even though having a proxy for the risk factors means that the factor sensitivities will generally be inconsistently estimated for each company, if the accounting data are homogeneous the intercepts of the model will be consistent, thus not leading to rejection of the model. If the accounting data are heterogeneous, the intercepts will also be inconsistent, and the model rejected.

Our empirical analysis is in line with the above statistical results. Furthermore, it provides strong evidence that the F-F model is 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. 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 pricing models or, more positively, that harmonization of accounting standards should improve the accuracy of pricing models and, therefore, should contribute greatly to a more efficient allocation of resources at the international level.

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APPENDIX I

Formula (1) in the text is straightforward to obtain.[20] Consider a firm that finances its investments with retained earnings. Dividends in period t (D_t) are equal to equity income (EI_t[21]) plus depreciation (DP_t) minus investment outlays (I_t),

$$D_t = EI_t + DP_t - I_t$$

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

$$E_t[D_{t+i}] = E_t[EI_{t+i} + DP_{t+i} - I_{t+i}] = E_t[EI_{t+i}](1 + a_1 - a_2)$$

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

$$ME_t = (1 + a_1 - a_2)\sum_{i=1}^{\infty} \frac{E_t[EI_{t+i}]}{(1+r)^i}$$

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). δ_i is therefore the sum of *deferred income* and *anticipated expenses* by the conservative accounting system at time i.[22] 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:

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

[20] 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.

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

[22] These results would be the same if we split δ_i, the *global* effect of a conservative accounting system, into the part of anticipated expenses and the part of deferred income.

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

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

In other words, the market value of B would depend on δ1 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:

$$BE_t(A) = C_0 + \sum_{i=1}^{t}\left(EI_i(A) - D_i(A)\right) = C_0 + \sum_{i=1}^{t}\left(EI_i(A) - EI_i(A) - DP_i(A) + I_i(A)\right) =$$

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

$$BE_t(B) = C_0 + \sum_{i=1}^{t}\left(EI_i(B) - D_i(B)\right) = C_0 + \sum_{i=1}^{t}\left(I_i(B) - DP_i(B)\right) =$$

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

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

We see that $BE_t(A)$ will usually be higher than $BE_t(B)$ since dividends will generally be lower than equity income:[23]

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

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:

[23] 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.

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

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 the case that $MB_t(B) > MB_t(A)$. 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.[24]

[24] We are working with firms that finance their investments with retained earnings so $a_2 \neq a_1$.

APPENDIX II

This Appendix derives the proofs of the probability limits mentioned in Section 3.

1. Probability limit of $\widehat{\beta}_{i,X}$

The first-pass of the analysis of the valuation model (4) requires obtaining estimates of the factor sensitivities β_i. Given the setup in equations (2), (3) and (5), the following time-series regression

$$r_{i,t}^{j} = \beta_0 + \beta_i f_t + \varepsilon_{i,t}$$

is estimated by replacing X_t for f_t.

It is not difficult to derive the probability limit of the estimate of the factor sensitivity that would result from this regression. Hereafter, $\overline{a}$ refers to the sample average of a_t. We use Slutsky's theorem in the convergence results of functions of the averages.

We start by using the regular expression of the estimate (we omit the subscript i from the equations in order to simplify the notation):

$$\begin{aligned} \widehat{\beta}_{i,X} &= \frac{\sum_t (X_t - \overline{X})(r_t - \overline{r})}{\sum_t (X_t - \overline{X})^2} = \frac{\sum_t (X_t - \overline{X})\left[\beta(f_t - \overline{f}) + (\varepsilon_t - \overline{\varepsilon})\right]}{\sum_t (X_t - \overline{X})^2} = \\ &= \frac{\beta \sum_t (X_t - \overline{X})(f_t - \overline{f})}{\sum_t (X_t - \overline{X})^2} + \frac{\sum_t (X_t - \overline{X})(\varepsilon_t - \overline{\varepsilon})}{\sum_t (X_t - \overline{X})^2} \end{aligned}$$

Under regular assumptions of no correlation between $\varepsilon_{i,t}$ and X_t, the second term goes to zero in probability. We omit that derivation.

The probability limit of the first term can be studied easily by dividing it into separate terms:

$$p\lim \widehat{\beta}_{i,X} = \beta \cdot p\lim \frac{\sum_t (X_t - \overline{X})(f_t - \overline{f})}{\sum_t (X_t - \overline{X})^2} = \beta \cdot p\lim \frac{\frac{1}{T}\sum_t X_t f_t - \overline{X}\overline{f}}{\frac{1}{T}\sum_t X_t^2 - \overline{X}^2}$$

We now look at the separate components:

1)

$$p\lim \overline{f} = p\lim \frac{1}{T}\sum_t f_t = E\left[f_t\right]$$

as long as the factor is ergodic (which it is, given (3)).

2)

$$\overline{X} = \left(\frac{1}{T}\sum_t X_t\right) = \left(\frac{1}{T}\sum_t \left(\varphi_j f_t + u_{jt}\right)\right) = \left[\varphi_j \frac{1}{T}\sum_t f_t + \frac{1}{T}\sum_t u_{jt}\right]$$

Under the same condition as in the previous result, the first term converges in probability to $E[f_t]$. The last term converges to $E[u_{jt}]$, which is zero by definition, so that:

$$p\lim \overline{X} = \varphi_j E[f_t]$$

3) From the above result, it also follows from Slutsky's theorem that:

$$p\lim \overline{X}^2 = \varphi_j^2 (E[f_t])^2$$

4)

$$\begin{aligned} \frac{1}{T}\sum_t X_t^2 &= \frac{1}{T}\sum_t (\varphi_j f_t + u_{jt})^2 = \\ &= \frac{1}{T}\sum_t \left[\varphi_j^2 f_t^2 + u_{jt}^2 + 2\varphi_j f_t u_{jt}\right] \end{aligned}$$

Under covariance stationarity of the factor, $\frac{1}{T}\sum_t f_t^2$ converges to $E\left[f_t^2\right]$, the cross-term $\frac{1}{T}\sum_t f_t u_{jt}$ converges to zero and $\frac{1}{T}\sum_t u_{jt}^2$ converges to $V[u_{jt}]$. Therefore,

$$p\lim \frac{1}{T}\sum_t X_t^2 = \varphi_j^2 E\left[f_t^2\right] + V[u_{jt}]$$

5)

$$\frac{1}{T}\sum_t X_t f_t = \frac{1}{T}\sum_t (\varphi_j f_t + u_{jt}) f_t = \frac{1}{T}\sum_t \varphi_j f_t^2 + \frac{1}{T}\sum_t f_t u_{jt}$$

where we can use previous results to yield

$$p\lim \frac{1}{T}\sum_t X_t f_t = \varphi_j E\left[f_t^2\right]$$

Putting together all the above results, we obtain

$$p\lim \widehat{\beta}_{i,X} = \beta_i \cdot \frac{\varphi_j E\left[f_t^2\right] - \varphi_j (E[f_t])^2}{\varphi_j^2 E\left[f_t^2\right] + V[u_{jt}] - \varphi_j^2 (E[f_t])^2} = \beta_i \cdot \frac{\varphi_j}{\varphi_j^2 + V[u_{jt}]}$$

where the equality follows from the normalizations $E[f_t^2] = 1$, $E[f_t] = 0$. This is equation (7) in the main text, and it can be seen as a case of the usual signal-to-noise relationship in the presence of an incorrectly measured regressor. In any case, there are two sources of inconsistency for the factor sensitivities:

1) The measurement error in X_t, measured by $V[u_{jt}]$

2) The (lack of) strength in the relationship between the proxy X_t and the factor f_t, measured by φ_i.

2. Probability limit of the estimator of λ and of the intercept in the pricing equation where $E[r_i] - r_f$ regressed on $\widehat{\beta}_{i,X}$

Given the result in (7), we have a situation where the regressor β_i is incorrectly measured. We define $\beta_{i,X} = p\lim \widehat{\beta}_{i,X} = \varphi_j \beta_i$ and define $e_i^\beta = \widehat{\beta}_{i,X} - \beta_{i,X}$ as the sampling error in $\widehat{\beta}_{i,X}$ with respect to its probability limit.

We show now that when φ_j differs across firms in the sample, the estimated coefficients on the regression of $E[r_i^j] - r_f$ on $\widehat{\beta}_{i,X}$, $\widehat{\lambda}_X$ and $\widehat{\alpha}_X$, will be inconsistent, and we compute the probability limits of the two estimators. We also show that when φ_j is common across firms, then $\widehat{\lambda}_X$ will be inconsistent –but easy to adjust– and $\widehat{\alpha}_X$ will be consistent.

In order to simplify the algebra –the results do not depend on this assumption at all–, we assume that companies in our sample come from two different accounting standards, and that the proportions of companies from each system stay constant as the sample size increases. We call p_1 and $p_2 = 1 - p_1$ the two proportions, and φ_1 and φ_2 are the measurement error induced in the factor sensitivities by the two different accounting systems.

The regression of excess returns on factor sensitivities is now carried out. In other words, the correct model is $E[r_i^j] - r_f = \alpha + \beta_i \lambda + e_i$ but we estimate the regression $E[r_i^j] - r_f$ on $\widehat{\beta}_{i,X}$. For simplicity of notation, we call $y_i = E[r_i^j] - r_f$ and $b_i = \widehat{\beta}_{i,X}$. The expression for the estimate of λ is

$$\widehat{\lambda}_X = \frac{\sum_i (b_i - \overline{b})(y_i - \overline{y})}{\sum_i (b_i - \overline{b})^2} = \frac{\sum_i (b_i - \overline{b}) \left[\lambda(\beta_i - \overline{\beta}) + (e_i - \overline{e})\right]}{\sum_i (b_i - \overline{b})^2} = \quad (1)$$

$$= \frac{\lambda \sum_i (b_i - \overline{b})(\beta_i - \overline{\beta})}{\sum_i (b_i - \overline{b})^2} + \frac{\sum_i (b_i - \overline{b})(e_i - \overline{e})}{\sum_i (b_i - \overline{b})^2} \quad (2)$$

Under regular assumptions of no correlation between e_i and the b_i, the second term can be easily shown to go to zero in probability. We omit that derivation.

The probability limit of the first term can be studied easily by dividing it in separate terms:

$$p\lim \widehat{\lambda}_X = \lambda \cdot p\lim \frac{\frac{1}{N}\sum_i (b_i - \overline{b})(\beta_i - \overline{\beta})}{\frac{1}{N}\sum_i (b_i - \overline{b})^2} = \lambda \cdot p\lim \frac{\frac{1}{N}\sum_i b_i \beta_i - \overline{b\beta}}{\frac{1}{N}\sum_i b_i^2 - \overline{b}^2} \quad (3)$$

We now look at the separate components. Given that the β_i should be treated as parameters, we define $\widetilde{\beta} = \lim_{n\to\infty} \overline{\beta}$ and $\widetilde{\widetilde{\beta}} = \lim_{n\to\infty} \frac{1}{N}\sum_i \beta_i^2$

1)

$$\begin{aligned}
\overline{b} &= \left(\frac{1}{N}\sum_i b_i\right) = \left(\frac{1}{N}\sum_{i\in 1} b_i + \frac{1}{N}\sum_{i\in 2} b_i\right) = \left(\frac{1}{N}\frac{p_1 N}{p_1 N}\sum_{i\in 1} b_i + \frac{1}{N}\frac{p_2 N}{p_2 N}\sum_{i\in 2} b_i\right) = \\
&= \left(p_1 \frac{1}{p_1 N}\sum_{i\in 1} b_i + p_2 \frac{1}{p_2 N}\sum_{i\in 2} b_i\right) = \left(p_1 \frac{1}{p_1 N}\sum_{i\in 1}\left(\varphi_1 \beta_i + e_i^\beta\right) + p_2 \frac{1}{p_2 N}\sum_{i\in 2}\left(\varphi_2 \beta_i + e_i^\beta\right)\right) = \\
&= \varphi_1 p_1 \left(\frac{1}{p_1 N}\sum_{i\in 1}\beta_i\right) + \varphi_2 p_2 \left(\frac{1}{p_2 N}\sum_{i\in 2}\beta_i\right) + \varphi_1 p_1 \left(\frac{1}{p_1 N}\sum_{i\in 1} e_i^\beta\right) + \varphi_2 p_2 \left(\frac{1}{p_2 N}\sum_{i\in 2} e_i^\beta\right)
\end{aligned}$$

The first two terms in brackets are averaging β_i over $(p_1 N)$ elements (first group of companies) and over $(p_2 N)$ elements (second group of companies). The limit of both of these terms as N goes to infinity is $\widetilde{\beta}$. The last two terms are zero in expectation by definition, so that:

$$p\lim \overline{b} = (\varphi_1 p_1 + \varphi_2 p_2)\,\widetilde{\beta}$$

2) From the above result, it follows that:

$$p\lim \overline{b}^2 = (\varphi_1 p_1 + \varphi_2 p_2)^2\,\widetilde{\beta}^2$$

4)

$$\begin{aligned}
\frac{1}{N}\sum_i b_i^2 &= \left(\frac{1}{N}\sum_{i\in 1} b_i^2 + \frac{1}{N}\sum_{i\in 2} b_i^2\right) = \left(\frac{1}{N}\frac{p_1 N}{p_1 N}\sum_{i\in 1} b_i^2 + \frac{1}{N}\frac{p_2 N}{p_2 N}\sum_{i\in 2} b_i^2\right) = \\
&= \left(p_1 \frac{1}{p_1 N}\sum_{i\in 1} b_i^2 + p_2 \frac{1}{p_2 N}\sum_{i\in 2} b_i^2\right) = \\
&= \left(p_1 \frac{1}{p_1 N}\sum_{i\in 1}\left(\varphi_1\beta_i + e_i^\beta\right)^2 + p_2 \frac{1}{p_2 N}\sum_{i\in 2}\left(\varphi_2\beta_i + e_i^\beta\right)^2\right) = \\
&= \varphi_1^2 p_1 \left(\frac{1}{p_1 N}\sum_{i\in 1}\beta_i^2\right) + \varphi_2^2 p_2 \left(\frac{1}{p_2 N}\sum_{i\in 2}\beta_i^2\right) + cross\ terms + ... \\
&\quad ... + \varphi_1^2 p_1 \left(\frac{1}{p_1 N}\sum_{i\in 1}\left(e_i^\beta\right)^2\right) + \varphi_2^2 p_2 \left(\frac{1}{p_2 N}\sum_{i\in 2}\left(e_i^\beta\right)^2\right)
\end{aligned}$$

The first two terms in brackets are averaging β_i^2 over $(p_1 N)$ elements (first group of companies) and over $(p_2 N)$ elements (second group of companies). The limit of both of these terms as N goes to infinity is $\widetilde{\widetilde{\beta}}$. By the same reasoning, the last two terms, converge to $E\left[\left(e_i^\beta\right)^2\right] = V\left[e_i^\beta\right]$. The cross terms contain sums of $\left(\varphi_{1,2}\beta_i e_i^\beta\right)$, which go to zero in expectation. Consequently,

$$p\lim \frac{1}{N}\sum_i b_i^2 = \left(\varphi_1^2 p_1 + \varphi_2^2 p_2\right)\left(\widetilde{\widetilde{\beta}} + V\left[e_i^\beta\right]\right)$$

5)

$$\begin{aligned}
\frac{1}{N}\sum_i b_i\beta_i &= \left(\frac{1}{N}\sum_{i\in 1} b_i\beta_i + \frac{1}{N}\sum_{i\in 2} b_i\beta_i\right) = \left(\frac{1}{N}\frac{p_1 N}{p_1 N}\sum_{i\in 1} b_i\beta_i + \frac{1}{N}\frac{p_2 N}{p_2 N}\sum_{i\in 2} b_i\beta_i\right) = \\
&= \left(p_1\frac{1}{p_1 N}\sum_{i\in 1} b_i\beta_i + p_2\frac{1}{p_2 N}\sum_{i\in 2} b_i\beta_i\right) = \\
&= \left(p_1\frac{1}{p_1 N}\sum_{i\in 1}\left(\varphi_1\beta_i^2 + e_i^\beta\beta_i\right) + p_2\frac{1}{p_2 N}\sum_{i\in 2}\left(\varphi_2\beta_i^2 + e_i^\beta\beta_i\right)\right) = \\
&= \varphi_1 p_1\left(\frac{1}{p_1 N}\sum_{i\in 1}\beta_i^2\right) + \varphi_2 p_2\left(\frac{1}{p_2 N}\sum_{i\in 2}\beta_i^2\right) + \\
&\quad + \varphi_1 p_1\left(\frac{1}{p_1 N}\sum_{i\in 1} e_i^\beta\beta_i\right) + \varphi_2 p_2\left(\frac{1}{p_2 N}\sum_{i\in 2} e_i^\beta\beta_i\right)
\end{aligned}$$

from where we can use the previous results and the fact that the last two terms converge to zero to yield

$$p\lim\frac{1}{N}\sum_i b_i\beta_i = (\varphi_1 p_1 + \varphi_2 p_2)\widetilde{\widetilde{\beta}}$$

Putting together the above results, we obtain

$$\begin{aligned}
p\lim\widehat{\lambda}_X &= \lambda\cdot\frac{(\varphi_1 p_1 + \varphi_2 p_2)\widetilde{\widetilde{\beta}} - (\varphi_1 p_1 + \varphi_2 p_2)\,\widetilde{\beta}^2}{(\varphi_1^2 p_1 + \varphi_2^2 p_2)\left(\widetilde{\widetilde{\beta}} + V\left[e_i^\beta\right]\right) - (\varphi_1 p_1 + \varphi_2 p_2)^2\,\widetilde{\beta}^2} = \\
&= \lambda\cdot\frac{(\varphi_1 p_1 + \varphi_2 p_2)\left(\widetilde{\widetilde{\beta}} - \widetilde{\beta}^2\right)}{(\varphi_1^2 p_1 + \varphi_2^2 p_2)\left(\widetilde{\widetilde{\beta}} + V\left[e_i^\beta\right]\right) - (\varphi_1 p_1 + \varphi_2 p_2)^2\,\widetilde{\beta}^2} = \\
&= \lambda\cdot\frac{\left(\widetilde{\widetilde{\beta}} - \widetilde{\beta}^2\right)}{\frac{(\varphi_1^2 p_1 + \varphi_2^2 p_2)}{(\varphi_1 p_1 + \varphi_2 p_2)}\left(\widetilde{\widetilde{\beta}} + V\left[e_i^\beta\right]\right) - (\varphi_1 p_1 + \varphi_2 p_2)\,\widetilde{\beta}^2}
\end{aligned}$$

A special case for this expression comes when all companies come from the same accounting standard, and therefore φ is common across all the cross-sectional units. In that case ($\varphi_1 = \varphi_2 = \varphi$, so that we can trivially set $p_1 = 1$ and $p_2 = 0$), the expression reduces to:

$$p\lim\widehat{\lambda}_X = \lambda\cdot\frac{\varphi\widetilde{\widetilde{\beta}} - \varphi\widetilde{\beta}^2}{\varphi^2\left(\widetilde{\widetilde{\beta}} + V\left[e_i^\beta\right]\right) - \varphi^2\widetilde{\beta}^2}$$

which, under small sampling error on $\widehat{\beta}_{i,X}$ (i.e. $V\left[e_i^{\beta}\right]\approx 0$) is equal to $\frac{\lambda}{\varphi}$, so that the risk premium is still inconsistent but an adjustment would be relatively easy to perform.

The results on the probability limit of the intercept in this second-pass regression are quite important, since tests of the validity of the model are usually based on testing $\alpha=0$. We can write the estimated intercept –omitting, for simplicity, the sampling error e_i^{β}– based on $\widehat{\beta}_{i,X}=b_i$ as:

$$\widehat{\alpha}_X=\overline{y}-\widehat{\lambda}_X\overline{b}=\alpha+\lambda\overline{\beta}+\overline{e}-\widehat{\lambda}_X\overline{b}$$

so that using the above results we obtain

$$\begin{aligned}
p\lim\widehat{\alpha}_X &= \alpha+\lambda\widetilde{\beta}-\lambda\cdot\frac{\left(\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2\right)\cdot(\varphi_1p_1+\varphi_2p_2)\,\widetilde{\beta}}{\frac{(\varphi_1^2p_1+\varphi_2^2p_2)}{(\varphi_1p_1+\varphi_2p_2)}\widetilde{\widetilde{\beta}}-(\varphi_1p_1+\varphi_2p_2)\,\widetilde{\beta}^2}= \\
&= \alpha+\lambda\widetilde{\beta}\left[1-\frac{\left(\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2\right)\cdot(\varphi_1p_1+\varphi_2p_2)}{\frac{(\varphi_1^2p_1+\varphi_2^2p_2)}{(\varphi_1p_1+\varphi_2p_2)}\widetilde{\widetilde{\beta}}-(\varphi_1p_1+\varphi_2p_2)\,\widetilde{\beta}^2}\right]= \\
&= \alpha+\lambda\widetilde{\beta}\left[1-\frac{\left(\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2\right)}{\frac{(\varphi_1^2p_1+\varphi_2^2p_2)}{(\varphi_1p_1+\varphi_2p_2)^2}\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2}\right]= \\
&= \alpha+\lambda\widetilde{\beta}\left[1-\frac{\left(\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2\right)}{\left(\widetilde{\widetilde{\beta}}-\widetilde{\beta}^2\right)+\frac{(\varphi_1^2p_1+\varphi_2^2p_2)-(\varphi_1p_1+\varphi_2p_2)^2}{(\varphi_1p_1+\varphi_2p_2)^2}\widetilde{\widetilde{\beta}}}\right]
\end{aligned}$$

Given that $\widetilde{\beta}\neq 0$, the estimate of the intercept will be inconsistent, and the extent of this inconsistency depends on $p\lim\widehat{\lambda}_X$, which is a function of the proportions of firms from the two groups and of the terms φ_1 and φ_2. In other words, one is bound to obtain intercepts that are significantly different from zero.

In the special case of equal accounting standards ($\varphi_1=\varphi_2=\varphi$, $p_1=1$, $p_2=0$) then the term in square brackets cancels out and, despite the inconsistent $\widehat{\lambda}_X$, $\widehat{\alpha}_X$ will be consistently estimated. Consequently, tests on the validity of the valuation model should not lead to rejection.[1]

[1] As before, this requires small sampling error in $\widehat{\beta}_{i,X}$ so that $V\left[e_i^{\beta}\right]\approx 0$. This will be the case if the first-stage time series regressions have a large number of observations.

Table 1. Descriptive statistics and weights

Panel A of the table reports descriptives on the *World* and *IASB samples*. Firms: Monthly average of 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: Singapur; IAS: firms following IAS/IFRS standards. Panel B reports weights of the nine countries in the *World sample* in factor construction. The weights are monthly averages expressed in percentage of total market value. WL: Weights of each country in world factors (all countries); CN: Weights of each country in continental (code-law) factors. Continental countries on the sample are Germany, France and Japan; CM: Weights of each country in common (common-law) factors. Common-law countries on the sample are Australia, Canada, Great Britain and USA; AS: Weights of each country in Asian factors. Asian countries on the sample are Malaysia and Singapur. Panel C shows the distribution among countries of firms in the IASB sample. AT: Austria; CH: Switzerland; CN: China; DE: Germany; FR: France; IT: Italy; PE: Peru; PH: Philippines; TR: Turkey; Rest: Rest of the countries.

Panel A: Descriptives of the World and IASB samples

	AU	CA	UK	US	DEU	FR	JP	MY	SG	IAS
Firms	227.83	279.48	435.27	1,710.62	252.62	378.05	2,429.09	311.27	178.92	516.60
Size	628.32	1,245.44	1,954.03	4,200.98	575.28	1,044.71	979.21	196.11	371.44	2,068.82
BM	0.89	0.91	0.84	0.66	0.88	0.99	1.27	1.11	1.26	1.03

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%

Panel C: IASB firms

AT	CH	CN	DE	FR	IT	PE	PH	TR	Rest
4.32%	14.69%	6.05%	29.63%	2.96%	10.00%	2.47%	3.70%	2.96%	23.21%

Table 2. Factor correlations

Factor correlations across countries and accounting systems. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapur; 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 Singapur); IA: IASB accounting system.

MARKET FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	
IA	0.41	0.54	0.53	0.56	0.61	0.58	0.31	0.39	0.44	0.57	0.41	0.57	0.46	1.00

SIZE FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	
IA	0.23	0.35	0.34	0.29	0.05	0.29	0.09	-0.03	0.09	0.30	0.13	0.32	0.05	1.00

BOOK-TO-MARKET FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	

IA	0.21	0.15	0.23	0.31	0.06	0.14	0.12	0.11	0.18	0.30	0.14	0.32	0.19	1.00

Table 3. Descriptive statistics on factors

This table shows 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: Singapur; 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 Singapur); IA: IASB accounting system.

MARKET FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	0.0072
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	0.0662

SIZE FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	0.0044
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	0.0466

BOOK-TO-MARKET FACTOR

	AU	CA	UK	US	DEU	FR	JP	MY	SG	WL	CN	CM	AS	IA
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	0.0066
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	0.0672

Table 4. Different versions of Fama-French model and beta coefficients.

This table shows results obtained using value weighted Fama-French factors. The betas are estimated, for each firm and month, using rolling time series regressions of the Fama-French setup: $R_{it} - R_{ft} = \beta_{oit} + \beta_{1it}(R_{mt} - R_{ft}) + \beta_{2it}SMB_t + \beta_{3it}HML_t + \varepsilon_{it}$. The values showed in this table are means of monthly averages for all firms. Residual: Mean residual for each model. Absolute Residual: Mean of absolute residuals. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapur. Domestic: Domestic version of Fama-French model; Accounting-System: Version of Fama-French model taking into account only countries in the same accounting system; World: World version of Fama-French model. ***Significant at 1% level, **Significant at 5% level and *Significant at 10% level.

Country	Model	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	Residual	Absolute Residual	R^2 (%)
AU	Domestic	0.0070***	0.4940***	0.2644***	0.0366***	0.0026	0.7726	15.01
	Accounting-System	0.0050***	0.4026***	0.2188***	0.0866***	0.0058	0.7701	10.32
	World	0.0071***	0.4459***	0.2333***	0.1493***	0.0059	0.7707	10.42
CA	Domestic	0.0042***	0.5940***	0.2521***	0.0176	0.0077	0.7750	18.97
	Accounting-System	0.0008	0.7308***	0.6789***	0.3772***	0.0060	0.7702	18.11
	World	0.0043***	0.7431***	0.7512***	0.3991***	0.0057	0.7712	17.55
UK	Domestic	0.0039***	0.8250***	0.6713***	0.3643***	0.0069	0.7723	18.54
	Accounting-System	-0.0011***	0.6008***	0.4401***	0.3906***	0.0033	0.7701	16.63
	World	0.0015***	0.6410***	0.4964***	0.4455***	0.0032	0.7717	17.17
US	Domestic	0.0006	0.9112***	0.5977***	0.3719***	0.0041	0.7808	24.78
	Accounting-System	0.0009**	0.9570***	0.6255***	0.3826***	0.0042	0.7806	24.90
	World	0.0050***	0.9514***	0.6727***	0.4373***	0.0038	0.7823	23.41
DEU	Domestic	0.0021***	0.2298***	0.5506***	0.1764***	0.0176	0.7314	10.57
	Accounting-System	0.0057***	0.1815***	0.0076	0.1920***	0.0161	0.7285	7.60
	World	0.0018***	0.3519***	0.1298***	0.2663***	0.0149	0.7294	9.23
FR	Domestic	0.0094***	0.4259***	0.0531***	-0.1677***	0.0073	0.7632	14.64
	Accounting-System	0.0144***	0.2576***	0.0727***	-0.0754***	0.0090	0.7592	9.66
	World	0.0081***	0.4404***	0.2766***	0.2947***	0.0048	0.7593	12.15
JP	Domestic	-0.0004	0.5302***	0.9270***	0.4336***	0.0094	0.7665	26.50
	Accounting-System	-0.0001	0.6269***	1.1535***	0.5768***	0.0101	0.7669	26.21
	World	-0.0095***	0.5664***	0.5368***	0.4952***	0.0098	0.7563	10.74
MY	Domestic	-0.0013***	0.7377***	0.9614***	0.7084***	0.0174	0.7595	58.85
	Accounting-System	0.0096***	1.0447***	0.9819***	0.1085***	0.0151	0.7431	46.19
	World	-0.0111***	1.6789***	1.6374***	1.3846***	0.0184	0.7404	20.86
SG	Domestic	0.0077***	1.0877***	0.6222***	0.2290***	0.0142	0.7603	50.49
	Accounting-System	0.0071***	0.9026***	0.4235***	0.5162***	0.0151	0.7493	43.50
	World	-0.0044***	1.6404***	1.0650***	1.1163***	0.0235	0.7365	21.36

Table 5. Differences in estimated betas: World vs domestic models

This table shows results obtained using value weighted Fama-French factors. The betas are estimated, for each firm and month, using rolling time series regressions of the Fama-French setup: $R_{it} - R_{ft} = \beta_{oit} + \beta_{1it}(R_{mt} - R_{ft}) + \beta_{2it}SMB_t + \beta_{3it}HML_t + \varepsilon_{it}$. The monthly mean differences between betas calculated using Domestic and World versions of the Fama-French model are reported in columns 3,5, 7 and 9. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapur. Domestic: Domestic version of Fama-French model; World: World version of Fama-French model. ***Significant at 1% level, **Significant at 5% level and *Significant at 10% level.

		$\hat{\beta}_{0C} - \hat{\beta}_{0W}$	p-value	$\hat{\beta}_{1C} - \hat{\beta}_{1W}$	p-value	$\hat{\beta}_{2C} - \hat{\beta}_{2W}$	p-value	$\hat{\beta}_{3C} - \hat{\beta}_{3W}$	p-value
DOMESTIC-WORLD	**AU**	-0.0002	0.7020	0.0348***	0.0000	0.0347***	0.0000	-0.1065***	0.0000
DOMESTIC -WORLD	**CA**	-0.0001	0.6021	-0.1594***	0.0000	-0.5170***	0.0000	-0.3737***	0.0000
DOMESTIC -WORLD	**UK**	0.0028***	0.0000	0.1873***	0.0000	0.1729***	0.0000	-0.0719***	0.0000
DOMESTIC -WORLD	**US**	-0.0043***	0.0000	-0.0414***	0.0000	-0.0847***	0.0000	-0.0589***	0.0000
DOMESTIC -WORLD	**DEU**	0.0002	0.2758	-0.1999***	0.0000	0.4198***	0.0000	-0.0938***	0.0000
DOMESTIC -WORLD	**FR**	0.0014***	0.0093	-0.0191	0.1082	-0.2226***	0.0000	-0.4585***	0.0000
DOMESTIC -WORLD	**JP**	0.0089***	0.0000	-0.0395**	0.0327	0.4038***	0.0000	-0.0608***	0.0008
DOMESTIC -WORLD	**MY**	0.0095***	0.0000	-0.9432***	0.0000	-0.6804***	0.0000	-0.6888***	0.0000
DOMESTIC -WORLD	**SG**	0.0118***	0.0000	-0.5645***	0.0000	-0.4443***	0.0000	-0.9068***	0.0000

Table 6. Differences in estimated betas: World vs IASB models

This table reports the results of firms around the world which use IASB standards. The betas are estimated, for each firm and month, using rolling time series regressions of the Fama-French setup: $R_{it} - R_{ft} = \beta_{oit} + \beta_{1it}(R_{mt} - R_{ft}) + \beta_{2it}SMB_t + \beta_{3it}HML_t + \varepsilon_{it}$. The values showed in this table are means of monthly averages for all firms. The monthly mean difference between betas calculated using the IASB and World version of the Fama-French model is reported in column 5. World: World version of Fama-French model; IASB: Version of Fama-French model taking into account only firms following the IAS/IFRS standards. ***Significant at 1% level, **Significant at 5% level and *Significant at 10% level.

	IASB	**WORLD**	**IASB - World**	**Value**	**p-value**
$\hat{\beta}_0$	0.0045***	0.0050***	$\hat{\beta}_{0I} - \hat{\beta}_{0W}$	-0.0003	0.5894
$\hat{\beta}_1$	0.7671***	0.8155***	$\hat{\beta}_{1I} - \hat{\beta}_{1W}$	-0.0523***	0.0000
$\hat{\beta}_2$	-0.0958***	0.4655***	$\hat{\beta}_{2I} - \hat{\beta}_{2W}$	-0.5612***	0.0000
$\hat{\beta}_3$	0.0056	0.5963***	$\hat{\beta}_{3I} - \hat{\beta}_{3W}$	-0.5863***	0.0000
Residual	0.0086	-0.0076			
Absolute Residual	0.7727	0.7352			
R^2 (%)	25.68	14.45			

Table 7. Final estimation of the four specifications of the F-F model: Value weighted Book-to-Market portfolios

This table shows 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. The regressions correspond to Domestic, International, World and Accounting system versions of the Fama and French model applied to the high and low book-to-market portfolios. Average return is mean raw return, α is the estimated intercept of the 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: Singapur. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

			Domestic Accounting System		**International**		**World**		**Global Accounting System**	
		Average Return (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	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 8. Final estimation of the four specifications of the F-F model: Equally weighted Book-to-Market portfolios

This table shows 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. The regressions correspond to Domestic, International, World and Accounting system versions of the Fama and French model applied to the high and low book-to-market portfolios. Average return is mean raw return, α is the estimated intercept of the 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: Singapur. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

			Domestic Accounting System		International		World		Global Accounting System	
		Average Return (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	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 9. Final estimation of the four specifications of the F-F model: Size and Book-to-Market portfolios

This table shows results obtained using value and equally weighted factors and value and equally weighted portfolios respectively. SH-BL is a portfolio long in smallest 20% assets and highest 20% book-to-market ratio and short in the biggest 20% and lowest 20% book-to-market ratio. The regressions correspond to Domestic, International, World and Accounting system versions of the Fama and French model applied to the size and book-to-market portfolios. Average return is mean raw return, α is the estimated intercept of the 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: Singapur. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

			Domestic Accounting System		**International**		**World**		**Global Accounting System**	
Value weighted factors and porfolios		Average Return (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	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 10. Wald Test for jointly zero intercepts

This table shows results of the Wald test where the null hypothesis is that all intercepts are jointly equal to zero. Both value weighted and equally weighted factors are used. 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. SH-BL is a portfolio long in smallest 20% assets and highest 20% book-to-market ratio and short in the biggest 20% and lowest 20% book-to-market ratio. χ^2 is the value of the Wald test. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

		Domestic Accounting System		**International**		**World**		**Global Accounting System**	
		χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
High	**Value Weighted**	14.41	0.1083	12.26	0.1990	10.41	0.3184	17.19	0.0458
Low	**Value Weighted**	13.90	0.1261	11.69	0.2315	11.82	0.2236	12.50	0.1866
High	**Equally Weighted**	17.79	0.0377	15.30	0.0830	29.04	0.0006	13.90	0.1258
Low	**Equally Weighted**	15.18	0.0860	12.19	0.2026	16.08	0.0652	13.18	0.1546
SH-BL	**Value Weighted**	17.95	0.0358	18.01	0.0350	13.49	0.1415	17.77	0.0380
SH-BL	**Value Weighted**	20.96	0.0128	28.07	0.0009	16.66	0.0543	14.36	0.1102

Table 11. Final estimation of F-F model: Firms following IASB standards

This table shows the results for firms around the world which 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 smallest 20% assets and highest 20% book-to-market ratio and short in the biggest 20% and lowest 20% book-to-market ratio. World: World version of Fama-French model; IASB Accounting System: Version of Fama-French model taking into account only firms following the IAS/IFRS standards.

			World		**IASB Accounting System**	
		Average Return (%)	α (%)	Adj. R^2 (%)	α (%)	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

APPENDIX III. Some robustness analyses.

1) Controlling for firm's characteristics

We present here the results of replicating the same analysis in the main text while controlling for firm/portfolio characteristics (profitability, growth, leverage and liquidity). In order to do so, we add to the different versions of the model the following four explanatory variables:

$ROA_{it} = \frac{net\ income_{it}}{Total\ Assets_{it}}$ → In order to control for profitability

$growth_{it} = \frac{Sales_{it} - Sales_{it-1}}{Sales_{it-1}}$ → In order to control for growth

$leverage_{it} = \frac{Total\ Liabilities_{it}}{Total\ Assets_{it}}$ → In order to control for leverage

$liquidity_{it} = number\ shares\ traded_{it} \times Price_{it}$ → In order to control for liquidity

The following tables replicate Tables 7, 8, 9 and Table 11, where the above four variables have been included in the F-F regressions.

Table A1. Final estimation of the four specifications of the F-F model: Value weighted Book-to-Market portfolios

This table shows 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. The regressions correspond to Domestic, International, World and Accounting system versions of the Fama and French model applied to the high and low book-to-market portfolios. Average return is mean raw return, α is the estimated intercept of the Fama-French model and Adj.R² is the adjusted R-Square coefficient. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapur. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

		Domestic Accounting System		International		World		Global Accounting System	
		α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)
High	AU	-0.26*	18.28	-0.32**	24.69	-0.38***	19.07	-0.37***	17.84
High	CA	0.02	4.51	-0.03	12.32	-0.05	5.39	-0.04	4.67
High	UK	7.31	13.37	8.45*	16.51	7.12	12.32	7.08	12.23
High	US	-0.36*	13.48	-0.26	17.03	-0.33*	14.77	-0.35	13.42
High	DEU	0.80***	20.11	0.79***	22.43	0.82***	21.54	0.75***	29.24
High	FR	-9.10***	18.03	-8.87***	18.77	-9.12***	17.06	-10.18***	22.58
High	JP	0.08	30.30	0.10	32.30	0.18*	20.20	0.15*	24.20
High	MY	-0.09	14.74	-0.09	018.15	-0.10	14.39	-0.10	13.41
High	SG	0.11	27.92	0.13	29.62	0.13	27.69	0.12	27.95
Low	AU	4.33*	57.09	3.67	61.04	14.73	36.51	14.73	37.37
Low	CA	0.16*	18.38	0.18*	21.02	0.25***	14.65	0.26***	14.48
Low	UK	10.97***	76.56	10.94***	76.93	11.37***	66.44	11.28***	66.14
Low	US	17.87	17.49	17.70	18.11	24.17*	14.44	24.69*	14.02
Low	DEU	-0.15	6.25	-0.11	9.54	-0.03	5.07	-0.30	12.05
Low	FR	26.90	25.41	26.79	25.75	17.06	8.40	18.29	11.74
Low	JP	0.23	25.25	0.20	28.20	0.58**	23.57	0.50*	25.10
Low	MY	0.28	12.81	0.33*	21.10	0.37**	15.20	0.28	9.24
Low	SG	-0.32*	10.61	-0.28*	16.21	-0.28**	12.45	-0.29**	10.20

Table A2. Final estimation of the four specifications of the F-F model: Equally weighted Book-to-Market portfolios

This table shows obtained results 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 book-to-market on domestic, international, world and accounting system versions of Fama and French model. Average return is mean raw return, α is the intercept of Fama-French model and Adj.R² is the adjusted R-Square coefficient. AU: Australia; CA: Canada; UK: Great Britain; US: USA; DEU: Germany; FR: France; JP: Japan; MY: Malaysia; SG: Singapur. 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: Version of Fama-French model taking into account only countries in the same accounting system.

		Domestic Accounting System		International		World		Global Accounting System	
		α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)
High	**AU**	0.21	24.80	0.20	24.86	0.15	24.30	0.16	24.38
High	**CA**	-0.14	11.13	-0.13	16.13	-0.17*	7.19	-0.17*	7.00
High	**UK**	-2.15	17.77	-2.57	18.72	-2.31	17.35	-1.77	16.54
High	**US**	-0.38*	13.58	-0.39*	16.58	-0.34	11.27	-0.35*	14.70
High	**DEU**	0.01	9.52	0.00	11.05	-0.02	8.87	-0.06	10.77
High	**FR**	-0.65	7.44	-0.55	7.98	-0.65	6.15	-0.73	7.78
High	**JP**	-0.03	10.20	-0.02	12.10	-0.04	9.23	-0.03	10.01
High	**MY**	-0.08	8.97	-0.08	10.64	-0.09	7.17	-0.08	10.73
High	**SG**	-0.29	26.63	-0.31	27.96	-0.30	26.68	-0.26	27.09
Low	**AU**	-0.90	61.01	-1.50	63.42	-1.10	61.31	-0.99	61.19
Low	**CA**	0.13	3.97	0.15	10.58	0.10	6.78	0.10	7.04
Low	**UK**	0.12	12.70	-0.00	23.23	-0.07	13.78	0.00	12.29
Low	**US**	0.09	16.16	0.08	17.88	0.17	11.58	0.24	15.82
Low	**DEU**	-0.04	6.16	-0.05	12.06	-0.05	8.49	-0.05	8.19
Low	**FR**	-3.98***	31.58	-3.92***	35.83	-4.00***	30.50	-3.85***	32.26
Low	**JP**	0.09	12.07	0.08	13.51	0.21	12.01	0.16	10.01
Low	**MY**	-0.02	13.73	-0.02	16.00	-0.05	11.27	-0.05	16.60
Low	**SG**	0.48*	18.42	0.38	20.03	0.45	18.52	0.50*	19.71

Table A3. Final estimation of the four specifications of the F-F model: Size and Book-to-Market portfolios

This table shows results obtained using value and equally weighted factors and value and equally weighted portfolios respectively. SH-BL is a portfolio long in smallest 20% assets and highest 20% book-to-market ratio and short in the biggest 20% and lowest 20% book-to-market ratio. The regressions correspond to Domestic, International, World and Accounting system versions of the Fama and French model applied to the size and book-to-market portfolios. Average return is mean raw return, α is the estimated intercept of the 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: Singapur. Domestic Accounting System: Domestic version of Fama-French model; International: International version of Fama-French model; World: World version of Fama-French model; Global Accounting System: Version of Fama-French model taking into account only countries in the same accounting system.

		Domestic Accounting System		International		World		Global Accounting System	
Value weighted factors and porfolios		α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)
SH-BL	**AU**	1.06***	24.81	1.18***	29.06	1.08***	27.05	1.00***	27.80
SH-BL	**CA**	-0.05**	21.18	-0.05**	24.32	-0.04*	17.05	-0.04*	16.19
SH-BL	**UK**	1.64***	75.77	1.65***	76.15	1.57***	75.00	1.57	76.05
SH-BL	**US**	-0.10*	10.47	-0.07	13.60	-0.10*	10.43	-0.10*	10.38
SH-BL	**DEU**	-0.09***	12.04	-0.09***	12.67	-0.10***	11.49	-0.11***	13.86
SH-BL	**FR**	-11.41***	30.24	-11.82***	30.96	-11.40***	29.67	-11.46***	32.62
SH-BL	**JP**	-0.19*	18.04	-0.15*	19.02	-0.30**	16.17	-0.21*	17.23
SH-BL	**MY**	0.07*	26.95	0.07*	28.17	0.05	15.56	0.05	23.12
SH-BL	**SG**	-0.12***	18.33	-0.13***	19.51	-0.13***	18.81	-0.12**	20.14
Equally weighted factors and portfolios									
SH-BL	**AU**	1.15	11.67	1.09	14.31	1.02	11.01	0.70	14.74
SH-BL	**CA**	-0.03	18.28	-0.03	20.10	-0.03	17.75	-0.03	17.28
SH-BL	**UK**	0.31***	56.37	0.32***	59.12	0.32***	57.82	0.31***	55.85
SH-BL	**US**	-0.16***	20.12	-0.15***	23.12	-0.16***	20.26	-0.16***	18.25
SH-BL	**DEU**	-0.08***	10.31	-0.08***	13.66	-0.08***	12.32	-0.08***	9.52
SH-BL	**FR**	-9.11***	27.01	-9.80***	29.28	-9.62***	28.01	-8.69***	27.94
SH-BL	**JP**	-0.03	31.20	-0.03	31.33	-0.08*	30.27	-0.04	31.07
SH-BL	**MY**	0.04	23.46	0.04	24.94	0.05	17.24	0.04	26.27
SH-BL	**SG**	-0.10***	19.09	-0.10**	19.96	-0.11***	19.01	-0.09**	19.51

Table A4. Final estimation of F-F model: Firms following IASB standards

This table shows the results of firms around the world which using 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 smallest 20% assets and highest 20% book-to-market ratio and short in the biggest 20% and lowest 20% book-to-market ratio. World: World version of Fama-French model; IASB Accounting System: Version of Fama-French model taking into account only firms following the IAS/IFRS standards.

		World		**IASB Accounting System**	
		α (%)	Adj. R^2 (%)	α (%)	Adj. R^2 (%)
Value weighted	High	-0.33	23.60	-0.13	55.44
	Low	0.18	6.09	-0.01	32.99
Equally weighted	High	-0.06	7.58	-0.03	84.97
	Low	0.11	9.06	0.05	76.31
Value weighted	SH-BL	0.09	40.62	0.21	66.95
Equally weighted	SH-BL	0.21	17.12	0.35**	58.77

2) A different valuation model

Following the framework in Ohlson (1995), numerous studies have investigated the relation between the market value of equity and accounting variables (book value and earnings). We evaluate the Ohlson model in the different countries of our sample to see whether there exist differences in the estimated coefficients caused by differences in accounting standards. The equation, estimated by Ordinary Least Squares (OLS), is:

$$\frac{V_{it}}{V_{it-1}} = \beta_0 + \beta_1 \frac{bv_{it}}{V_{it-1}} + \beta_2 \frac{x_{it}}{V_{it-1}} + \varepsilon_{it}$$

where V_{it} is market value of firm i at the end of fiscal year t, bv_{it} is book value of firm i in year t, x_{it} are earnings before extraordinary items of firm i in year t less any type of dividends, ε_{it} is residual error on firm i in year t and V_{it-1} is market value in year $t-1$.

The results indicate that indeed the coefficients change and that there seems to be some higher comparability of these coefficients *within* the accounting system, thus again giving some evidence for the impact of the accounting system. This last result, however, is subject to further validation and analysis.

Table A5. Regression results based on Ohlson model.
This equation is estimated by OLS:

$$\frac{V_{it}}{V_{it-1}} = \beta_0 + \beta_1 \frac{bv_{it}}{V_{it-1}} + \beta_2 \frac{x_{it}}{V_{it-1}} + \varepsilon_{it}$$

where V_{it} is market value of firm i at the end of fiscal year t, bv_{it} is book value of firm i in year t, x_{it} are earnings before extraordinary items of firm i in year t less any type of dividends, ε_{it} is residual error on firm i in year t and V_{it-1} is market value in year $t-1$; * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

Country	β_0	β_1	β_2	$R^2_{adj.}$ (%)	N
AU	1.09568***	0.15965***	-0.10647***	5.14	3,670
CA	1.35157***	0.10462***	-0.07229***	4.58	6,591
UK	1.25953***	0.73960***	-6.22333***	47.46	12,565
US	2.34650***	0.00453**	-0.01083*	0.01	42,171
DEU	1.59379***	0.09034	0.00176	0.02	6,399
FR	1.09049***	0.00982***	-0.05266***	5.91	6,257
JP	1.32658***	0.07852	0.00326	1.03	37,923
MY	0.87405	0.07564	-0.05810	23.41	6,573
SG	0.98154***	0.10616***	-0.02140	5.16	3,713
IAS	1.01736***	0.23962***	-0.78855***	20.97	2,529