Common Risk Factors in Equity Markets*

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Abstract

A betting against consumption (BAC) factor, which goes long high consumption growth markets and short low consumption growth markets, explains most of the cross-sectional variation in returns on equity portfolios from 47 developed and emerging markets over a four-decade period. High sensitivity to BAC is associated with high average returns and commands a pervasive and statistically significant premium. This risk premium is about 50 to 80 basis points per month and has increased in recent years. By investing in high BAC beta markets, investors load up on common macroeconomic risks.

JEL: G11; G12

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1. Introduction

The idea that differences in exposure to systematic risk should justify differences in excess returns across assets is central to asset pricing. The canonical international consumption capital asset pricing model in Stulz (1981) postulates that equity premium should be determined by its ability to insure against fluctuations in world consumption growth. Yet, evidence presented in Wheatley (1988), Cumby (1990), Karolyi and Stulz (2003), Li and Zhong (2005), Darrat et al. (2011) and Rangvid et al. (2012) cannot validate this prediction empirically. While the intuitive appeal of consumption-based asset pricing remains well preserved, its empirical shortcomings are hotly debated among financial economists. In particular, identifying systematic sources of macroeconomic risk that can rationalize patterns in realized excess returns continues to be an important issue in international finance.

In this article, I show that a betting against consumption (BAC) factor, which goes long high consumption growth markets and short low consumption growth markets, explains most of the cross-sectional variation in returns on equity portfolios from 47 developed and emerging markets over the period from January 1970 to December 2012. If BAC is a systematic risk factor, the finance theory predicts that markets with different sensitivities to this factor should have vastly different excess returns. I find strong support for this hypothesis.

In the data, there is almost a monotonic relation between BAC betas and average excess returns. Spreads in these betas explain a large part of the spreads in excess returns. Evidence from both Fama and MacBeth (1973) regressions and portfolio sorts based on estimated risk exposures supports that BAC betas convey important information about risk. High sensitivity to BAC commands a pervasive and statistically significant premium to compensate investors for taking on common macroeconomic risks.

The empirical approach in this paper relies on portfolio formation. Using portfolios of stocks as base assets to test asset pricing models diminishes idiosyncratic variation, mitigates the error-in-variables bias, and promises a more precise estimation of risk premiums (e.g. Black et al., 1972; Fama and MacBeth, 1973). Since the early 1970s it has become a tradition in the empirical finance literature to employ financial characteristics as a sorting criterion for portfolios. However, this procedure has a strong disadvantage, as it cannot directly answer the question as to what fundamental economic sources drive price changes.

Several recent contributions address this issue in the framework of currency pricing. For example, Menkhoff et al. (2013), Hoffmann and Suter (2013), and Della Corte et al. (2014) sort currencies according to countries' macro characteristics such as consumption growth, GDP, industrial production, and net foreign asset position to study the formation of risk premiums on foreign exchange rates. The present paper applies an analogous methodology to zoom-in on the risk-return trade-off in equity markets.

More specifically, I build portfolios of international equity returns by sorting countries' MSCI indices according to fourth-quarter-over-fourth-quarter consumption growth such that the first portfolio always contains the lowest consumption growth economies, while the last the highest. The BAC portfolio mimics the return on a bet on high versus low consumption growth markets. Its excess return is easily computed as the difference in returns between baskets of high and low consumption growth portfolios.

Using fourth-quarter-over-fourth-quarter consumption changes as a sorting criterion for portfolios is motivated by the literature on long-run consumption risks (Bansal and Yaron, 2004; Parker and Julliard, 2005; Rangvid et al., 2012) and its key insight that consumption growth rates cumulated over several quarters should promise an adequate approximation of true consumption spending and be sufficiently informative about changes in market wealth. In particular, Jagannathan and Wang (2007) show that matching calendar year returns with annual consumption growth based upon the fourth quarter promises most success for the empirical paradigm of consumption-based asset pricing.

This article is perhaps most closely related to Lustig et al. (2011) who study two common risk factors in foreign exchange markets: the average currency excess return on a large set of currencies against the US dollar—termed the dollar factor and denoted as DOL—and the return to a factor which is long in high interest rate currencies and short in low interest rate currencies—termed the carry trade factor and denoted as $\mathrm{HML}_{\mathrm{FX}}$ for high-minus-low interest rate currencies. The authors show that the cross-section of returns to carry trades can be well rationalized by relating them to these two factors. In particular, the carry trade factor explains the dispersion in interest rate differential sorted currency portfolios and variation in country-level currency returns.

In the present paper, I similarly employ two common risk factors. However, my focus is on macroeconomic risks in international equity markets rather than on financial determinants of foreign exchange rates. The first factor is the average equity excess return on a large set of equity indices measured in US dollar, also labelled the dollar factor (DOL). The second factor is the betting against consumption factor or BAC, which is similar to the high-minus-low investment strategy with a long position in high consumption growth markets and a short position in low consumption growth markets. This factor is the equity market analogue of the consumption carry factor proposed by Hoffmann and Suter (2013).

The main results of this paper are easy to summarize. The BAC portfolio constructed to mimic macroeconomic risks related to long-run consumption growth captures most of the common variation in international equity returns and retains its pricing power in the presence of alternative risk factors previously proposed in the literature. This is evidence that BAC proxies for a common source of risk in stock returns. Further, high sensitivity to BAC commands a pervasive and statistically significant risk premium. This premium is of the order of 50 to 80 basis points per month and it has increased in recent years. I find no similar evidence with respect to the DOL factor. In particular, there is no feedback of DOL exposures on average portfolio performance.

These results survive a battery of robustness checks: (i) Evidence from both Fama and MacBeth (1973) cross-sectional regressions and portfolio formation based on the estimated BAC risk exposures suggests that high sensitivities to BAC are associated with high average returns. (ii) I study portfolios based on alternative return index computation methods. (iii) I vary the sample period and the cross-section of countries. (iv) I investigate portfolios and individual country indices as base assets. (v) I control for additional risk factors which are usually considered in the literature. (vi) I work with real and nominal returns. (vii) I experiment with different return frequencies. (viii) I build portfolios based on consumption growth in USD and local currency units. (ix) I experiment with alternative number of portfolios. (x) I investigate different computation ways of betas including full-sample estimates, time-varying betas and betas estimated for each factor independently. The results are robust to each of these changes and thus support that BAC is an important driver of risk premiums in international equity markets.

This paper sheds new light on the relation between risk and expected returns, which is a central issue in financial economics. Specifically, it contributes to two literatures. The first encompasses a long sequence of papers which emphasize the importance of return-based factors for empirical asset pricing. For instance, Fama and French (1992) show that factor mimicking portfolios related to firm size and book-to-market equity explain average returns in stocks. Carhart (1997) demonstrates that a common return-based risk factor explains much of the short-term persistence in returns. More recently, Frazzini and Pedersen (2014) construct a betting against beta (BAB) factor as a portfolio that holds low-beta assets and shorts high-beta assets. They show that BAB generates highly significant risk-adjusted returns within a large number of developed stock markets and across different asset classes. Della Corte et al. (2014) propose a factor mimicking portfolio for global imbalances and find that it goes a long way in pricing the cross-section of currency excess returns. Assness et al. (2014) show that their quality-minus-junk (QMJ) factor which goes long in high-quality stocks and short in low-quality stocks, can explain the size effect in the data.

This paper is also related to a second literature which argues that long-run consumption-based risks are priced in the cross-section. For example, Parker and Julliard (2005) demonstrate that assets' sensitivities to long-run consumption growth explain returns on US size- and book-to-market sorted portfolios. Jagannathan and Wang (2007) show that changes in year-over-year fourth quarter consumption are most informative about equity returns. Yogo (2006) highlights the importance of long-run risks incorporated in durables. Relatedly, Bansal and Yaron (2004), Bansal et al. (2005), and Da (2009) show that long-run risks captured by the slow-moving persistent component of consumption growth and characteristics related to cash-flow duration can justify many of the observed features of asset market data. Unfortunately, these studies focus almost exclusively on the US stock market and keep silent about whether similar mechanisms are at work across borders. Recent attempts to validate the long-run risk explanation of international equity returns remain to date very rare and their evidence is controversial (Rangvid et al., 2012; Grammig et al., 2009).

I depart from the aforementioned studies in a number of important ways. First, I document that a return-based factor which mimics macroeconomic risks related to long-run consumption growth provides a simple and powerful characterization of the risk-return trade-off in international equity markets both at portfolio level and at the individual country level. This result emphasizes a common source of systematic risk in returns that is reflected in macro fundamentals. Second, my dataset covers a larger number of countries and a longer time span compared to the related studies which investigate forex markets. Third, I use different sets of portfolios to construct the common risk factors and the base assets to test model performance. Fourth, I employ contemporaneous consumption growth as a sorting criterion for portfolios, as the contemporaneous relationship between factor loadings and risk premiums is the core of a traditional cross-sectional risk-return trade-off. Fifth, I work with annual consumption growth based on the fourth quarter motivated by the empirical evidence in Jagannathan and Wang (2007).

The remainder of this article is organized as follows. Section 2 describes the data. Section 3 details the construction of common risk factors and summarizes the properties of base portfolios used as test assets. Section 4 presents the empirical findings, and Section 5 concludes.

2. Data

This section briefly summarizes the data employed in the empirical analysis. It then outlines the construction of common risk factors and describes the properties of equity portfolios used as base assets in empirical tests of the model.

2.1 MSCI EQUITY INDEX RETURNS

The dataset is comprised of monthly MSCI equity index returns over the longest available period from January 1970 to December 2012 freely available on http://www.msci.com. The sample comprises at most 47 countries: Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Russia, Singapore, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, and United States.

As a robustness check, I also study a smaller group that contains at most 25 developed countries[1]: Australia, Austria, Belgium, Canada, Denmark, Estonia, Finland, France,

[1] Estonia and Slovenia are classified as frontier markets according to the MSCI but belong to developed economies according to the UN and IMF, and to high-income economies according to the World Bank. In the recent MSCI classification, Greece has been shifted from developed to emerging markets and Morocco has been reallocated from emerging to frontier markets.

Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States.

For most of the developed markets, the series start in January 1970, except for Finland, Ireland, Israel, New Zealand, and Portugal. The earliest series for emerging markets become available in January 1988. The total number of countries in our portfolios varies over time from 16 at the beginning of the sample to 28 at the end of sample. The maximum number of equity indices attained during the sample is 47.

The benchmark tests are done on a set of standard MSCI equity index returns, whereas other index variants based on alternative size classifications and return computation methods are used for robustness tests. All equity index returns are denominated in USD.

2.2 MACROECONOMIC DATA

The macroeconomic data on international private consumption expenditures, population, and prices are collected from different sources. Nominal series are converted to real by deflating the original series with the consumer price index (CPI). Series available in annual frequency are interpolated to quarterly. Many of the original time series are already seasonally adjusted. The remaining series are adjusted with seasonal fluctuations by using Census-X12.

Most series for consumption expenditures come from the national accounts downloaded from OECD.Stat. Consumption data for Egypt, Malaysia, Morocco, Peru, Philippines, Singapore, and Thailand are from the IMF International Financial Statistics, for Colombia from the National Administrative Department of Statistics of Colombia accessed via Datastream, for Hong Kong from the Hong Kong Census and Statistics

Department and for Taiwan from the national accounts as published by the Statistical Bureau of Taiwan.

Population numbers for most countries are obtained from OECD.Stat. Population data for Colombia, Egypt, India, Indonesia, Malaysia, Morocco, Peru, Philippines, and Thailand are from the IMF International Financial Statistics, for China from the World Bank Development Indicators, for Hong Kong from the Demographic Statistics Section of the Census and Statistics Department of Hong Kong, for Singapore from the Singapore Department of Statistics, and for Taiwan from the Federal Reserve Economic Data (FRED) of St. Louis Fed.

3. Construction of Common Risk Factors and Test Portfolios

3.1 COMMON RISK FACTORS IN EQUITY MARKETS

Following Lustig et al. (2011), I identify two common risk factors in equity markets.[2] The first is the dollar factor (DOL), measured as the average equity excess return on a large set of equity indices in US dollar. The second is the betting against consumption factor (BAC), measured as the excess return on equity markets with high versus low consumption growth rates.

These risk factors are constructed out of three basic portfolios of MSCI equity indices sorted by the contemporaneous year-over-year consumption growth rates based upon the

[2] Based on unreported results, the first and the second principal components capture more than 80% of the variation in test portfolios detailed in Section 3.2. All portfolios load almost equally on the first factor but reveal a monotonic pattern with respect to the second factor and exhibit no systematic relation to the remaining factors. These results are broadly in line with Lustig et al. (2011).

fourth quarter. [3] Portfolios are rebalanced at the end of each December, such that the first portfolio always contains equity indices with the lowest fourth-quarter-over-fourth-quarter consumption growth rates, while the last the highest.

This procedure emerges naturally from the standard asset pricing models which imply that there should be stable patterns between average asset returns and their sensitivities to sources of risk contemporaneously.[4] While a relationship between quarterly consumption growth and asset returns is rejected on statistical grounds (Mankiw and Shapiro, 1986), cumulating consumption over several quarters promises a more accurate approximation of true consumption spending and should be more informative about changes in market wealth (Bansal and Yaron, 2004; Parker and Julliard, 2005; Rangvid et al., 2012). In particular, Jagannathan and Wang (2007) underscore that annual changes in consumption growth based upon the fourth quarter are tightly linked to the respective calendar year returns, as consumption and investment decisions are most likely to be made simultaneously by the end of each December due to the resolution of uncertainty.

The approach in this paper is differs from Lustig et al. (2011), Hoffmann and Suter (2013), and Menkhoff et al. (2013), among others, who construct the pricing factors from portfolio returns used to test the empirical performance of the model.[5] My methodology has the advantage that it rules out a possibility that risk factors and returns to be explained can be correlated per construction.

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[3] Results are similar for higher and lower number of basic portfolios. For comparison, Fama and French (1992) similarly work with three book-to-market equity groups.

[4] See e.g. Ang et al. (2006) and references therein.

[5] I thank Grigory Vilkov for proposing this course of analysis.

Table I summarizes the descriptive statistics of the three basic portfolios used to construct the DOL and BAC risk factors. Portfolio P1 contains equity indices with the lowest fourth-quarter-over-fourth-quarter consumption growth rates. Portfolio P3 contains equity indices with the highest fourth-quarter-over-fourth-quarter consumption growth rates. For each portfolio the table reports the average consumption growth and its standard deviation. The excess portfolio return is calculated for by taking the average of the equity index excess returns in each portfolio over the risk-free rate.

The common risk factors are constructed for all 47 countries (upper panel) and for a subsample of 25 developed countries (lower panel). The DOL factor is computed as the average excess return on three basic portfolios. The BAC factor is computed as the difference in excess returns on P3 and P1.

Average monthly excess returns tend to increase from low consumption growth markets to high consumption growth markets. For all countries, the average excess returns go up from 0.17% on P1 to 0.84% on P3. For developed countries, the average excess returns lie closer to each other and increase from 0.13% on P1 to 0.58% on P3. There are similar patterns in the portfolios' Sharpe ratios. The underlying consumption growth rates vary from -0.01 to 0.06 in the full sample, and from -0.00 to 0.05 in a subset of developed markets.

The average unconditional excess return on the DOL portfolio is about 0.46% and 0.33% for all and developed countries, respectively. The average excess return on the BAC portfolio is roughly 0.67% and 0.45% in monthly terms for all and developed countries, respectively.

3.2 INTERNATIONAL EQUITY PORTFOLIOS

The returns on test portfolios are constructed in a similar fashion by sorting all equity indices in the sample by the contemporaneous year-over-year consumption growth rates based upon the fourth quarter, such that the first portfolio always contains equity indices with the lowest fourth-quarter-over-fourth-quarter consumption growth rates, while the last the highest. As regards the choice of a total number of portfolios, I follow Lustig et al. (2011) and construct six portfolios for all countries and five portfolios for a smaller subset of developed countries.[6]

Table II provides an overview of the properties of the international equity portfolios from the perspective of a US investor and is structured analogously to Table I. The last column gives the average excess return on a portfolio with the highest consumption growth rates over the portfolio with the lowest consumption growth rates.

The entries in Table II support that average monthly excess returns tend to increase from low consumption growth markets to high consumption growth markets. The relation is almost monotonic, as shown in Figure 1. The excess return on the highest over the lowest consumption growth portfolios is 0.85% in the upper panel and 0.58% in the lower panel.

Figures 2 and 3 give plots of cumulative log excess returns on the highest and lowest consumption growth portfolios for the full sample and a subsample of developed countries, respectively. These figures demonstrate that there are systematic differences in returns on markets with different macroeconomic fundamentals: Investments in countries with low long-run consumption growth rates are associated with economically low gains

[6] I experimented with a higher and a lower number of portfolios but obtained generally similar results.

or losses for long-term equity investors, while investments in countries with high long-run consumption growth rates promise strong profitability in the long term.[7]

4. Empirical Results

My strategy for finding a BAC risk premium in the cross-section is two-fold. First, I provide a systematic investigation of how BAC is priced in the cross-section of expected returns. Second, I create portfolios of equities that have different sensitivities to BAC. If BAC is a priced source of risk, markets with high BAC sensitivities should have high average returns.

4.1 CROSS-SECTIONAL ASSET PRICING RESULTS

The asset pricing tests in this paper rely on the two-stage methodology of Fama and MacBeth (1973) which emerges as one of the most popular approaches for estimating and testing linear asset pricing models. The first stage runs time-series regressions for each portfolio excess returns on a constant and DOL and BAC risk factors to obtain the estimates of factor loadings β^j_{DOL} and β^j_{BAC}:

$$rx^j_{t+1} = \beta^j_0 + \beta^j_{DOL} DOL_{t+1} + \beta^j_{BAC} BAC_{t+1} + \varepsilon^j_{t+1}, \quad (1)$$

where rx^j_{t+1} denotes log excess return on portfolio *j*.

In the second stage, the factor risk premiums are estimated from a cross-sectional regression of average excess returns on the estimated betas:

$$E\left(rx^j\right) = \lambda_{DOL}\beta^j_{DOL} + \lambda_{BAC}\beta^j_{BAC}, \quad (2)$$

where E denotes the expectation operator, and λ_{DOL} and λ_{BAC} are the associated DOL and BAC factor risk premiums.

[7] Portfolios formed on consumption growth denominated in local currency reveal similar properties.

Table III shows OLS estimates of the DOL and BAC betas with HAC *t*-statistics in parentheses for consumption sorted equity portfolios detailed in Section 3.2. Similar to the evidence presented in Lustig et al. (2011), the DOL betas turn out all about unity. The difference in the DOL betas between the extreme portfolios with the highest and the lowest consumption growth rates is economically close to zero and statistically insignificant. Presumably, this factor cannot capture cross-sectional return differentials, but it is important for explaining the average level of excess returns as indicated by the precise measurement of the estimates.

In contrast, the patterns in BAC betas appear to be tightly linked to patterns in portfolios' average returns. The upper panel demonstrates that BAC betas increase from negative -0.63 for the first portfolio to 0.62 for the last portfolio. Portfolios with the lowest consumption growth rates, P1 and P2, have significantly negative BAC loadings; portfolios with the highest consumption growth rates, P5 and P6, have significantly positive BAC loadings, and the two middle portfolios, P3 and P4, have BAC betas which are not statistically distinguishable from zero. The wedge in the BAC betas between the two extreme portfolios, P6 and P1, is about 1.28 with a *t*-statistic of 15.71. The patterns in BAC betas for developed countries' portfolios turn out very similar as indicated in the bottom panel of the table.

Table IV reports the baseline cross-sectional estimates of factor risk prices with Shanken (1992) adjusted *t*-statistics in parentheses. The test assets are six (five) portfolios of standard international MSCI equity indices from all (developed) countries. The last two rows in the table give the cross-sectional adjusted $\overline{R}^2$ and the annualized root mean squared error (RMSE) in percent.

The benchmark regressions in Table IV suggest that the estimate for the market price of BAC is positive and statistically significant, of the order of 70 basis points in monthly terms for all countries and of about 50 basis points for a subsample of developed countries. This means that an asset with a BAC beta of one earns a risk premium of about 50-70 basis points per month. The estimated market price corresponds closely to the average factor excess return reported in Table I. These results are indicative of investors who demand a positive premium for bearing the betting against consumption risk. The risk premium estimates are measured with high precision; the respective *t*-statistics are 4.41 in the full sample and 3.37 in a subsample of developed countries.

Contrary to these findings, the DOL risk factor obtains a premium which is further away from the actual factor mean. Its standard error is high and statistical significance low. The DOL factor cannot explain differences in average returns across portfolios. This result is not surprising, however, since portfolios display virtually no dispersion in DOL exposures as documented in Table III. Replacing the DOL factor with a constant has almost no impact on the BAC risk premium estimate and the general fit of the regression, but this leads to an increase in the RMSE of the regression (not reported).

The estimates in Table IV indicate that BAC can explain a large share of the cross-sectional variation in equity returns with measures of fit in excess of 90%. These results support that international equity excess returns can be understood as compensation for their exposure to BAC risk.

4.2 BETA-SORTED PORTFOLIOS

This section explores the explanatory power of BAC from a different perspective. If fluctuations in BAC are a source of priced risk, then it is reasonable to assume that sorting equity indices according to their BAC risk exposures generates a significant spread in mean returns.

To form portfolios, I follow Lustig et al. (2011) and use rolling window estimates of BAC betas obtained in a 36-month moving window time-series regressions of individual equity index log excess return on a constant and BAC. The first portfolio contains equities with the lowest BAC betas, whereas the last portfolio contains equities with the highest BAC betas. The summary statistics of these portfolios are reported in Table V. For each portfolio, the table gives mean returns in % per month, standard deviations and Sharpe ratios. In addition, it shows portfolios' average BAC betas and their standard deviations.

Figure 4 demonstrates graphically that average returns and their BAC betas increase almost monotonically from the first to the last portfolio. Thus, sorts based on consumption growth and sorts based on betas tend to be related. Furthermore, Figures 5 and 6 give plots of cumulative log excess returns on the extreme portfolios with the highest and lowest BAC betas for the full sample and a subsample of developed countries, respectively. These figures are similar to Figures 2 and 3 and demonstrate that there are systematic differences in returns on markets with different macroeconomic fundamentals: Investments in countries with low BAC betas are associated with economically low gains or losses for long-term equity investors, while investments in countries with high BAC betas promise strong profitability in the long term. These results remain valid for alternative rolling window lengths, different MSCI index specifications, and portfolio sorts based on consumption growth measured in USD and national currency units.

4.3 ROBUSTNESS ANALYSIS

This section provides further results which support the association of equity returns with betting against consumption risk. I investigate the robustness of benchmark findings in the following dimensions: First, I study portfolios based on alternative return index computation methods. Second, I vary the sample period and the cross-section of countries. Third, I look at the individual country indices as base assets. Fourth, I control for additional risk factors which are usually considered in the literature. Fifth, I work with real and nominal returns; with different return frequencies; with alternative number of portfolios; with portfolios formed on consumption growth in USD and local currency units. Furthermore, I experiment with different computation ways of betas including full-sample estimates, time-varying betas and betas estimated for each factor independently.

The results are robust to each of these changes and hence support that BAC is an important driver of risk premiums in international equity markets.

4.3.1 Alternative Index Variants

Table VI uses four alternative variants of MSCI equity indices to form equity portfolios based on fourth-quarter-over-fourth-quarter consumption growth: (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distribution; and (IV) indices of small caps. While the returns on indices in (I)-(III) are available for the full sample from January 1970 to December 2012, indices of small companies become available in 1993.

The estimates in column (I) correspond to the benchmark findings in Table IV and serve as reference point. The inference turns out similar for alternative index return computation methods as reported in columns (II)-(IV) of the table. The BAC risk price is highly significant and varies between 50 and 80 basis points in monthly terms. The model fit is generally high but it deteriorates somewhat for small caps, which are known to be particularly challenging to price. In general, the evidence in Table VI supports the view that investors with access to international equity markets demand a positive compensation for high sensitivity to BAC.

4.3.2 Sample Split

In order to examine the variation in results over different sample periods, I study the pre-2002 and the post-2002 samples as in 2002 the returns on all 47 MSCI equity indices become available. The sample split analysis is done for each of the four return computation methods: (I) standard indices; (II) indices with net dividends; (III) indices with gross dividends; and (IV) indices of small caps. The left half of Table VII presents the estimates for the early sample running from January 1970 to December 2001 in columns (I)-(III) and from January 1993 to December 2001 in column (IV). The right half of Table VII reports the findings for the late sample running from January 2002 to December 2012.

Two points stand out: First, the BAC factor is a pervasive risk factor in equity returns, which commands a positive and statistically significant premium. Second, the importance of BAC has increased over time from about 35-65 basis points in the early period to about 50-100 basis points in the modern period. While the pricing errors become larger for developed countries in the second half of the sample, the estimates strongly support an increase in economic and statistical significance of BAC in the modern period.

4.3.3 Alphabetic Country Split

To guard against the possibility of a mechanical relation between the returns and the factors, I randomly split the sample of 47 developed and emerging countries into one subsample with 23 countries and another subsample with 24 countries. To do so, I sort all countries alphabetically and consider Group I of countries with first letters A-I and Group II of countries with first letters J-U. For each group, I build five equity portfolios by sorting MSCI equity indices based on fourth-quarter-over-fourth-quarter consumption growth as described in Section 3.2.

Table VIII reports cross-sectional pricing results for both groups for each of the four MSCI equity index variants. The results support that the variation in the sample of countries does not affect the main findings. Similar to the benchmark results, the BAC betas tend to increase from low to high consumption growth markets (unreported). The two-factor model with DOL and BAC risk factors has a lower $\overline{R}^2$ when faced with Group I portfolios due to a low return dispersion, but it is generally successful in explaining cross-sectional differences in average returns. Furthermore, BAC remains a powerful driver of risk premiums.

4.3.4 Country-Level Asset Pricing

To respond to a recent criticism raised by Ang et al. (2010) that portfolio construction might shrink the dispersion in betas and lead to biases in statistical inference, this section investigates the ability of the BAC factor to explain individual country-level returns. To tackle this issue empirically, I study a beta framework in which betas are time-varying functions of individual countries' consumption growth. In particular, this approach for estimating dynamic factor loadings assumes that $\beta^k_{DOL,t} = d^k_0 + d^k_1 z^k_t$ and $\beta^k_{BAC,t} = h^k_0 + h^k_1 z^k_t$, where z^k_t is country k fourth-quarter-over-fourth-quarter consumption growth. The parameters d^k_0, d^k_1, h^k_0 and h^k_1 are easily estimated from the following time-series regression for each country k:

$$rx^k_{t+1} = c^k + d^k_0 DOL_{t+1} + d^k_1 z^k_t DOL_{t+1} + h^k_0 BAC_{t+1} + h^k_1 z^k_t BAC_{t+1} + \varepsilon^k_{t+1}. \quad (3)$$

The time-varying factor risk prices can then be estimated from a series of cross-sectional regressions of returns on the fitted conditional betas:

$$rx^k_{t+1} = \lambda_{DOL,t+1}\beta^k_{DOL,t+1} + \lambda_{BAC,t+1}\beta^k_{BAC,t+1} + \xi^k_{t+1}. \quad (4)$$

Finally, the model's cross-sectional fit can be evaluated by comparing the true unconditional excess returns with their predicted values:

$$E\left(rx^k_{t+1}\right) = E\left(\lambda_{DOL,t+1}\beta^k_{DOL,t+1} + \lambda_{BAC,t+1}\beta^k_{BAC,t+1}\right). \quad (5)$$

The results of this estimation are provided in Table IX. The table gives risk premium estimates and Fama-MacBeth (1973) *t*-statistics in parentheses. Country-level asset pricing tests are done on an annual sample running from 1970 to 2012, as the conditioning variables are not available on a monthly basis.

The conditional betas are computed based on four different proxies for z^k_t: Column (I) employs real per capita year-over-year consumption growth based upon the fourth quarter and measured in USD; Column (II) uses the gross domestic product (GDP)-weighted annual consumption growth rates based upon the fourth quarter and measured in USD; Column (III) employs fourth-quarter-over-fourth-quarter consumption growth measured in local currency units; finally, Column (IV) uses GDP-weighted annual consumption growth rates based upon the fourth quarter and measured in local currency units.

Country-level results turn out generally consistent with the portfolio evidence: BAC commands a positive premium, whereas the risk price of DOL is typically insignificant and often negative. When faced with individual country index returns, the model generates lower fit as the number of test assets goes up from 6 to 47 for all countries, and from 5 to 25 in the case of developed markets.

4.3.5 Model Horse Race

Finally, Table X runs a horse race between conventional benchmark models and their augmented specifications which include BAC as an additional pricing factor. In particular, I consider the international versions of the CAPM and consumption CAPM, the three-factor Fama-French model and the heterogeneous world consumption CAPM.

The upper panel of Table X summarizes the estimates for six equity portfolios constructed from all 47 developed and developing market indices; the bottom panel presents the results for a subsample of developed countries. These tests are based on annual data, as world consumption growth (WCG) and world consumption dispersion (WCD) series based on the fourth quarter cannot be computed at a higher frequency. Returns are annual and the sample period runs from 1991 to 2012 in columns (II) and (II-A), restricted by the availability of the global Fama and French factors; and from 1972 to 2012 otherwise, restricted by the availability of WCD.

Column I gives estimates for the international CAPM which assumes that fluctuations in the world MSCI index return are the only source of systematic risk. The results are similar to Li and Zhong (2005) who find a positive but insignificant estimate for the world market premium. The associated negative $\overline{R}^2$ statistic indicates that the model explains less of the variation across average portfolio returns than a constant. Related findings are reported in Darrat et al. (2011) and discussed in Karolyi and Stulz (2003).

The estimates in column I-A reveal that by including BAC in a set of pricing factors, the model fit can be raised from the negative -2.38% to more than 90%. Accordingly, the average pricing errors are more than three times lower. The estimated risk premium of BAC is highly significant, economically close to 9% p.a. and thus close to its actual mean.

The benchmark model in column II is the three-factor Fama-French model. Since the global Fama-French factors are not available prior to 1991, I measure the portfolio returns from 1991 to 2012. The estimates in column II suggest that the three-factor model is a better tool to explain differences in returns. However, the market risk is not priced and the standard HML factor reveals virtually no explanatory power. The model performance improves markedly when confronted with developed markets' portfolios as indicated in column II in the bottom panel. The augmented specification in column II-A suggests that the pricing errors can be substantially reduced by taking the exposures to BAC into account. Interestingly, a standard three-factor Fama-French model works substantially better on a set of five portfolios of developed markets. In this case, augmenting the set of pricing factors with BAC lowers the significance of HML and does not improve the general model fit.

The model presented in column III is the international consumption CAPM with WCG as a single determinant of risk. The world consumption growth is proxied here by the average cross-country consumption growth based on the fourth quarter to assure consistency with the previous analysis. For this model, the point estimate of WCG is positive but insignificant. The cross-sectional $\overline{R}^2$ measure is negative and the root mean squared pricing error is slightly higher than for the international CAPM. For example Darrat et al. (2011) also find a larger pricing error for the international consumption CAPM against the CAPM on a set of 17 MSCI country equity indices as test assets.

The estimates in column III-A of the table further support that there are significant benefits to be realized from including BAC into a set of pricing factors. The fit of the international consumption CAPM goes up from the negative -3% to slightly more than 90%, while the pricing error declines from about 9% to close to 2% per annum.

Further, column IV of the table estimates a version of heterogeneous world consumption CAPM with WCG and WCD as pricing factors. I use a straightforward measure of WCD based on the cross-sectional variance of log consumption growth rates of all countries in the sample. Consumption series are real, seasonally adjusted, in per capita terms, denominated in local currency units in line with the arguments outlined in Sarkissian (2003). I follow Assness et al. (2013) and measure dispersion innovations by the innovations from an AR(2) model for WCD, as these residuals are uncorrelated with their own lags.[8]

Taking the dispersion risk into account increases the adjusted $\overline{R}^2$ statistic from barely -3% to more than 20% in the full sample and close to 60% in the subsample of developed markets. While the WCG premium is positive, the estimate of the WCD risk price is negative in line with the theoretical prediction. These estimates are close to the findings reported in Sarkissan (2003) for a set of excess currency returns.

[8] Autoregressive models AR(1) and AR(3) and unconditional cross-sectional dispersion measures yield similar cross-sectional results.

The estimates in column IV-A indicate that including BAC as an additional factor increases the model performance and produces a lower pricing error.

Finally, column V of the table gives the estimates for the two-factor model with DOL and BAC factors. In line with the monthly baseline tests, this parsimonious specification explains between 85% and 90% of the cross-sectional variation in excess returns.

4.3.6 Additional Tests

The results hold true for real and nominal returns; returns measured in different frequencies; higher and lower number of portfolios; DOL and BAC factors constructed from the set of portfolios used to evaluate the model; portfolios formed on consumption growth in USD and local currency units; different computation ways of betas including full-sample estimates, time-varying betas and betas estimated for each factor independently. These results are not reported here to conserve space but are readily available upon request.

5. Conclusions

The idea that differences in exposure to systematic risk should justify differences in excess returns is central to finance. This paper shows that a betting against consumption (BAC) factor which mimics macroeconomic risks related to long-run consumption growth provides a simple and powerful characterization of the cross-sectional variation in international equity returns. The results highlight a common source of systematic risk in equity markets that is reflected in macro fundamentals.

This paper contributes to two strands of literature. First, it shows that differences in BAC loadings explain most of the differences in excess returns. This finding provides further support for the ability of return-based factors to explain patterns in risk premiums in equity markets. Second, it shows that high sensitivity to BAC commands a pervasive, economically plausible and statistically significant premium. By investing in high BAC beta markets, investors load up on common macroeconomic risks. This finding extends a growing literature that emphasizes the importance of consumption-based long-run risks for empirical asset pricing.

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Table I. Basic Portfolios and Common Risk Factors

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for three basic portfolios used to construct the DOL and BAC risk factors. DOL is computed as the average excess return on P1, P2 and P3. BAC is computed as the difference in excess returns on P3 and P1. For each portfolio, the table reports the average consumption growth and its standard deviation. Consumption is real, in per capita terms, measured in USD. The portfolios are built by sorting standard international MSCI equity indices annually on year-over-year country consumption growth based upon the fourth quarter. Portfolio P1 contains equity indices with the lowest consumption growth rates. Portfolio P3 contains equity indices with the highest consumption growth rates. All returns are excess returns in USD. The upper panel shows the basic portfolios and the common risk factors for all countries; the lower panel shows the basic portfolios and the common risk factors for developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries					
	P1	P2	P3	DOL	BAC
Excess Returns (in %)					
Mean	0.17	0.38	0.84	0.46	0.67
Std.	5.58	5.01	5.39	4.98	3.44
SR	0.03	0.08	0.16	0.09	0.19
Consumption Growth					
Mean	-0.01	0.02	0.06		
Std.	0.03	0.01	0.02		
Developed Countries					
	P1	P2	P3	DOL	BAC
Excess Returns (in %)					
Mean	0.13	0.28	0.58	0.33	0.45
Std.	5.04	4.89	5.12	4.73	3.02
SR	0.03	0.06	0.11	0.07	0.15
Consumption Growth					
Mean	-0.00	0.02	0.05		
Std.	0.02	0.01	0.02		

Table II. Portfolios Sorted on Consumption Growth

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for test asset portfolios constructed by sorting standard international MSCI equity indices annually on year-over-year country consumption growth based upon the fourth quarter. For each portfolio, the table reports the average consumption growth and its standard deviation. Consumption is real, in per capita terms, measured in USD. The first portfolio contains equity indices with the lowest consumption growth rates. The last portfolio contains equity indices with the highest consumption growth rates. All returns are excess returns in USD. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
Excess Returns (in %)							
Mean	0.18	0.16	0.28	0.47	0.68	1.03	0.85
Std.	6.54	5.46	5.36	5.36	5.42	6.21	5.25
SR	0.03	0.03	0.05	0.09	0.12	0.17	0.16
Consumption Growth							
Mean	-0.03	0.01	0.02	0.03	0.04	0.08	
Std.	0.05	0.02	0.01	0.01	0.01	0.03	

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
Excess Returns (in %)						
Mean	0.12	0.18	0.27	0.41	0.70	0.58
Std.	5.74	5.01	5.10	4.97	5.71	4.36
SR	0.02	0.04	0.05	0.08	0.12	0.13
Consumption Growth						
Mean	-0.01	0.01	0.02	0.03	0.06	
Std.	0.02	0.01	0.01	0.01	0.02	

Table III. Portfolio Betas

The table shows the DOL and BAC beta estimates with HAC *t*-statistics in parentheses for consumption sorted equity portfolios presented in Table II. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
DOL Betas							
Estimate	1.11	1.00	0.94	0.97	1.00	1.11	-0.02
t-stat.	(46.30)	(27.51)	(32.65)	(35.73)	(39.33)	(26.03)	(-0.42)
BAC Betas							
Estimate	-0.63	-0.37	-0.00	0.04	0.38	0.62	1.28
t-stat.	(-12.64)	(-6.56)	(-0.07)	(0.70)	(10.04)	(12.29)	(15.71)

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
DOL Betas						
Estimate	1.09	1.00	1.00	0.96	1.10	-0.02
t-stat.	(34.95)	(36.62)	(46.30)	(32.26)	(22.26)	(-0.47)
BAC Betas						
Estimate	-0.58	-0.25	0.00	0.30	0.58	1.21
t-stat.	(-9.87)	(-4.70)	(0.04)	(7.42)	(11.93)	(11.67)

Table IV. Benchmark Asset Pricing Results

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of standard international MSCI equity indices from all (developed) countries detailed in Table II. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 - December 2012.

	All Countries	Developed Countries
DOL	0.29	0.18
t-stat.	(1.32)	(0.88)
BAC	0.69	0.48
t-stat.	(4.41)	(3.37)
$\overline{R}^2$	92.78	95.60
RMSE	2.14	0.98

Table V. Portfolios Sorted on BAC Betas

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for standard MSCI equity indices sorted into portfolios according to their BAC beta in a 36-month moving window time-series regression of individual equity index excess returns on a constant and BAC. For each portfolio, the table reports the average BAC beta and its standard deviation. The first portfolio contains equity indices with the lowest BAC betas. The last portfolio contains equity indices with the highest BAC betas. All returns are excess returns in USD. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
Excess Returns (in %)							
Mean	-0.19	0.04	0.20	0.31	0.42	0.47	0.65
Std.	1.37	1.05	1.01	0.95	1.07	1.29	1.32
SR	-0.14	0.04	0.20	0.33	0.40	0.36	0.50
BAC Beta							
Mean	-0.67	-0.26	-0.07	0.13	0.37	0.85	
Std.	0.50	0.40	0.38	0.38	0.43	0.60	

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
Excess Returns (in %)						
Mean	-0.22	0.11	0.18	0.34	0.23	0.46
Std.	1.05	0.92	0.98	0.93	1.17	0.89
SR	-0.21	0.12	0.18	0.36	0.20	0.51
BAC Beta						
Mean	-0.57	-0.16	0.06	0.30	0.70	
Std.	0.53	0.46	0.44	0.46	0.54	

Table VI. Alternative Index Variants

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of international MSCI equity indices from all (developed) countries. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 – December 2012 in columns (I)-(III) and January 1993 – December 2012 in column (IV).

	All Countries				Developed Countries			
	I	II	III	IV	I	II	III	IV
DOL	0.29	0.49	0.54	0.47	0.18	0.38	0.44	0.38
t-stat.	(1.32)	(2.28)	(2.43)	(1.22)	(0.88)	(1.82)	(2.12)	(1.05)
BAC	0.69	0.56	0.52	0.82	0.48	0.47	0.45	0.59
t-stat.	(4.41)	(4.01)	(3.57)	(3.22)	(3.37)	(3.25)	(3.17)	(3.10)
$\overline{R}^2$	92.78	85.01	88.14	72.40	95.60	91.74	87.22	76.29
RMSE	2.14	2.58	2.14	5.44	0.98	1.31	1.61	3.19

Table VII. Sample Split

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of international MSCI equity indices from all (developed) countries. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. The early sample covers the period January 1970 - December 2001 in columns (I)-(III) and January 1993 - December 2001 in column (IV). The late sample covers the period January 2002 - December 2012.

	Early Period				Late Period			
	I	II	III	IV	I	II	III	IV
				All Countries				
DOL	0.17	0.36	0.43	0.05	0.64	0.85	0.87	0.80
t-stat.	(0.74)	(1.64)	(1.80)	(0.10)	(1.21)	(1.61)	(1.64)	(1.38)
BAC	0.57	0.40	0.35	0.66	0.95	0.94	0.99	0.87
t-stat.	(2.93)	(2.37)	(1.93)	(1.36)	(4.01)	(3.96)	(4.38)	(3.66)
$\overline{R}^2$	78.54	64.30	68.55	9.92	87.62	87.65	87.16	77.09
RMSE	3.29	3.35	2.86	13.52	3.98	3.91	4.14	5.14
				Developed Countries				
DOL	0.17	0.36	0.44	0.15	0.23	0.44	0.46	0.56
t-stat.	(0.77)	(1.64)	(1.97)	(0.38)	(0.45)	(0.86)	(0.93)	(0.98)
BAC	0.42	0.41	0.38	0.62	0.53	0.52	0.56	0.60
t-stat.	(2.37)	(2.27)	(2.14)	(1.84)	(2.50)	(2.47)	(2.68)	(2.82)
$\overline{R}^2$	68.42	70.55	60.87	65.02	33.38	27.52	53.69	68.70
RMSE	2.65	2.44	2.82	4.39	5.77	5.93	4.37	3.86

Table VIII. Alphabetic Country Split

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are five portfolios of international MSCI equity indices from all countries sorted annually on year-over-year country consumption growth based upon the fourth quarter. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. Group I uses the first half of all countries sorted alphabetically. Group II uses the second half of all countries sorted alphabetically. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 - December 2012 in columns (I)-(III) and January 1993 - December 2012 in column (IV).

	Group I				Group II			
	I	II	III	IV	I	II	III	IV
DOL	0.18	0.43	0.45	0.42	0.27	0.48	0.55	0.45
t-stat.	(0.81)	(1.98)	(1.98)	(1.06)	(1.28)	(2.20)	(2.46)	(1.17)
BAC	0.46	0.36	0.28	1.19	1.27	0.84	1.00	0.92
t-stat.	(1.72)	(1.76)	(1.12)	(2.89)	(4.69)	(4.09)	(3.78)	(2.54)
$\overline{R}^2$	60.19	47.10	63.04	84.35	89.56	59.50	68.93	43.84
RMSE	2.60	3.43	1.84	3.31	3.30	5.56	4.70	7.98

Table IX. Country-Level Results

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Fama and MacBeth (1973) *t*-statistics in parentheses. The test assets are excess equity returns to individual MSCI equity index returns from all 47 countries (left panel) and from 25 developed countries (right panel). Conditional betas are computed using (I) individual countries' consumption growth measured in USD, (II) GDP-weighted countries' consumption growth measured in USD, (III) individual countries' consumption growth measured in national currency, and (IV) GDP-weighted countries' consumption growth measured in national currency. The cross-sectional adjusted $\overline{R}^2$ statistics and the annual root mean squared error (RMSE) are in %. Returns are annual and the sample period is 1970 - 2012.

	All Countries				Developed Countries			
	I	II	III	IV	I	II	III	IV
DOL	0.14	-1.43	-0.04	-1.32	-0.08	-1.08	0.18	-0.92
t-stat.	(0.04)	(-0.42)	(-0.01)	(-0.38)	(-0.02)	(-0.29)	(0.05)	(-0.25)
BAC	7.10	8.52	7.75	8.05	6.31	9.72	7.11	8.82
t-stat.	(2.49)	(2.50)	(2.52)	(2.20)	(2.37)	(2.70)	(2.66)	(2.38)
$\overline{R}^2$	9.02	10.71	7.52	9.53	1.17	3.51	-0.69	3.24
RMSE	1.23	1.24	1.27	1.28	0.78	0.79	0.82	0.82

Table X. Model Horse Race

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of standard international MSCI equity indices from all (developed) countries. The cross-sectional adjusted $\overline{R}^2$ statistics and the annual root mean squared error (RMSE) are in %. Returns are annual and the sample period is 1991 - 2012 in columns (II) and (II-A) and 1972 – 2012 otherwise.

	I	I-A	II	II-A	III	III-A	IV	IV-A	V
					All Countries				
MKT	1.56	1.79	1.84	1.21					
t-stat.	(0.48)	(0.53)	(0.37)	(0.25)					
SMB			-8.45	3.44					
t-stat.			(-1.74)	(0.56)					
HML			6.50	-1.42					
t-stat.			(0.92)	(-0.20)					
WCG					0.27	0.16	0.27	0.16	
t-stat.					(0.48)	(0.25)	(0.37)	(0.25)	
WCD							-0.30	-0.05	
t-stat.							(-1.77)	(-0.31)	
DOL									1.90
t-stat.									(0.50)
BAC		8.72		12.31		8.69		8.62	8.73
t-stat.		(3.88)		(4.07)		(3.87)		(3.73)	(3.89)
$\overline{R}^2$	-2.38	90.12	33.45	88.82	-3.03	92.10	20.39	89.57	90.40
RMSE	9.09	2.53	7.41	2.48	9.12	2.26	7.17	2.25	2.49

Table X. *Continued*

	I	I-A	II	II-A	III	III-A	IV	IV-A	V
					Developed Countries				
MKT	0.53	0.35	1.03	0.84					
t-stat.	(0.17)	(0.11)	(0.21)	(0.18)					
SMB			-11.07	-8.88					
t-stat.			(-1.91)	(-0.73)					
HML			-8.54	-7.24					
t-stat.			(-0.76)	(-0.52)					
WCG					0.11	-0.12	0.03	-0.20	
t-stat.					(0.16)	(-0.18)	(0.04)	(-0.23)	
WCD							-0.22	0.11	
t-stat.							(-1.32)	(0.29)	
DOL									0.34
t-stat.									(0.10)
BAC		4.83		7.71		4.86		5.43	4.80
t-stat.		(2.18)		(2.88)		(2.21)		(2.01)	(2.17)
$\overline{R}^2$	-0.38	85.43	93.19	91.86	-1.55	85.41	58.37	84.77	84.99
RMSE	4.77	1.57	1.16	0.90	4.80	1.57	2.66	1.31	1.60

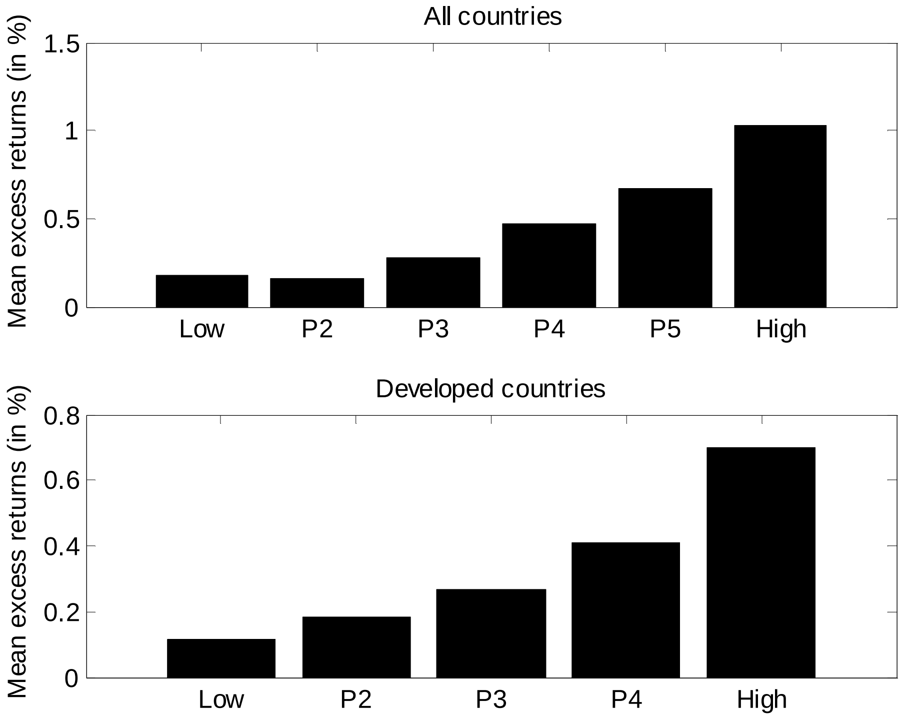

Figure 1. Equity Portfolios Sorted on Consumption Growth

The figure shows monthly average excess returns for equity portfolios sorted on year-over-year consumption growth based upon the fourth-quarter presented in Table II. The first portfolio (Low) contains equity indices with the lowest consumption growth rates. The last portfolio (High) contains equity indices with the highest consumption growth rates. All returns are excess returns in USD. The upper plot shows six portfolios from all countries; the lower plot shows five portfolios from developed countries.

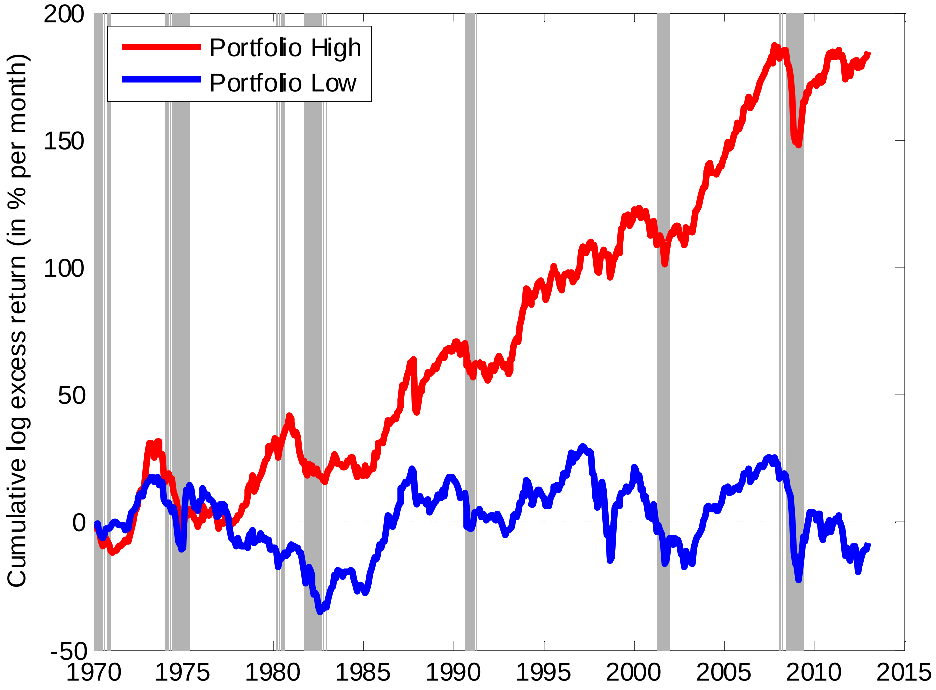

Figure 2. High versus Low Consumption Growth Portfolios: All Countries

The figure shows cumulative log excess returns on the portfolio with the highest year-over-year consumption growth based upon the fourth-quarter (red) against the portfolio with the lowest year-over-year consumption growth based upon the fourth-quarter (blue) for all countries. Shaded areas in the figure correspond to NBER recessions.

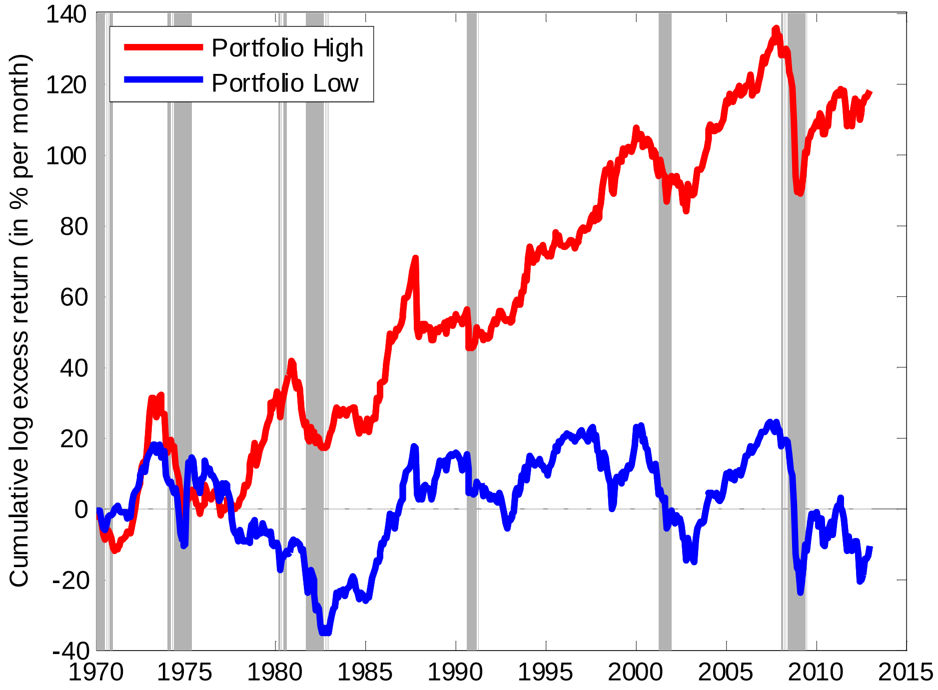

Figure 3. High versus Low Consumption Growth Portfolios: Developed Countries

The figure shows cumulative log excess returns on the portfolio with the highest year-over-year consumption growth based upon the fourth-quarter (red) against the portfolio with the lowest year-over-year consumption growth based upon the fourth-quarter (blue) for a subsample of developed countries. Shaded areas in the figure correspond to NBER recessions.

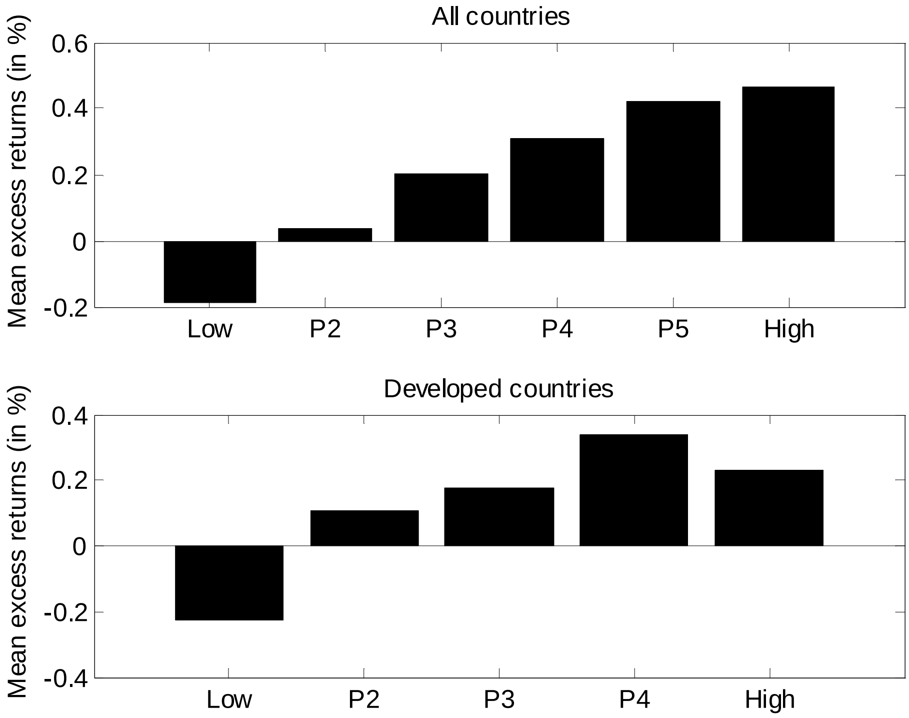

Figure 4. Equity Portfolios Sorted on BAC Betas

The figure shows monthly average excess returns for equity portfolios sorted on BAC betas presented in Table II. The betas are estimated in 36-month moving window time-series regressions of individual equity index excess returns on a constant and the BAC risk factor. The first portfolio (Low) contains equity indices with the lowest BAC betas. The last portfolio (High) contains equity indices with the highest BAC betas. All returns are excess returns in USD. The upper plot shows six portfolios from all countries; the lower plot shows five portfolios from developed countries.

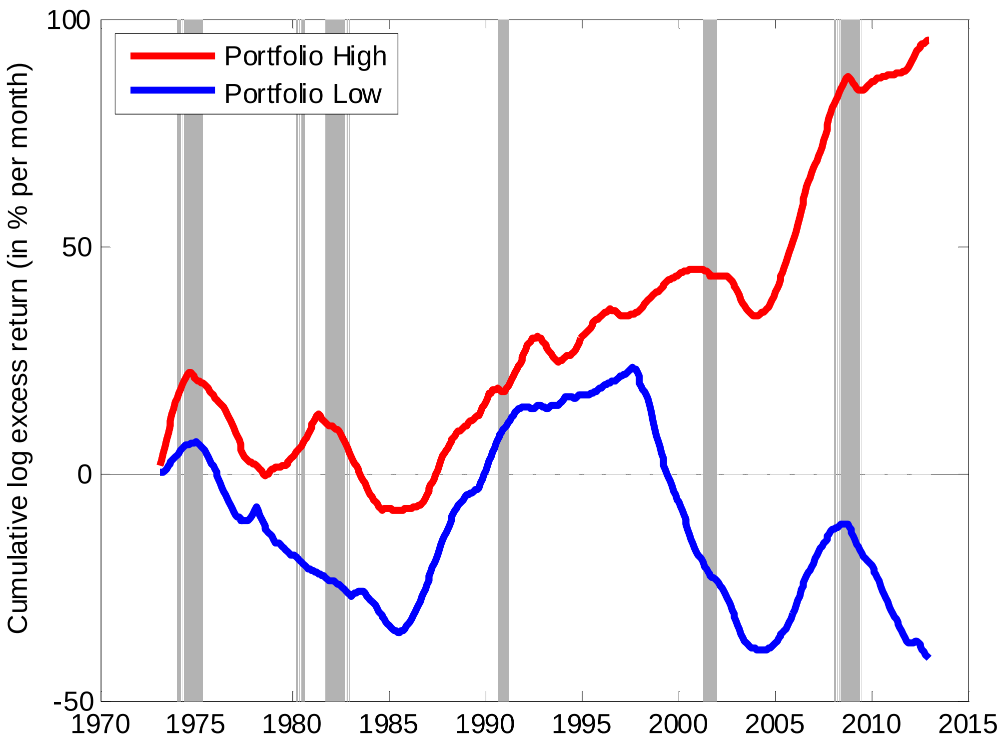

Figure 5. High versus Low BAC Beta Portfolios: All Countries

The figure shows cumulative log excess returns on the portfolio with the highest BAC betas (red) against the portfolio with the lowest BAC betas (blue) for all countries detailed in Table V. The betas are computed in 36-month moving window time-series regressions of individual equity index excess returns on a constant and BAC. Shaded areas in the figure correspond to NBER recessions.

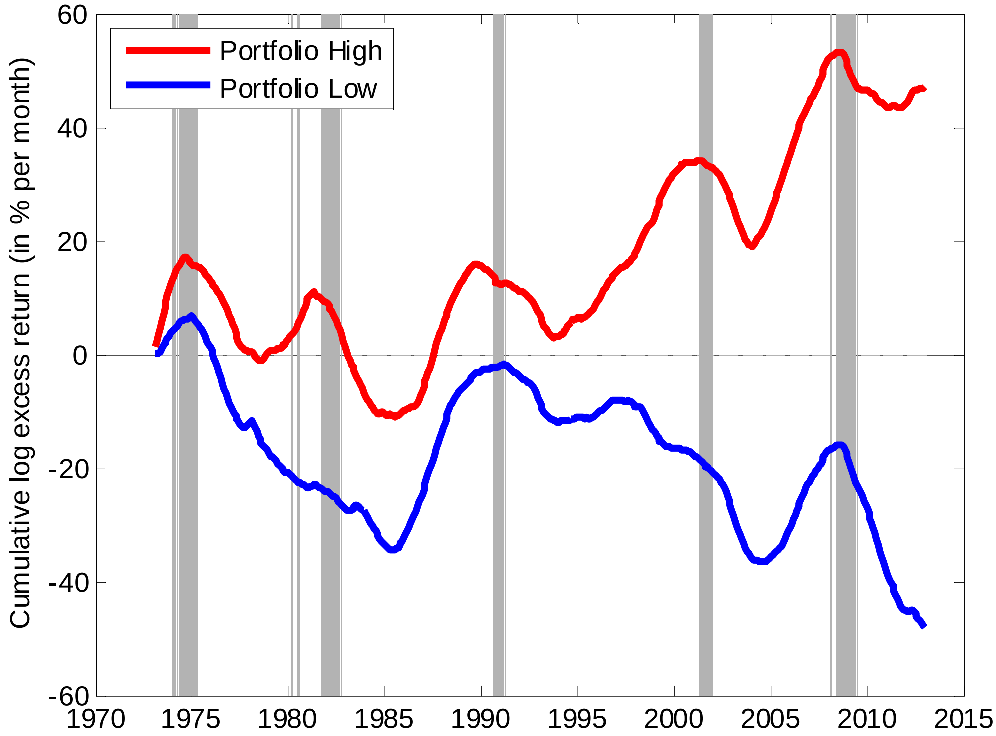

Figure 6. High versus Low Consumption Growth Portfolios: Developed Countries

The figure shows cumulative log excess returns on the portfolio with the highest BAC betas (red) against the portfolio with the lowest BAC betas (blue) for developed countries detailed in Table V. The betas are computed in 36-month moving window time-series regressions of individual equity index excess returns on a constant and BAC. Shaded areas in the figure correspond to NBER recessions.

Additional Appendix for:

Common Risk Factors in Equity Markets

Table AI. Basic Portfolios and Common Risk Factors

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for three basic portfolios used to construct the DOL and BAC risk factors. DOL is computed as the average excess return on P1, P2 and P3. BAC is computed as the difference in excess returns on P3 and P1. For each portfolio, the table reports the average consumption growth and its standard deviation. Consumption is real, in per capita terms, measured in local currency units. The portfolios are built by sorting standard international MSCI equity indices annually on year-over-year country consumption growth based upon the fourth quarter. Portfolio P1 contains equity indices with the lowest consumption growth rates. Portfolio P3 contains equity indices with the highest consumption growth rates. All returns are excess returns in USD. The upper panel shows the basic portfolios and the common risk factors for all countries; the lower panel shows the basic portfolios and the common risk factors for developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries					
	P1	P2	P3	DOL	BAC
Excess Returns (in %)					
Mean	0.22	0.38	0.90	0.50	0.68
Std.	5.52	5.05	5.55	5.03	3.46
SR	0.04	0.08	0.16	0.10	0.20
Consumption Growth					
Mean	-0.01	0.02	0.06		
Std.	0.02	0.01	0.01		
Developed Countries					
	P1	P2	P3	DOL	BAC
Excess Returns (in %)					
Mean	0.14	0.27	0.67	0.36	0.54
Std.	5.10	4.85	5.30	4.79	3.16
SR	0.03	0.06	0.13	0.08	0.17
Consumption Growth					
Mean	-0.00	0.02	0.05		
Std.	0.02	0.01	0.02		

Table AII. Portfolios Sorted on Consumption Growth

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for test asset portfolios constructed by sorting standard international MSCI equity indices annually on year-over-year country consumption growth based upon the fourth quarter. For each portfolio, the table reports the average consumption growth and its standard deviation. Consumption is real, in per capita terms, measured in local currency units. The first portfolio contains equity indices with the lowest consumption growth rates. The last portfolio contains equity indices with the highest consumption growth rates. All returns are excess returns in USD. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
Excess Returns (in %)							
Mean	0.16	0.28	0.35	0.42	0.54	1.25	1.08
Std.	6.45	5.44	5.31	5.47	5.33	6.73	5.40
SR	0.03	0.05	0.07	0.08	0.10	0.19	0.20
Consumption Growth							
Mean	-0.02	0.01	0.02	0.03	0.04	0.07	
Std.	0.03	0.01	0.01	0.01	0.01	0.02	

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
Excess Returns (in %)						
Mean	0.16	0.09	0.27	0.53	0.71	0.54
Std.	5.45	5.26	5.04	5.12	5.84	4.13
SR	0.03	0.02	0.05	0.10	0.12	0.13
Consumption Growth						
Mean	-0.01	0.01	0.02	0.03	0.05	
Std.	0.02	0.01	0.01	0.01	0.02	

Table AIII. Portfolio Betas

The table shows the DOL and BAC beta estimates with HAC *t*-statistics in parentheses for consumption sorted equity portfolios presented in Table AII. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
DOL Betas							
Estimate	1.13	0.98	0.94	0.98	0.96	1.15	0.01
t-stat.	(34.30)	(33.44)	(38.03)	(27.07)	(36.72)	(25.31)	(0.24)
BAC Betas							
Estimate	-0.60	-0.42	-0.03	0.05	0.33	0.66	1.27
t-stat.	(-8.60)	(-12.14)	(-0.79)	(0.82)	(7.19)	(11.05)	(22.88)

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
DOL Betas						
Estimate	1.06	1.03	0.97	0.95	1.09	0.02
t-stat.	(39.79)	(48.54)	(37.86)	(28.23)	(22.14)	(0.77)
BAC Betas						
Estimate	-0.52	-0.32	0.01	0.26	0.56	1.08
t-stat.	(-11.44)	(-6.86)	(0.17)	(4.49)	(12.55)	(22.94)

Table AIV. Benchmark Asset Pricing Results

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of standard international MSCI equity indices from all (developed) countries detailed in Table AII. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 - December 2012.

	All Countries	Developed Countries
DOL	0.33	0.20
t-stat.	(1.47)	(0.96)
BAC	0.72	0.55
t-stat.	(4.59)	(3.75)
$\overline{R}^2$	86.24	88.84
RMSE	3.26	1.74

Table AV. Portfolios Sorted on BAC Betas

The table shows mean returns, standard deviations (Std.), and Sharpe ratios (SR) for standard MSCI equity indices sorted into portfolios according to their BAC beta in a 36-month moving window time-series regression of individual equity index excess returns on a constant and BAC. For each portfolio, the table reports the average BAC beta and its standard deviation. The first portfolio contains equity indices with the lowest BAC betas. The last portfolio contains equity indices with the highest BAC betas. All returns are excess returns in USD. The upper panel shows six portfolios from all countries; the lower panel shows five portfolios from developed countries. Returns are monthly and the sample period is January 1970 - December 2012.

All Countries							
	P1	P2	P3	P4	P5	P6	P6-P1
Excess Returns (in %)							
Mean	-0.26	0.05	0.19	0.31	0.42	0.55	0.80
Std.	1.30	1.01	1.04	0.98	1.08	1.25	1.19
SR	-0.20	0.05	0.18	0.31	0.39	0.44	0.67
BAC Beta							
Mean	-0.60	-0.23	-0.03	0.18	0.41	0.94	
Std.	0.54	0.41	0.37	0.38	0.41	0.55	

Developed Countries						
	P1	P2	P3	P4	P5	P5-P1
Excess Returns (in %)						
Mean	-0.24	0.07	0.18	0.31	0.29	0.53
Std.	1.02	0.93	0.97	1.00	1.14	0.83
SR	-0.23	0.07	0.19	0.31	0.26	0.64
BAC Beta						
Mean	-0.52	-0.14	0.07	0.32	0.74	
Std.	0.49	0.42	0.39	0.41	0.44	

Table AVI. Alternative Index Variants

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of international MSCI equity indices from all (developed) countries. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 – December 2012 in columns (I)-(III) and January 1993 – December 2012 in column (IV).

	All Countries				Developed Countries			
	I	II	III	IV	I	II	III	IV
DOL	0.33	0.52	0.57	0.48	0.20	0.41	0.45	0.38
t-stat.	(1.47)	(2.39)	(2.55)	(1.25)	(0.96)	(1.92)	(2.17)	(1.05)
BAC	0.72	0.59	0.66	0.69	0.55	0.53	0.52	0.60
t-stat.	(4.59)	(4.00)	(3.77)	(2.87)	(3.75)	(3.59)	(3.41)	(3.08)
$\overline{R}^2$	86.24	84.69	85.43	67.21	88.84	86.67	79.50	76.95
RMSE	3.26	2.74	2.69	5.40	1.74	1.83	2.24	3.01

Table AVII. Sample Split

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are six (five) portfolios of international MSCI equity indices from all (developed) countries. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. The early sample covers the period January 1970 - December 2001 in columns (I)-(III) and January 1993 - December 2001 in column (IV). The late sample covers the period January 2002 - December 2012.

	Early Period				Late Period			
	I	II	III	IV	I	II	III	IV
				All Countries				
DOL	0.22	0.40	0.48	0.07	0.63	0.85	0.87	0.81
t-stat.	(0.92)	(1.78)	(1.97)	(0.16)	(1.20)	(1.60)	(1.64)	(1.38)
BAC	0.65	0.46	0.47	0.53	0.95	0.93	0.91	0.72
t-stat.	(3.30)	(2.56)	(2.53)	(1.17)	(3.98)	(3.90)	(4.00)	(3.06)
$\overline{R}^2$	74.84	75.22	74.67	31.23	93.31	93.07	80.74	66.79
RMSE	4.21	2.93	3.28	7.95	2.83	2.82	5.02	5.61
				Developed Countries				
DOL	0.19	0.39	0.46	0.16	0.24	0.45	0.48	0.56
t-stat.	(0.85)	(1.74)	(2.05)	(0.40)	(0.48)	(0.89)	(0.95)	(0.99)
BAC	0.54	0.51	0.50	0.63	0.54	0.53	0.55	0.56
t-stat.	(2.93)	(2.74)	(2.69)	(1.84)	(2.68)	(2.59)	(2.72)	(2.68)
$\overline{R}^2$	76.45	74.94	72.16	57.97	35.03	28.57	47.96	87.16
RMSE	2.63	2.60	2.77	4.75	5.51	5.65	4.51	2.22

Table AVIII. Alphabetic Country Split

The table shows coefficient estimates of factor risk prices obtained by Fama and MacBeth (1973) cross-sectional regressions with Shanken (1992) corrected *t*-statistics in parentheses. The test assets are five portfolios of international MSCI equity indices from all countries sorted annually on year-over-year country consumption growth based upon the fourth quarter. The four variants of MSCI equity indices are (I) standard indices; (II) indices with net dividends, i.e. net total return indices reinvest dividends after the deduction of withholding taxes; (III) indices with gross dividends, i.e. gross total return indices reinvest as much as possible of a company's dividend distributions; and (IV) indices of small caps. Group I uses the first half of all countries sorted alphabetically. Group II uses the second half of all countries sorted alphabetically. The cross-sectional adjusted $\overline{R}^2$ statistics and the annualized root mean squared error (RMSE) are in %. Returns are monthly and the sample period is January 1970 - December 2012 in columns (I)-(III) and January 1993 - December 2012 in column (IV).

	Group I				Group II			
	I	II	III	IV	I	II	III	IV
DOL	0.25	0.48	0.50	0.45	0.33	0.52	0.64	0.56
t-stat.	(1.10)	(2.15)	(2.17)	(1.15)	(1.45)	(2.36)	(2.77)	(1.48)
BAC	0.46	0.41	0.32	1.12	1.43	1.05	1.31	-1.72
t-stat.	(1.99)	(2.03)	(1.45)	(3.03)	(4.43)	(4.38)	(3.98)	(-1.28)
$\overline{R}^2$	59.10	53.11	66.07	88.30	71.42	68.21	55.23	50.07
RMSE	3.31	4.03	2.26	2.93	5.29	4.74	6.03	7.98