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Has the Pricing of Stocks Become More Global?[*]

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Abstract

We show that in recent years global factor models have been catching up significantly with their local counterparts in terms of explanatory power (R^2) for international stock returns. This catch-up is driven by a rise in global factor betas, not a rise in factor volatilities, suggesting that the effect is likely to be permanent. Yet, there is no conclusive evidence for a global factor model catch-up in terms of pricing errors (alpha) or a convergence in country-specific factor premia. These findings suggest that global financial markets have progressed surprisingly little towards fully integrated pricing, different from what should be expected under financial market integration. We discuss alternative explanations for these patterns and assess implications for practice.

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1 Introduction

We investigate whether global factor models have been catching up with local models in explaining international stock returns and seek to identify potential sources of any such changing performance. Our work is motivated from the fact that in many academic and practical applications, such as performance attribution regressions and calculations of the cost of capital, researchers need to compute an asset's expected return. While empirically motivated multi-factor models such as the three factor model of Fama and French (1993) (in short, Fama-French) or the four factor model of Carhart (1997) (in short, Carhart) are commonly recognized as useful tools in this context, it is much less clear whether one should use local or global versions of these models.

The literature on global vs. local asset pricing comes to arguably puzzling conclusions. On the one hand, it is commonly accepted that in a world with efficient and integrated financial markets a single set of global risk factors should price the cross-section of international stock returns. On the other hand, despite the perception that developed markets are nowadays highly financially integrated and that globalisation has progressed significantly in recent years (see, e.g., Rey (2015)), empirical factor models computed from local stock market data significantly outperform global counterparts empirically. For example, Griffin (2002) and Hou et al. (2011) test local vs. global versions of the Fama-French model on data from several advanced economies. They conclude that local models outperform global ones in terms of pricing errors (alpha) and time-series explanatory power (R^2). Similarly, Fama and French (2012) examine the performance of local vs. global Fama-French and Carhart factors in pricing the cross-section of regional stock portfolios and find that local (regional) factors outperform global ones. Even more strikingly, in these studies, hybrid model specifications including both local factors plus factors constructed from all international securities except for the country in which the model aims to explain returns (so-called "foreign" factors) do not conclusively outperform purely local model versions.[1]

In these studies, estimation is performed unconditionally over long periods spanning the 1980s to the 2010s. However, tests with parameters fixed over a very long time-period do not allow for the flexibility needed to account for the potentially increasing financial market integration over the past decades. As markets become more integrated, the asset return generating process

[1] Hou et al. (2011) present a model which includes the market factor, a value factor constructed from cashflow-to-price ratios, and a momentum factor. The hybrid version of the model yields lower rejection rates but similar average pricing errors and R^2 when compared to the purely local version of the model (Hou et al. (2011, Table 5)).

will ultimately be altered and, therefore, factor exposures as well as associated factor premia will change (see Bekaert and Harvey (1995)).

Against this backdrop, our aim in this paper is to tackle the following two questions:

1. Has global model performance improved relative to local model performance over time?
2. What is the source of a potential improvement of global models?

To answer these questions, we use data for 18 capital markets and the period from 1989 to February 2012 (or 29 capital markets for partially shorter time periods) to assess the relative performance of local vs. global versions of the market (CAPM), Fama-French and Carhart models on a rolling period basis.[2, 3] In extensions, we also account for exchange rate risk or use factors extracted by principal component analysis, with very similar results.

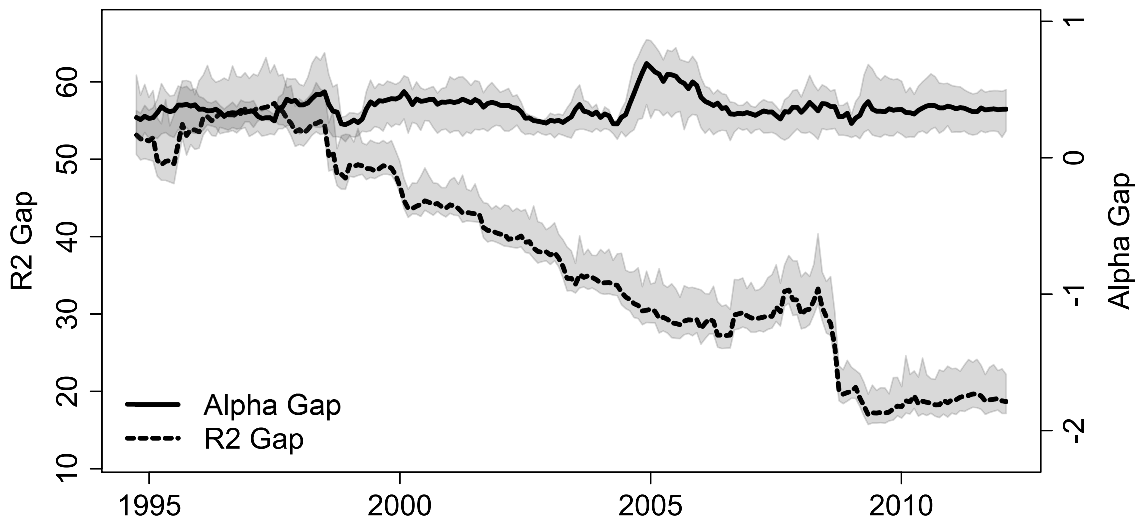
As for the first research question, we find that local factor models still outperform their global counterparts in terms of R^2 in recent years, but that global models have been catching up considerably. The observed time trends are both statistically and economically significant. They are driven by an improvement of global models and not deteriorating local model performance. The catch-up in the relative performance of global vis-a-vis local models occurs in all countries under study, even though the strength of the trends and statistical significance differ across countries. These main empirical results are illustrated in Figure 1 (see next page).

In contrast to the rise in relative global factor model R^2, we do not find any conclusive evidence for a similar catch-up of global models in terms of pricing errors (alphas), as illustrated in Figure 1. Neither when aggregated across countries, nor at the country level, do we observe any economically and statistically significant downward trend in pricing errors of global factor models relative those of local models. These results hold controlling for exchange rate risk factors following Kolari et al.

[2]We allow variation in model parameters in a non-parametric fashion, as opposed to the conditional approaches used in the international asset pricing literature. We choose this methodology due to the inherent uncertainty with regards to the parametrization of time-varying conditional moments. In fact, in a similar setting to ours, Bekaert et al. (2009) find that conditional beta versions of the CAPM, Fama-French and APT factors significantly underperform time-varying unconditional versions of these factors in explaining the realized correlation structure of international portfolios. In slightly different contexts, Pukthuanthong and Roll (2009) and Brusa et al. (2015) also choose time-varying unconditional approaches. Examples of contributions in the international asset pricing literature that use conditional (parametric) approaches include Harvey (1991), Bekaert and Harvey (1995), De Santis and Gerard (1997), Carrieri et al. (2007), Chambet and Gibson (2008), Arouri et al. (2012), among many others.

[3]In most of our tests, we rely on foreign instead of global factors so as to avoid that our results are driven by the weight of local components in the global factors. All results are quantitatively and qualitatively similar for both types of factors, though. In the following, for ease of exposition, unless the distinction is appropriate and explicitly stated, by global factors we mean both global and foreign factors.

Figure 1. Global asset pricing models have been catching up in terms of R^2, but not alpha.



This figure illustrates the time-variation in the relative performance of global vs. local linear factor models. Relative performance is evaluated based on R^2 and alpha gaps. R^2 gaps are given by the difference between the country-specific local and global factor R^2s (equally weighted average). Likewise, we construct the alpha gap as the difference between country-specific global and local factor absolute alphas (equal-weighted average). The factor models draw on the four-factor Carhart specification (market, size, value and momentum). The underlying performance metrics are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors. These two relative performance metrics are then aggregated across the main sample of 18 markets in this study. The bold lines are the respective estimated gap series, whereas the grey shaded areas represent 95% bootstrap confidence intervals. Local factors are based on data of the respective capital market only, whereas global factors are value-weighed averages of local factors. A more detailed description of the set of countries as well as test asset and factor construction is given in Section 2.2. Alphas are shown in monthly percentage points and the dates on the x-axes represent the end-dates of the rolling windows.

(2008) or "Dollar" and "Carry" factors as in Brusa et al. (2015)). And, they also hold with APT factors from individual stock returns using the procedure of Jones (2001).

Our second contribution is to shed light on how these patterns in the relative performance between global and local models can best be understood, in particular the seemingly opposite conclusions based on R^2 and alpha.

Under *financial market integration*, assets with perfectly correlated cash-flows command the same prices irrespective of the country they are traded in (Stulz (1981)). Local country-specific risks that are not common across countries are diversifiable and, therefore, a single set of global factors should explain expected returns of all assets in the world. That is, financial market integration implies *globally integrated pricing* of assets. Locally constructed factors, on the other hand, should fare worse at pricing assets (see Stulz (1995), Fama and French (2012)). By contrast, financial segmentation implies *local pricing*, that is, risks that are common across countries will in general command different factor risk prices. More specifically, even under *perfect real integration* (where factor risk is entirely driven by common global real shocks), factor premia could in general remain quite different across countries. Put differently, while real integration would eventually increase global comovement in cash-flows, in the absence of financial integration discount rates may remain asynchronous across countries.[4]

Overall, theoretical considerations inspired by existing literature suggest that while real integration would explain, even with local pricing, an improvement of global factors' R^2 (e.g., through higher commonality in cash-flows), no uniform trend in pricing errors across countries would necessarily occur. By contrast, the process of financial integration would eventually lead to both higher global factor R^2 (e.g., through higher commonality in discount rates) *and* lower global model pricing errors (alphas), as local risks become more and more diversifiable and pricing is set more and more by the global marginal investor. Further, for any form of integration to be a viable explanation of our results on R^2, changes in local factors' exposures to global factors rather than factor volatilities must be the driver.

Guided by these considerations, we conduct tests to dissect the observed patterns into these possible drivers. Our results suggest that the R^2 catch-up of global factor models is indeed due to increasing global factor betas, i.e., increasing local asset (factor) exposures on global factors, rather than a rise in global factor volatilities. We then proceed by directly examining the components of local factor risk premia, given the lack of evidence of decreasing global factor model pricing errors. Based on these tests, we find no evidence that factor risk premia have become more global over time. Nor do we observe that the performance of hybrid models that include both local as well as foreign factors has improved over time relative to that of purely local factors.

All in all, these findings suggest that – contrary to what should be expected under financial market integration – global financial markets have progressed surprisingly little towards fully integrated pricing. Progressing real integration in the presence of some limits to international arbitrage provides a plausible explanation for the documented patterns in the relative performance of the local and global versions of the factor models we study.[5]

[4] Bekaert et al. (2013) also emphasize the distinction between financial and real integration.

[5] As with previous international asset pricing literature, our tests are subject to the usual joint hypothesis critique. Our hypotheses with regards to real vs. financial integration assume efficient markets and that the models we estimate are correct. Hence, we assume that depending of the level of financial market integration a given

One may wonder how this interpretation squares with the observation that nowadays legal barriers to foreign investment are basically non-existent in developed markets. One potential reason is that indirect barriers (such as informational asymmetries between local and foreign investors or home/foreign bias in general) remain strong enough to discourage arbitrage across countries (see, e.g., Cooper et al. (2012) and the references therein). As a consequence, even though the real side of economies across the world may have become more integrated over time, integrated pricing as implied by financial market integration in its purest form may still have remained infeasible.

Our findings have two main implications. First, even in the most recent period of time, for practical purposes such as cost of capital and performance attribution calculations, local factors are more suitable than global factors. Second, narrow measures (e.g., based on correlations, R^2 or pricing errors alone) each potentially lead to very different conclusions on the level and evolution of market integration. Our results thus suggest that multiple dimensions need to be assessed in order to understand the complex process and rich nature of integration.

Related literature. The papers closest to ours are the contributions in international asset pricing assessing the performance of local and/or global single- or multi-factor models with firm-level data. For example, studies such as Griffin (2002), Hou et al. (2011) and Fama and French (2012) test local (or regional) vs. global versions of the Fama-French (and Carhart) factors unconditionally. Asness et al. (2013) examine value and momentum returns across eight different markets and asset classes. However, they do not directly test the performance of local vs. global factors except for in the U.S.. Karolyi and Wu (2014) propose new hybrid (partial segmentation) versions of the Fama-French and Carhart Factors, which outperform their global counterparts and perform similarly as the local counterparts. We add to this literature (1) by examining the time-trends of global vs. local model performance and (2) by drawing conclusions from a simple analytical framework on the potential economic sources of the time patterns we uncover.

Other contributions in an international context have also examined versions of the Fama-French or Carhart factors dynamically. Allowing for time-variation in factor exposures, Bekaert

version of either the market, Fama-French, Carhart or exchange rate risk augmented Carhart factors explains the cross-section of expected returns worldwide. See, for example, Fama and French (2012) for an exposition on the limitations in international asset pricing model testing and the discussion in Griffin (2002) on risk vs. behavioral explanations for the Fama-French factors. Kozak et al. (2015) provide a recent exposition of the difficulties of distinguishing between rational and behavioral factor explanations.

et al. (2009) show that hybrid Fama-French models (which include global and regional factors) explain international return co-movements better than purely global factor models. They do not not examine trends in local vs. global factor model R^2 or pricing errors, though. Moreover, in a recent paper, Brusa et al. (2015) propose a new international three factor model, which adds two currency factors ("Dollar" and "Carry") to a global equity factor denominated in local currencies. They show that their model outperforms both the world (global) CAPM and the international CAPM estimated by Dumas and Solnik (1995) and fares similarly relative to the global Carhart factors in pricing a wide cross-section of international returns. However, they do not compare the relative performance of global factor models to local factor models over time.

Finally, our work on local firm portfolios is complementary to the large strand of international asset pricing literature using aggregate market-level data (see also Karolyi and Stulz (2003) and Lewis (2011) for reviews). For example, an extensive body of research contributions has examined the correlation structure of international equity markets (see, e.g., Longin and Solnik (1995) and Goetzmann et al. (2005)). Beginning with tests of the global CAPM (see Harvey (1991) and De Santis and Gerard (1997), among others), a lot of effort has been directed towards measuring market integration. Key contributions that use econometrically estimated indicators include Bekaert and Harvey (1995), Carrieri et al. (2007), Pukthuanthong and Roll (2009), Arouri et al. (2012), Carrieri et al. (2013), among many others. Bekaert et al. (2011, 2013) develop a non-parametric measure based on industry valuation differentials which encompasses both real and financial market integration. While our approach employs traditional model-based estimation, using local firm portfolios as opposed to market indices has the advantage that these portfolios present significant cross-sectional variation in average returns, allowing for more powerful tests.

Plan of the paper. Section 2 deals with the first research question, namely, *if* there is a catch-up of global model performance. Section 3 addresses the second research question, namely, *how* that potential catch-up can be interpreted, that is, what the underlying economic reasons are for the potential catch-up. Finally, Section 4 provides a series of additional tests and robustness checks. Section 5 concludes.

2 Is there a Catch-up of Global Factor Models?

2.1 Estimating Model Performance

To assess the relative performance of competing models, we employ the time-series regression approach of Black et al. (1972), which has also been used by Griffin (2002), Hou et al. (2011) and Fama and French (2012), for example. More specifically, we perform time-series regressions with local, foreign and global factors, that is,

$$r_{it} = \alpha_i + \sum_{k=1}^{K} \beta_{ik} f_{kt} + \varepsilon_{it}, \tag{1}$$

where r_{it} denotes the excess return (in U.S. dollar) of local asset i, α_i is the asset-specific intercept, β_{ik} is the k-th factor loading of asset i, f_{kt} is the k-th factor realization (in U.S. dollar) and ε_{it} is the asset-specific idiosyncratic return. Let superscripts L, G, F denote *local* factors (constructed from data of the local capital market only), *global* factors (constructed from *all* capital markets under study) and *foreign* factors (constructed from all capital markets under study *excluding* the local capital market for which the model attempts to explain returns), respectively.

Hybrid models, denoted by superscript H, include both local and foreign factors. Further, denote by (i) MRF_t the return of the broad market portfolio in excess of the risk-free rate, (ii) SMB_t the difference in returns on a small stocks portfolio and a large stocks portfolio, (iii) HML_t the difference in returns on a portfolio of high book-to-market (value) stocks and a portfolio of low book-to-market (growth) stocks, and (iv) WML_t, the difference in returns on a portfolio of past year's return winners and a portfolio of past losers. The main set of models we consider can thus be summarized as follows:

- Local/Global/Foreign factor models:
  - Market (MRF): $\{f_{kt}^{MRF,L/G/F}\} = \{MRF_t^{L/G/F}\}$
  - Fama-French (FF): $\{f_{kt}^{FF,L/G/F}\} = \{MRF_t^{L/G/F}, SMB_t^{L/G/F}, HML_t^{L/G/F}\}$
  - Carhart (CH): $\{f_{kt}^{CH,L/G/F}\} = \{MRF_t^{L/G/F}, SMB_t^{L/G/F}, HML_t^{L/G/F}, WML_t^{L/G/F}\}$
- Hybrid factor models:
  - Market (MRF): $\{f_{kt}^{MRF,H}\} = \{MRF_t^{L}, MRF_t^{F}\}$
  - Fama-French (FF): $\{f_{kt}^{FF,H}\} = \{MRF_t^{L}, SMB_t^{L}, HML_t^{L}, MRF_t^{F}, SMB_t^{F}, HML_t^{F}\}$

– Carhart (CH): $\{f_{kt}^{CH,H}\} = \{MRF_t^L, SMB_t^L, HML_t^L, UMD_t^L, MRF_t^F, SMB_t^F, HML_t^F, WML_t^F\}$

In Section 4, we check the consistency of the results of the main set of models by examining foreign and global Carhart specifications which are augmented by exchange rate risk factors. We also investigate local, foreign and global model versions, with factors extracted as statistical principal components.

If the model we employ explains the cross-section of local test asset average returns well, then the intercepts, i.e. the alphas, should be jointly close to zero. The alphas are therefore a measure of the corresponding model's pricing errors. In addition, we evaluate each model's time-series explanatory power by means of the regressions' (adjusted) R^2.

In all regression specifications, our left-hand-side variables are local size and book-to-market and size and momentum sorted portfolios. The advantage of local test assets as opposed to globally sorted test assets is that they allow us to directly test local vs. global factor models. Importantly, global test assets may conceal priced country-specific return components and hence bias results towards accepting integrated asset pricing (see, e.g., Fama and French (2012) for a similar argument). In fact, in the absence of financial market integration, we would attempt to price portfolios that are generally not available to investors.

2.2 Data and Summary Statistics

For the primary analysis, we use a dataset compiled by Schmidt et al. (2015) which includes U.S. dollar (USD) denominated individual stock returns and market values, local factor and characteristic sorted portfolio returns, as well as risk-free rates for 29 countries at a monthly frequency.[6]

There is a trade-off between coverage (number of countries and sample period length) and overall data quality. Our dataset includes 29 countries with differing initial availability of country-specific factor and test asset returns. In general, book-to-market data is reliably available only from the late 1980s onwards. Further, our aim is to capture the potential effects of financial

[6] The data are made publicly available by the authors and can be accessed via http://www.bf.uzh.ch/risk-factors. An advantage of the dataset is that its underlying data are drawn from a single source (Thomson Reuters Datastream and Worldscope) and that it is largely free of survivorship bias. After a series of static and dynamic screens, the constructed market factors closely mimic the realizations of well known publicly available market indices. See Schmidt et al. (2015) for details and comparisons with other data sources.

market integration over the last two to three decades and ensure maximum comparability with previous literature. Therefore, for the main analysis, we require data to be available for the period of November 1989 to February 2012. Our primary dataset hence includes 18 countries: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Italy, Japan, the Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, the United Kingdom (U.K.), and the United States (U.S.). For 11 additional countries test asset and/or factor returns are available from the early or mid 1990s onwards only. In Section SA.1 of the Supplementary Appendix we show that the results are qualitatively the same with the extended sample of 29 countries.[7]

Factors. To construct the local market (MRF), size (SMB) and value (HML) factor mimicking portfolios, we largely follow Fama and French (1993). Similarly, the local momentum (WML) factor is constructed in the spirit of Carhart (1997). Details are provided in Section A.1 of the Appendix. Further, we follow Griffin (2002) and construct global versions of the factors by taking value-weighted averages of the respective local factors. We also compute so-called *foreign* factors, which are defined as value-weighted averages of local factors, excluding the country in which the model aims to explain returns. An alternative approach to construct global factors is to compute the factors from global sorts. We show in Section 4 that results are qualitatively the same with this method, drawing on the global factors of Fama and French (2012). Throughout the analyses, for all factors under study, i.e., local, foreign and global factors, returns are denominated in U.S. dollar.

Test Assets. Finally, in line with previous literature, we use local double sorted characteristic portfolios as test assets in all asset pricing tests that follow. The portfolios are constructed from the intersection of (three) size and (three) book-to-market groups (annual sorting as with SMB and HML) and (three) size and (three) momentum groups (monthly sorting as with WML), i.e., there are 18 local portfolios in each country in total. The three-by-three approach is motivated by the relatively small number of firms in smaller markets (see, e.g., Bekaert et al. (2009)). All

[7] Sequentially adding countries to the sample can potentially obscure existing trends in models' time series explanatory power and pricing errors. For example, if global factor models have lower R^2 and higher alphas in countries which appear later in the sample than the average country of the initial sample, any otherwise existing trends in our country-aggregated results would be reduced or even completely obliterated by the inclusion of these "late arrivals". Therefore, we conservatively focus on the countries for which the complete time series is available. The additional countries are: Czech Republic, Finland, Hong Kong, Hungary, Iceland, Ireland, Luxembourg, Poland, Portugal, Slovakia and Turkey.

test asset returns are denominated in U.S. dollar and are computed in excess of the U.S. 3-month T-bill rate; see Section 4 for robustness checks.

Summary Statistics. Panel A of Table 1 shows country-aggregated descriptive statistics of the test assets. We report the country-averaged mean annualized returns (premia), annualized volatility, t-statistics of the premia (t-stat) and the percentage of premia which are positive and statistically significant at the 5% level (% Pos. Rejections).

[Insert Table 1 about here]

In line with Fama and French (2012) and Asness et al. (2013), we find large international value and momentum premia. Within each of the extreme size portfolios, high book-to-market (value) and high momentum (winner) stocks feature higher returns and positive rejection rates than low book-to-market (growth) and low momentum (loser) stocks. Moreover, while there is a strong size effect in size/momentum sorted portfolios, size premia in the size/book-to-market sorted portfolios are generally small.[8]

Summary statistics on the local, foreign and global versions of the factors are reported in Panel B of Table 1. Again, country-averaged mean annualized premia, volatility, t-statistics of the premia and the percentage of positive rejection rates are shown. The market factor premia are positive but noisy, consistent with Hou et al. (2011) and Fama and French (2012), for example. The average local market premium amounts to 6.83% (p.a.) but we observe positive rejections at the 5% significance level in only 11% of the countries under study. The global market risk premium and the country-averaged foreign market risk premia are almost identical (4.13% and 4.14% p.a., respectively). Average premia on the size factor are small in magnitude and even negative for country-averaged local factors (-0.39%), consistent with evidence on diminishing size premia.[9] By contrast, we observe large value and momentum factor premia and in line with prior literature, momentum factors exhibit the strongest return patterns among the factors we consider.

[8]Unlike Fama and French (2012), we do not observe a reverse size-effect in the size/book-to-market portfolios. Thus, on average small-growth portfolios do not feature significantly lower average returns and positive rejection rates than large-growth portfolios. The most likely reason is that Fama and French (2012) use finer five-by-five sorts than our three-by-three sorts and hence their extreme low book-to-market portfolios likely have a stronger tilt towards growth stocks than ours.

[9]For an overview of international evidence on the size effect, see van Dijk (2011).

The average local value (momentum) premium amounts to 4.91% (9.84%), p.a., and is statistically significant in 55% (83%) of the countries under study. Global value and momentum premia are economically large, too, and both are statistically significant at conventional levels. Again, global and foreign factor premia are on average very similar.

Country-averaged correlations between the local and global versions of the market factors are fairly high (0.77), as indicated by Panel C of Table 1. By contrast, the correlations between the local versions of the size, value and momentum factors and the global versions of these factors are relatively low, i.e., 0.37, 0.39 and 0.58, respectively. Foreign and global factors are almost perfectly correlated. That is, all correlations are above 0.98, which together with the above results on the factor premia suggests that on average foreign and global factors are interchangeable. Finally, the correlations within a set of local, global and foreign factors are modest.[10]

2.3 Local vs. Global Factor Models: Baseline results

For the sake of comparability with prior literature, we first briefly report the results for unconditional full-sample period estimation of local, foreign, global and hybrid versions of the asset pricing models. Tests of a similar form have been extensively conducted by previous studies. Since our results are qualitatively the same, to save space we only report country-aggregated statistics. Our main results are reported in Sections 2.4 and 3.

[Insert Table 2 about here]

Panel A in Table 2 shows the asset pricing test results for the competing models, aggregated over all countries under study. We report standard performance measures such as the average test asset adjusted R^2 (Avg. R^2), the average test asset absolute alphas (Avg. $|\alpha|$), the F-test of Gibbons et al. (1989) (GRS-Stat.) and the percentage of 5% significance level rejections based on the GRS statistic (% Rejections). In addition, we follow Fama and French (2012) and also show

[10] One interesting observation we make is that similar to Hou et al. (2011) our results suggest almost zero correlations between value and momentum factors. By contrast, Asness et al. (2013) find significantly negative correlations. This is presumably due to differences in the factor construction. For example, they use only roughly 20% of the largest stocks in a given market and also scale book-values of equity by contemporaneous market equity rather than market equity in December of the previous calender year (Schmidt et al. (2015) use December market values as in Fama and French (1993)).

the average test asset alpha standard errors (Avg. SE α) and the alpha Sharpe ratios (SR α).[11] All statistics, except for % Rejections are averages of the respective country-specific statistics.

Irrespective of the model of interest, local asset pricing models feature higher time-series explanatory power (R^2) and incur lower pricing errors than either foreign or global counterparts. For instance, the R^2 of the local Carhart factors (82.17%) is roughly twice as large as the R^2 of foreign (41.55%) or global versions of the factors (46.70%) and the pricing errors are significantly smaller (0.28 percentage points relative to 0.43 or 0.42 percentage points, respectively). The relatively stronger explanatory power of local factors is also reflected in the average alpha standard errors, indicating a higher precision in the local model alpha estimates. This also explains why the differences between local and global or local and foreign factor Sharpe ratios are rather small. However, the evidence against foreign and global models is very strong when we consider the percentage of rejections based on the GRS statistics. Even though the GRS tests lack power in the global or foreign factor specifications due to the models' inherently small R^2, these models are rejected more frequently than local factor models. For example, in the Carhart specifications, models based on local factors are rejected in 61% of the cases, while the global and foreign versions are rejected in 72% of the cases.

Strikingly, models that include both local and foreign factors – so-called hybrid models – do not appear to add any value relative to purely local models. All statistics are similar and in some instances, hybrid models feature even somewhat larger pricing errors and alpha Sharpe ratios.

Overall, local factor models outperform global factor models in unconditional full-sample tests, and there is no conclusive evidence that hybrid models beat purely local models. These baseline results are in line with prior literature.

2.4 Local vs. Global Factor Models: Time-variation in Performance

While local models may dominate global ones in full-sample unconditional tests, the relative performance differentials may have been narrowing in recent years, either driven by real or financial integration. Our first contribution in the following is to shed light on the time-variation in the

[11] SR α is defined as $(\alpha' S^{-1} \alpha)^{1/2}$, where α is the vector of test asset regression intercepts and S is the covariance matrix of the regression residuals. It thus takes both the magnitude and the precision of pricing errors into account and should therefore be evaluated together with its main drivers, i.e., the estimated alphas, the alpha standard errors and the regressions R^2 (see Fama and French (2012)).

performance of global vis-a-vis local models by evaluating the models dynamically.

Specifically, we estimate Equation (1) on a 60 months rolling period basis.[12] Our main interest is in the evolution in the relative performance of local and foreign (global) models. To this end, we define the R^2 *gap*, which is the difference between the country-specific test asset averaged R^2 of the local and the foreign (global) versions of the respective factors at each point in time, i.e.,

$$\hat{R}^2_{gap,j} = \frac{1}{N_j}\sum_{i=1}^{N_j}\left(\hat{R}^2_{ij}\right)_L - \frac{1}{N_j}\sum_{i=1}^{N_j}\left(\hat{R}^2_{ij}\right)_{G/F}, \tag{2}$$

where $N_j = 18$ (the number of test assets in each country j). Moreover, we define the *alpha gap*, which is the difference between the country-specific test asset averaged absolute pricing errors of the global (foreign) and the local versions of the respective factors in each point in time, i.e.,[13]

$$\hat{\alpha}_{gap,j} = \frac{1}{N_j}\sum_{i=1}^{N_j}|\hat{\alpha}_{ij}|_{G/F} - \frac{1}{N_j}\sum_{i=1}^{N_j}|\hat{\alpha}_{ij}|_L\,. \tag{3}$$

Gaps are computed for each of the rolling periods. We also estimate country-aggregated versions of (2) and (3) by taking equal- or value-weighted averages of the respective series.[14] Throughout the remainder of this study, unless otherwise stated, we will report results based on foreign factors, that is, global factors excluding local assets in their construction. The reason is that our global factors are computed from value-weighted averages of local factors, including the country for which the model attempts to explain test asset returns. Thus, a possible concern with global factors would be that any patterns we uncover might simply be the result of the time-varying weight of the respective local factor.[15]

[12]The choice of the window length entails a trade-off between lower measurement error and higher parameter flexibility. In Section SA.2 of the Supplementary Appendix, we re-run the analyses with 24, 36, 48, 72, 84, and 96 months rolling periods, obtaining similar results throughout.

[13]Computing the difference in the absolute pricing errors rather than the absolute value of the difference in the pricing errors avoids the possibility that we spuriously inflate the gaps when pricing errors of the local and global (foreign) models are of different sign. Assume, for instance, that for some asset, global (local) alpha amounts to -0.1 (+0.1). Then, the absolute value of the difference in alphas would be +0.2, whereas the difference in the absolute alphas would be 0.

[14]Alteratively, one can examine the relative performance of hybrid and local models to test the contribution of foreign factors controlling for local factors over time. We do so in Section 4.

[15]The results are qualitatively the same if we use global gaps instead; see Section 4.

2.4.1 Graphical Analysis

We begin the analysis by graphically examining the time-trends in foreign-local gaps, aggregated over all countries under study. Later, we assess the trends in the foreign and local components separately, and examine countries individually.

[Insert Figure 2 about here]

Figure 2 depicts the evolution of the R^2 and alpha gaps over time. All gaps are aggregated by averaging over the respective country-specific gaps in each point in time. Panels (a), (c), and (e) contain the results for the market, Fama-French and Carhart R^2 *gaps*, respectively, whereas Panels (b), (d), and (f) show results for the market, Fama-French and Carhart *alpha gaps*, respectively. The bold lines depict the time-variation in the estimated gaps, and thus sheds light on the relative performance of local vs. foreign asset pricing models. The grey shaded areas represent 95% bootstrap confidence intervals. A detailed description of the bootstrap procedure is given in Section A.2 of the Appendix.

Most strikingly, we find that the R^2 *gaps* exhibit strong downward trends, suggesting that foreign models have been catching up with local models over our sample period. Even though they differ in levels among model specifications, the overall patterns for the market, Fama-French and Carhart gaps are very similar. In fact, for example with Carhart factors, the relative outperformance of local versions of the factors relative to foreign versions of the factors has decreased from around 60 percentage points at the beginning of the estimation period to around 20 percentage points at the end of the estimation period.[16] Furthermore, as indicated by the bootstrap confidence intervals, the catch-up of foreign factors is statistically significant, too.

Sharply in contrast to the results on the R^2 gaps, there is no evidence for downward trending *alpha gaps* over time. With Fama-French and Carhart factors, local versions feature lower pricing errors in the amount of 0.3-0.4 percentage points per month on average (recall that alpha gaps are defined as the difference between foreign factor and local factor alphas), and the superiority of local versions remains roughly stable over time. The market factor alpha gaps are somewhat lower on average (around 0.2 percentage points per month), but do not decrease over time either.

[16] A part of the trend occurs in the financial crisis of 2008/09. We investigate the role of volatility for the R^2 gaps further below.

2.4.2 Trend Tests

The graphical analysis above reveals a downward and significant trend in country-aggregated R^2 gaps, suggesting that global asset pricing models have been closing the performance gap to local counterparts over our sample period. For alpha gaps, however, no such trend is evident. In this subsection, we expand on this analysis by conducting trend tests on the foreign and local components of the R^2 and alpha gaps separately, and also consider countries individually. Specifically, consider the following time series process:

$$\begin{aligned} x_t &= \mu + \beta t + \varepsilon_t \\ \varepsilon_t &= \rho \varepsilon_{t-1} + \upsilon_t, \end{aligned} \tag{4}$$

where x_t is the time-series of interest, μ is the intercept, β is the linear trend coefficient and ε_t is the residual shock, which follows an $AR(1)$ process. Moreover, υ_t is allowed to be weakly serially dependent. When $\rho = 1$, the series x_t reduces to a random walk with drift parameter β, whereas when $\mid \rho \mid < 1$, x_t is trend-stationary. Given the persistence of our alpha and R^2 gap series, we require a test for $H_0 : \beta = 0$ which is robust to both $I(0)$ and $I(1)$ realizations. Previous literature implements the Vogelsang (1998) and Bunzel and Vogelsang (2005) trend tests which satisfy this requirement. We use the more recently introduced testing procedure by Harvey et al. (2007), since it retains good size properties but has better power in finite samples, especially when ε_t is $I(1)$.[17]

Time-series Explanatory Power (R^2). Table 3 reports the estimated country-level trend coefficients and p-values from a two-sided test (in parentheses) for the time-series explanatory power (R^2) of the market, Fama-French and Carhart factors. We report results for the local and foreign versions of the factors as well as the gap between the two.

[Insert Table 3 about here]

To begin with, irrespective of the model of interest, the trend coefficients for country-level *foreign factor* R^2 – given in columns (2), (5) and (8) – are positive for all countries under study.

[17] Given the persistence in the series of interest (especially the R^2 series), power in the $I(1)$ case is particularly important in our context. A more detailed description of the estimation of the trend coefficients and the test statistics is given in Section A.3 of the Appendix.

This again suggests that models based on foreign factors have seen a rise in their explanatory power for local stock returns over our sample period. Most importantly, trend coefficients for the evolution of the equal- and value-weighted country-aggregated foreign factor R^2s are large and positive as well as statistically significant at least at the 5% confidence level (the p-values for the foreign market, Fama-French and Carhart factors are 0.049, 0.018, and 0.004, respectively). Consider the coefficient of 0.24 for the equal-weighted average foreign R^2. This trend coefficient implies a 0.24 percentage points increase of foreign R^2 per month. Over the whole sample period (209 monthly periods), this results in a 50.16 (=209x0.24) percentage points increase.

By contrast, the results on R^2 *from local factor models* – reported in columns (1), (4) and (7) – suggest that trends are relatively small in magnitude, of inconclusive sign and uniformly insignificant across the majority of countries and models. Also the equal and value-weighted country-aggregated results indicate that trends in local factor R^2 have been economically small and statistically indistinguishable from zero.

Consequently, the trend tests for the country-level R^2 *gaps* – reported in columns (3), (6) and (9) – suggest that the performance differentials between foreign and local asset pricing models have shrunk considerably. All estimated trend coefficients at the country level are negative. When aggregated across countries, trends in the gaps are strongly negative and statistically significant at the 1% level, in line with the graphical results from above. For example, the equal-weighted (value-weighted) Carhart gap trend coefficient is equal to -0.21 (-0.28). In economic terms, this suggest that the performance differential between local and foreign asset pricing models has declined by 43.89 (58.52) percentage points over our sample period.

Pricing Errors (Alpha). The trend test results for the alphas of the market, Fama-French and Carhart factors are given in Table 4. All coefficients are multiplied by 100.

[Insert Table 4 about here]

Contrary to the evidence for R^2, trend coefficients for the foreign factor alphas (columns (2), (5) and (8)) and alpha gaps (columns (3), (6) and (9)) are highly inconclusive across countries. Importantly, for none of the countries are the documented trends in alpha gaps statistically different from zero. The largest coefficients (in absolute magnitudes) are observed for Japan and the United States. For example, with Carhart factors, the estimated alpha gap trend in the United States amounts to -0.29. However, the effect can to a large extent be attributed to higher local factor pricing errors (+0.19) rather than lower pricing errors of the foreign model (-0.09). The strong negative gap coefficients combined with the large weight of the U.S., also explains the negative but statistically insignificant trend coefficients of the aggregate value-weighted alpha gaps.[18] With equal weighting, the estimated trends are small in magnitude and far from statistically significant, which is in line with the graphical results in Section 2.4.1.

2.4.3 Summary

The gap between local and foreign factor model R^2 has shrunk considerably over our sample. The shrinkage of R^2 gaps derives from a rise in the performance of foreign models, rather than a decline in local factor performance. This is the case for all countries under study, even if the strength and statistical significance of the patterns differs among countries. By contrast, we do not find statistically reliable evidence for a convergence in local-foreign model performance in terms of pricing errors (alphas). In Section 3, we seek to interpret these results.

3 Understanding the Time Patterns in Factor Model Performance

3.1 Theory-based Guidance

3.1.1 Background and Strategy of Inquiry

The large strand of literature analyzing the level of market integration suggests that the process of globalization should be associated with increasing factor correlations (see, e.g., Longin and Solnik (1995), Goetzmann et al. (2005), Bekaert et al. (2009)), increasing local factor exposures on global factors, i.e., global betas (see, e.g., Bekaert and Harvey (1997), Baele (2005)), increasing global factor time-series explanatory power, i.e., global factor R^2 (see, e.g., Carrieri et al. (2007), Pukthuanthong and Roll (2009), Carrieri et al. (2013)), and decreasing global factor pricing errors (see, e.g., Korajczyk (1996), Bekaert and Harvey (1995), Arouri et al. (2012)).

[18] Throughout the analyses we additionally report value-weighted results but these should be taken with care. Since our main interest is in whether international markets have moved closer to integrated pricing, there is no reason to overweight any of the countries under study. Excluding the U.S. (and Japan) results in trend coefficients for the market, Fama-French and Carhart value-weighted alpha gaps in the amount of -0.04 (-0.01), -0.01 (+0.07) and -0.19 (+0.05), respectively.

The definition of globalization encompasses both financial market integration as well as real integration, and this distinction can be quite important when interpreting the results, depending on the application. In particular when it comes to the choice of the correct model in performance attribution and cost of capital calculations, the distinction becomes non-trivial. In general, only under financial market integration will global factor models price the cross-section of asset returns correctly. If we are mainly interested in whether potential benefits of international diversification have decreased over time, then the distinction may be less important.

The question whether the above documented patterns in time-variation of R^2 and alpha gaps can be attributed to either financial or real integration or both is important, but poses both empirical and theoretical challenges. To begin with, both forms of integration are likely to be interrelated. For example, Chambet and Gibson (2008) construct a financial integration measure from a conditional asset pricing model, which allows for priced local, global and emerging market risks simultaneously and show that their measure is related to trade openness. However, there are also reasons to believe that certain limits to financial integration, for instance implicit barriers to foreign investment such as informational asymmetries between local and foreign investors or home/foreign bias in general, might decouple financial and real integration (see, e.g., Cooper et al. (2012), Arouri et al. (2012), Carrieri et al. (2013) and the references therein).

Further, a theoretical challenge is that the stochastic process governing stock returns changes with the level of financial market integration (see, e.g., Bekaert and Harvey (1995)). While theory clearly predicts that under financial segmentation (integration) only local (global) risks are priced, a formal specification of the return generating process for the intermediate cases between financial segmentation and integration is difficult to derive, as the pricing kernel changes in an unknown manner as markets become more financially integrated.[19] Indeed, existing theoretical models which assume partially integrated markets yield different asset pricing predictions.[20]

[19] Previous literature has attempted to overcome this difficulty by empirically modeling the changing importance of global vs. local risk for local market expected returns. For example, in their seminal paper, Bekaert and Harvey (1995) use a conditional regime switching model to infer the level of financial market integration. Similarly, Chambet and Gibson (2008) model the relative importance of global and local residual risk for market premia with time-varying conditional weights, while Carrieri et al. (2007) and Carrieri et al. (2013) measure integration using an empirical time-varying version of the international asset pricing model of Errunza and Losq (1985).

[20] For example, in the mild segmentation model of Errunza and Losq (1985), international assets *without* investment restrictions are priced as if markets were integrated, i.e., they command a global market risk premium only, whereas international assets *with* investment restrictions command an additional risk premium for undiversifiable domestic risk. By contrast, the model of Arouri et al. (2012, 2013) predicts that *all* international assets command a global market premium plus a premium related to undiversifiable domestic risk. Furthermore, these are CAPM-type

Thus, instead of specifying a formal model of asset returns which explicitly captures the effect of financial market integration, we follow an alternative strategy. We consider the case of complete financial segmentation and assess the effect of increasing real integration on global factor time-series explanatory power and pricing errors. This approach is attractive because the nature of factors does not change with real integration. Put differently, under financial segmentation, irrespective of the level of real integration, factors are local and global factor model performance is affected only through the commonality of local real shocks. This exercise allows us to gain insights on the extent to which real integration can drive model performance metrics in the absence of financial market integration. Then, we draw on the generally accepted intuition in the literature on what should be expected with regards to global model performance as markets become increasingly financially integrated, and confront these predictions with the data.

3.1.2 Real Integration under Financial Market Segmentation

Assume there are N_j assets in each country j and J countries in the global economy. Thus, there is a total of $N = \sum_{j=1}^{J} N_j$ assets globally. Further suppose that world markets are completely financially *segmented* and that asset returns are determined by K *local* traded factors, that is,

$$r_{ijt} \;=\; \sum_{k=1}^{K} \beta_{ijk}^{L} f_{kt}^{L} + \varepsilon_{ijt}, \tag{5}$$

where r_{ijt} represents the excess return of asset i in country j, β_{ijk}^{L} is the local k-factor loading of the i-th asset in country j, f_{kt}^{L} denotes the k-th local factor realization and ε_{ijt} is the asset specific term capturing idiosyncratic movements in asset returns. Moreover, let $E(\varepsilon_{ijt}) = 0$ and $Cov(f_{kt}^{L}, \varepsilon_{ijt}) = 0$.

Now suppose that *global* factors, i.e. f_{kt}^{G}, instead of local factors are used to estimate (5). Further let β_{jk}^{G} be the k-th local factor exposure on the corresponding global factor, that is, $\beta_{jk}^{G} = \frac{Cov(f_{kt}^{L}, f_{kt}^{G})}{Var(f_{kt}^{G})}$. Then, in Section A.4 of the Appendix we show that the time-series explanatory

models and hence cannot be applied in a multi-factor framework.

power when using global factors is given by[21]

$$R^2_{ij,G} = R^2_{ij,L} - \frac{\sum_{k=1}^{K} (\beta^L_{ijk})^2 Var(f^L_{kt}) \left[1 - Corr(f^L_{kt}, f^G_{kt})^2\right]}{\sum_{k=1}^{K} (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})}, \tag{6}$$

where

$$Corr(f^L_{kt}, f^G_{kt})^2 = (\beta^G_{jk})^2 \frac{Var(f^G_{kt})}{Var(f^L_{kt})}.$$

This expression has an intuitive appeal. Whenever $Corr(f^L_{kt}, f^G_{kt}) = 0$, $R^2_{ij,G} = 0$ and whenever $Corr(f^L_{kt}, f^G_{kt}) = 1$, $R^2_{ij,G} = R^2_{ij,L}$. Thus, under financial segmentation, the time series explanatory power of global factors for local assets is a function of the correlation between the true local factors and the naïvely constructed global factors. We note the following comparative statics:

- $Var(f^G_{kt})$: All else equal, an *increase* in global factor variance will lead to an *increase* in $Corr(f^L_{kt}, f^G_{kt})$ and $R^2_{ij,G}$. There is no theoretical reason for global factor variance being related to any form of integration. Thus, the correlation between local and global factors as well as the time-series explanatory power of global factors for local assets will both be misleadingly high in periods when global factor variance is high (see Forbes and Rigobon (2002), Bekaert et al. (2009), Pukthuanthong and Roll (2009)). In the empirical section below, we will control for the possibility that our results are driven by variation in factor variances (what we call *variance bias*).
- β^G_{jk}: All else equal, an *increase* in the exposure of local factors to global factors will lead to an *increase* in $Corr(f^L_{kt}, f^G_{kt})$ and $R^2_{ij,G}$. The more difficult question is how one interprets this result and the source of any rising beta. Some contributions in the literature use global factor betas as measures of financial market integration (e.g. Bekaert and Harvey (1997), Baele (2005)). Further, Bekaert et al. (2009) argue that increases in betas are more likely to be permanent and hence signal permanent changes in the levels of integration. However, it is also recognized that increases in global factor betas as well as factor correlations may be associated with either higher comovement in cash flows or higher comovement in discount rates (premia) or both. The former type of increasing comovement is commonly believed

[21] For simplicity, we derive the expression under the assumption that the k-th local factor is uncorrelated with the m-th global factor. Even though such types of comovements may drive global factor R^2 empirically, we later show evidence for strong and significant trends in the comovements between the k-th local and k-th global factors, the quantities for which we study comparative statics. See Section 3.2.1.

to be the result of real integration. Regarding the latter, however, there is less agreement; some attribute increasing correlations or betas in discount rates to financial integration (see, e.g., Ammer and Mei (1996), Baele and Soriano (2010)), while others argue that they may be the result of common real shocks driving country-specific premia (see, e.g., Engsted and Tanggaard (2004)). The main take-away for our work is that even under perfect financial market segmentation, the case we consider here, real integration plausibly results in higher global factor betas and thereby leads to greater commonality between local and global factors, as well as higher explanatory power of global asset pricing models in the time-series.

We conclude that the above documented convergence of local-global performance in terms of R^2 may be due to variance bias, real integration, financial market integration or a combination of these factors. In the analysis below, we will first control for variance bias. Further insights are obtained from our second performance metric, the unconditional pricing errors.

In Section A.4 of the Appendix we show that the absolute alphas of global factors under financial segmentation are given by

$$|\alpha_{ij,G}| = \left| \alpha_{ij,L} + \sum_{k=1}^{K} \beta_{ijk}^{L} \left[E(f_{kt}^{L}) - \beta_{jk}^{G} E(f_{kt}^{G}) \right] \right|, \tag{7}$$

where $\alpha_{ij,L} = 0$ since, by assumption, pricing errors of local factors under financial market segmentation are zero. Using this expression, we can again derive the following comparative statics:

- β_{jk}^{G}: All else equal, an *increase* in the exposure of local factors to global factors will have an ambiguous effect on $|\alpha_{ij,G}|$. Assume for simplicity that all asset local factor exposures, β_{ijk}^{L}, are positive. Moreover, suppose that global betas, β_{jk}^{G}, marginally increase due to real integration. Then, if $E(f_{kt}^{L}) - \beta_{jk}^{G} E(f_{kt}^{G}) < 0$, i.e. when the difference between the true factor premium and the naïvely estimated factor premium is smaller than zero, absolute pricing errors may even become larger. On the other hand, if $E(f_{kt}^{L}) - \beta_{jk}^{G} E(f_{kt}^{G}) > 0$, then absolute alpha will decrease.

We conclude that real integration will have an ambiguous effect on global factor pricing errors. This implies that, aggregated across test-assets or countries, global factor alphas should not exhibit any significant trends. The key point is that, even under perfect real integration, global factor models will in general incur pricing errors, as prices for risks are set locally and not globally. By contrast, local factors will in theory produce zero pricing errors.

3.1.3 Financial Market Integration

The above predictions were derived under the assumption of perfect financial market segmentation. Even though we do not specify a formal model to capture the dynamic effects on global relative to local factor model performance as markets progressively become more financially integrated, the intuition is straightforward and also in line with the reasoning in the prior literature. Thus, we posit that, in contrast to increasing real integration in segmented capital markets (the case considered above), the process of *financial market integration* will ultimately lead to *both* greater explanatory power of global factors in the time-series (e.g., through higher global discount rate betas) and lower pricing errors as local risks become more and more diversifiable. As pricing is set more and more by the global marginal investor when markets become financially integrated, we expect to see a convergence towards *integrated pricing*.[22] This also means that any premia attributable to residual local factor risk will ultimately vanish, i.e., local factor premia will be increasingly determined by global factors. By the same token, purely local factor models should deteriorate in performance as global factors become more important.

3.1.4 Summary and Roadmap

[Insert Figure 3 about here]

Figure 3 describes our approach to apply the insights from above to uncover the driving sources of our empirical results. We proceed in two steps. First, we assess whether the R^2 convergence between local and global asset pricing models mechanically derives from factor volatilities. If this is not the case, given the previous theoretical exposition, the convergence may be explained by financial market integration and/or real integration. We showed that even under financial market segmentation real integration leads to higher global model time-series explanatory power, while pricing errors should not decrease uniformly across countries, i.e., there should be no significant trend in alphas on average. With increasing financial market integration, we expect to see a rise in global R^2, but at the same time also a decline in pricing errors.

[22] If markets are partially integrated, existing CAPM-type models imply that advancing real integration may ultimately lead to lower global model pricing errors (see e.g, Arouri et al. (2012, 2013)). This potential effect of real integration under partial financial integration blurs our theoretical clear-cut distinction of the effects of real and financial integration on pricing errors. However, this effect also suggests that, if real integration increases but global factor model alphas do not in fact decline, financial markets are potentially more segmented than one might expect.

Our interpretation of the drivers behind the patterns in the data, therefore, comes from the "dog that did not bark." The empirical absence of a clear trend towards lower relative pricing errors of global factor models – given strong evidence for greater explanatory power of global models in the time-series – is difficult to reconcile with the process of financial market integration as a main economic driver of the underlying patterns. Instead, a pick-up in real integration in the presence of some limits to international arbitrage emerges as a more plausible driver.

Second, a remaining caveat is that financial integration may indeed permanently alter local assets' return generating process. While factors and the associated risk premia may have become more global, risk exposures may have evolved in a way which temporarily kept the pricing errors of global models at higher levels. Alternatively, a few, difficult to price assets (e.g., smaller sized and less populated portfolios) may have hindered the convergence in the alpha gaps. Therefore rather than performing further tests on portfolios we next examine the components of local factor risk premia directly, i.e., we test whether residual country-specific factor premia have decreased over time. If this is not the case, a rise in real integration survives as the most plausible explanation.

3.2 Empirics

3.2.1 R^2 Catch-up: Rising Factor Betas or Variances?

To decompose the contributions of the evolution of factor betas and the factor variance-covariance matrix to the trends in R^2 gaps, we follow a procedure inspired by the one used by Bekaert et al. (2009) in the context of international stock return correlations. More specifically, we sequentially, one by one, fix the aforementioned parameters to their corresponding first time series observations and compute the theoretically implied R^2 gaps for each of the subsequent time periods. From this exercise, we gain insights on the relative importance of variation in the respective parameters for the previously documented time patterns in the R^2 gaps.

Intuitively, if fixing a given parameter removes an existent trend compared to the case where all parameters are free, then one can deduce that the trend must have been caused by variation in that particular parameter. Also note that fixing the variance-covariance matrix means we fix the variances (volatilities) and the covariances within a given set of factors but not the covariances between the local and the foreign versions of the factors. That is, for instance, covariances between the local market and the local size and value factors are fixed, but the covariance between the local market and the foreign market factor is not. The latter is indirectly approximated by fixing betas.

[Insert Table 5 about here]

Table 5 shows the trend decomposition results for the country equal- and value-weighted market, Fama-French and Carhart R^2 gaps. We report the trend coefficient β_λ and the corresponding p-value on the test statistic in parentheses, which are both computed by means of the methodology of Harvey et al. (2007). In addition, the correlation between a given series and the observed series is given and denoted by ρ.

Fixing the variance-covariance matrix leads to even stronger negative trend coefficients relative to the observed R^2 gap series. That is, variance bias can be ruled out as a driver of the observed trend. By contrast, fixing factor betas results in trend coefficients close to 0 and statistically insignificant. Taking the equal-weighted Carhart R^2 gaps as an example, fixing betas reduces the observed trend from -0.21 to -0.02.

Finally, we examine the trends in local factor exposures on their foreign (global) factor counterparts. These results are presented in detail in Section SA.6 of the Supplementary Appendix. In short, betas exhibit positive and significant trends while foreign (global) factor volatilities do not.

Altogether, these results suggest that variance bias cannot explain the observed patterns in R^2 gaps. Instead, fixing betas obliterates the observed trends. Thus, the decrease in the superiority of local relative to foreign models in terms of time-series explanatory power is driven by changes in factor betas rather than changes in the factor variance-covariance matrices, an indication for the patterns being permanent.[23]

3.2.2 Have Residual Local Factor Premia Declined?

To deepen our understanding of the non-convergence in foreign-local pricing errors and to mitigate the concern that our results are driven by noise in certain test assets, we next examine the evolution of factor risk premia over our sample. That is, we estimate the distances between

[23]Indeed, this argument is further strengthened by the correlations with the observed R^2 gap series. Fixing the variances-covariance matrices does not have a large impact, as the correlation coefficients remain all above 0.9. On the contrary, fixing betas results in correlation coefficients that are significantly lower in most instances.

local and foreign factor premia in 60 months rolling windows and test for the presence of linear trends. Under financial integration, the distance, which is an estimate of residual country-specific priced factor risk, should be equal to zero. Thus, we compute two versions of the distance metric. The first one is defined as in Eun and Lee (2010). We calculate the equal- and value-weighted averages of the country-specific absolute differences between local and foreign factor mean returns (premia), i.e., $dist_k^1 = \sum_{j=1}^{J} w_j \left|E(f_{kt}^L) - E(f_{kt}^F)\right|$. The second one is computed by replacing raw foreign factor premia by beta weighted foreign factor premia, where the betas are the local factor exposures on the corresponding foreign factors (estimated via OLS regression), i.e., $dist_k^2 = \sum_{j=1}^{J} w_j \left|E(f_{kt}^L) - \beta_{jk}^F E(f_{kt}^F)\right|$. Hence, the first measure assumes unit beta exposures of local factor portfolios on foreign factors in each country, while the second one explicitly accounts for differing betas across countries. In fact, non-unitary betas are consistent with empirical specifications of time-varying financial market integration (see, e.g., Bekaert and Harvey (1997) and Chambet and Gibson (2008)). The second approach is hence our preferred measure for the distance in premia.

[Insert Table 6 about here]

Trend test results for the distance measure (assuming unitary betas), presented in Panel A of Table 6, suggest that there has been no meaningful convergence in local and foreign factor premia over time. Across factors, mean distances are substantial and vary between 0.24 (value factor; value-weighted) and 0.59 (momentum factor; value-weighted) percentage points per month. With equal-weighting, for all factors under study, the estimated trend coefficients are small, positive and far from significant. With value-weighting, the trends for the market and momentum factors are negative but also far from significant, whereas the trends in the size and value factors are positive and non-significant. Graphical examination (non-reported) suggests that again, the negative coefficients for the market and momentum factors with value-weighting are mainly due to the U.S. and should, therefore, not be regarded as evidence of an uniform convergence in local-foreign factor premia across countries.[24]

[24] Eun and Lee (2010) find a significant downward trend in the market distance measure. One difference in our methods is that we use monthly returns, whereas they use weekly returns. More importantly, they use equal-weighted country returns as an estimate of the global market factor, whereas we use value-weighted country returns. We believe that the latter is closer to the true global (foreign) market portfolio.

Trend tests based on non-unitary betas also suggest that estimated premium differences have not converged over our sample period (Panel B of Table 6). Similar to the case with unit betas, we see large mean absolute differences in premia across all factors in the range between 0.34 (value factor; value-weighted) and 0.74 (momentum factor; equal-weighted) percentage points per month. The estimated trends (whether on an equal-weighted or value-weighted basis) are typically small, always statistically insignificant and with ambiguous sign.

3.2.3 Summary

In summary, the lack of statistically and economically significant negative trends in local-foreign premia distances suggests that factor risk premia do not seem to become more global over time, i.e., residual local premia do not vanish. This explains the non-convergence of foreign-local pricing errors. The decomposition of the trends in the R^2 gaps reveals that variance bias does not explain these trends, but changing betas do. In other words, both questions raised in the our roadmap in Figure 3 are answered by "No." Thus, we conclude that real integration in the presence of some limits to international arbitrage rather than financial market integration is likely to drive the observed time-series differentials between local and foreign factor performance.

4 Additional Tests and Robustness

In this section, we perform a battery of additional tests to verify the consistency of our results. We first examine the time-trends in the relative performance of hybrid and purely local factor models. Then, we assess the effects of the choice of foreign vs. global factors, the risk-free rate in the computation of excess returns, and the method of global factor construction. Next, we control for exchange rate risk. Moreover, we conduct sub-sample tests and further evaluate whether statistically derived factors yield different results. Finally, we perform robustness checks on the R^2 and premia trend decomposition results from above.

Hybrid vs. Local Factor Models. Estimated on a rolling sample, hybrid models, which include both local as well as foreign factors, should capture the time-varying relative importance of local and foreign components for asset returns driven by the process of financial market integration. By the same token, hybrid models should improve when compared to models including local factors only. The intuition here is that as markets move from complete segmentation to complete integration, models based on both local and foreign factors should capture the increasing importance of foreign factors. At the same time, except by chance, purely local factor versions should deteriorate in performance since they do not capture the increasing importance of foreign factors for asset returns.[25]

By contrast, recall that under financial segmentation the process of real integration affects only the statistical correlation structure between local and foreign factors through increased global comovement of local real shocks. In this case, the added value of foreign factors conditional on local factors will be constant over time and hence hybrid-local R^2 and alpha gaps will not exhibit any trending behaviour.

[Insert Table 7 about here]

We find that neither local nor hybrid factor models exhibit statistically or economically significant trends in terms of explanatory power in the time-series (Table 7, Panel A). Consequently, this evidence translates into the hybrid-local R^2 gaps which are economically and statistically indistinguishable from zero, too. Moreover, a similar picture emerges when it comes to pricing errors (Panel B). The estimated trends of the hybrid factor model versions are small, statistically insignificant and of a similar magnitude as those of local factor models. Hence, the estimated alpha gap trends are also close to zero and far from being statistically significant. Overall, foreign factors do not contribute anything to the time-varying patterns in purely local factor model time-series explanatory power and pricing errors.

These results corroborate our earlier conclusions. Financial integration is unlikely to be a driver of global factor model performance for the set of countries and the time period we investigate.

Foreign vs. Global Factors and Global Factor Construction. Next, we examine the robustness of the findings to (i) the choice of foreign vs. global factors, (ii) the choice of local vs. U.S. risk-free rates in the computation of excess returns, and (iii) the construction procedure of

[25] Note that even under perfect financial market integration, local assets returns may still covary with local factor realizations. Local factors will not command a premium, though, as local factor realizations are diversifiable globally. Therefore, hybrid-local R^2 gaps would eventually decline mainly due to premia variation being increasingly global rather than local.

global factors. With regards to the latter, recall that we compute foreign and global factors as value-weighted averages of local factors. Alternatively, Fama and French (2012) construct global (SMB, HML, WML) factors by sorting stocks globally, i.e., they sort on characteristics using the pooled sample of global stocks to calculate the factors.[26] In the following, we hence check the consistency of our results by using the Fama and French (2012) global factors instead of our own ones in the calculation of the R^2 and alpha gaps.[27]

[Insert Table 8 about here]

Table 8 reports the results. In Panel A, trend test results on the country-aggregated (equal-weighted) R^2 gaps are shown. Gaps based on our factors are labeled by "Own", whereas gaps computed using the Fama and French (2012) factors are labeled by "F&F". While the R^2 gap trend estimates differ somewhat in magnitude, irrespective of the risk-free rate or factor choice (F&F's or our factors), all coefficients are large, negative and statistically significant at least at the 5% significance level. Using global instead of foreign factors also yields quantitatively similar results when looking at country-averaged pricing errors (Panel B). Choosing local risk-free rates instead of U.S. risk-free rates produces alpha gap trend coefficients which tend to be negative, but as with U.S. risk-free rates, they are far from being close to any conventional significance level. In addition, gaps computed using the F&F global factors do not yield significantly different results, either. Overall, our general conclusions remain.[28]

The Role of Exchange Rate Risk. In the previous analyses, we have implicitly assumed that PPP holds. If this is not the case, international asset pricing theory suggests that even under perfect financial market integration there could be a role for exchange rate risk (see Solnik (1974), Sercu (1980) and Adler and Dumas (1983)). Omitting a potentially priced FX risk factor from the model specification may result in the previously documented absence of foreign (global) factor model catch-up in terms of pricing errors.

[26] Note that for size they use global breakpoints, whereas for book-to-market they use regional breakpoints to allocate stocks to the global portfolios.

[27] The data was downloaded via Kenneth French's website. Since data on the global momentum (WML) factor is only available from November 1990 onwards, the rolling gap series with the Fama and French (2012) factors are 12 months shorter than the respective series with our factors.

[28] The time-series plots of the estimated Carhart factor gaps together with the corresponding bootstrap confidence intervals are shown in Section SA.3 of the Supplementary Appendix.

Therefore, we add an empirical FX risk factor, XMI, to the foreign (global) versions of the Carhart factors when constructing our relative performance metrics. To do so, we rely on the procedure proposed by Kolari et al. (2008). (See Section A.1 of the Appendix for methodological details.) Furthermore, in Section SA.4 of the Supplementary Appendix, we show that the results are qualitatively and quantitatively similar if we use "Dollar" and "Carry" factors as in Brusa et al. (2015) instead.

[Insert Figure 4 about here]

Figure 4 shows the evolution of the R^2 and alpha gaps over time, controlling for exchange rate risk. Panels (a) and (b) depict results on the foreign-local Carhart + XMI R^2 and alpha gaps, respectively. The gaps represent the differential performance of a local model including the local market, size, value and momentum factors and a foreign factor model including the foreign market, size, value, momentum and exchange rate risk (XMI) factors. Likewise, results on the global-local R^2 and alpha gaps are given in Panels (c) and (d), respectively.

The observed trends in Figure 4 suggest a significant downward trend in the R^2 gaps and a flat or zero trend in the alpha gaps. This holds for local-foreign as well as local-global gaps. Thus, controlling for exchange rate risk does not alter our general conclusions.[29]

Varying Rolling Period Length and Sub-period Results. One concern is that our rolling period estimates may be sensitive to the size of the estimation windows. In fact, five years of monthly data may be insufficient to produce precise estimates of the true premia, which could be a potential reason for the non-existence of any apparent trends in the alpha gaps. One way to check the potential relevance of measurement error to our results is to re-run the analyses on larger sub-samples.[30] Albeit rather arbitrary, we therefore split our sample in two equal-sized periods of eleven years, i.e., period 1 starts in November 1989 and ends in December 2000, whereas period 2 ranges between January 2001 and February 2012. Then, for each of the two sub-samples, we

[29] Additional, confirming, evidence is shown in Section SA.2 of the Supplementary Appendix.

[30] In Section SA.2 of the Supplementary Appendix, we provide additional evidence on the sensitivity of the results with respect to the choice of the rolling period length. In sum, results are qualitatively the same for 24, 36, 48, 60, 72, 84, and 96 month periods. Importantly, wider windows are *not* associated with stronger alpha gap trends, which further mitigates measurement error concerns.

recompute the country-aggregated (equal-weighted) R^2 and alpha gaps, as well as the respective differences between both periods.

The results on the foreign-local as well global-local R^2 (alpha) gaps of the market, Fama-French, Carhart and Carhart + XMI factors are tabulated in Panel A (Panel B) of Table 9. In addition, we report 95% bootstrap confidence intervals in parentheses.

[Insert Table 9 about here]

The results are generally consistent with the rolling period analyses. In both periods, R^2 gaps are positive and statistically well above zero. The superiority of local factors, however, is much lower in the second half of the sample period and the bootstrap confidence intervals suggest that the decrease is statistically significant. This holds true for foreign-local as well as global-local gaps. Again, adding an exchange rate factor to the Carhart factors has basically no influence on the local-foreign and local-global R^2 gaps.

In terms of alpha gaps, the results in Panel B suggest that in both periods, local factors produce significantly lower pricing errors than foreign and global factors, i.e., the alpha gaps are positive. Further, the difference between the market factor alpha gaps between both periods is statistically indistinguishable from zero. And even though the Fama-French and Carhart alpha gaps tend to decrease from the first to the second half of the sample period, the upper bounds of the bootstrap confidence intervals lie well above zero. Hence unlike the strong evidence for lower R^2 gaps in the second sub-sample period, no statistically reliable decrease in alpha gaps is observed.

Factors obtained via Principal Components. Another possible concern is that the factor models, either local or global or both, we employ may be misspecified. To mitigate this concern, we compute statistically derived APT factors using the procedure of Jones (2001), which extends the asymptotic principal component (APC) factor extraction methodology of Connor and Korajczyk (1986, 1988) to account for heteroskedasticity in returns. Within each sub-sample period, we extract four local factors from all individual stocks in the respective country, four global factors from the pooled cross-section of individual stocks in all countries and four foreign factors from the pooled sample of individual stocks, excluding the country in which the factors attempt to explain returns. By re-running the factor extraction procedure in each period, we hence allow for potential effects of financial integration on the asset return-generating process.

The sub-sample test results on the statistical APC factors are shown in Table 9 and are in line with our baseline findings. First, the R^2 and the alpha gaps are positive in both subsamples. Second, while R^2 gaps are statistically and economically smaller in the second compared to the first sub-sample period, changes in the alpha gaps are small and far from statistically significant. This holds for both global-local as well as foreign local-gaps.

R^2 and Local Premium Decomposition. Finally, we examine the robustness of the R^2 and local premium decomposition tests. Section SA.6 in the Supplementary Appendix shows that different factor construction methodologies yield similar conclusions as our main analysis.

5 Conclusion

Recent work in international asset pricing shows that local versions of the Fama-French and Carhart factors achieve significantly higher time-series explanatory power and yield lower pricing errors than global versions of these factors (Griffin (2002), Hou et al. (2011), Fama and French (2012)). Taking these existing findings as a starting point, we study (1) how the relative performance of local vs. global factors has evolved over time and (2) to what extent the observed patterns are consistent with financial market and/or real integration.

We obtain four key results. First, in terms of time-series explanatory power (R^2), our results suggest a strong and statistically significant catch-up of global (foreign) factor models resulting from improving global (foreign) factor model performance rather than deteriorating local factor model performance. The documented trends are a common phenomenon across countries and are not observed in just a subset of the countries under study. Second, the improvement of global (foreign) model R^2 is driven by factor exposures rather than factor volatilities. Third, by contrast, global (foreign) factor models incur relatively large pricing errors relative to local factor models, and there is no statistically reliable evidence that this has changed over time. Fourth, factor premia do not appear to be increasingly globally determined over the course of the sample period.

As we argue in this paper, these four pieces of evidence are most plausibly explained by progressing real integration in the presence of some limits to international arbitrage, rather than by financial market integration. We acknowledge that such an interpretation comes with some caveats, and we note that it leaves room for further research. On the one hand, the interpretation is subject to the usual limitations of asset pricing model tests in international markets. In particular, such tests still always be prone to the well-known joint hypothesis problem. Thus, the inability to uncover trends in pricing errors may be due to financial markets being inefficient, the models we employ being incorrect or the lack of rising financial market integration (see Fama and French (2012) for similar arguments). Also, as argued by Bekaert et al. (2009), the fact that returns are very noisy renders inference regarding expected returns a challenging task. On the other hand, further research may shed light on whether the time variation in the model performance is partially driven by some changes in institutional features, such as cross-listing and common foreign ownership, which have been shown to be important for understanding international returns (Karolyi and Wu (2014), Bartram et al. (2015)).

Despite these caveats and open questions, it is worth noting that our findings have two far-reaching implications. First, even though developed markets are nowadays widely believed to be highly financially integrated, which has significant implications for policy, the findings of this paper suggest a more nuanced view on the matter. Second, for practical purposes, our findings suggest that local rather than global (foreign) factor models should be used in cost of capital and performance attribution calculations.

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Appendix

A.1 Factor Construction

Local Fama-French and Carhart Factors. The local market factor (MRF) is the value-weighted monthly return (in excess of the U.S. 3-month T-bill rate) of all available stocks in a given market. For the construction of the local size (SMB) and value (HML) factors, stocks are sorted each June into three book-to-market groups (breakpoints are the 0.3 and 0.7 quantiles), i.e., low (L), medium (M) and high (H), as well as into two size groups (breakpoint is the 0.5 quantile), i.e., small (S) and big (B). Book-to-market in June of the sorting year is defined as the ratio of book equity at the end of the previous fiscal year to size at the end of December of the previous calender year. For the size sorts, size at the end of June of the sorting year is used. Six portfolios are then formed from the intersection of the groups and value-weighted monthly returns between July of the sorting year and June of the subsequent year are computed. SMB is then defined as the average return of the three small-size portfolios (S/L, S/M, S/H) minus the average return of the three big-size portfolios (B/L, B/M, B/H), whereas HML is calculated as the average return of the two high book-to-market portfolios (S/H, B/H) minus the average return of the two low book-to-market portfolios (S/L, B/L).

Similarly, in the spirit of Carhart (1997), for the construction of the local momentum factor (WML), stocks are sorted each month into two size groups (breakpoint is the 0.5 quantile), i.e., small (S) and big (B), and three momentum groups (breakpoints are the 0.3 and 0.7 quantiles), i.e., winners (W), medium (M) and losers (L), whereas momentum is defined as the stock's return over the previous 12 months, excluding the month prior to portfolio formation. From the intersection of the groups, six value-weighted portfolios are then constructed, which are held for one month. WML is then defined as the difference between the average return of the two winners portfolios (S/W,B/W) minus the average return of the two losers portfolios (S/L, B/L).

The interested reader is referred to Schmidt et al. (2015) for more details on the Datastream lists, employed screens and the factor construction procedure.

Foreign Exchange Rate Risk Factor (XMI). To construct the FX Factor (XMI) as in Kolari et al. (2008), we rely on the real Federal Reserve's Major Currencies Index as our proxy for exchange rate movements relative to the reference currency in this paper, i.e., the U.S. dollar.[31] This choice is motivated as follows. First, while theoretical models suggest that all bilateral exchange rates between the reference currency and all other currencies should be included, previous empirical applications use exchange rate indices for parsimony (see, e.g., Carrieri and Majerbi (2006) and the references therein). Second, the Major Currencies Index includes the Euro, Japanese Yen, Swiss Franc, British Pound, Canadian dollar and the Swedish Krona and is, therefore, a good representation of the countries included in this study. Third, the choice of the real over the nominal version of the index is justified by the argument of Carrieri and Majerbi (2006) that consistency with the Adler and Dumas (1983) model requires either the inclusion of both inflation factors (in local currency) and nominal exchange rate factors or real exchange rate factors (in the reference currency) only.[32] The latter is preferred in order to avoid multi-collinearity problems.

Having chosen the FX proxy, we construct a factor mimicking portfolio, XMI, by applying the procedure proposed by Kolari et al. (2008) to the pooled cross-section of stocks in our sample. More specifically, in June of each year, using data for the preceding two years, we regress each stock's excess return on the Carhart global factors and the monthly percentage change of the Major Currencies Index. Stocks are then ranked into 25 portfolios based on their exchange rate risk sensitivity, and value-weighted one year holding period portfolio returns are computed from July of the sorting year to June of the subsequent year. The XMI factor is then defined as the zero investment portfolio which takes a value-weighted long position in the most sensitive stocks (portfolios 1 and 25) and a value-weighted short position in the less sensitive stocks (portfolios 2 to 24).

A.2 Residual Bootstrap

The procedure we use to compute confidence intervals is based on the bootstrap of Efron (1979). It is repeated on each of the rolling subsamples and therefore results in rolling period confidence intervals. Our approach is close to the one used in Kosowski et al. (2007), except for that we aim for confidence intervals rather than hypothesis tests and hence do not resample under the

[31] Data was downloaded via http://www.federalreserve.gov/releases/h10/summary/indexnc_m.htm.

[32] In the Adler and Dumas (1983) model, excess returns are determined by the global market factor and the sum of country-specific inflation factors, where all factors are denominated in the reference currency. Assuming that country-specific inflation in local currency units is non-stochastic or zero, consistent with the models of Solnik (1974) and Sercu (1980), the Adler and Dumas (1983) inflation factors reduce to nominal exchange rate factors (see also Vassalou (2000)).

respective null hypothesis (see, e.g., Boos (2003)). The steps are the following:

1. For each asset i in each country j, run OLS regressions of the respective asset's excess returns on local factors, denoted by superscript L, and global factors, denoted by superscript G (with foreign factors, just substitute F for G). I.e., estimate

$$r_{ijt} \quad = \alpha_{ij}^{L,G} + \sum_{k=1}^{K} \beta_{ijk}^{L,G} f_{kt}^{L,G} + \varepsilon_{ijt}^{L,G}, \quad t = 1, ..., T$$

   and save the coefficient estimates $\left\{\hat{\alpha}_{ij}, \hat{\beta}_{ij1}, ..., \hat{\beta}_{ijK}\right\}_{L,G}$ as well as the vector of estimated residuals $\{\hat{\varepsilon}_{ijt}, t = 1, ..., T\}_{L,G}$.

2. Draw a sample with replacement from the local as well as global factor model vectors of estimated residuals $\{\hat{\varepsilon}_{ijt}, t = 1, ..., T\}_{L,G}$ for each asset i in each country j and save the vectors of resampled residuals. Repeating this step 999 times produces the resampled residuals $\left\{\hat{\varepsilon}_{ijt}^{b}, t = s_1^b, ..., s_T^b\right\}_{L,G}$, where $b = 1, ..., 999$. Importantly, the randomly sampled time indices, $s_1^b, ..., s_T^b$, are kept equal for all assets in the global economy, which ensures that the cross-sectional correlation structure is preserved in each bootstrap iteration b.

3. For each asset i in each country j and each bootstrap repetition b compute a vector of pseudo-random excess returns:

$$r_{ijt}^{b} \quad = \hat{\alpha}_{ij} + \sum_{k=1}^{K} \hat{\beta}_{ijk}^{L,G} f_{kt}^{L,G} + \hat{\varepsilon}_{ijt}^{b}$$

4. For each asset i in each country j and each bootstrap repetition b re-run the OLS regressions from step 1 using bootstrap generated pseudo-random returns instead of the original returns and save the regression intercepts $\left\{\hat{\alpha}_{ij}^{b}\right\}_{L,G}$ and the regression R-squareds $\left\{\hat{R}_{ij}^{2,b}\right\}_{L,G}$.

5. For each bootstrap repetition b compute the country-aggregated absolute alpha and R-squared gaps::
   (a) Alpha gaps:
   $\hat{\alpha}_{gap}^{b} = \sum_{j=1}^{J} \sum_{i=1}^{N_j} w_j w_i \left|\hat{\alpha}_{ij}^{b}\right|_G - \sum_{j=1}^{J} \sum_{i=1}^{N_j} w_j w_i \left|\hat{\alpha}_{ij}^{b}\right|_L$.
   (b) R-squared gaps:
   $\hat{R}_{gap}^{2,b} = \sum_{j=1}^{J} \sum_{i=1}^{N_j} w_j w_i \left(\hat{R}_{ij}^{2,b}\right)_L - \sum_{j=1}^{J} \sum_{i=1}^{N_j} w_j w_i \left(\hat{R}_{ij}^{2,b}\right)_G$.

6. For each of the statistics, compute the bias corrected and accelerated (BC_a) intervals by Efron (1987) at a 95% confidence level. The main advantage of BC_a intervals as opposed to other types of intervals, such as the standard and percentile methods, is their higher

accuracy (see Efron and Tibshirani (1993, p. 188)).

A.3 Linear Trend Test

We employ the linear trend test of Harvey et al. (2007). The test statistic is computed as a weighted average of two statistics, which would be appropriate when the time series generating process is known to be $I(0)$ or $I(1)$, respectively. The first statistic, z_0, is the conventional t-ratio of the linear trend parameter in an OLS regression of the series in levels on a constant and a linear time trend, i.e.,

$$z_0 = \frac{\hat{\beta}_0 - 0}{SE(\hat{\beta}_0)},$$

where $\hat{\beta}_0$ is the OLS estimate of β in (4). The second statistic, z_1, is the t-ratio of the intercept in an OLS regression of the series in first differences on a constant term, i.e.,

$$z_1 = \frac{\hat{\beta}_1 - 0}{SE(\hat{\beta}_1)},$$

where $\hat{\beta}_1$ is the OLS estimate of β in $\Delta x_t = \beta + \Delta\varepsilon_t$. Furthermore, $SE(\hat{\beta}_0) = \sqrt{\hat{\sigma}_0^2 / \sum_{t=1}^{T}(t-\bar{t})}$ and $SE(\hat{\beta}_1) = \sqrt{\hat{\sigma}_1^2 / T-1}$, where $\hat{\sigma}_0^2$ and $\hat{\sigma}_1^2$ are the respective residual variance estimators. In order to compute a heteroskedasticity and autocorrelation consistent (HAC) estimate of $\hat{\sigma}_0^2$ and $\hat{\sigma}_1^2$, we follow Harvey et al. (2007) and use the quadratic spectral kernel with bandwidth automatically selected by the Newey and West (1994) procedure. The trend test statistic, z_λ, is then given by

$$z_\lambda = (1-\lambda)z_0 + \lambda z_1,$$

where λ is a weighting parameter which consistently estimates the integration order of the series (either $I(1)$ or $I(0)$). More specifically, λ reads

$$\lambda = \exp\left[-0.00025\left(\frac{DF-GLS}{KPSS}\right)^2\right],$$

where $DF - GLS$ is the trend-inclusive version of the local GLS unit root test statistic by Elliott et al. (1996) and $KPSS$ is the trend-inclusive version of the stationarity test statistic by

Kwiatkowski et al. (1992). The z_λ statistic is asymptotically standard normally distributed. In addition, Harvey et al. (2007) provide a consistent and asymptotically efficient estimator of the linear trend parameter, irrespective of whether the series of interest is integrated of order 0 or 1. It is given by

$$\hat{\beta}_\lambda = \frac{(1-\lambda)\hat{\beta}_0 SE(\hat{\beta}_1) + \lambda\hat{\beta}_1 SE(\hat{\beta}_0)}{(1-\lambda)SE(\hat{\beta}_1) + \lambda SE(\hat{\beta}_0)}.$$

A.4 Derivation of Global Factor $\mathbf{R}^2$ and α under Financial Segmentation

Global Factor $\mathbf{R}^2$. Assume that $Cov(f_{kt}^L, f_{mt}^L) = 0$ and $Cov(f_{kt}^L, f_{mt}^G) = 0$ for $k \neq m$. Then, the time-series explanatory power with global factors under financial market segmentation is given by

$$\begin{aligned}
R^2_{ij,G} &= 1 - \frac{Var(r_{ijt} - \hat{r}^G_{ijt})}{Var(r_{ijt})} \\
&= 1 - \frac{Var(\sum_{k=1}^K \beta^L_{ijk} f^L_{kt} + \varepsilon_{ijt} - \sum_{k=1}^K \beta^G_{ijk} f^G_{kt})}{Var(\sum_{k=1}^K \beta^L_{ijk} f^L_{kt} + \varepsilon_{ijt})} \\
&= 1 - \frac{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt}) + \sum_{k=1}^K (\beta^G_{ijk})^2 Var(f^G_{kt})}{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})} \\
&\quad - \frac{2\sum_{k=1}^K \beta^L_{ijk}\beta^G_{ijk} Cov(f^L_{kt}, f^G_{kt})}{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})}.
\end{aligned}$$

Further, β^G_{ijk} can be expressed as

$$\beta^G_{ijk} = \frac{Cov(r_{ijt}, f^G_{kt})}{Var(f^G_{kt})} = \beta^L_{ijk}\frac{Cov(f^L_{kt}, f^G_{kt})}{Var(f^G_{kt})} = \beta^L_{ijk}\beta^G_{jk},$$

where β^G_{jk} is the exposure of the k-th local factor to the corresponding global factor. Using this decomposition, the expression for the global factor R-squared can be further simplified to

$$\begin{aligned}
R^2_{ij,G} &= 1 - \frac{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt}) + \sum_{k=1}^K (\beta^G_{ijk})^2 Var(f^G_{kt}) - 2\sum_{k=1}^K (\beta^G_{ijk})^2 Var(f^G_{kt})}{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})} \\
&= 1 - \frac{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt}) - \sum_{k=1}^K (\beta^G_{ijk})^2 Var(f^G_{kt})}{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})} \\
&= 1 - \frac{Var(\varepsilon_{ijt}) + \sum_{k=1}^K (\beta^L_{ijk})^2 \left[Var(f^L_{kt}) - \frac{Cov(f^L_{kt}, f^G_{kt})^2}{Var(f^G_{kt})}\right]}{\sum_{k=1}^K (\beta^L_{ijk})^2 Var(f^L_{kt}) + Var(\varepsilon_{ijt})}
\end{aligned}$$

$$= 1 - \frac{Var(\varepsilon_{ijt}) + \sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) \left[1 - (\beta_{jk}^{G})^2 \frac{Var(f_{kt}^{G})}{Var(f_{kt}^{L})}\right]}{\sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) + Var(\varepsilon_{ijt})}$$

$$= 1 - \frac{Var(\varepsilon_{ijt}) + \sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) \left[1 - Corr(f_{kt}^{L}, f_{kt}^{G})^2\right]}{\sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) + Var(\varepsilon_{ijt})}.$$

Further, the time-series explanatory power of local factors under segmentation reads

$$\begin{aligned} R_{ij,L}^2 &= 1 - \frac{Var(r_{ijt} - \hat{r}_{ijt}^{L})}{Var(r_{ijt})} \\ &= 1 - \frac{Var(\sum_{k=1}^{K} \beta_{ijk}^{L} f_{kt}^{L} + \varepsilon_{ijt} - \sum_{k=1}^{K} \beta_{ijk}^{L} f_{kt}^{L})}{Var(\sum_{k=1}^{K} \beta_{ijk}^{L} f_{kt}^{L} + \tilde{\epsilon}_{il})} \\ &= 1 - \frac{Var(\varepsilon_{ijt})}{\sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) + Var(\varepsilon_{ijt})}. \end{aligned}$$

Therefore,

$$R_{ij,G}^2 = R_{ij,L}^2 - \frac{\sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) \left[1 - Corr(f_{kt}^{L}, f_{kt}^{G})^2\right]}{\sum_{k=1}^{K} (\beta_{ijk}^{L})^2 Var(f_{kt}^{L}) + Var(\varepsilon_{ijt})},$$

where

$$Corr(f_{kt}^{L}, f_{kt}^{G})^2 = (\beta_{jk}^{G})^2 \frac{Var(f_{kt}^{G})}{Var(f_{kt}^{L})}.$$

Global Factor $\boldsymbol{\alpha}$. In absolute terms, the pricing error (alpha) of global factors under financial segmentation is given by

$$\begin{aligned} |\alpha_{ij,G}| &= |E(r_{ij})_L - E(r_{ij})_G| \\ &= \left| \sum_{k=1}^{K} \beta_{ijk}^{L} E(f_{kt}^{L}) - \sum_{k=1}^{K} \beta_{ijk}^{G} E(f_{kt}^{G}) \right| \end{aligned}$$

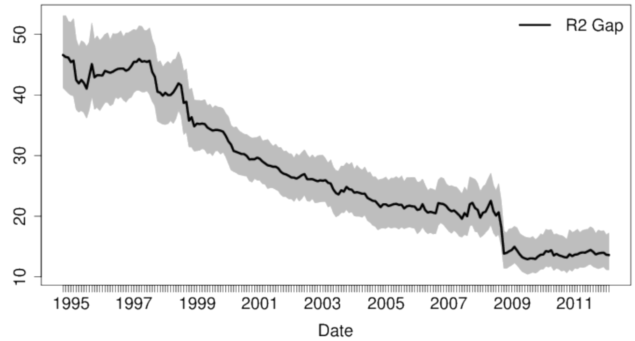
Using the expression for β_{ijk}^{G} from above, i.e. $\beta_{ijk}^{G} = \beta_{ijk}^{L} \beta_{jk}^{G}$,

$$|\alpha_{ij,G}| = \left| \sum_{k=1}^{K} \beta_{ijk}^{L} \left[E(f_{kt}^{L}) - \beta_{jk}^{G} E(f_{kt}^{G})\right] \right|.$$

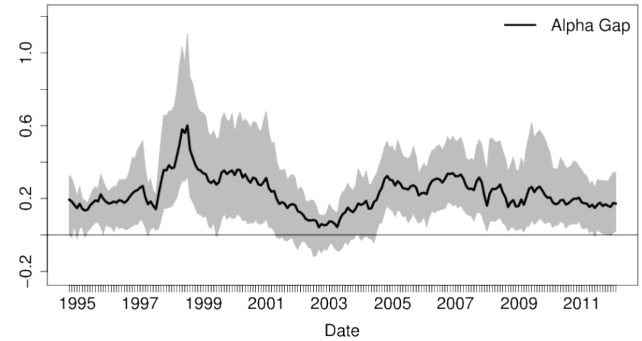
Finally, since by assumption, pricing errors of local factors under financial market segmenation ($\alpha_{ij,L}$) are equal to zero,

$$|\alpha_{ij,G}| = \left| \alpha_{ij,L} + \sum_{k=1}^{K} \beta_{ijk}^{L} \left[E(f_{kt}^{L}) - \beta_{jk}^{G} E(f_{kt}^{G}) \right] \right| .$$

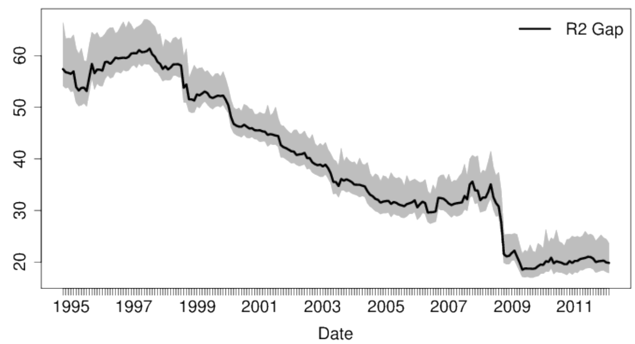
Figure 2. Time-varying performance of foreign vs. local asset pricing models.



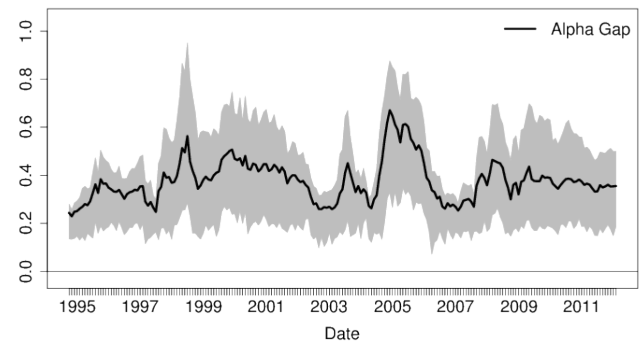
Panel (a): Foreign-Local Market Factor R^2 Gap



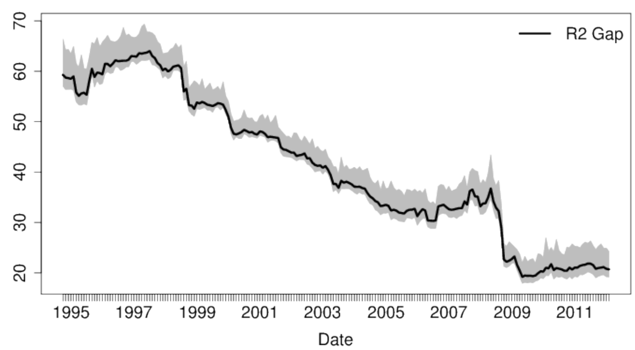
Panel (b): Foreign-Local Market Factor Alpha Gap



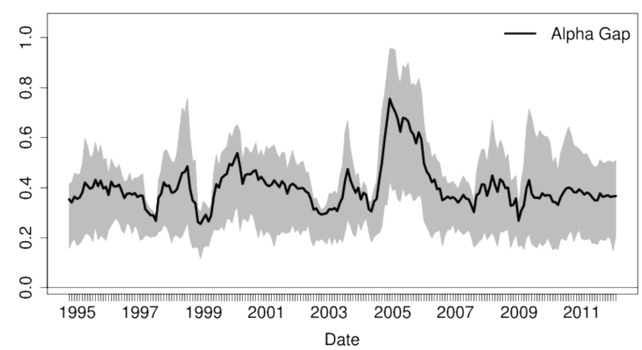
Panel (c): Foreign-Local Fama-French Factors R^2 Gap



Panel (d): Foreign-Local Fama-French Factors Alpha Gap



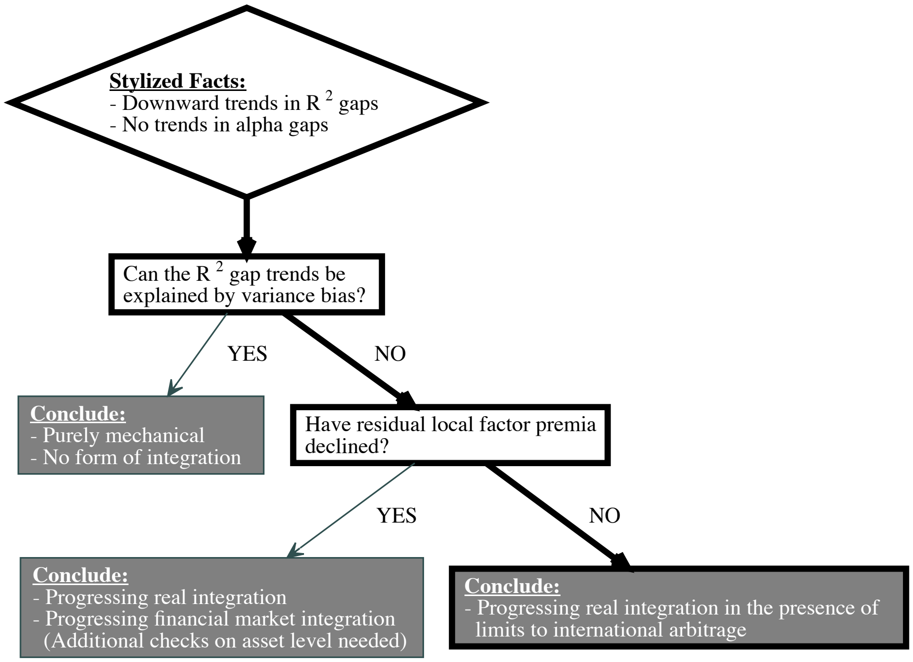
Panel (e): Foreign-Local Carhart Factors R^2 Gap



Panel (f): Foreign-Local Carhart Factors Alpha Gap

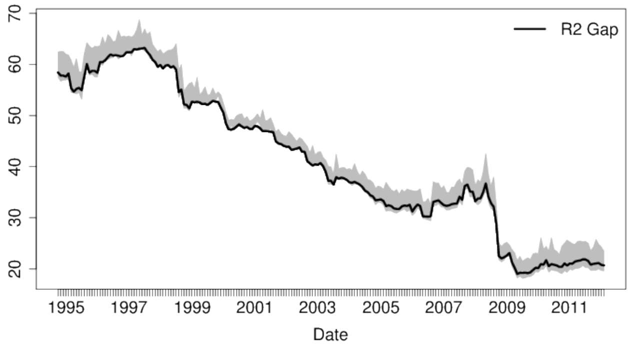
This figure illustrates the time-varying performance of foreign vs. local asset pricing models, based on R^2 gaps and alpha gaps, for the main sample of 18 markets in this study. R^2 gap is defined as the difference between the aggregated equal-weighted country-specific local and foreign factor R^2s. Alpha gap is defined as the difference between the aggregated equal-weighted country-specific foreign and local factor absolute alphas. The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. The bold lines are the respective estimated gap series, whereas the grey shaded areas represent 95% bootstrap confidence intervals (see Section A.2 of the Appendix for a description of the procedure). Panels (a), (c) and (e) show results for the time-series explanatory power (R^2) gaps of the market, Fama-French and Carhart factors, respectively, while panels (b), (d) and (f) show results for the pricing errors (alpha) gaps. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighed averages of local factors, excluding the country of interest. A more detailed description of the set of countries as well as test asset and factor construction is given in Section 2.2. Alphas are shown in monthly percentage points and the dates on the x-axes represent the end-dates of the rolling windows.

Figure 3. Interpreting Time-trends in Relative Model Performance.

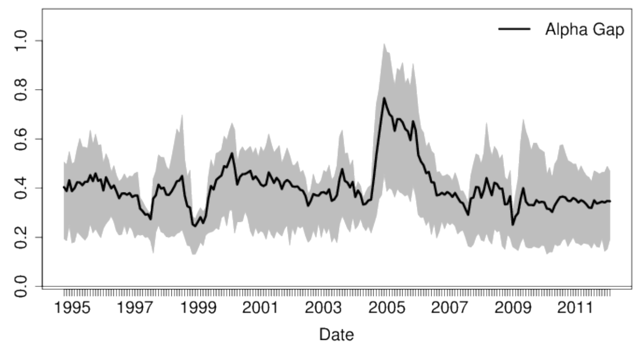


This figure shows our approach to identifying the source of the patterns in the R^2 and alpha gaps (that is, the difference in performance between foreign and local factor models) that are documented in Section 2.4. See Section 3.1 for the theoretical intuition. The path highlighted in bold depicts the empirical findings of Section 3.2.

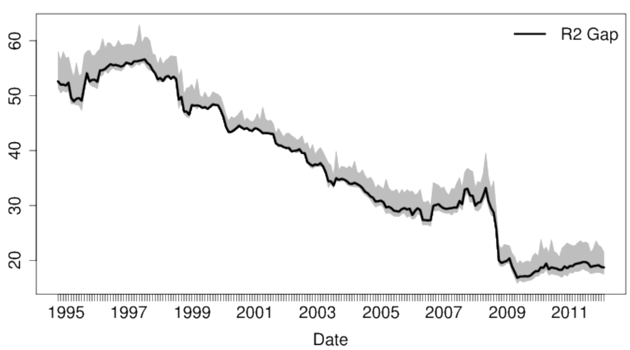
Figure 4. Evolution of R^2 and Alpha Gaps: The Role of Exchange Rate Risk.



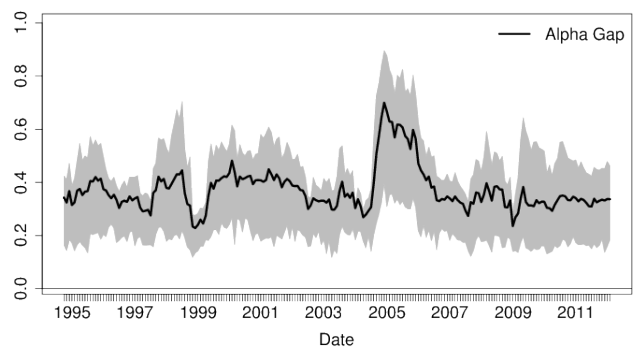
Panel (a): Foreign-Local Carhart + XMI Factors R^2 Gap



Panel (b): Foreign-Local Carhart + XMI Factors Alpha Gap



Panel (c): Global-Local Carhart + XMI Factors R^2 Gap



Panel (d): Global-Local Carhart + XMI Factors Alpha Gap

This figure illustrates the time-varying performance of exchange rate risk augmented foreign (or global) Carhart factor models (with a common exchange rate risk factor (XMI) added to the foreign (or global) Carhart specifications) vs. local versions of these models, based on R^2 gaps and alpha gaps, for the main sample of 18 markets in this study. R^2 gap is defined as the difference between the aggregated equal-weighted country-specific local and foreign (or global) factor R^2s. Alpha gap is defined as the difference between the aggregated equal-weighted country-specific foreign (or global) and local factor absolute alphas. The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. The bold lines are the respective estimated gap series, whereas the grey shaded areas represent 95% bootstrap confidence intervals (see Section A.2 of the Appendix for a description of the procedure). Panels (a) and (c) show results for the time-series explanatory power (R^2) gaps of the foreign and global exchange rate risk (XMI) augmented Carhart factors, respectively, while panels (b) and (d) show results for the foreign and global pricing errors (alpha) gaps. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. A more detailed description of the set of countries as well as test asset and factor construction is given in Section 2.2. The construction of the exchange rate risk factor (XMI) is outlined in Section A.1 of the Appendix. Alphas are shown in monthly percentage points and the dates on the x-axes represent the end-dates of the rolling windows.

Table 1. Descriptive Statistics.

This table provides country-averaged factor and test asset descriptive statistics for the main sample of 18 markets in this study. In panel A average returns (premia), average volatilities, average t-statistics of the premia (t-stat) and the percentage of premia which are positive and statistically significant at the 5% level (% Pos. Rejections) for the extreme local size and book-to-market and size and momentum sorted test asset portfolios are shown. Panel B tabulates average returns (premia), average volatilities, average t-statistics of the premia (t-stat) and the percentage of premia which are positive and statistically significant at the 5% level (% Pos. Rejections) for the local, foreign and global versions of the market (MRF), size (SMB), value (HML) and momentum (WML) factors, respectively. In panel C country-averaged sample correlations between factors with superscripts denoting the local (L), foreign (F) or global (G) version of the respective factor are depicted. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighted averages of local factors, excluding the country of interest. A more detailed description of the set of countries as well as test asset and factor construction is given in Section 2.2. The sample period starts 1989:11 and ends 2012:2.

Panel A. Country-aggregated Local Test Asset Summary Statistics

	Small-Growth	Small-Value	Big-Growth	Big-Value	Small-Losers	Small-Winners	Big-Losers	Big-Winners
(Avg.) Premium	6.84	11.12	5.80	10.26	10.69	18.85	1.68	9.26
(Avg.) Volatility	27.94	24.13	23.23	27.25	28.94	25.54	31.91	23.42
(Avg.) t-stat	1.04	2.22	1.27	1.83	1.50	3.55	0.26	1.92
% Pos. Rejections	16.67	61.11	16.67	50.00	27.78	94.44	0.00	55.56

Panel B. Country-aggregated Factor Summary Statistics

	Market (MRF)			**Size (SMB)**			**Value (HML)**			**Momentum (WML)**		
	Local	Foreign	Global	Local	Foreign	Global	Local	Foreign	Global	Local	Foreign	Global
(Avg.) Premium	6.83	4.14	4.13	-0.39	1.17	1.20	4.91	5.72	5.74	9.84	8.69	8.68
(Avg.) Volatility	22.33	16.48	16.40	14.60	10.47	10.43	13.89	8.28	8.27	19.01	15.70	15.73
(Avg.) t-stat	1.50	1.19	1.19	-0.17	0.52	0.54	1.80	3.28	3.28	2.52	2.61	2.61
% Pos. Rejections	11.11	0.00	0.00	0.00	0.00	0.00	55.56	100.00	100.00	83.33	100.00	100.00

(continued)

Table 1. Continued.

Panel C. Country-aggregated Factor Correlations

	MRF^{L}	SMB^{L}	HML^{L}	WML^{L}	MRF^{F}	SMB^{F}	HML^{F}	WML^{F}	MRF^{G}	SMB^{G}	HML^{G}	WML^{G}
MRF^{L}	1.00											
SMB^{L}	-0.27	1.00										
HML^{L}	-0.03	-0.19	1.00									
WML^{L}	-0.26	0.04	-0.02	1.00								
MRF^{F}	0.74	-0.21	-0.05	-0.26	1.00							
SMB^{F}	-0.03	0.31	-0.10	0.06	-0.05	1.00						
HML^{F}	-0.12	-0.05	0.34	-0.02	-0.25	-0.35	1.00					
WML^{F}	-0.32	0.10	-0.02	0.55	-0.41	0.06	0.03	1.00				
MRF^{G}	0.77	-0.22	-0.05	-0.27	0.99	-0.05	-0.25	-0.41	1.00			
SMB^{G}	-0.02	0.37	-0.12	0.05	-0.05	0.98	-0.36	0.06	-0.05	1.00		
HML^{G}	-0.13	-0.06	0.39	-0.01	-0.25	-0.35	0.99	0.03	-0.25	-0.36	1.00	
WML^{G}	-0.33	0.10	-0.02	0.58	-0.41	0.06	0.03	0.99	-0.41	0.06	0.03	1.00

Table 2. Asset Pricing Tests.

This table provides country-aggregated asset pricing test results of local, foreign, global and hybrid versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. For each class of factor models (Market, Fama-French and Carhart), four specifications are estimated based on time-series regressions of local test asset excess returns on the respective factors. These model versions include (i) local factor models (Local, factors based on data of the respective capital market only), (ii) foreign factor models (Foreign, factors based on global data excluding the respective capital market), (iii) global factor models (Global, based on global data including the respective capital market) and (iv) hybrid factor models (Hybrid, combination of local and foreign factors). See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. Model performance is evaluated according to the following metrics: Average (adj.) R^2 in the time-series regressions, average absolute alpha, average standard error of alpha and Sharpe ratio of alpha as in Fama and French (2012), and the GRS-test statistic of Gibbons et al. (1989) with the corresponding percentage of rejections at the 5% level. All statistics, except for % Rejections are averages of the respective country-specific statistics. Avg. $|\alpha|$ and Avg. R^2 are reported in percentage points. The sample period starts 1989:11 and ends 2012:2.

	Market				**Fama-French**				**Carhart**			
	Local	Foreign	Global	Hybrid	Local	Foreign	Global	Hybrid	Local	Foreign	Global	Hybrid
Avg. R^2	63.24	35.28	37.95	63.51	79.18	40.40	44.37	79.67	82.17	41.55	45.70	82.60
Avg. $\|\alpha\|$	0.42	0.54	0.53	0.43	0.35	0.46	0.45	0.36	0.28	0.43	0.42	0.28
Avg. SE α	0.26	0.37	0.36	0.26	0.20	0.37	0.36	0.20	0.19	0.38	0.37	0.20
SR α	0.45	0.46	0.46	0.46	0.45	0.46	0.46	0.46	0.42	0.45	0.45	0.44
GRS-Stat.	2.97	3.03	3.02	2.97	2.81	2.86	2.85	2.76	2.39	2.58	2.56	2.30
% Rejections	72.22	77.78	77.78	72.22	72.22	77.78	77.78	72.22	61.11	72.22	72.22	50.00

Table 3. R^2 Trend Tests: Local vs. Foreign Factors.

This table provides trend test results on the time-varying time series explanatory power (R^2) of local and foreign versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. The reported trend coefficients and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated to country level by taking equal weighted averages of the country-specific test asset R^2s. The gaps are defined as the difference between the local and the foreign versions of the respective time series. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighed averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

	Market			**Fama-French**			**Carhart**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Local	Foreign	Gap	Local	Foreign	Gap	Local	Foreign	Gap
Australia	0.10	0.29	-0.19	0.10	0.27	-0.17	0.09	0.27	-0.18
	(0.23)	(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Austria	-0.02	0.25	-0.26	-0.03	0.22	-0.25	-0.02	0.24	-0.26
	(0.89)	(0.09)	(0.02)	(0.78)	(0.12)	(0.00)	(0.85)	(0.10)	(0.00)
Belgium	0.08	0.18	-0.11	0.05	0.19	-0.14	0.06	0.20	-0.14
	(0.41)	(0.24)	(0.36)	(0.49)	(0.22)	(0.17)	(0.43)	(0.21)	(0.19)
Canada	0.11	0.23	-0.12	0.11	0.27	-0.16	0.11	0.27	-0.16
	(0.20)	(0.00)	(0.14)	(0.03)	(0.03)	(0.12)	(0.00)	(0.03)	(0.11)
Denmark	0.07	0.20	-0.14	0.01	0.23	-0.22	0.02	0.22	-0.20
	(0.66)	(0.15)	(0.05)	(0.95)	(0.13)	(0.01)	(0.84)	(0.14)	(0.00)
France	0.07	0.22	-0.15	0.03	0.23	-0.20	0.03	0.24	-0.21
	(0.48)	(0.11)	(0.07)	(0.53)	(0.06)	(0.03)	(0.51)	(0.04)	(0.03)
Germany	0.03	0.30	-0.26	0.02	0.31	-0.28	0.02	0.31	-0.28
	(0.84)	(0.05)	(0.02)	(0.81)	(0.01)	(0.01)	(0.82)	(0.01)	(0.02)
Greece	0.05	0.23	-0.19	0.08	0.23	-0.14	0.08	0.23	-0.15
	(0.62)	(0.11)	(0.18)	(0.19)	(0.09)	(0.36)	(0.23)	(0.19)	(0.38)
Italy	0.03	0.34	-0.28	0.04	0.34	-0.29	0.03	0.35	-0.32
	(0.76)	(0.00)	(0.00)	(0.59)	(0.00)	(0.01)	(0.65)	(0.00)	(0.00)
Japan	-0.08	0.05	-0.12	-0.03	0.11	-0.14	-0.02	0.11	-0.12
	(0.27)	(0.63)	(0.25)	(0.52)	(0.40)	(0.20)	(0.62)	(0.46)	(0.34)

(continued)

Table 3. Continued.

	Market			Fama-French			Carhart		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Local	Foreign	Gap	Local	Foreign	Gap	Local	Foreign	Gap
Netherlands	0.12	0.25	-0.12	0.06	0.27	-0.18	0.05	0.27	-0.19
	(0.35)	(0.04)	(0.12)	(0.51)	(0.00)	(0.05)	(0.43)	(0.00)	(0.04)
Norway	0.12	0.25	-0.12	0.09	0.24	-0.14	0.09	0.25	-0.15
	(0.10)	(0.01)	(0.17)	(0.17)	(0.02)	(0.14)	(0.17)	(0.01)	(0.12)
Singapore	-0.03	0.15	-0.17	0.03	0.20	-0.19	0.03	0.20	-0.19
	(0.77)	(0.26)	(0.20)	(0.46)	(0.00)	(0.00)	(0.41)	(0.03)	(0.00)
Spain	0.02	0.10	-0.08	0.02	0.10	-0.08	0.02	0.11	-0.10
	(0.83)	(0.50)	(0.46)	(0.75)	(0.53)	(0.52)	(0.78)	(0.49)	(0.45)
Sweden	0.08	0.24	-0.15	0.08	0.23	-0.14	0.07	0.24	-0.16
	(0.34)	(0.03)	(0.04)	(0.13)	(0.08)	(0.21)	(0.00)	(0.10)	(0.19)
Switzerland	0.09	0.17	-0.09	0.04	0.16	-0.13	0.04	0.17	-0.14
	(0.43)	(0.30)	(0.24)	(0.57)	(0.23)	(0.20)	(0.51)	(0.21)	(0.09)
U.K.	0.02	0.11	-0.09	-0.01	0.14	-0.14	-0.01	0.16	-0.16
	(0.85)	(0.29)	(0.30)	(0.90)	(0.11)	(0.09)	(0.87)	(0.08)	(0.05)
U.S.	0.05	0.31	-0.23	-0.02	0.32	-0.34	-0.01	0.34	-0.36
	(0.74)	(0.00)	(0.03)	(0.60)	(0.01)	(0.01)	(0.32)	(0.01)	(0.01)
EW Average	0.05	0.21	-0.16	0.04	0.23	-0.20	0.04	0.24	-0.21
	(0.48)	(0.05)	(0.00)	(0.41)	(0.02)	(0.00)	(0.36)	(0.00)	(0.00)
VW Average	0.01	0.25	-0.21	-0.01	0.26	-0.27	-0.01	0.27	-0.28
	(0.90)	(0.00)	(0.00)	(0.75)	(0.00)	(0.00)	(0.77)	(0.00)	(0.00)

Table 4. Alpha Trend Tests: Local vs. Foreign Factors.

This table provides trend test results on the time-varying absolute pricing errors ($|\alpha|$) of local and foreign versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. The reported trend coefficients (mulitplied by 100) and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated to country level by taking equal weighted averages of the country-specific test asset absolute alphas. The gaps are defined as the difference between the foreign and the local versions of the respective time series. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

	Market			**Fama-French**			**Carhart**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Local	Foreign	Gap	Local	Foreign	Gap	Local	Foreign	Gap
Australia	-0.06	0.14	0.19	0.00	0.34	0.34	0.07	0.34	0.28
	(0.85)	(0.79)	(0.61)	(0.98)	(0.38)	(0.37)	(0.69)	(0.40)	(0.50)
Austria	-0.03	-0.05	-0.02	-0.01	-0.06	-0.09	-0.01	-0.07	-0.12
	(0.92)	(0.94)	(0.97)	(0.98)	(0.87)	(0.67)	(0.96)	(0.86)	(0.63)
Belgium	0.10	0.05	-0.05	0.07	0.06	-0.01	0.07	0.10	0.03
	(0.43)	(0.90)	(0.88)	(0.69)	(0.88)	(0.98)	(0.64)	(0.81)	(0.94)
Canada	-0.34	-0.24	0.11	-0.29	0.04	0.33	-0.29	0.06	0.34
	(0.49)	(0.73)	(0.80)	(0.17)	(0.95)	(0.56)	(0.14)	(0.93)	(0.60)
Denmark	0.36	0.37	-0.02	0.18	0.29	0.12	0.13	0.23	0.12
	(0.33)	(0.53)	(0.96)	(0.31)	(0.36)	(0.66)	(0.43)	(0.41)	(0.60)
France	0.00	-0.07	-0.01	-0.03	0.00	0.06	-0.01	0.03	0.05
	(1.00)	(0.87)	(0.87)	(0.79)	(0.99)	(0.70)	(0.87)	(0.90)	(0.80)
Germany	0.05	-0.06	-0.02	0.06	-0.03	-0.09	0.05	0.01	-0.04
	(0.81)	(0.80)	(0.86)	(0.67)	(0.92)	(0.80)	(0.62)	(0.99)	(0.90)
Greece	-0.14	-0.01	0.10	-0.26	0.18	0.44	-0.27	0.00	0.27
	(0.87)	(0.99)	(0.94)	(0.20)	(0.94)	(0.86)	(0.29)	(1.00)	(0.92)
Italy	-0.02	0.14	0.17	-0.07	-0.12	-0.00	-0.05	-0.11	0.01
	(0.93)	(0.71)	(0.62)	(0.67)	(0.54)	(1.00)	(0.72)	(0.51)	(0.98)
Japan	0.08	-0.08	-0.17	0.01	-0.15	-0.12	0.01	-0.39	-0.40
	(0.84)	(0.91)	(0.81)	(0.95)	(0.76)	(0.82)	(0.91)	(0.50)	(0.50)

(continued)

Table 4. Continued.

	Market			Fama-French			Carhart		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Local	Foreign	Gap	Local	Foreign	Gap	Local	Foreign	Gap
Netherlands	0.03	-0.05	-0.09	0.06	0.01	-0.05	0.13	0.02	-0.08
	(0.91)	(0.89)	(0.76)	(0.21)	(0.99)	(0.87)	(0.00)	(0.95)	(0.81)
Norway	-0.13	-0.10	0.04	-0.10	0.03	0.10	-0.11	-0.09	0.04
	(0.60)	(0.88)	(0.94)	(0.64)	(0.92)	(0.49)	(0.43)	(0.82)	(0.71)
Singapore	0.05	-0.15	-0.28	0.04	0.14	0.12	0.12	0.16	0.06
	(0.91)	(0.85)	(0.78)	(0.82)	(0.84)	(0.79)	(0.49)	(0.79)	(0.91)
Spain	0.13	0.26	0.06	0.05	0.10	0.08	0.04	0.04	0.06
	(0.72)	(0.68)	(0.82)	(0.77)	(0.81)	(0.87)	(0.80)	(0.90)	(0.89)
Sweden	-0.09	-0.14	-0.05	-0.16	-0.15	-0.01	-0.18	-0.07	0.11
	(0.77)	(0.76)	(0.90)	(0.40)	(0.05)	(0.95)	(0.32)	(0.41)	(0.33)
Switzerland	-0.05	0.02	0.05	-0.04	0.13	0.16	-0.01	0.11	0.10
	(0.82)	(0.96)	(0.86)	(0.66)	(0.13)	(0.35)	(0.93)	(0.25)	(0.74)
U.K.	0.00	-0.05	-0.05	0.01	-0.07	-0.07	0.01	-0.08	-0.09
	(0.99)	(0.90)	(0.56)	(0.94)	(0.87)	(0.84)	(0.91)	(0.86)	(0.82)
U.S.	0.14	-0.13	-0.21	0.14	-0.19	-0.32	0.19	-0.09	-0.29
	(0.72)	(0.72)	(0.53)	(0.39)	(0.46)	(0.11)	(0.10)	(0.89)	(0.64)
EW Average	0.01	-0.01	-0.01	-0.02	0.03	0.04	-0.01	-0.00	0.01
	(0.98)	(0.98)	(0.93)	(0.83)	(0.88)	(0.82)	(0.88)	(1.00)	(0.98)
VW Average	0.09	-0.02	-0.11	0.08	-0.10	-0.18	0.11	-0.13	-0.24
	(0.76)	(0.94)	(0.63)	(0.43)	(0.52)	(0.07)	(0.16)	(0.73)	(0.47)

Table 5. R^2 Trend Decomposition: Rising Factor Betas or Inflated Variances.

This table provides trend decomposition test results on the time-varying R^2 difference between local and foreign versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. The R^2 gaps are defined as the difference between the aggregated (equal- or value-weighted) country-specific local and foreign factor R^2s. Results are shown for the underlying time series realization, i.e., when all relevant parameters are free and for two additional cases, when either one of the relevant parameters is fixed at its initial value. The relevant parameters are the factor betas (Betas) and the factor variance-covariance matrix (Vcov). We show two statistics: ρ, which denotes the correlation between the series of interest and the series when all parameters are free and β_λ, which is the trend coefficient reported with the corresponding test statistic p-value (in parentheses), both computed by means of the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). The underlying time series (when all parameters are free) are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal- or value-weighting the country-specific test asset R^2 averages. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

	Equal Weighted						**Value Weighted**					
Betas	Free		Free		Fixed		Free		Free		Fixed	
Vcov	Free		Fixed		Free		Free		Fixed		Free	
	β_λ	ρ	β_λ	ρ	β_λ	ρ	β_λ	ρ	β_λ	ρ	β_λ	ρ
Market	-0.16	1.00	-0.18	0.93	0.03	0.04	-0.21	1.00	-0.29	0.96	0.01	0.52
	(0.00)		(0.04)		(0.58)		(0.00)		(0.13)		(0.95)	
Fama-French	-0.20	1.00	-0.22	0.94	-0.03	0.32	-0.27	1.00	-0.38	0.95	-0.07	0.84
	(0.00)		(0.00)		(0.68)		(0.00)		(0.03)		(0.10)	
Carhart	-0.21	1.00	-0.23	0.94	-0.03	0.19	-0.28	1.00	-0.38	0.92	-0.06	0.90
	(0.00)		(0.00)		(0.72)		(0.00)		(0.03)		(0.11)	

Table 6. Trend Tests: Residual Local Factor Premia.

This table provides trend test results on the country-aggregated (equal- or value-weighted) time-varying premium distance between the local and foreign versions of the market, size, value and momentum factors for the main sample of 18 markets in this study. In panel A, distance is measured as in Eun and Lee (2010), i.e., it is the absolute value of the difference between the average return of the respective local factor and the average return of the corresponding foreign factor. In panel B, distance is computed as the absolute value of the difference between the average return of the respective local factor and the factor beta weighted average return of the corresponding foreign factor, where the factor beta is the OLS estimated beta of the local factor on the foreign factor. Further, the distance measures are calculated for each market and then aggregated by equal- or value-weighting the country-sprecific distances. The reported trend coefficients β_λ and test statistic p-values (in parentheses) are computed by means of the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). In addition, we report the time-series average of the series (TS Mean). The underlying time series are derived on a rolling 60 months period basis. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.2 for a more detailed description of the set of countries as well as factor construction. The sample period starts 1989:11 and ends 2012:2.

Panel A. Unit Beta

	Equal Weighted		**Value Weighted**	
	β_λx100	TS Mean	β_λx100	TS Mean
Market Factor	0.01	0.52	-0.12	0.50
	(0.96)		(0.70)	
Size Factor	0.04	0.51	0.10	0.41
	(0.88)		(0.83)	
Value Factor	0.04	0.34	0.01	0.24
	(0.77)		(0.94)	
Momentum Factor	0.01	0.54	-0.22	0.59
	(0.97)		(0.41)	

(continued)

Table 6. Continued.

Panel B. Estimated Beta				
	Equal Weighted		Value Weighted	
	β_λx100	TS Mean	β_λx100	TS Mean
Market Factor	-0.01	0.51	-0.13	0.49
	(0.96)		(0.65)	
Size Factor	0.02	0.43	0.06	0.37
	(0.83)		(0.82)	
Value Factor	-0.03	0.48	0.03	0.34
	(0.85)		(0.90)	
Momentum Factor	-0.05	0.74	-0.22	0.69
	(0.87)		(0.61)	

Table 7. Additional Results I: Trend Tests for Local vs. Hybrid Factor Models.

This table provides trend test results on the time-varying performance difference between local and hybrid versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. In panel A we report results on the aggregated (equal- or value-weighted) country-specific local and hybrid factor R^2s, as well as the R^2 gaps, which are computed as the difference between the respective local and hybrid factor R^2 series. In addition, panel B depicts results on the aggregated (equal- or value-weighted) country-specific local and hybrid factor alphas, as well as the alpha gaps, which are defined as the difference between the respective hybrid and local factor alpha series. The reported trend coefficients and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal- or value-weighting the country-specific test asset R^2 and absolute alpha averages. Local factors are based on data of the respective capital market only, whereas hybrid factors include both local as well as foreign factors, where the latter are value-weighted averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

Panel A. R^2 Gap

	Equal Weighted			**Value Weighted**		
	Local	Hybrid	Gap	Local	Hybrid	Gap
Market	0.05	0.05	-0.00	0.01	0.02	-0.00
	(0.48)	(0.47)	(0.88)	(0.90)	(0.88)	(0.68)
Fama-French	0.04	0.04	-0.00	-0.01	-0.01	-0.00
	(0.41)	(0.39)	(0.97)	(0.75)	(0.83)	(0.54)
Carhart	0.04	0.04	-0.00	-0.01	-0.00	-0.01
	(0.36)	(0.34)	(0.87)	(0.77)	(0.90)	(0.24)

Panel B. Alpha Gap

	Equal Weighted			**Value Weighted**		
	Local	Hybrid	Gap	Local	Hybrid	Gap
Market	0.01	0.01	0.00	0.09	0.10	0.01
	(0.98)	(0.96)	(0.87)	(0.76)	(0.72)	(0.89)
Fama-French	-0.02	-0.03	-0.01	0.08	0.06	-0.02
	(0.83)	(0.76)	(0.83)	(0.43)	(0.53)	(0.79)
Carhart	-0.01	-0.01	-0.01	0.11	0.09	-0.02
	(0.88)	(0.86)	(0.89)	(0.16)	(0.29)	(0.51)

Table 8. Additional Results II: Foreign vs. Global Factors & Global Factor Construction.

This table provides trend test results on the time-varying perfomance difference between local and foreign (global) versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. The following results are given: (i) with foreign vs. global factors, (ii) for excess returns computed using local vs. U.S. risk-free rates, and (iii) when the global versions of the factors we employ (Own) are replaced by the Fama and French (2012) (F&F) global factors in the calculation of the differential performance of the local and global versions of the factor models. In panel A we report results for the R^2 gap, which is defined as the difference between the aggregated equal-weighted country-specific local and foreign (global) factor R^2s, whereas panel B depicts results for the alpha gap, which is defined as the difference between the aggregated equal-weighted country-specific foreign (global) and local factor absolute alphas. The reported trend coefficients with the corresponding test statistic p-values (in parentheses) are both computed by means of the methodology of Harvey et al. (2007) (see Section A.3 of the Appendix for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

Panel A. R^2 Gaps

	Foreign-Local (Own)		**Global-Local (Own)**		**Global-Local (F&F)**	
	Loc-Rf	US-Rf	Loc-Rf	US-Rf	Loc-Rf	US-Rf
Market	-0.13	-0.16	-0.11	-0.14	-0.13	-0.14
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Fama-French	-0.14	-0.20	-0.12	-0.18	-0.11	-0.16
	(0.02)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Carhart	-0.15	-0.21	-0.13	-0.19	-0.13	-0.17
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

(continued)

Table 8. Continued.

Panel B. Alpha Gaps						
	Foreign-Local (Own)		**Global-Local (Own)**		**Global-Local (F&F)**	
	Loc-Rf	US-Rf	Loc-Rf	US-Rf	Loc-Rf	US-Rf
Market	-0.03	-0.01	-0.02	-0.01	-0.07	-0.03
	(0.83)	(0.93)	(0.87)	(0.94)	(0.47)	(0.87)
Fama-French	-0.04	0.04	-0.03	0.04	-0.12	-0.04
	(0.84)	(0.82)	(0.85)	(0.80)	(0.48)	(0.83)
Carhart	-0.08	0.01	-0.05	0.02	-0.11	-0.03
	(0.73)	(0.98)	(0.78)	(0.89)	(0.54)	(0.91)

Table 9. Additional Results III: Sub-sample Tests.

This table provides sub-sample test results on the performance difference between local and foreign (or global) versions of the market, Fama-French, Carhart (with or without an additional common exchange rate risk factor (XMI) added to the foreign (or global) Carhart specifications), and asymptotic principal component (APC) factors. In Panel A we report results for the R^2 gap, which is defined as the difference between the aggregated equal-weighted country-specific local and foreign (or global) factor R^2s, whereas Panel B depicts results for the alpha gap, which is defined as the difference between the aggregated equal-weighted country-specific foreign (or global) and local factor absolute alphas. We report the gaps for the first half of the sample period (Period 1; 1989:11-2000:12), the second half of the sample period (Period 2; 2001:1-2012:2), as well as the change from Period 1 to Period 2 (Change). The alphas and the R^2s are derived from time-series OLS regression using all observations during the respective sample period and 95% bootstrap confidence intervals are shown in parentheses (see Section A.2 of the Appendix for a description of the procedure). Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. A more detailed description of the set of countries as well as test asset and factor construction is given in Section 2.2. The construction of the exchange rate risk factor (XMI) is outlined in Section A.1 of the Appendix. The asymptotic principal components (APC) factors are computed using the methodology of Jones (2001) (see Section 4).

Panel A. R^2 Gaps

	Foreign-Local			Global-Local		
	Period 1	Period 2	Change	Period 1	Period 2	Change
Market	0.38	0.17	-0.22	0.35	0.15	-0.19
	(0.35,0.42)	(0.15,0.19)	(-0.26,-0.18)	(0.32,0.39)	(0.13,0.18)	(-0.24,-0.16)
Fama-French	0.53	0.25	-0.28	0.48	0.23	-0.25
	(0.51,0.57)	(0.23,0.29)	(-0.33,-0.24)	(0.45,0.52)	(0.21,0.26)	(-0.30,-0.22)
Carhart	0.55	0.26	-0.29	0.50	0.23	-0.26
	(0.53,0.59)	(0.24,0.29)	(-0.35,-0.25)	(0.48,0.54)	(0.22,0.27)	(-0.31,-0.23)
Carhart + XMI	0.55	0.26	-0.29	0.50	0.23	-0.26
	(0.54,0.59)	(0.25,0.29)	(-0.35,-0.26)	(0.48,0.54)	(0.22,0.26)	(-0.32,-0.23)
APC	0.44	0.22	-0.23	0.36	0.16	-0.20
	(0.43,0.49)	(0.20,0.25)	(-0.26,-0.20)	(0.34,0.41)	(0.14,0.19)	(-0.24,-0.17)

(continued)

Table 9. Continued.

Panel B. Alpha Gaps						
	Foreign-Local			Global-Local		
	Period 1	Period 2	Change	Period 1	Period 2	Change
Market	0.20	0.18	-0.02	0.18	0.17	-0.01
	(0.04,0.41)	(0.07,0.30)	(-0.25,0.19)	(0.03,0.35)	(0.07,0.29)	(-0.22,0.19)
Fama-French	0.25	0.14	-0.11	0.24	0.13	-0.11
	(0.10,0.35)	(0.05,0.19)	(-0.30,0.10)	(0.07,0.34)	(0.05,0.18)	(-0.29,0.09)
Carhart	0.31	0.19	-0.13	0.30	0.17	-0.13
	(0.13,0.40)	(0.11,0.23)	(-0.30,0.11)	(0.13,0.40)	(0.10,0.22)	(-0.31,0.10)
Carhart + XMI	0.33	0.18	-0.15	0.31	0.16	-0.15
	(0.14,0.42)	(0.09,0.21)	(-0.34,0.09)	(0.13,0.42)	(0.09,0.20)	(-0.34,0.08)
APC	0.18	0.12	-0.06	0.13	0.11	-0.01
	(0.08,0.25)	(0.02,0.24)	(-0.21,0.20)	(0.03,0.19)	(0.01,0.25)	(-0.14,0.22)

Supplementary Appendix

SA.1 Extended Sample

Since data for the complete period from November 1989 to December 2012 is not available for all 29 countries in the initial dataset, throughout the analyses in the paper we used a reduced sample of 18 capital markets. To check the robustness of the results, we recompute the R^2 and alpha gaps using the extended sample of countries. Hence, we sequentially add one by one the following countries based on their respective initial data availability: Czech Republic, Finland, Hong Kong, Hungary, Iceland, Ireland, Luxembourg, Poland, Portugal, Slovakia and Turkey.

[Insert Table SA-1 about here]

Table SA-1 shows the results for the baseline sample (18 countries) and the extended sample (29 countries). In Panel A, trend test results on the country-aggregated (equal-weighted) R^2 gaps are shown, whereas country-aggregated alpha gap trends are given in Panel B. As in the main text, the models we consider are the market, Fama-French and Carhart factors, as well as the Carhart factors augmented by an exchange rate risk factor (Carhart + XMI).

Irrespective of the model of interest, the R^2 gap trend coefficients for the extended sample are all negative, statistically and economically significant and of a similar magnitude to the ones obtained using the baseline sample. This holds for both foreign-local and global-local gaps. By contrast, alpha gap trends with the extended sample are all positive and far from statistically significant. Thus, if anything, extending the sample leads to even stronger evidence against a catch-up of global or foreign models in terms of pricing errors.

SA.2 Rolling Period Length

One potential concern with respect to our inferences is that the results may be sensitive to the choice of the rolling period length in the regressions. We check this possibility by re-computing the R^2 and alpha gaps with various rolling-period lengths (24, 36, 48, 60, 72, 84, and 96 month periods).

[Insert Table SA-2 about here]

Table SA-2 shows the (equal-weighted) country-aggregated trend test results for the market, Fama-French (FF) and Carhart (CH) factors, as well as the Carhart factors augmented by an exchange rate risk factor (CHX). Again, Panel A (B) depicts results on the foreign-local and global-local R^2 (alpha) gaps.

All R^2 gap trend coefficients in Panel A are negative, strong and of similar magnitudes as before. Moreover, the vast majority of the estimated slopes is highly statistically significant, too. For alpha gaps (Panel B), results do not appear to be sensitive to the choice of the rolling period window either. All estimated trends are small and of differing sign. Out of 56 experiments, we can reject the null of zero trends in only 2 cases. Even with these 2 cases, inspection of the plots of the series with bootstrap confidence intervals (available upon request) suggests that there is no statistically significant decline in alpha gaps over time.

SA.3 Local Risk-free Rates and Global Factor Construction

The robustness of the results to the choice of foreign vs. global factors or the relevant risk-free rate, as well as the construction of global factors is discussed in Section 4 of the paper. Here we provide the respective plots with bootstrap confidence intervals for the Carhart alpha gaps, constructed either using the Schmidt et al. (2015) or the Fama and French (2012) global factors. For the former, only results with local risk-free rates are shown, as the relevant plots are given in the main part of the paper.

[Insert Figure SA-1 about here]

Results are depicted in Figure SA-1. Irrespective of the factor construction methodology or choice of risk-free rates, none of the alpha gap series exhibits a statistically and economically significant trending behaviour. Overall, these results in line with those in the main text.

SA.4 Alternative Exchange Rate Risk Proxies

Motivated by the recent foreign exchange rate literature, Brusa et al. (2015) propose a new model which augments the global CAPM by a "Dollar" factor and a "Carry" factor, where Dollar is the return on a portfolio long (short) in the U.S. dollar (all foreign currencies) and Carry is the return on a portfolio long (short) in high (low) interest rate currencies. Therefore, we re-examine the sensitivity of the results on the R^2 and alpha gap trends to different foreign exchange rate rate risk proxies. More specifically, we compute the gap series with (i) foreign (global) Carhart factors augmented by our exchange rate risk factor, XMI, plus a Carry factor (Carhart + XMI + Carry), and (ii) foreign (global) Carhart factors augmented by Dollar and Carry factors (Carhart + Dollar + Carry). In all tests that follow, we employ the Dollar and Carry factors from Kroencke et al. (2014), which were kindly provided to us by the authors.

[Insert Table SA-3 about here]

Table SA-3 shows the results. Again, trend tests on the R^2 gaps are given in Panel A, whereas Panel B depicts results on the alpha gaps. For comparability with previous findings, we also report results for the Carhart as well as the Carhart + XMI specifications.

The trend coefficients and corresponding p-values in Panel A suggest that alternative exchange rate risk factors yield qualitatively and quantitatively similar results. All R^2 gap coefficients are large, negative and statistically well below zero. As to alpha gaps (Panel B), the the exchange rate risk factors choice does not affect our basic conclusions either. Alpha gaps are large (based on the time-seies averages of the series) and there is no evidence that these have declined over the course of our sample period. Overall, results are in line with those in the main text.

SA.5 R^2 and Local Premium Decomposition: Factor Construction

One potential concern with the R^2 trend decomposition and the local premium decomposition results of Section 3.2 in the main text is that the findings may be sensitive to the factor construction methodology. We check this possibility be examining the robustness of the tests to the choice of foreign vs. global factors and the construction procedure of global factors.

[Insert Table SA-4 about here]

Table SA-4 depicts the trends in the R^2 gaps for the market, Fama-French and Carhart factors when (i) all parameters are free, (ii) the variance-covariance matrices are fixed, and (iii) betas are fixed. Results are shown for the foreign-local and global-local gaps with our factors (Own) as well as the global-local gaps with the Fama and French (2012) (F&F) factors.

In all specifications, fixing variances results in trend coefficients which are of comparable magnitudes to the respective raw series and remain significant in most instances. By contrast, fixing betas leads to trend estimates which are considerably lower and insignificant in all cases. Thus, different factor construction methodologies yield similar conclusions, i.e., variance bias cannot explain the catch-up of foreign (global) models in terms of time-series explanatory power.

[Insert Table SA-5 about here]

Table SA-5 shows the trend test results for the factor premium distances with non-unitary betas. Again, we examine the sensitivity of the previous results to the choice of foreign vs. global factors and the construction methodology of global factors. Based on the time-series averages of the respective series, all premium distances are large on average. In addition, the trend coefficients are generally small, of inconclusive sign and uniformly insignificant across all specifications. All in all, our conclusion of no evidence for a decline in residual local factor premia remains unchanged.

SA.6 R^2 Decomposition: Trends in Factor Betas vs. Factor Volatilities

In the main text, we applied a decomposition methodology to examine whether factor betas or factor variances are behind the catch-up of foreign (global) factors in terms of time-series explanatory power (R^2). Here we provide additional evidence by examining the trends in the exposure of local factors with respect to foreign (global) factors (foreign (global) factor betas) as well as foreign (global) factor volatilities. The former come from rolling period regressions of local factors on their respective foreign (global) counterparts, whereas the latter are computed as rolling period standard deviations of the respective foreign (global) factors. Both quantities are estimated on a 60 months rolling period basis and given in decimals.

[Insert Figure SA-2 about here]

Preliminary evidence for rising betas is given in Figure SA-2. For the market, size and momentum factors, (country-averaged) local factor exposures on their respective foreign counterparts increase significantly over time. For the value factor, betas exhibit an increasing but weaker pattern.

[Insert Table SA-6 about here]

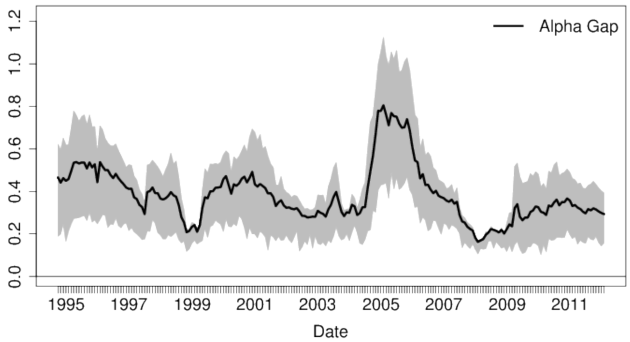
Formal trend test results on the beta as well as volatility series are given in Table SA-6. We show results for the foreign and global versions of our factors (denoted by "Own"), as well as the global versions of the Fama and French (2012) factors (denoted by "F&F"). All trend coefficients are multiplied by 100.

For all factors under study and irrespective of the factor construction methodology, the factor beta trend coefficients are all positive. Averaged across factors, all trend coefficients are large and economically as well as statistically significant. In economic terms, the trend coefficient of the averaged foreign factor betas in the amount of 0.23 suggests that foreign factor betas have on average increased by 0.48 (=0.23x209/100) over the course of our sample period.

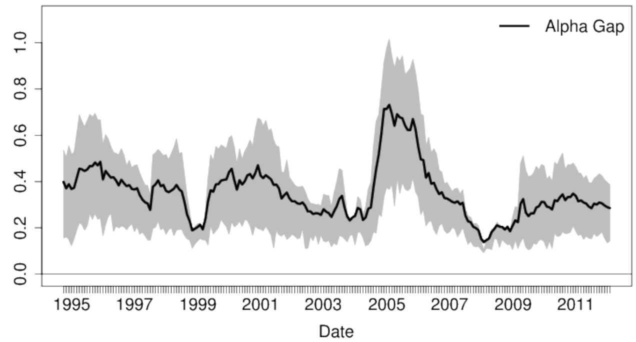
By contrast, the estimated trends of foreign (global) factor volatilites are all close to 0 and far from being statistically significant at any conventional level. Thus, there is no evidence for a long-term trend in factor volatilities.

Overall this evidence is supportive for the catch-up of foreign (global) factor models being driven by factor betas rather than factor volatilities and is hence in line with the decomposition results in the main text.

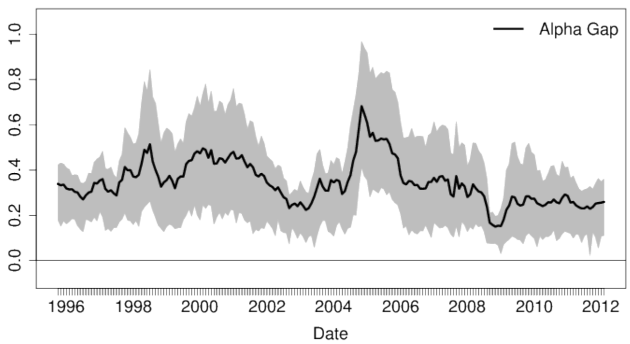
Figure SA-1. Carhart Alpha Gap Robustness: Global Factor Construction & Risk-free Rate Choice.



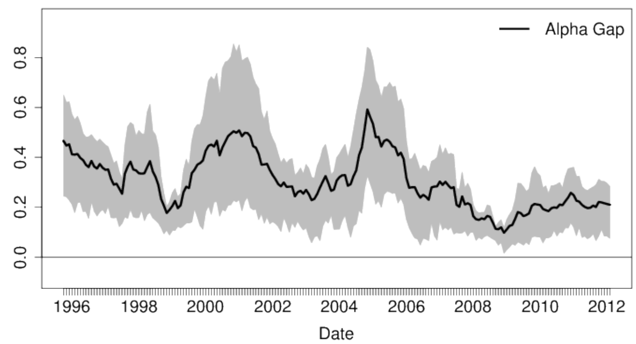
Panel (a): Foreign-Local with Loc-Rf (Own)



Panel (b): World-Local with Loc-Rf (Own)



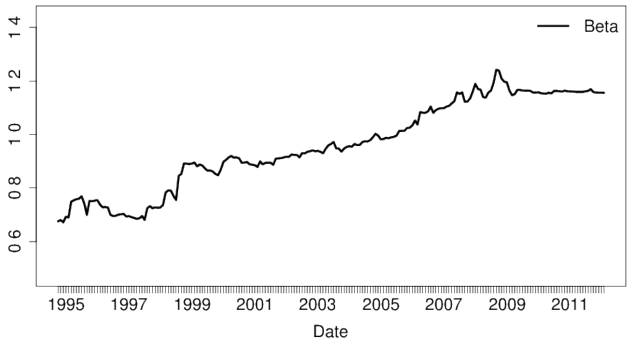
Panel (c): World-Local with US-Rf (F&F)



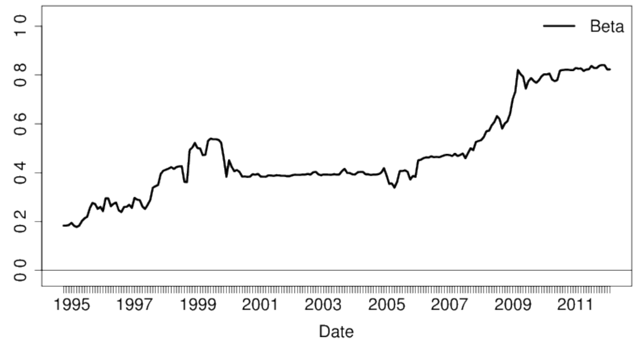
Panel (d): World-Local with Loc-Rf (F&F)

This figure illustrates the time-varying performance of foreign (global) Carhart factor models vs. local versions of these models, based on alpha gaps. Alpha gap is defined as the difference between the aggregated equal-weighted country-specific foreign (global) and local factor absolute alphas. The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. The bold lines are the respective estimated gap series, whereas the grey shaded areas represent 95% bootstrap confidence intervals (see Section A.2 of the Appendix for a description of the procedure). Panels (a) and (b) show results for the pricing errors (alpha) gaps of the foreign and global Carhart factors when factors are constructed as outlined in Section 2.2 and returns are in excess of the corresponding country-specific risk-free rate, respectively. Panels (c) and (d) show results for the pricing errors (alpha) gaps of the global Carhart factors when the global factors of Fama and French (2012) are used in the computation of the gaps instead and excess returns are computed using the U.S. 3-month T-bill rate or the corresponding country-specific risk-free rate, respectively. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. Alphas are shown in monthly percentage points and the dates on the x-axes represent the end-dates of the rolling windows.

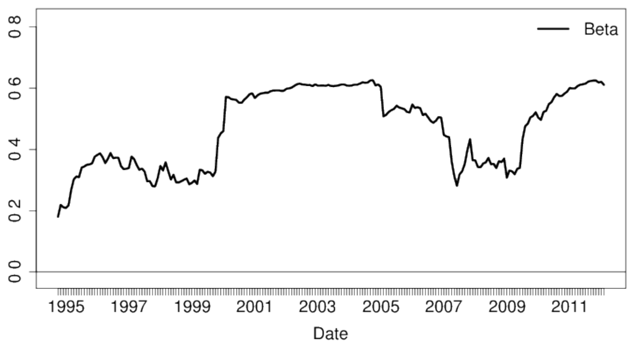
Figure SA-2. R^2 Trend Decomposition Robustness: Trends in Factor Betas.



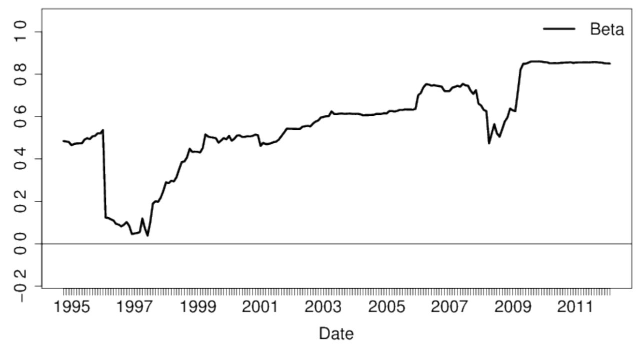
Panel (a): MRF



Panel (b): SMB



Panel (c): HML



Panel (d): WML

This figure illustrates the country-aggregated (equal-weighted) time-varying factor betas of the market (VWR), size (SMB), value (HML) and momentum (WML) factors for the main sample of 18 markets in this study. Factor beta is the OLS estimated beta (exposure) of the local factor on the respective foreign factor. Local factors are based on data of the respective capital market only, whereas foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.2 in the main text for a more detailed description of the set of countries as well as factor construction. The underlying time series are derived on a rolling 60 months period basis. The dates on the x-axes represent the end-dates of the rolling windows.

Table SA-1. Robustness: Adding Excluded Countries.

This table provides trend test results on the time-varying performance difference between local and foreign (foreign-local) or local and global (global-local) versions of the market, Fama-French, Carhart and exchange rate risk augmented Carhart (Carhart + XMI; additional common exchange rate risk factor (XMI) added to the foreign (or global) Carhart specifications) factors for two sample compositions. The first one (main sample) includes the selection of 18 countries as described in Section 2.2 of the paper. The second one (extended sample) includes the countries in the baseline sample plus the 11 countries, which were initially screened out as explained in Section 2.2 of the paper. In panel A we report results on the aggregated (equal-weighted) country-specific R^2 gaps, which are computed as the difference between the respective local and foreign (global) factor R^2 series. In addition, panel B depicts results on the aggregated (equal-weighted) country-specific alpha gaps, which are defined as the difference between the respective foreign (global) and local factor alpha series. The reported trend coefficients and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.1 in the main text for details on the factor models under study and Section 2.2 in the main text for a more detailed description of the set of countries as well as test asset and factor construction. The construction of the exchange rate risk factor (XMI) is outlined in Section A.1 of the Appendix. The sample period starts 1989:11 and ends 2012:2.

Panel A. R^2 Gap

	Foreign-Local		**Global-Local**	
	Main Sample	Extended Sample	Main Sample	Extended Sample
Market	-0.16	-0.15	-0.14	-0.13
	(0.00)	(0.00)	(0.00)	(0.00)
Fama-French	-0.20	-0.18	-0.18	-0.16
	(0.00)	(0.00)	(0.00)	(0.00)
Carhart	-0.21	-0.19	-0.19	-0.17
	(0.00)	(0.00)	(0.00)	(0.00)
Carhart + XMI	-0.21	-0.18	-0.19	-0.17
	(0.00)	(0.00)	(0.00)	(0.00)

(continued)

Table SA-1. Continued.

	Foreign-Local		Global-Local	
Panel B. Alpha Gap				
	Main Sample	Extended Sample	Main Sample	Extended Sample
Market	-0.01	0.01	-0.01	0.01
	(0.93)	(0.95)	(0.94)	(0.95)
Fama-French	0.04	0.09	0.04	0.09
	(0.82)	(0.70)	(0.80)	(0.69)
Carhart	0.01	0.04	0.02	0.06
	(0.98)	(0.87)	(0.89)	(0.81)
Carhart + XMI	-0.03	0.01	-0.00	0.03
	(0.90)	(0.97)	(0.98)	(0.90)

Table SA-2. Robustness: Rolling Period Length.

This table provides trend test results on the time-varying performance difference between local and foreign (foreign-local) or local and global (global-local) versions of the market, Fama-French (FF), Carhart (CH) and exchange rate risk augmented Carhart (CHX; additional common exchange rate risk factor (XMI) added to the foreign (or global) Carhart specifications) factors for various estimation period lengths. In panel A we report results on the aggregated (equal-weighted) country-specific R^2 gaps, which are computed as the difference between the respective local and foreign (global) factor R^2 series. In addition, panel B depicts results on the aggregated (equal-weighted) country-specific alpha gaps, which are defined as the difference between the respective foreign (global) and local factor alpha series. The reported trend coefficients and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). The underlying time series are derived from rolling OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.1 in the main text for details on the factor models under study and Section 2.2 in the main text for a more detailed description of the set of countries as well as test asset and factor construction. The construction of the exchange rate risk factor (XMI) is outlined in Section A.1 of the Appendix of the main text. The sample period starts 1989:11 and ends 2012:2.

Panel A. R^2 Gaps

	Foreign-Local				**Global-Local**			
	Market	FF	CH	CHX	Market	FF	CH	CHX
24 months	-0.14	-0.16	-0.16	-0.14	-0.12	-0.14	-0.14	-0.13
	(0.09)	(0.05)	(0.06)	(0.12)	(0.02)	(0.07)	(0.08)	(0.16)
36 months	-0.15	-0.17	-0.18	-0.17	-0.13	-0.15	-0.16	-0.15
	(0.03)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)
48 months	-0.16	-0.19	-0.20	-0.20	-0.14	-0.17	-0.18	-0.18
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
60 months	-0.16	-0.20	-0.21	-0.21	-0.14	-0.18	-0.19	-0.19
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
72 Months	-0.17	-0.21	-0.22	-0.22	-0.15	-0.19	-0.20	-0.20
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
84 months	-0.17	-0.22	-0.23	-0.23	-0.15	-0.20	-0.21	-0.21
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
96 months	-0.17	-0.22	-0.23	-0.23	-0.15	-0.20	-0.20	-0.20
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

(continued)

Table SA-2. Continued.

Panel B. Alpha Gaps

	Foreign-Local				**Global-Local**			
	Market	FF	CH	CHX	Market	FF	CH	CHX
24 months	0.00	-0.01	-0.05	-0.06	0.02	-0.01	-0.05	-0.06
	(0.99)	(0.99)	(0.94)	(0.92)	(0.95)	(0.98)	(0.93)	(0.92)
36 months	0.01	0.00	-0.03	-0.06	0.03	0.01	-0.00	-0.03
	(0.94)	(0.98)	(0.93)	(0.88)	(0.88)	(0.95)	(0.99)	(0.94)
48 months	0.00	0.01	-0.04	-0.06	0.01	0.02	-0.01	-0.03
	(0.98)	(0.97)	(0.88)	(0.82)	(0.94)	(0.93)	(0.96)	(0.90)
60 months	-0.01	0.04	0.01	-0.03	-0.01	0.04	0.02	-0.00
	(0.93)	(0.82)	(0.98)	(0.90)	(0.94)	(0.80)	(0.89)	(0.98)
72 months	-0.04	0.01	-0.01	-0.02	-0.03	0.02	0.00	-0.01
	(0.70)	(0.88)	(0.93)	(0.86)	(0.76)	(0.83)	(1.00)	(0.92)
84 months	-0.05	-0.01	-0.04	-0.05	-0.04	-0.00	-0.03	-0.04
	(0.69)	(0.74)	(0.10)	(0.26)	(0.75)	(0.97)	(0.59)	(0.26)
96 months	-0.05	-0.01	-0.05	-0.05	-0.04	-0.00	-0.03	-0.05
	(0.64)	(0.81)	(0.01)	(0.01)	(0.69)	(0.96)	(0.74)	(0.74)

Table SA-3. Robustness: Alternative Foreign Exchange Rate Risk Factors.

This table provides trend test results on the time-varying performance difference between local and foreign (foreign-local) or local and global (global-local) versions of the exchange rate risk augmented Carhart factors with various exchange rate risk proxies (additional common exchange rate risk factors added to the foreign (or global) Carhart specifications). The exchange rate risk proxies we consider are (i) XMI as in Kolari et al. (2008) and (ii) Dollar and Carry as in Brusa et al. (2015). In panel A we report results on the aggregated (equal-weighted) country-specific R^2 gaps, which are computed as the difference between the respective local and foreign (global) factor R^2 series. In addition, Panel B depicts results on the aggregated (equal-weighted) country-specific alpha gaps, which are defined as the difference between the respective foreign (global) and local factor alpha series. The reported trend coefficients and test statistic p-values (in parentheses) are computed using the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). The underlying time series are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 and absolute alpha averages. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.2 in the main text for a more detailed description of the set of countries as well as test asset and factor construction. The construction of the XMI factor is outlined in Section A.1 of the Appendix of the main text. The Dollar and Carry factors are from Kroencke et al. (2014). The sample period starts 1989:11 and ends 2012:2.

Panel A. R^2 Gaps

	Foreign-Local		**World-Local**	
	β_λ	TS Mean	β_λ	TS Mean
Carhart	-0.21	41.02	-0.19	37.14
	(0.00)		(0.00)	
Carhart + XMI	-0.21	41.02	-0.19	36.93
	(0.00)		(0.00)	
Carhart + XMI + Carry	-0.21	39.95	-0.19	36.17
	(0.00)		(0.00)	
Carhart + Dollar + Carry	-0.18	37.57	-0.17	33.94
	(0.00)		(0.00)	

(continued)

Table SA-3. Continued.

Panel B. Alpha Gaps				
	Foreign-Local		**World-Local**	
	β_λx100	TS Mean	β_λx100	TS Mean
Carhart	0.01	40.12	0.02	36.96
	(0.98)		(0.89)	
Carhart + XMI	-0.03	40.12	-0.00	37.19
	(0.90)		(0.98)	
Carhart + XMI + Carry	-0.04	41.30	-0.01	38.09
	(0.87)		(0.95)	
Carhart + Dollar + Carry	-0.05	40.59	-0.02	37.26
	(0.82)		(0.91)	

Table SA-4. R^2 Trend Decomposition Robustness: Foreign vs. Global Factors & Global Factor Construction.

This table provides trend decomposition test results on the time-varying R^2 difference between local and foreign (global) versions of the market, Fama-French and Carhart factors for the main sample of 18 markets in this study. In addition, results are given for the case when the global versions of the factors we employ (Own) are replaced by the Fama and French (2012) (F&F) global factors in the calculation of the differential performance of the local and global versions of the factor models. The R^2 gaps are defined as the difference between the aggregated (equal-weighted) country-specific local and foreign (global) factor R^2s. Results are shown for the underlying time series realization, i.e., when all relevant parameters are free and for two additional cases, when either one of the relevant parameters is fixed at its initial value. The relevant parameters are the factor betas (Betas) and the factor variance-covariance matrix (Vcov). Trend coefficients are reported with the corresponding test statistic p-value (in parentheses), both computed by means of the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). The underlying time series (when all parameters are free) are derived from rolling 60 months OLS regressions of local test asset excess returns on the respective version of the factors and aggregated by equal-weighting the country-specific test asset R^2 averages. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. See Section 2.1 for details on the factor models under study and Section 2.2 in the main text for a more detailed description of the set of countries as well as test asset and factor construction. The sample period starts 1989:11 and ends 2012:2.

	Foreign-Local (Own)			**Global-Local (Own)**			**Global-Local (F&F)**		
Betas	Free	Free	Fixed	Free	Free	Fixed	Free	Free	Fixed
Vcov	Free	Fixed	Free	Free	Fixed	Free	Free	Fixed	Free
Market	-0.16	-0.18	0.03	-0.14	-0.17	0.04	-0.14	-0.14	0.04
	(0.00)	(0.04)	(0.58)	(0.00)	(0.02)	(0.47)	(0.00)	(0.14)	(0.59)
Fama-French	-0.20	-0.22	-0.03	-0.18	-0.19	-0.02	-0.16	-0.14	-0.04
	(0.00)	(0.00)	(0.68)	(0.00)	(0.01)	(0.83)	(0.00)	(0.03)	(0.57)
Carhart	-0.21	-0.23	-0.03	-0.19	-0.20	-0.02	-0.17	-0.15	-0.04
	(0.00)	(0.00)	(0.72)	(0.00)	(0.01)	(0.82)	(0.00)	(0.04)	(0.56)

Table SA-5. Residual Local Factor Premia Robustness: Foreign vs. Global Factors & Global Factor Construction.

This table provides trend test results on the country-aggregated time-varying premium distance between the local and foreign (global) versions of the market, size, value and momentum factors for the main sample of 18 markets in this study. In addition, results are given for the case when the global versions of the factors we employ (Own) are replaced by the Fama and French (2012) (F&F) global factors in the calculation of the premium distances. Distance is computed as the absolute value of the difference between the average return of the respective local factor and the factor beta weighted average return of the corresponding foreign (global) factor, where the factor beta is the OLS estimated beta of the local factor on the foreign (global) factor. Further, the distance measure is calculated for each market and then aggregated by equal-weighting the country-specific distances. The reported trend coefficients β_λ and test statistic p-values (in parentheses) are computed by means of the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). In addition, we report the time-series average of the series (TS Mean). The underlying time series are derived on a rolling 60 months period basis. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighed averages of local factors, excluding the country of interest. See Section 2.2 in the main text for a more detailed description of the set of countries as well as factor construction. The sample period starts 1989:11 and ends 2012:2.

	Foreign-Local (Own)		**Global-Local (Own)**		**Global-Local (F&F)**	
	β_λx100	TS Mean	β_λx100	TS Mean	β_λx100	TS Mean
Market Factor	-0.01	0.51	-0.01	0.49	-0.03	0.50
	(0.96)		(0.98)		(0.91)	
Size Factor	0.02	0.43	0.01	0.41	0.02	0.41
	(0.83)		(0.94)		(0.87)	
Value Factor	-0.03	0.48	-0.03	0.45	0.06	0.47
	(0.85)		(0.85)		(0.74)	
Momentum Factor	-0.05	0.74	-0.05	0.70	-0.05	0.73
	(0.87)		(0.87)		(0.84)	

Table SA-6. R^2 Trend Robustness: Trends in Factor Betas vs. Factor Volatilities.

This table provides trend test results on the country-aggregated (equal-weighted) time-varying factor betas and factor volatilities of the market, size, value and momentum factors for the main sample of 18 markets in this study. Factor beta is the OLS estimated beta (exposure) of the local factor on the respective foreign (global) factor, whereas factor volatility is the standard deviation of the respective foreign (global) factor. We show results with foreign (global) factors computed as outlined in Section 2.2 of the main text (Own), as well as global factors from Fama and French (2012) (F&F). Further, the beta and volatility series are calculated for each market and then aggregated by equal-weighting the country-sprecific series. The reported trend coefficients and test statistic p-values (in parentheses) are computed by means of the methodology of Harvey et al. (2007) (see Section A.3 in the Appendix of the main text for a description of the procedure). The underlying time series are derived on a rolling 60 months period basis. Local factors are based on data of the respective capital market only, whereas global factors are value-weighted averages of local factors. Foreign factors are value-weighted averages of local factors, excluding the country of interest. See Section 2.2 in the main text for a more detailed description of the set of countries as well as factor construction. The sample period starts 1989:11 and ends 2012:2.

	Betas			**Volatilities**		
	Foreign (Own)	Global (Own)	Global (F&F)	Foreign (Own)	Global (Own)	Global (F&F)
Market Factor	0.25	0.21	0.20	0.01	0.01	0.01
	(0.00)	(0.00)	(0.03)	(0.40)	(0.39)	(0.21)
Size Factor	0.31	0.26	0.28	0.00	0.00	0.00
	(0.02)	(0.07)	(0.13)	(0.85)	(0.84)	(0.95)
Value Factor	0.20	0.18	0.06	0.00	0.00	0.00
	(0.25)	(0.20)	(0.72)	(0.92)	(0.91)	(0.86)
Momentum Factor	0.28	0.20	0.29	0.02	0.02	0.01
	(0.00)	(0.02)	(0.15)	(0.44)	(0.43)	(0.45)
Factor Average	0.23	0.19	0.21	0.01	0.01	0.01
	(0.00)	(0.01)	(0.00)	(0.54)	(0.53)	(0.48)

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