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Residual Income Approach to Equity Country Selection

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The predictive power for country selection of expected returns estimated through the residual income model is examined through analysis of 19 developed-country indices for 1988–2005. Zero-investment strategies based on a ranking or optimization methodology—expected returns and conditional country risk estimates—posted significant positive performance over various holding periods. Risk-adjusted returns remained significant after control for four world risk factors—market, size, the book-to-market ratio, and momentum—constructed through a country stratification methodology based on stock constituents. The results were robust to various long-term growth estimates and to different country-universe subsamples and remained robust after transaction costs were taken into account.

Ample evidence exists that country versions of company characteristics have a certain degree of predictive power for future country returns. In testing country selection strategies, some authors have shown the predictive power of a specific fundamental or technical variable—such as dividend yield (Keppler 1991b), cash flow to price (Keppler 1991a), earnings to price or book to price (Asness, Liew, and Stevens 1997), and price or earnings momentum (Griffin, Ji, and Martin 2005). Other researchers have documented the predictive power of using both fundamental and technical variables (Cavaglia and Moroz 2002; Desrosiers, L'Her, and Plante 2004).

A basic technique for examining the predictive power of a variable for country selection involves sorting countries according to the variable and then partitioning them into several groups. The first (last) group, which is typically composed of the most (least) favored countries according to the variable, corresponds to the long (short) position. Variants of this technique include scoring methods that integrate several predictive variables, methods that use a priori weights, and methods that bet on the potential benefits of diversification based on an information signal.

Multiple-regression techniques are appropriate for identifying the weighting scheme and the incremental contribution of each variable in a multivariate framework. Researchers can use estimated regression coefficients to project future performance. Cavaglia and Moroz (2002) documented the profitability of zero-investment portfolios with long positions in local industries with the best expected returns and short positions in local industries with the worst expected returns. Among the merits of the regression approach, they reported, is that it provides estimates of the projected returns that can be used in portfolio optimization.

Projected returns based on regression coefficients tend to be sensitive to outliers, however, and to the addition or exclusion of predictive variables. Because errors in mean return estimates have a much greater impact than variance or covariance errors in any optimization process (Chopra and Ziemba 1993), regression-based projected returns are not the best candidates for portfolio optimization.

Other ways of estimating expected country returns are more appropriate for portfolio optimization. Asset pricing–based estimates—for example, estimates based on the capital asset pricing model—should be natural candidates, but they use historical data and tend to be imprecise (Fama and French 1997; Elton 1999; Gebhardt, Lee, and Swaminathan

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2001). Estimates of prospective equity risk premiums based on the dividend discount model (Fama and French 2002; Ibbotson and Chen 2003; Ilmanen 2003) would be more appropriate for portfolio optimization. Examining the 1891–2001 period in the United States, Arnott and Bernstein (2002) provided evidence of a strong correlation between expected real stock returns and actual real stock returns over the subsequent 10-year period. The DDM could thus provide a good estimate for strategic asset allocation. We did not use this alternative in this study, however, because the aforementioned studies differed considerably in how they estimated expected growth, which is a crucial component (see Bernstein and Arnott 2003 for a warning about the use of GDP growth instead of earnings growth). Furthermore, errors in expected growth estimates can cause extensive damage to the model output when dividend yields are at historical lows (Fama and French 2001).

We adopted a forward-looking, fundamentals-based approach. Following Claus and Thomas (2001), who estimated the equity risk premium for the United States and five other markets, we used the discounted residual income valuation model to deduce the implicit expected rate of return of country indices.[1] The main advantage of this model is that it relies on analysts' forward-looking information (Frankel and Lee 1999) to deduce the implicit expected rates of return, which may increase the precision of estimates (Lee, Ng, and Swaminathan 2003). Another advantage is that the model allows one to translate accounting numbers computed according to differing country-specific accounting standards into a consistent measure of expected return. Finally, Liu and Thomas (2000) and Frankel and Lee (1998) showed empirically the potential usefulness of the residual income model in explaining cross-sectional variations in U.S. stock returns and in picking stocks.

In the study reported here, we examined the profitability of this fundamentals-based approach in a tactical country selection context by using a universe of 19 developed-country indices in the 1988–2005 period. The most distinctive elements of our study are the following. First, we tested the predictive power of the implicit expected returns estimated by using the discounted residual income valuation model over various horizons. The zero-investment strategies tested involved (1) a ranking of country expected returns and (2) an optimization based on both expected returns and conditional risk estimates (RiskMetrics).[2] Second, we scrutinized the risk-adjusted performance of our strategies while controlling for four world risk factors—market, size, the book-to-market ratio, and momentum—which we constructed through a country stratification methodology based on stock constituents. Finally, we analyzed the robustness of our results to different long-term growth estimates, to different country-universe subsamples, and to the effect of transaction costs.

Residual Income Model

According to the discounted residual income valuation model, the intrinsic value of the market index is equal to the sum of the book value of the market index plus the present value of abnormal earnings. Abnormal earnings are equal to the difference between forecast earnings and normal earnings, where normal earnings represent the charge for the cost of capital as measured by the implicit expected return multiplied by the beginning book value. The intrinsic value is

$$\begin{aligned} v_t &= bv_t + \sum_{s=1}^{\infty} \frac{ae_{t+s}}{(1+k)^s} \\ &= bv_t + \sum_{s=1}^{\infty} \frac{e_{t+s} - (k)bv_{t-1+s}}{(1+k)^s}, \end{aligned} \tag{1}$$

where

v_t = intrinsic value of the market index at time t

bv_t = book value of the market index at time t

ae_{t+s} = forecast abnormal earnings at time $t+s$

e_{t+s} = forecast earnings at time $t+s$

k = implicit expected return

$(k)bv_{t-1+s}$ = charge for the cost of capital or normal earnings

In the simplest case, where the companies in the market index generate earnings equal to the charge for the cost of capital, no abnormal earnings are created and the intrinsic value is equal to the value of the invested capital (the book value). If the market index constituents generate higher (lower) earnings than the charge for the cost of capital, the intrinsic value is higher (lower) than the book value.

The residual income model (RIM) is the same as the DDM only if the accounting identity known as the "clean surplus relationship" stands. This relationship states that no accounting items can be directly charged to the book value of equity unless the items have been run through the income statement.[3] The clean surplus relationship is given by

$$\begin{aligned} bv_{t+1} &= bv_t + e_{t+1} - div_{t+1} \\ &= bv_t + e_{t+1}(1 - d_{t+1}), \end{aligned} \tag{2}$$

where *div* stands for dividends and *d* represents the dividend payout ratio.

Equation 1 expresses intrinsic value as an infinite series of economic profits. Because earnings are forecasted only on a finite horizon (earnings forecasts are available for fiscal years 1, 2, and 3 from I/B/E/S), we had to capture the value beyond this forecast horizon in an estimated final term.[4] As in Claus and Thomas (2001), we assumed that the growth in abnormal earnings, g, is the long-term expected rate of inflation. We used a simple proxy for the expected inflation rate, namely, the average realized inflation rate over the previous year with a one-quarter lag.[5] The intrinsic value is consequently equal to

$$v_t = bv_t + \sum_{s=1}^{N} \frac{ae_{t+s}}{(1+k)^s} + \frac{ae_{t+N}(1+g)}{(k-g)(1+k)^N}. \qquad (3)$$

The last term of Equation 3 represents the terminal value, a perpetuity in which the abnormal earnings increase at growth rate g (the long-term expected inflation rate).

Rather than estimating the intrinsic value, v_t, conditional on an estimated market rate of return (Lee and Swaminathan 1999), we inferred the implicit expected return, k, that equates the intrinsic value to the market price of the index (Gebhardt, Lee, and Swaminathan 2001). We assumed, as did Claus and Thomas (2001), that the expected rate of return could be approximated through the discount rate.

This implicit expected return k was denominated in local currency. So, to separate the country selection decision from the currency effect (Hopkins and Miller 2001), we translated the local-currency implicit expected return into a U.S. dollar–hedged expected return. We estimated the expected U.S. dollar–hedged return as the sum of the local expected return and the premium or discount of the forward exchange rate contract.

Although the residual income valuation model is equivalent to the DDM, it presents certain advantages over the DDM. First, the RIM splits the intrinsic value of equity into two components—a no-growth component and a growth component (see Miller and Modigliani 1961). Thus, a lower proportion of the estimated intrinsic value is obtained from the final discounted terminal term than is the case with the DDM. Second, the decomposition into two components—a measure of capital invested (the book value) and the expected wealth-creating activities—provides better intuition with respect to the origin of the creation of value than does the focus on the distribution of value in the DDM (Lee and Swaminathan 1999; White, Sondhi, and Fried 2003). Third, in addition to using such readily available accounting information as book value, the RIM also uses the main product of the financial industry: earnings forecasts (Claus and Thomas 2001). Finally, this forward-looking approach largely circumvents the cross-border differences in accounting standards among countries. Indeed, countries with depressed book values because of accounting standards will have lower normal earnings and then higher forecast abnormal earnings than countries with inflated book values. The two parts of the RIM—the book value of the market index and the present value of abnormal earnings—will then counterbalance so as not to systematically advantage or disadvantage countries with a specific set of accounting standards. Therefore, the RIM is the more reliable and consistent measure of implicit expected rates of returns among countries. Even with the harmonization of international standards, which is unlikely to completely eliminate accounting disparities among countries, the advantage of this forecast-based model over models using historical accounting data should remain (Frankel and Lee 1999).

Data

Our data sample spans 19 developed markets for the period January 1988 through December 2005. We used Morgan Stanley Capital International (MSCI) developed-market total return (including dividends) indices denominated in U.S. dollars (hedged). We computed the realized U.S. dollar–hedged return on the basis of a 100 percent hedge of capital at the beginning of the period. Consequently, only the realized return was exposed to variations in exchange rates. We obtained one-month forward and spot exchange rates from Data Resources, Incorporated (DRI). We then computed those exchange rates from the arithmetic average of bid and ask prices at the close of the London market. Book values, dividend yields, and consensus financial analysts' earnings forecasts were derived from I/B/E/S. We obtained data on U.S. 91-day T-bills from Ibbotson Associates and data on historical inflation rates from Thomson Financial's Datastream. All the data were available on a monthly basis.

Historical Realized Returns. Table 1 presents summary statistics for historical monthly return distributions for the 19 countries, for an equally weighted index comprising the 19 countries (hereafter, "world index"), and for a value-weighted world index. The average monthly return varied considerably from one country to another—ranging from a minimum of 0.31 percent for Japan and New Zealand to a maximum of 1.07 percent for Switzerland. At the aggregate level, the equally weighted world index outperformed the value-weighted world index by 0.21 percentage points.

Table 1. Summary Statistics: Country Monthly U.S. Dollar–Hedged Returns, 1988–2005

	Historical				Residual Income Model		Stable DDM		
Country	Average Weight	Average Geometric Return	Standard Deviation	Reward-to-Volatility Ratio	Average Expected Return	Standard Deviation	Average Expected Return	Standard Deviation	Correlation Coefficient[a]
Australia	1.6%	0.66%	4.0%	0.17	0.55%	0.12%	0.38%	0.15%	0.77**
Belgium	0.6	0.81	5.1	0.16	0.79	0.49	0.45	0.48	0.65**
Canada	2.5	0.68	4.3	0.16	0.64	0.12	0.32	0.12	0.68**
Denmark	0.4	0.95	5.4	0.18	0.56	0.35	0.23	0.33	0.16**
Finland	0.5	0.89	9.8	0.09	0.60	0.36	0.26	0.25	0.29**
France	3.9	0.84	5.7	0.15	0.65	0.25	0.34	0.20	0.78**
Germany	3.8	0.79	6.3	0.13	0.67	0.24	0.41	0.17	0.28**
Hong Kong	1.2	0.99	7.8	0.13	0.84	0.30	0.69	0.37	0.88**
Italy	1.7	0.57	6.4	0.09	0.50	0.35	0.32	0.20	0.56**
Japan	20.7	0.31	5.7	0.05	0.61	0.18	0.39	0.16	0.01
Netherlands	2.1	0.96	5.0	0.19	0.78	0.21	0.47	0.16	0.65**
New Zealand	0.1	0.31	5.8	0.05	0.54	0.20	0.36	0.19	0.62**
Norway	0.2	0.76	6.5	0.12	0.67	0.25	0.23	0.26	0.49**
Singapore	0.5	0.73	6.5	0.11	0.61	0.24	0.40	0.13	0.50**
Spain	1.3	0.69	6.2	0.11	0.52	0.29	0.37	0.19	0.51**
Sweden	1.1	1.03	7.2	0.14	0.56	0.21	0.26	0.23	0.25**
Switzerland	2.8	1.07	5.2	0.20	0.81	0.24	0.43	0.17	0.54**
United Kingdom	10.2	0.59	4.2	0.14	0.55	0.16	0.39	0.14	0.64**
United States	44.8	0.96	4.1	0.23	0.71	0.14	0.44	0.14	0.87**
Equally weighted world index		0.93	4.3	0.22	0.64	0.15	0.38	0.14	0.90**
Value-weighted world index		0.72	4.3	0.17	0.64	0.09	0.40	0.09	0.77**

Notes: Austria, Greece, Ireland, and Portugal were not included because consensus financial analysts' earnings forecasts were unavailable for the entire period for those countries. Earnings forecasts used in the RIM were available only as of February 1988 for Italy and as of March 1988 for Finland and New Zealand.

[a]The correlation of $E(r)$ from the RIM and $E(r)$ from the DDM.

*Significant at the 10 percent level.
**Significant at the 5 percent level.

Volatility varied as much as return among the developed markets—from Finland's high monthly standard deviation of 9.8 percent to the low percentages of Australia and the United States. The monthly volatility for the world indices was the same in this period. The United States posted the best reward-to-volatility ratio; Japan and New Zealand, the worst.

Expected Country Returns. Summary statistics for the average monthly forecast returns obtained from the RIM are also in Table 1. Hong Kong had the highest average monthly expected U.S. dollar–hedged return, and Italy had the lowest. Australia and Canada exhibited the most stable expected return estimates (standard deviation of 0.12 percent), and Belgium, the least stable.

DDM Data. For comparison purposes, we also report in Table 1 summary statistics of the average monthly country forecast returns obtained from the stable DDM for the 1988–2005 period. To compute these expected returns, we took the same long-term growth forecasts used for the RIM, namely, the average realized inflation rate over the previous year with a one-quarter lag. Denmark, Norway, Finland, and Sweden experienced the lowest average monthly expected U.S. dollar–hedged return when measured by the DDM, whereas Hong Kong experienced by far the highest.

Expected returns derived from the stable DDM were lower, on average, than those derived from the RIM. The rank correlation of forecast returns obtained through the RIM and those obtained from the stable DDM was 63 percent.

Finally, the last column of Table 1 presents time-series correlation coefficients of expected monthly returns per country obtained by the RIM and those returns obtained by the DDM. Although correlations of expected returns derived from the two models are high on average, for some countries—such as Japan, Denmark, Sweden, and Germany—the correlation is quite low.

Portfolio Construction and Performance Measure

We describe in this section two types of strategies we tested—a ranking strategy and an optimization strategy—the various holding periods we used, and the estimates of risk-adjusted returns of the strategies when we controlled for the three Fama–French factors plus a momentum factor.

Ranking Strategy. We first implemented a ranking strategy to test whether the expected return from the RIM provides specific information on the future relative performance of country indices. In each month t, we created equally weighted portfolios, P_{Long} and P_{Short}, according to the ranking of expected returns as of the end of month $t-1$. P_{Long} contained the most attractive countries (those with the highest expected U.S. dollar–hedged returns), and P_{Short}, the least attractive countries (those with the lowest expected U.S. dollar–hedged returns).

We tested the strategy with seven countries in P_{Long} and seven countries in P_{Short}. The zero-investment portfolio, $P_{Long-Short}$, which then contained positions in 14 countries, was a gauge of the ability of our expected return estimation to discriminate between attractive and unattractive markets.

Optimization Strategy. Rather than betting solely on the ranking of expected country returns, we used the return estimates together with risk parameters as inputs in a mean–variance-optimization process. We estimated risk parameters via an exponentially weighted moving average (EWMA) model rather than a simple moving average (SMA) model. The EWMA has two main advantages over the SMA.[6] First, in the EWMA, the latest observations carry the highest weights in the risk-parameter estimates, whereas in the SMA, each observation carries a fixed and equal weight. Risk parameters thus react faster to recent shocks in stock markets when the EWMA is used. Second, the risk parameters in the EWMA model have a short memory following a shock because volatility declines smoothly and rapidly as the weight of this shock observation decreases. In contrast, the risk parameters in the SMA model are long affected by a shock and react abruptly once it falls out of the measurement window—which is typically 60 months.

The parameters for variance, $\sigma^2_{j,t}$, and covariance, $\sigma^2_{kj,t}$, were estimated as follows:

$$\sigma^2_{j,t} = \sum_{s=1}^{S} \frac{\lambda^{s-1}}{\Lambda} \left(r_{j,t-s} - \bar{r}_j\right)^2 \tag{4a}$$

and

$$\sigma^2_{kj,t} = \sum_{s=1}^{S} \frac{\lambda^{s-1}}{\Lambda} \left(r_{k,t-s} - \bar{r}_k\right)\left(r_{j,t-s} - \bar{r}_j\right), \tag{4b}$$

where λ is the decay factor, S is the number of months considered in the calculations, and

$$\Lambda = \sum_{s=1}^{S} \lambda^{s-1}. \tag{5}$$

The decay factor, λ, was set at 0.97, and the number of months considered in calculations was set at 150 months.[7]

Each month, we optimized the country weights that maximized the expected information ratio (IR)—that is, the expected $P_{Long-Short}$ return per unit of risk—subject to various constraints. First, we constrained $P_{Long-Short}$ to be dollar neutral: Weights had to add up to 1 for the long component and to –1 for the short component. Second, we limited the weight optimization of the long portfolio component to the seven countries selected in the long portfolio of the ranking strategy and limited the weight optimization of the short portfolio component to the seven countries selected in the short portfolio of the ranking strategy.[8] The third constraint required that country weights vary only between 0 and 20 percent for the long portfolio and between –20 percent and 0 for the short portfolio. This constraint limited concentration in country bets. Formally, the optimization was

$$\max(\text{IR}) = \max\left[\frac{E(R_P)}{\sigma_P}\right] \tag{6}$$

subject to the following constraints:

1. $\sum_{i=1}^{7} |\omega_i|$ equal to 1 for each long and short portfolio,
2. 0 percent $\le \omega_i \le$ 20 percent for the long portfolio, P_{Long}, and
3. –20 percent $\le \omega_i \le$ 0 percent for the short portfolio, P_{Short},

where

$E(R_P)$ = $P_{Long-Short}$ expected U.S. dollar–hedged return

σ_P = EWMA estimated risk

ω_i = country weights (i = 1 through 19)

Holding Periods. To implement the country selection strategies over a horizon longer than one month, we used a method similar to the one developed by Jegadeesh and Titman (1993) for momentum-based strategies. Each month, we created portfolios by using a ranking or optimization strategy. We then held the portfolios for K months, with K being equal to 1, 3, 6, or 12 months. For example, with $K = 6$, the portfolio created on the basis of the expected return at time $t - 1$ was held for the subsequent 6-month period (t through $t + 5$).

To avoid the problem of overlapping in the series, we constructed K independent series of returns, which involved the rebalancing of $1/K$ of the holdings each month. Thus, we obtained a series of monthly returns, with each monthly return being an equally weighted combination of the K series considered. For example, if we used a three-month horizon for the ranking strategy, the January long (short) portfolio comprised one-third of the stock market indices with the highest (lowest) expected returns from the previous October ranking, another third from the previous November ranking, and a last third from the previous December ranking.

Risk-Adjusted Performance. We first examined the raw performance of country selection strategies. Then, we estimated the risk-adjusted returns of our strategies after controlling for the three Fama–French risk factors—the market, size, and book-to-market ratio (B/M) risk factors—augmented by a momentum risk factor (Carhart 1997).

We constructed global risk factors from stock constituents available on Datastream and Worldscope. We retained all companies with available market-capitalization and country affiliation data and a positive B/M. All returns were denominated in U.S. dollars hedged. We used the value-weighted world index return as a proxy for the world market return, WR_m, and the 91-day U.S. T-bill as a proxy for the risk-free rate, R_f.

To construct global risk factors, we applied a country stratification methodology and a value-weighted scheme.[9] We first used the Fama–French methodology to construct risk factors for each country. To construct the SMB (return of the small-capitalization portfolio minus return of the large-capitalization or "big" portfolio) and HML (return of the "high" B/M portfolio minus return of the "low" B/M portfolio) factors, we ranked stocks independently according to their market capitalization and B/Ms every end of June. The B/M value used in June of year y was the ratio of the book value of equity for the last fiscal year-end in $y - 1$ divided by the market value of equity in December of year $y - 1$. For the UMD ("up" minus "down," or momentum) factor, we ranked stocks on a monthly basis and independently according to their market capitalization and their past performances between the months $t - 12$ and $t - 2$.[10]

Then, we used country weights to construct the global, or world, risk factors for size (WSMB), B/M (WHML), and momentum (WUMD).

To examine whether the returns of our strategies were explained by the market, size, B/M, or momentum world factors, we regressed both the return of the zero-investment portfolios and the excess return of long and short portfolios on the excess world market return and world size, B/M, and momentum risk factors. The model was specified as follows:

$$\begin{aligned} R_{p,t} &= \alpha_p + \beta_p \left(WR_{m,t} - R_{f,t}\right) + s_p \left(WSMB_t\right) \\ &\quad + h_p \left(WHML_t\right) + u_p \left(WUMD_t\right) + e_{p,t}, \qquad (7) \\ &\quad \text{with } t = 1 \text{ to } 216, \end{aligned}$$

where $R_{p,t}$ stands for the $P_{Long-Short}$ return (P_{Long} or P_{Short} excess return) at time t; the alpha coefficient, α_p, stands for the world four-factor risk-adjusted return; and the risk factor loadings β_p, s_p, h_p, and u_p represent exposure to, respectively, the world market factor, world size factor, world B/M factor, and world momentum factor.

Empirical Results

On an *ex ante* basis (not shown in the tables), the optimization strategy dominated the ranking strategy. The average monthly expected optimization strategy return, at 0.45 percent, was slightly higher than the ranking strategy return, at 0.40 percent. In addition, the expected risk (estimated from the EWMA model) was lower for the optimization strategy (2.42 percent) than for the ranking strategy (2.73 percent). The real test, however, came with the performances of the strategies on an *ex post* basis.

Raw Performance. As **Table 2** shows, for the 1988–2005 period, both the ranking and the optimization long–short portfolios posted positive and significant average monthly raw returns over every holding horizon. The highest raw performance was for the one-month holding period, reported in Panel A. For that horizon, the ranking strategy's long–short portfolio posted a monthly average raw return of 0.67 percent, with a monthly standard deviation of 2.49 percent. The optimization strategy's long–short portfolio posted a slightly lower monthly average raw return but also a lower monthly standard deviation. For the one-month holding period, the IR was thus higher for the optimization strategy than for the ranking strategy.[11]

Table 2. Monthly Raw Performance of Strategies, 1988–2005

Holding Period and Measure	Ranking Strategy Long	Ranking Strategy Short	Ranking Strategy Long–Short	Optimization Strategy Long	Optimization Strategy Short	Optimization Strategy Long–Short
A. One-month holding period						
Arithmetic average excess return (%)	0.96**	0.29	0.67**	0.92**	0.27	0.65**
Standard deviation (%)	4.40	4.48	2.49	4.34	4.30	2.09
Information ratio	0.22	0.06	0.27	0.21	0.06	0.31
Lowest 12-month cumulative return (%)			–12.5			–9.3
Highest 12-month cumulative return (%)			51.8			50.9
Downside risk (%)			15			11
B. Three-month holding period						
Arithmetic average excess return (%)	0.78**	0.31	0.47**	0.79**	0.26	0.53**
Standard deviation (%)	4.36	4.50	2.33	4.28	4.34	2.16
Information ratio	0.18	0.07	0.20	0.18	0.06	0.25
Lowest 12-month cumulative return (%)			–14.0			–10.6
Highest 12-month cumulative return (%)			52.4			49.3
Downside risk (%)			30			20
C. Six-month holding period						
Arithmetic average excess return (%)	0.84**	0.22	0.63**	0.81**	0.23	0.58**
Standard deviation (%)	4.36	4.50	2.16	4.29	4.38	2.09
Information ratio	0.19	0.05	0.29	0.19	0.05	0.28
Lowest 12-month cumulative return (%)			–36.8			–12.4
Highest 12-month cumulative return (%)			60.7			50.3
Downside risk (%)			25			19
D. Twelve-month holding period						
Arithmetic average excess return (%)	0.83**	0.25	0.57**	0.78**	0.27	0.50**
Standard deviation (%)	4.35	4.55	2.07	4.32	4.45	2.09
Information ratio	0.19	0.06	0.28	0.18	0.06	0.24
Lowest 12-month cumulative return (%)			–16.3			–16.6
Highest 12-month cumulative return (%)			43.5			45.2
Downside risk (%)			16			21

Notes: We calculated the arithmetic average excess return relative to 91-day T-bills (average return of 0.38 percent over the period) for the long and short portfolios and relative to zero for the long–short portfolios. For the long and short portfolios, the significance (t-statistic) was measured against the value-weighted world index. Downside risk is the percentage of periods with negative 12-month cumulative returns.

*Significant at the 10 percent level.
**Significant at the 5 percent level.

Table 2 also provides descriptive statistics for the best and worst twelve-month performances during the various holding periods, together with a measure of downside risk. Over the one-month holding period, the ranking and optimization long–short portfolios posted their highest twelve-month cumulative returns in the year ending in September 1992. The ranking strategy produced its lowest twelve-month cumulative return in February 2000, and the optimization portfolio produced the –9.3 percent return in August 2000. We observed negative twelve-month cumulative returns 15 percent of the time for the ranking strategy and only 11 percent of the time for the optimization strategy.

For the three-month holding period (Panel B), the *ex post* IR was slightly better for the optimization strategy than for the ranking strategy because the optimization strategy produced a higher raw return and lower risk. The optimization strategy's outperformance vanishes, however, when we view the six- and twelve-month holding periods (respectively, Panel C and Panel D).

In the ranking strategy, we formed a long portfolio and a short portfolio and then obtained a long–short portfolio by construction. In the optimization strategy, however, we directly obtained the weights of the constituents of the long–short portfolio, which we could then decompose into a long portfolio and a short portfolio. "Winner" portfolios largely generated the $P_{Long-Short}$ portfolio performance because excess returns from such portfolios were all significant. In contrast, short portfolio excess returns were not significantly different from the value-weighted world index returns. Implementation of country tilts in long-only portfolios would be facilitated because the profitability of global zero-investment country portfolios was mainly driven by the most attractive, not the least attractive, countries.

We also examined the persistence of the constituents of the long and short portfolio counterparts (results not shown in Table 2). More than 86 percent of the constituents of the long or short portfolios remained in the same portfolio over the following month. This percentage decreased to 80 percent for the following three months and 75 percent for the following six months. A cost is incurred in holding a position over a couple of months, however, if the signal for any of its constituents changes. For example, countries in the long portfolio at month $t - 1$ that were still ranked in the long zone at month t generated an average return of 1.30 percent over $t + 1$. For constituents that were in the long zone at month $t - 1$ but were downgraded at month t, the average return over $t + 1$ fell to 1.14 percent if downgraded to neutral and 0.05 percent if downgraded to short. The underperformance of countries downgraded from the long to the neutral or short zone persisted over the next three months (six months) with average returns of, respectively, 0.95 percent and 0.69 percent (for six months, 1.07 percent and 0.67 percent). In contrast, the average return was 1.30 percent and 1.27 percent for those countries ranked in the long zone that stayed in the long portfolios over, respectively, a three-month and a six-month period.

Return and Risk Contributions. Table 3 provides summary statistics of the frequency, for a one-month holding period, with which each country was included in the long or short portfolio for the ranking and the optimization strategies. Table 3 also displays the return and risk contribution of each country to the strategy's overall return.

For both strategies, Switzerland, Belgium, and the Netherlands were the countries most often included in the long side of the portfolio. For the ranking strategy, Australia, the United Kingdom, and Sweden were the countries most often included in the short portfolio. The picture is similar for the optimization strategy, which took short positions most commonly in the United Kingdom, Australia, and Italy.

Table 3. Country Inclusion and Contribution to Return and Risk for the Strategies: One-Month Horizon, 1988–2005

	Ranking Strategy					Optimization Strategy				
	Inclusion (% of time)			Contribution to Return of Strategy (%)	Contribution to Risk of Strategy (%)	Inclusion (% of time)			Contribution to Return of Strategy (%)	Contribution to Risk of Strategy (%)
Country	Long	Short	Long–Short			Long	Short	Long–Short		
Australia	13.0	71.3	84.3	–9.3	1.8	9.3	66.2	75.4	–13.6	1.0
Belgium	84.3	3.7	88.0	16.8	5.6	83.8	3.9	87.7	24.1	5.8
Canada	21.8	41.7	63.4	–7.9	2.0	20.4	39.2	59.6	–7.1	1.8
Denmark	24.1	32.9	56.9	8.1	3.4	23.6	33.3	56.9	5.0	6.3
Finland	29.6	40.3	69.9	8.5	18.4	35.4	26.5	61.8	17.7	10.3
France	29.6	29.6	59.3	11.1	7.6	25.9	31.4	57.3	8.8	6.9
Germany	25.5	26.4	51.9	17.0	9.0	13.9	27.5	41.3	8.6	5.2
Hong Kong	61.6	22.7	84.3	12.8	14.2	61.1	17.2	78.3	16.7	13.5
Italy	13.4	56.5	69.9	–8.8	5.7	10.6	59.8	70.5	–15.2	9.4
Japan	34.3	36.6	70.8	–2.4	2.5	34.3	33.3	67.6	4.4	2.5
Netherlands	81.0	0.9	81.9	20.5	4.0	79.2	1.0	80.1	21.4	8.9
New Zealand	16.7	53.2	69.9	–2.6	0.3	17.1	50.0	67.1	1.9	–0.4
Norway	43.5	28.2	71.8	22.0	5.6	36.1	29.9	66.0	11.2	2.4
Singapore	38.4	43.1	81.5	3.6	–0.4	36.1	36.8	72.9	9.6	2.7
Spain	38.4	54.6	93.1	–1.5	4.9	37.5	57.4	94.9	–2.6	5.7
Sweden	2.3	58.8	61.1	–6.3	8.0	1.4	55.9	57.3	–15.1	5.8
Switzerland	89.4	0.5	89.8	25.1	6.1	88.0	0.5	88.5	35.2	9.1
United Kingdom	7.4	69.9	77.3	–8.8	–0.5	4.2	67.6	71.8	–12.5	0.1
United States	45.8	29.2	75.0	2.0	1.8	45.8	27.0	72.8	1.5	3.1

For the ranking strategy, Switzerland, Norway, and the Netherlands were the top three performers in terms of the contributions of each country to the overall return of the strategy. Australia, Italy, and the United Kingdom made the most negative contributions to the strategy's return. Results for the optimization strategy are similar—with Switzerland, Belgium, and the Netherlands contributing the most positively and Italy, Sweden, and Australia contributing the most negatively. Overall, 11 of the 19 countries contributed positively to the returns of the ranking strategy (13, to the returns of the optimization strategy). With such a large number of countries contributing to the returns, we conclude that the positive sources of return (bets) are well diversified rather than being driven by a single country or a few countries.

In terms of risk contribution—ratio of the covariance of country and portfolio returns to the portfolio return variance—the same level of diversification prevailed; most countries had an impact on the overall risk of the strategies. Finland and Hong Kong contributed the most to the risk of the ranking and optimization strategies.

Risk-Adjusted Performance. Table 4 shows that the long–short portfolios from the ranking and optimization strategies provided positive and significant four-factor risk-adjusted returns (alphas) in every holding period. The alpha coefficients of the zero-investment portfolios are only slightly lower than the raw returns given in Table 2. For instance, for the most rewarding strategies, the one-month holding period, alphas are 0.60 percent

Table 4. Monthly Four-Factor Risk-Adjusted Performance of Strategies, 1988–2005

	Ranking Strategy			Optimization Strategy		
Holding Period and Measure	Long	Short	Long–Short	Long	Short	Long–Short
A. One-month holding period						
Risk-adjusted return (%)	0.38**	–0.23	0.60**	0.35**	–0.26*	0.61**
Market ($WR_M - R_F$)	1.03	1.02	0.01	1.02	0.99	0.03
Size (WSMB)	–0.07	0.03	–0.11*	–0.07	0.04	–0.10**
B/M (WHML)	0.26**	0.15*	0.11	0.24**	0.19**	0.05
Momentum (WUMD)	0.02	0.03	0.00	0.03	0.03	0.00
B. Three-month holding period						
Risk-adjusted return (%)	0.28*	–0.18	0.46**	0.27*	–0.23	0.51**
Market ($WR_M - R_F$)	1.03	1.04	–0.01	1.01	1.00	0.01
Size (WSMB)	–0.08	0.00	–0.08	–0.07	0.00	–0.07
B/M (WHML)	0.24**	0.15**	0.09	0.26**	0.18**	0.09
Momentum (WUMD)	0.00	0.02	–0.03	0.01	0.01	0.00
C. Six-month holding period						
Risk-adjusted return (%)	0.33**	–0.26*	0.59**	0.28*	–0.26*	0.54**
Market ($WR_M - R_F$)	1.02	1.05	–0.03	1.00	1.02	–0.01
Size (WSMB)	–0.09*	–0.01	–0.08	–0.09*	0.00	–0.09*
B/M (WHML)	0.23**	0.16**	0.07	0.25**	0.19**	0.05
Momentum (WUMD)	0.01	0.02	–0.01	0.02	0.00	0.02
D. Twelve-month holding period						
Risk-adjusted return (%)	0.34**	–0.22	0.55**	0.28*	–0.23	0.50**
Market ($WR_M - R_F$)	1.02	1.06	–0.04	1.00	1.04	–0.04
Size (WSMB)	–0.08	–0.02	–0.06	–0.09*	0.00	–0.09*
B/M (WHML)	0.23**	0.17**	0.06	0.25**	0.23**	0.02
Momentum (WUMD)	0.01	0.00	0.01	0.01	–0.01	0.02

Notes: The significance (t-statistic) associated with betas was based on the null hypothesis that the slope coefficients were equal to 1 for the long or short portfolios and equal to 0 for the long–short portfolios. Over the entire sample period, the average monthly WSMB, WHML, and WUMD returns were positive (respectively, 0.04 percent, 0.61 percent, and 0.22 percent), but only the WHML was significantly different from zero.

*Significant at the 10 percent level.
**Significant at the 5 percent level.

and 0.61 percent per month for, respectively, the ranking and optimization strategies versus 0.67 percent and 0.65 percent in terms of raw returns. The $P_{Long-Short}$ portfolios are market-neutral because no beta coefficients were found to be statistically different from zero. These portfolios posted a moderate size tilt; the size loadings are statistically different from zero in four out of the eight cases considered. The $P_{Long-Short}$ portfolios reveal neither significant growth–value tilts nor significant momentum tilts. For both the ranking and optimization strategies, the $P_{Long-Short}$ risk-adjusted performance is higher for the one-month holding period than for the other holding periods. The risk-adjusted performance of the optimization strategy long–short portfolios is slightly higher than that of the ranking strategy portfolios for one- and three-month holding periods but slightly lower for six- and twelve-month holding horizons.

A decomposition of the long–short portfolio performance between the long and the short parts showed that the long positions generated most of the portfolio performance; all alpha coefficients of the long portfolios were significant (at the 10 percent level), and three of eight alpha coefficients of the short portfolios were significant (at the 10 percent level). This asymmetry facilitated the implementation of long-only portfolios.

In summary, expected returns of developed-country indices estimated through the RIM had predictive power for country selection in the 1988–2005 period. The outperformance of the ranking and optimization strategies based in this methodology still held after we controlled for four world risk factors. Therefore, considering countries' conditional risk estimates in addition to expected returns in an optimization process seems to add slightly to the risk-adjusted performance of strategies for one- and three-month holding periods. Returns from long–short portfolios in this period came mainly from the long constituents.

Robustness of Results

To document the robustness of the results obtained from the country selection model, we focus the analysis in this section on the performance of the ranking and optimization strategies in the one-month holding period—the most profitable horizon.[12] We tested various long-term growth proxies and various country-universe subsamples, and then we assessed the performance after taking transaction costs into account.

Other Proxies for the Growth in Abnormal Earnings. The long-term growth rate in abnormal earnings, g, is a critical input in the estimation of the intrinsic value of equity. We assumed in the previous section that abnormal earnings grew at the long-term expected inflation rate, as measured by the historical inflation rate observed over the previous year (with a one-quarter lag). We also used two other proxies of g, however, to assess the robustness of our previous results. These proxies are short-term interest rates (as a proxy for expected inflation) and consensus inflation forecasts.

Many researchers (among others, see Stevenson 2000 and Solnik 1983) have corroborated and broadened the conclusions of Fama and Schwert (1977) supporting the use of short-term interest rates as a proxy for expected inflation. In our tests of robustness, we used the one-month LIBOR when it was available as the short-term rate.[13] When the LIBOR was not available, we derived implicit short-term interest rates from the one-month forward rate and spot exchange rate differential.[14]

We also used the long-term inflation forecasts published by Consensus Economics as a proxy for the long-term expected growth in abnormal earnings. When Consensus Economics inflation forecasts were not available for particular countries, we used the Consensus Economics forecast of the country most similar in economy or nearest geographically.[15]

Table 5 shows that both the ranking and optimization strategies posted positive raw and four-factor risk-adjusted returns that were significant at the 5 percent level when either alternative proxy of g was used. Although the optimization strategy had lower volatility than the ranking strategy when short-term rates were used, it also had lower realized raw and risk-adjusted returns.

Results for tests using the consensus forecasts are very similar to those for tests using short-term rates, but the reduction in volatility compensated for the lower return, resulting in an IR of 0.31 for the ranking and optimization strategies. When the consensus was used, the optimization strategy's four-factor risk-adjusted performance was lower than that of the ranking strategy.

Using either the short-term interest rate or long-term inflation consensus forecasts as a proxy for the growth rate in abnormal earnings had no impact on the conclusions respecting the predictive power of the RIM for country selection.

Different Universe Subsamples. We divided our sample of countries in various ways to test the robustness of our findings. These results are presented in **Table 6**.

Table 5. Monthly Raw and Risk-Adjusted Performance of Long–Short Portfolios for Alternative Proxies of Expected Long-Term Inflation: One-Month Holding Period, 1988–2005

	Ranking		Optimization	
Measure	Short-Term Interest Rates	Consensus Forecast	Short-Term Interest Rates	Consensus Forecast
Arithmetic return (%)	0.70**	0.78**	0.51**	0.65**
Standard deviation (%)	2.72	2.47	2.21	2.10
Information ratio	0.26	0.31	0.23	0.31
Risk-adjusted return (%)	0.61**	0.74**	0.48**	0.67**

*Significant at the 10 percent level.
**Significant at the 5 percent level.

Table 6. Monthly Raw and Risk-Adjusted Performance of Long–Short Portfolios for Various Sample Universes: One-Month Holding Period,1988–2005

	Ranking			Optimization		
Measure	World ex United States	EAFE ex Japan	12 Largest Countries	World ex United States	EAFE ex Japan	12 Largest Countries
Arithmetic return (%)	0.66**	0.63**	0.60**	0.67**	0.59**	0.59**
Standard deviation (%)	2.69	2.64	2.69	2.25	2.20	2.68
Information ratio	0.25	0.24	0.22	0.30	0.27	0.22
Risk-adjusted return (%)	0.60**	0.53**	0.60**	0.61**	0.54**	0.61**

*Significant at the 10 percent level.
**Significant at the 5 percent level.

☐ *World ex United States.* Table 6 provides insights into the performance of our country selection strategies for world-ex-U.S. equity mandates. The raw and four-factor risk-adjusted returns remained statistically significant for both strategies after we excluded the largest world market. For the ranking and optimization strategies, the subsample monthly four-factor risk-adjusted returns, at 0.60 percent, were equal to those of the full sample (0.61 percent).

☐ *EAFE ex Japan.* The period we examined was special in that it included the Japanese stock bubble, during which the weight of Japan dropped from 40.4 percent of world market capitalization at the beginning of the period to 11.7 percent at the end of the period. We thus tested whether our previous strategy results held when we considered another common, specific equity mandate—that limited to the MSCI Europe/Australasia/Far East (EAFE) Index ex Japan. Table 6 shows that the risk-adjusted returns are significant at a 5 percent level but slightly lower than those of the original 19-country sample.

☐ *Exclusion of less-liquid markets.* To ensure that the results of our strategies were not driven by the inclusion of small and illiquid country indices in the universe, we tested the same strategies by including only countries for which index futures were available and liquid. Thus, we reduced the investment universe to the 12 largest countries in terms of market capitalization: Australia, Canada, France, Germany, Hong Kong, Italy, Japan, the Netherlands, Spain, Switzerland, the United Kingdom, and the United States. Table 6 presents the monthly performance for the ranking and the optimization strategies when we used only these 12 markets. Note that the risk-adjusted returns for the long–short portfolios—five countries in the long and in the short counterparts—remained significantly positive and very similar to the results presented in Table 4.

☐ *Implementation costs.* Finally, we examined the extent to which transaction costs could hinder the profitable implementation of our strategies. We first estimated the average monthly turnover at roughly 31 percent and 39 percent for, respectively, the ranking and optimization strategies. Thus, for both strategies, approximately one-third of all long–short portfolios was replaced every month. This ratio included weight rebalancing resulting from market effects for countries that stayed in the same portfolio zone. Our (conservative) average equal-weighted estimate of transaction costs was around 30 bps for the 19 countries.[16]

Table 7 sheds light on the impact of transaction costs on the performance of country selection strategies implemented with the 19 countries and with the more liquid subsample. The ranking strategy monthly risk-adjusted return fell to 0.41 percent for the full sample when transaction costs were taken into account, and the optimization strategy risk-adjusted return dropped to 0.38 percent. Both risk-adjusted returns remained significant, however, after transaction costs.

When implementation was carried out with only the 12 most liquid markets, we incorporated futures and assumed the average equal-weighted transaction cost on index futures to be 10 bps.[17] The risk-adjusted return fell only to 0.59 percent for either strategy and remained significant at the 5 percent level.

We also report in Table 7 the maximum transaction costs that would allow each strategy to continue to post a significant (at the 5 percent level) positive risk-adjusted return. For the original sample of 19 developed countries, we found the maximum cost to be about 38 bps for both strategies. For the 12 largest countries, higher maximum transaction costs were possible because turnover would be lower in the smaller sample. These findings suggest that implementation costs are unlikely to be high enough to dissipate the strategies' risk-adjusted performance.

Conclusion

We examined the suitability of using expected returns derived from the residual income model in global equity country selection. Our sample comprised 19 developed countries and spanned the period 1988–2005. First, we reported that zero-investment portfolios based on a ranking strategy, in which the long portfolio contained the most attractive countries and the short portfolio contained the least attractive countries, posted significant positive excess returns. Second, we showed that an optimization strategy based on conditional risk estimates—RiskMetrics exponentially weighted moving averages—in addition to the implicit expected return estimates posted a slightly better performance on an IR basis than the ranking strategy over short holding periods.

The ranking and optimization strategies' results held when we controlled for four world risk factors—market, size, B/M, and momentum—which were constructed through a country stratification methodology and a value-weighted scheme. All the results were significant for holding periods of one, three, six, and twelve months, when different long-term growth estimates were used, or when universe subsamples were analyzed. Although RIM strategies could involve relatively high turnover, we found that performance net of transaction costs remained positive and statistically significant for both strategies.

Although we documented basic zero-investment strategies, many alternative ways of implementing RIM strategies are possible. For example, because the long portfolio posted significantly positive raw and risk-adjusted returns, an investor could construct a long-only portfolio from countries with the highest expected returns. An investor could also overweight P_{Long} countries

Table 7. Monthly Raw and Risk-Adjusted Performance of Long–Short Portfolios after Transaction Costs: One-Month Holding Period, 1988–2005

	Ranking		Optimization	
Measure	19 Countries	12 Largest Countries	19 Countries	12 Largest Countries
Arithmetic return (%)	0.67**	0.60**	0.65**	0.59**
Arithmetic return (net of transaction costs) (%)	0.49**	0.55**	0.41**	0.54**
Turnover ratio	0.31	0.27	0.39	0.27
Risk-adjusted return (%)	0.60**	0.60**	0.61**	0.61**
Risk-adjusted return (net of transaction costs) (%)	0.41**	0.59**	0.38**	0.59**
Maximum transaction costs (at the 5% level, in bps)	38	47	38	46

Note: We used a transaction cost assumption of 30 bps for the sample comprising 19 countries and 10 bps for the sample comprising 12 countries.

*Significant at the 10 percent level.
**Significant at the 5 percent level.

and underweight P_{Short} countries by a certain percentage relative to a value-weighted world benchmark and thus limit active risk (relative to the benchmark). All such variants of the basic zero-investment strategies would add value over a passive benchmark.

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This article qualifies for 1 PD credit.

Notes

1. The residual income model is also referred to as the "abnormal earnings model" (Liu and Thomas 2000) or the "Edwards–Bell–Ohlson" (EBO) model, in reference to the authors who contributed to its origin (Edwards and Bell 1961; Ohlson 1995). However, the work by Preinreich (1938) was also important.
2. The J.P. Morgan/Reuters RiskMetrics Technical Document may be found at www.riskmetrics.com/rmcovv.html.
3. This critical assumption does not hold equally in all countries. "Dirty surplus adjustments" can arise from differences in accounting standards among countries (Frankel and Lee 1999). Chen, Jorgensen, and Yoo (2004) provided evidence that clean surplus deviation is relatively small for Australia, Canada, Japan, and the United States but is more significant for France, Germany, and the United Kingdom.
4. Analysts' earnings forecasts may be subject to timeliness and bias problems that reduce the accuracy of estimates of the implicit market rate of return. Guay, Kothari, and Shu (2003) documented that sluggish updates of long-term earnings forecasts that receive a large weight in the estimation of the implied cost of capital can induce errors in estimates. Frankel and Lee (1999), however, concluded that sell-side analysts provide reasonably reliable earnings forecasts and that the systematic positive bias is no worse in other countries than in the United States.
5. This choice was motivated by the availability of realized inflation rates for every country over the entire period. We present the results of using two other proxies, however, in a subsequent section.
6. See the RiskMetrics Technical Document.
7. See the discussion of estimating λ and S in the RiskMetrics Technical Document.
8. We also used the methodology proposed by Jacobs, Levy, and Markowitz (2006). We constructed the zero-investment strategy in terms of 38 nonnegative variables of which the first 19 represented the countries held long and the second 19 variables represented the 19 shorted countries. We maximized the expected return of the zero-investment strategy for the same risk level as that of the ranking strategy. Given our concentration constraints, this methodology slightly improved the *expected* return, but the *ex post* performance was not significantly different from the one reported here. Results are available on request.
9. Results did not differ significantly whether we used country stratification or no country stratification, in which all stocks are pooled together. The "no country stratification" results are available on request. Griffin (2002) extensively tested international versions of the Fama–French three-factor pricing model for equity returns. He constructed world factors by using value-weighted or equal-weighted averages, with country stratification and no country stratification. Cavaglia and Moroz (2002) also constructed equal- and value-weighted world versions of the Fama–French risk factors augmented by a world momentum factor with stratification by country and by global industry and with no country or industry stratification.
10. We used 50 percent as a breakpoint to separate big and small for the size portfolios; we used 30 percent and 70 percent as breakpoints for the B/M and momentum portfolios. The SMB factors were constructed by using six value-weighted portfolios formed on size and B/M. The HML and UMD country risk factors were constructed by using four value-weighted portfolios based on size, B/M, and momentum. See Kenneth French's website: mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
11. In comparison, an optimization strategy with a one-month holding period based on expected returns from the stable DDM generated a monthly average raw return of only 0.30 percent (and the ranking strategy, 0.34 percent) with a monthly standard deviation of 2.03 percent (2.52 percent).
12. The conclusions did not differ significantly for the three-, six-, and twelve-month holding periods. For space considerations, those results are not presented here, but they are available on request.
13. The one-month LIBOR is available for the United States starting with December 1986; for Germany, Japan, Switzerland, and the United Kingdom starting with November 1989; for Canada starting with October 1990; for Australia, France, Italy, the Netherlands, and Spain starting with January 1995; and for Denmark and New Zealand starting with June 2003.
14. Claus and Thomas (2001) contended that short-term interest rates are an upper bound for the long-term growth estimates of earnings forecasts. They used short-term interest rates minus 3 percent (the real-interest-rate assumption). We used $R_f - 3\%$ in our model as a proxy for expected inflation (in addition to the LIBOR) and found results to be the same. Results are available on request.
15. Consensus Economics long-term inflation forecasts are available for the complete period for the G–7 countries, starting with April 1995 for the Netherlands and Sweden, and starting with October 2000 for the remaining countries.
16. We estimated the transaction costs (direct commission, bid–ask spread, and price impact) on index futures at around 10 bps for Japan, Sweden, and Singapore; around 7 bps for Australia and Switzerland; and at less than 5 bps for Canada, France, Germany, Hong Kong, Italy, the Netherlands, Spain, the United Kingdom, and the United States. For Belgium, New Zealand, Denmark, Finland, and Norway, futures contracts exist but are not sufficiently liquid to use, so for those countries, we used a conservative 100 bps estimate. Thus, our global cost estimate was 30 bps.
17. Jorion and Roisenberg (1993) estimated that transaction costs (direct commission and bid–ask spread) of index futures range between 4 bps and 48 bps, depending on the market considered (4 bps in the U.S. market, 23 bps in the Japanese market, and 48 bps in the U.K. market).

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