FURTHER EVIDENCE ON GLOBAL PRICING:

IMPLICATIONS FOR RISK MANAGEMENT

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Abstract: The internationalization of capital markets suggests that global factors will play an increasingly important role in the pricing of securities. Identifying the source of those global factors and structuring portfolios that exploit the reward to risk opportunities from variation in these factors presents a new challenge for investment managers. In this paper we build on current research that suggests that industry factors capture an economically important component of the variation in security returns. We postulate a risk model that explicitly accounts for regional sector rotation decisions. We examine whether the statistically estimated factor risk exposures are related to firm level economic activities. In particular we find that sensitivities to foreign factors are positively associated with the extent of firms' foreign sales activities. This provides empirical support for our reduced form structural model, and it suggests that foreign sales data can be utilized as a conditioning variable to obtain economically sensible risk factor sensitivities.

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1. Introduction:

Over the most recent decades, the global equity landscape has been characterized by two striking and complimentary trends: the increasing integration of capital markets and the accelerating globalization of business enterprise activities. These phenomena have far reaching implications for the pricing of securities and hence for the investment management profession.

Institutional arrangements amongst public and private entities have been fundamentally altered in favor of supranational organizations. Increased economic policy coordination amongst OECD member countries (and in particular EMU member countries), the decline in trade barriers resulting from the growing importance of the World Trade Organization, and the emergence of large trading blocks suggest that differences in national economic fundamentals are likely to diminish. Indeed the dispersion in short-term interest rates and in various indicators of political risk (as reported by the Political Risk Services Group) has markedly declined over the past fifteen years. Corporations have responded to this more open landscape by consolidating and rationalizing enterprise activities globally. This is well reflected in the explosion of cross border mergers and acquisitions rising from an average of $40b/annum over the 1989-1993 period to an average of $400b/annum over the 1994-2000 period as reported by the Interactive Data Corporation. Indeed the emergence of supranational corporations has prompted index vendors (FTSE and S&P) to construct benchmarks aimed at measuring the performance of a "new" asset class: the multinational.

These institutional developments suggest that global factors should play an increasingly important role in the pricing of securities. Until recently, empirical evidence suggested that local factors were the dominant determinant of security returns.[1] Diermeier and Solnik (2000) provide strong contrary evidence for corporations domiciled in the seven largest developed capital markets. Starting from the first principles of valuation analysis, they demonstrate that a corporation should be regarded as a portfolio of international activities. They provide empirical support for this hypothesis by demonstrating that firm level sensitivities to non-domestic factors are related to firms' foreign sales activities. Their findings imply a new paradigm for investment managers. Firm level fundamentals data should be utilized in understanding the local and global risk factors that impact security returns; these bottom up estimates can then be aggregated to obtain the relevant risk exposures for a portfolio of securities. Proxies like country of domicile can now be highly misleading indicators of local factor risk exposures. In related research, Cavaglia, Brightman, and Aked (2000) identify the increasing importance of global industry factors relative to country factors as determinants of security returns; they show that diversification across industries now provide greater risk reduction than diversification across countries. As first suggested by Cavaglia, Miyashita, and Melas (1994), it follows that there is more to international allocation than choosing winning countries; a cross-country, cross-industry matrix approach is needed to capture the maximal reward to risk benefits of international equity diversification.

The purpose of this study is to gain a better understanding of the sources of "global" pricing or rather "non-domestic" pricing which are documented in Diermeier and Solnik (2000). In this paper, we focus on industry factors; in subsequent papers we will focus on the international dimension of value and size factors. We first extend the risk model developed by Heston and Rouwenhorst (1994) to account for an investment style that is becoming increasingly popular: regional sector rotations. We recognize that finding the "best" risk model is a worthy endeavour. However, our objective is narrower; we aim to build a model that is well grounded in financial theory and that is consistent with a current investment style. We examine security level fundamentals data for the constituents of the 22 developed markets that comprise the FT World Index, and we find that firm level regional sector exposures can be explained by the extent of firms' regional sales over the 1990-2000 period. This suggests that the reduced form of the structural model we estimate is a reasonable representation of the economic phenomena we observe. Furthermore, foreign sales data provide valuable information that can be used to condition factor loading estimates in the construction of global equity risk models.

2. Methodology:

We first postulate a model of security returns. We posit that the local excess returns of security j at time t $R_j(t)$ is determined by the following relationship:

$$
\begin{aligned}
R_j(t) = \quad & \beta_1 * [\text{World Market Return (t)}] + \\
& \beta_2 * [\text{Country Market Return (t)}] + \\
& \beta_3 * [\text{North America Sector Return (t)}] + \\
& \beta_4 * [\text{Europe Sector Return (t)}] + \\
& \beta_5 * [\text{Asia} - \text{Pacific sector Return (t)}] + \quad \varepsilon(t)
\end{aligned}
$$

Note that the country of domicile and the sector to which security j belongs to are the relevant explanatory variables in equation (1). Thus, for instance, the return on General Motors stock is driven by the world market factor, the US market factor, and regional consumer durables factors. The above extends and nests Heston and Rouwenhorst (1994) and Diermeier and Solnik (2000).

Heston and Rouwenhorst (1994) impose the strong assumption that industry factors are global in nature. This is particularly unrealistic in relation to the practice of active portfolio management. Consider an asset manager who is long Japanese autos, short US autos, long US banks, and short Japanese banks. If industry factors are global in nature, these portfolio holdings result in neutral country positions and neutral industry positions.

This might lead to the misleading conclusion that the portfolio is only exposed to security specific risk to the extent this has not been diversified away. Clearly, the asset manager has made an explicit decision to bear the risk and reward benefits of sector rotations. The risk model should capture this aspect of the decision process; we thus allow for regional sector effects. [2]

In Diermeier and Solnik (2000) non-domestic risks are captured by regional market factors (Asia, North America, and Europe) and currency factors. We allow for two sources of non-domestic factors: the world market and regional sector effects. We defer our treatment of currency factors to subsequent research though we provide some preliminary evidence relating to currency risk in ensuing sections.

As is discussed in Heston and Rouwenhorst (1994, 1995), estimating equation (1) or variants of equation (1) is a rather difficult task. In particular they suggest that it is desirable to control for differing industrial structures across countries and for the differing country composition of global industries. To do so it is necessary to impose some identifying restrictions. In particular, one can assume that factor loadings are given (unitary or zero as required); cross sectional dummy variables regressions can then be estimated to obtain the relevant "pure" country and industry factor returns. The pure returns provide a useful investment interpretation; they are the returns from sector (country) tilts that are country (industry) neutral. Marsh and Pfleiderer (1997) argue that this procedure results in an unnecessary loss of information. Harvey, Solnik, and Zhou (1994) demonstrate that differences in risk loadings are important in accounting for the cross-sectional variation in industry and country equity returns. Marsh and Pfleiderer (1997) propose an iterative estimation approach aimed at obtaining estimates of the risk loadings. In step *one* values for the factor loadings are assumed and a cross sectional regression yielding the pure country and industry factor returns is estimated. In step *two* the time series of the pure factor returns is utilized in ordinary least squares estimates of equation (1) to obtain factor loadings. In step *three* the factor loadings obtained in step *two* are utilized to estimate the constrained H-R regression. This procedure is repeated until convergence is obtained. We adopt this suggested approach by Marsh and Pfleiderer though we stop at the first iteration (or step *two*) of the approach they outline. [3]

Having estimated equation (1) we examine the cross section of factor loadings (the estimated betas) in light of the theoretical international valuation model of Diermeier and Solnik (2000). If rational international asset pricing is reflected in security prices, then we would expect to find empirical support for the following hypotheses:

Hypothesis 1: Firm level exposures to the global risk factor are positively related to the extent of firms' foreign activities.

Hypothesis 2: Firm level exposures to the domestic risk factor are inversely related to the extent of firms' foreign activities.

Hypothesis 3: Firm level exposures to the regional sector risk factor are positively related to the extent of firms' regional activities.

We test the above hypotheses via cross sectional regressions of the estimated betas on the relevant foreign sales to total sales ratios which are used to proxy firms' foreign activities. [4] Thus for instance, hypothesis 1 is tested via a cross sectional regression of the $\hat{\beta}_1$ on the foreign sales to total sales for all firms in our sample.

Several robustness checks are performed. We examine the extent to which our findings are stable over time by estimating year by year cross sectional regressions over the 1990-1999 period. We also examine whether our results are sensitive to country of domicile; for instance, we examine whether companies domiciled in Europe behave differently from those in the rest of the world. Finally we examine the residuals of our estimated factor model and review whether they are systematically related to currency factors.

3. Data:

The constituents of the FT World Index for 22 developed equity markets define our universe of securities. This universe covers the top 85-95% market capitalization of each country and the generally more liquid securities; this constrasts with the current MSCI universe of securities that covers the top 60-65% of market capitalization in each country. Table 1 provides the number of companies by country at year-end for the time period of analysis.

Our empirical estimation was conducted on weekly excess returns; hence, our results can be viewed as currency hedged from any investor's perspective. [5] Excess returns were obtained from local total returns as reported by FTSE International less the one month Eurodeposit rates (appropriately scaled for the holding period horizon) reported in Standard & Poor's DRI Fixed Income and Money Markets Database. Securities were classified into 10 broad sectors (enumerated in table 1b) for 3 regions: North America, Asia-Pacific, and Europe. We utilized MSCI industry classification released in 1999. [6] Our use of MSCI industry classifications is arbitrary and was driven more by practical considerations rather than by the merits of this classification scheme as compared to other classification schemes.

When this research was conducted, MSCI industry classifications were not available for securities that were in the index prior to 1999. We created a back history by mapping pre 1999 FT industry classifications and Factset industry classifications onto MSCI industry classifications. In some instances we were unable to identify an appropriate mapping; these securities were classified in an 11^{th} "multi-industry" sector. Stocks belonging to multi-industries were excluded from the sample of companies used to test our hypotheses since factor loadings on a "multi-industry" factor are somewhat difficult to interpret.

Regional sales data was obtained from two data sources. For the US domiciled companies we utilized Worldscope starting in 1992. For all other companies we obtained a complete sales breakdown by country or region from WorldVest starting in 1990. [7] The breadth and depth of this data is noteworthy. In table 2 we report the number of

companies in the FT universe for which we have relevant foreign sales data. In table 3 we report the percentage of FT market capitalization covered by our foreign sales data; generally speaking we cover about 60% of the capitalization of each country.

4. Empirical Results:

The primary objective of our empirical analysis is to use fundamentals data to gain a better understanding of the statistically estimated factor loadings in equation (1). We also aim to gain confidence in the reasonableness and consistency over time in the structural form of the model.

We estimated equation (1) via the two pass modified methodology we have outlined for each year over the 1990-1999 period. A rolling 52-week window of data was used to estimate factor loadings at any point in time. We then examined the hypotheses formulated in section one at each year-end. Results for the cross sectional regressions of factor loadings on the relevant foreign sales ratios are reported in table 4. We review these results in light of our testable hypotheses.

Hypothesis 1: Firm level exposures to the global risk factor are positively related to the extent of firms' foreign activities.

This can be tested via a cross sectional regression of the form:

$$(2) \quad \beta_1^j(t) = \text{constant} + \delta_1 * \left[\frac{\text{Total Foreign Sales}}{\text{Total Sales}}(t) \right]^j + \varepsilon(t)$$

We use the latest available foreign sales data; thus, if a company has not reported its foreign sales in the most recent period, we use last period's values. The estimated β_1's at year-end are used as left-hand side variables. We find the slope coefficients to be positive thus confirming our hypothesis. The coefficient is however rather small in size and marginally statistically significant over time. Figure 1 provides a scatter plot of the estimated regression for the 1999 period.

Hypothesis 2: Firm level exposures to the domestic risk factor are inversely related to the extent of firms' foreign activities.

This can be tested via a cross sectional regression of the form:

$$(3) \quad \beta_2^j(t) = \text{constant} + \delta_1 * \left[\frac{\text{Total Foreign Sales}}{\text{Total Sales}}(t) \right]^j + \varepsilon(t)$$

We find the slope coefficients to be negative confirming our hypothesis; however they are generally not statistically significant.

Hypothesis 3: Firm level exposures to the regional sector risk factor are positively related to the extent of firms' regional activities.

This can be tested via cross sectional regressions of the form:

$$(4a)\quad \beta_3^j(t) = \text{constant} + \delta_3 * \left[\frac{\text{North American Sales}}{\text{Total Sales}}(t)\right]^j + \varepsilon(t)$$

$$(4b)\quad \beta_4^j(t) = \text{constant} + \delta_4 * \left[\frac{\text{Asia - Pacific Sales}}{\text{Total Sales}}(t)\right]^j + \varepsilon(t)$$

$$(4c)\quad \beta_5^j(t) = \text{constant} + \delta_5 * \left[\frac{\text{Europe Sales}}{\text{Total Sales}}(t)\right]^j + \varepsilon(t)$$

In estimating each of the above equations we control for systematic mean level effects by fitting panel regressions having removed sector means from each side of the equation. The results provide strong corroborating evidence in support of our hypothesis; the betas are positive and statistically significant over the full sample period. Figures 2-4 provide a scatter plot of the data and fitted regressions for (4a)-(4c) for the 1999 period.

Our annual estimations confirm the stability of the relationship over time. As a further check on the robustness of our results we examine whether the estimated slope coefficients in equations (4a) – (4c) differ for companies domiciled in different regions. This is to ensure that our general results not be unduly determined by any one group of securities. This analysis is undertaken by introducing relevant regional interaction terms in each of equations (4a) – (4c). Consider for instance (4a), to test whether European companies have a differential slope we fit:

$$(5a)\quad \beta_3^j = \text{constant} + \delta_3 * \left[\frac{\text{North America Sales}}{\text{Total Sales}}(t)\right]^j +$$

$$\gamma_3 * \left[\frac{\text{North America Sales}}{\text{Total Sales}}(t)\right]^j * [\text{Dummy for Europe (t)}]^j + \varepsilon(t)$$

We then examine whether the interaction term is significantly different from zero. Similarly we can examine equation (5a) with interaction terms that test for different slope effects for Asian and for North American companies. The results of these tests are reported in table 5. In tables 6 and 7 we provide the analogous tests for equations (4b) and (4c). By and large we find that the relationship between regional factor sensitivities and regional sales exposure to be similar across firms regardless of their country of domicile. The only exception appears to be European companies that report a somewhat

perverse effect; the relationship between a firm's sensitivity to European sector factors and the extent of their European sales activities is weaker in scope than that of other firms. This may be attributable to some interaction effect between local market factors and European sector factors.

As further verification of the model structure postulated in equation (1), we examine whether the fitted residuals are systematically related to currency effects. Diermeier and Solnik (2000) present evidence in support of currency factors being priced into security returns. We thus regressed the residuals onto weekly effective exchange rate returns for the German Mark, the US Dollar, and the Japanese Yen. On a cross sectional basis, currency factor loadings were found to be centered about zero. Moreover, the loadings were not significantly related (either positively or negatively) to firms' foreign activities. [8] Our results are not inconsistent with those of Diermeier and Solnik (2000) since it is possible that currency risks in our model could be systematically related to regional sector risks; this will be explored in a subsequent paper.

5. Conclusions

The internationalization of capital markets suggests that global factors will play an increasingly important role in the pricing of securities. Identifying the source of those global factors and structuring portfolios that exploit the reward to risk opportunities from variation in these factors presents a new challenge for investment managers. In this paper we build on current research that suggests that industry factors capture an economically important component of the variation in security returns. We postulate a risk model that explicitly accounts for regional sector rotation decisions. We examine whether the statistically estimated factor risk exposures are related to firm level economic activities. In particular we find that sensitivities to foreign factors are positively associated with the extent of firms' foreign sales activities. This provides empirical support for our reduced form structural model, and it suggests that foreign sales data can be utilized as a conditioning variable to obtain economically sensible risk factor sensitivities. In subsequent research we will explore this approach in the construction of a global risk model, and we will examine other risk factors that may be priced in global equity returns.

ENDNOTES

1. See for instance Rouwenhorst (1999), Griffin and Karolyi (1998), Beckers, Connor, and Curds (1996), and Grinold, Rudd, and Stefek (1989).

2. Cavaglia, Melas, Tsouderos, and Cuthbertson (1995) present evidence that local industry returns are predictable. They present the performance of simulated strategies and demonstrate that active sector rotation across countries provide an additional source of alpha beyond simplistic country rotation strategies.

3. Details of the modified Heston and Rouwenhorst (1994) estimation are available on request from the authors. In this paper we arbitrarily stop at the second iteration; the benefits of recursively estimating the system of equations will be examined in a subsequent paper.

4. Foreign income would be a better indicator of foreign activities. However this data is more difficult to obtain.

5. As demonstrated in Singer and Karnovsky (1995), this conclusion follows from the arbitrage relationship that interest differentials equal the forward discount.

6. We acknowledge that there is some look ahead bias in using an industry classification scheme developed in 1999 for the pre 1999 period. However the sector granularity which we use is quite broad and is largely consistent with industry classification schemes available as far back as 1985 (e.g. The FT industry classification scheme).

7. WorldVest Base Inc. (http://www.wvb.com) is a respected international financial information provider to the investment banking and web site community.

8. Results of this analysis are available from the authors on request.

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Table 1: FT universe - Company Coverage

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria	**ATS**	19	24	20	18	17	29	27	28	23	21
Australia	**AUD**	85	76	69	69	69	91	82	78	83	76
Belgium	**BEF**	68	63	46	41	43	34	35	31	25	21
Canada	**CAD**	121	131	115	113	107	104	129	129	122	131
Switzerland	**CHF**	73	72	65	63	48	46	39	36	32	31
Germany	**DEM**	96	93	65	62	59	59	63	60	61	55
Denmark	**DKK**	38	41	38	33	33	33	36	31	33	33
Spain	**ESP**	43	58	52	48	43	38	38	35	33	30
Finland	**FIM**	27	27	15	24	25	25	28	28	29	29
France	**FRF**	126	132	109	104	107	103	101	98	85	76
United Kingdom	**GBP**	309	301	235	228	222	213	226	217	221	208
Hong Kong	**HKD**	48	56	55	55	56	61	62	67	67	74
Ireland	**IEP**	16	18	17	16	14	17	16	17	18	17
Italy	**ITL**	97	102	78	76	75	62	60	64	55	54
Japan	**JPY**	455	484	474	472	469	498	483	489	487	445
Netherlands	**NLG**	44	42	31	29	27	19	19	19	27	26
Norway	**NOK**	33	32	25	23	23	34	38	41	41	37
New Zealand	**NZD**	18	17	14	14	18	14	17	14	18	18
Portugal	**PTE**	0	0	0	0	0	0	0	0	19	18
Sweden	**SEK**	35	29	31	35	35	49	47	47	47	44
Singapore	**SGD**	22	37	34	35	42	40	40	39	38	45
United States	**USD**	547	562	524	525	522	682	643	671	657	623
Total		2320	2397	2112	2083	2054	2251	2229	2239	2221	2112

Note:
We report the number of companies that are constituents of the FT index at year end.

Table 2: Foreign Sales Data - Company Coverage

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria	**ATS**	9	12	9	12	13	19	19	22	21	17
Australia	**AUD**	59	75	75	86	94	95	86	85	84	76
Belgium	**BEF**	25	38	22	24	25	28	36	34	32	18
Canada	**CAD**	95	103	67	97	117	122	125	121	109	85
Switzerland	**CHF**	33	39	44	54	52	51	45	48	46	46
Germany	**DEM**	65	72	67	74	79	79	80	79	81	68
Denmark	**DKK**	19	27	26	29	32	33	35	36	35	26
Spain	**ESP**	22	39	**32**	33	30	30	35	33	24	9
Finland	**FIM**	13	21	19	27	30	32	31	33	31	24
France	**FRF**	96	103	82	97	102	100	96	99	91	63
United Kingdom	**GBP**	195	258	231	252	271	266	253	247	223	189
Hong Kong	**HKD**	28	44	53	56	58	59	63	63	61	48
Ireland	**IEP**	8	11	9	12	15	15	16	17	15	11
Italy	**ITL**	36	45	60	60	54	59	66	67	50	29
Japan	**JPY**	213	224	181	66	113	94	101	98	86	76
Netherlands	**NLG**	27	29	29	30	32	30	31	30	29	20
Norway	**NOK**	23	30	26	33	36	39	38	36	35	30
New Zealand	**NZD**	9	16	17	17	19	19	19	24	25	22
Portugal	**PTE**	0	0	0	2	8	7	8	10	10	2
Sweden	**SEK**	37	42	36	48	46	46	45	46	45	30
Singapore	**SGD**	37	40	38	44	46	46	46	46	45	41
United States	**USD**	0	0	624	629	638	634	636	622	608	580
Total		1049	1268	1747	1782	1910	1903	1910	1896	1786	1510

Notes:
Foreign Sales data is obtained from World Vest for companies domiciled outside the United States.
Foreign Sales data is obtained from Worldscope for companies domiciled in the United States.

Table 3: Percentage of Capitalization Covered by Foreign Sales Data

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria	**ATS**	31.30	27.70	36.40	41.30	42.00	59.20	63.30	70.70	63.50	52.00
Australia	**AUD**	58.70	64.00	72.10	72.80	79.00	74.00	68.80	65.60	60.60	62.40
Belgium	**BEE**	36.50	65.10	42.30	48.40	47.60	48.90	58.00	52.50	45.00	11.90
Canada	**CAD**	74.40	75.30	43.80	61.90	84.20	85.40	75.70	72.40	55.70	42.30
Switzerland	**CHF**	57.30	61.30	54.20	61.10	69.80	69.00	72.00	66.90	66.40	66.80
Germany	**DEM**	55.80	57.20	56.30	56.80	66.80	66.50	71.60	64.10	68.50	69.90
Denmark	**DKK**	23.70	45.50	38.90	35.60	54.20	55.30	64.30	56.00	57.40	56.20
Spain	**ESP**	19.80	55.00	63.40	59.00	58.50	62.70	67.40	56.40	59.90	52.40
Finland	**EIM**	18.60	43.10	39.30	61.10	76.70	86.00	85.90	84.20	84.80	90.40
France	**FRE**	74.30	82.10	79.80	81.50	87.20	85.30	89.90	88.30	87.20	78.30
United Kingdom	**GBP**	49.50	71.30	67.90	59.80	68.90	66.60	65.60	61.80	64.40	65.00
Hong Kong	**HKD**	47.60	62.80	73.50	77.40	78.70	82.00	80.90	80.40	81.30	63.30
Ireland	**IEP**	18.70	39.10	29.30	43.70	52.90	49.80	49.90	41.60	34.40	33.70
Italy	**ITL**	17.50	33.50	36.30	47.60	46.30	40.30	55.60	47.10	40.40	35.50
Japan	**JPY**	34.00	35.70	31.70	16.20	31.20	28.00	33.10	36.30	33.10	31.70
Netherlands	**NGD**	17.50	18.00	16.00	21.90	31.50	29.00	26.30	22.80	24.00	19.20
Norway	**NOK**	61.70	68.40	56.80	78.90	81.50	66.80	80.00	73.30	66.00	63.70
New Zealand	**NZD**	31.80	97.60	99.50	61.90	97.20	92.20	85.50	100.00	100.00	96.70
Portugal	**PTE**									65.60	11.00
Sweden	**SEK**	76.90	76.30	71.90	82.90	74.80	73.10	74.70	70.50	70.10	64.90
Singapore	**SGD**	56.90	76.00	69.90	76.30	79.80	77.50	71.90	75.30	71.50	33.20
United States	**USD**	0.00	0.00	86.80	85.10	85.60	85.00	85.90	86.90	82.70	88.70
Total											

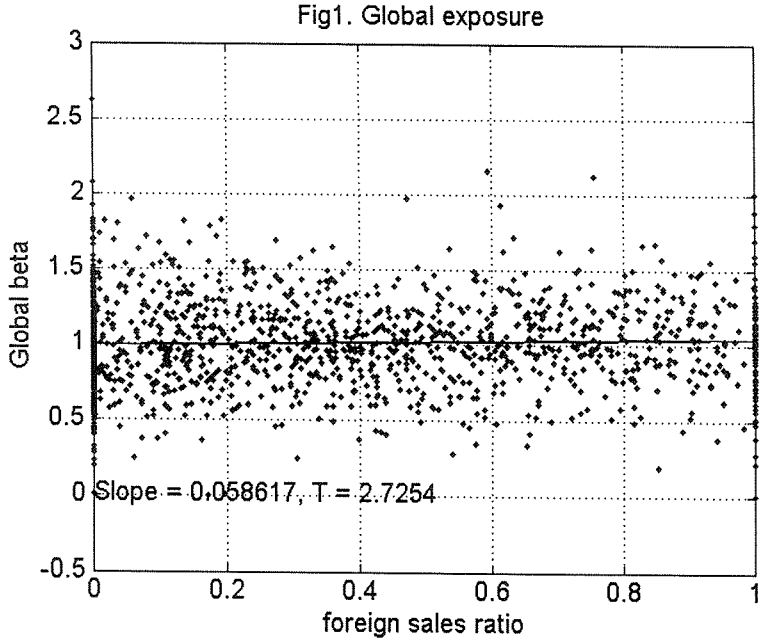
Fig1. Global exposure
Global beta
foreign sales ratio
Slope = 0.058617, T = 2.7254

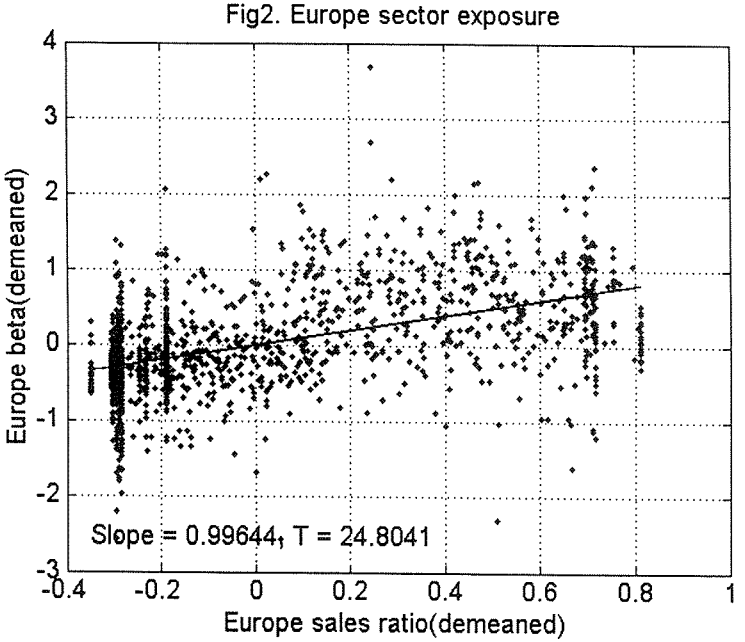
Fig2. Europe sector exposure
Europe beta(demeaned)
Europe sales ratio(demeaned)
Slope = 0.99644, T = 24.8041

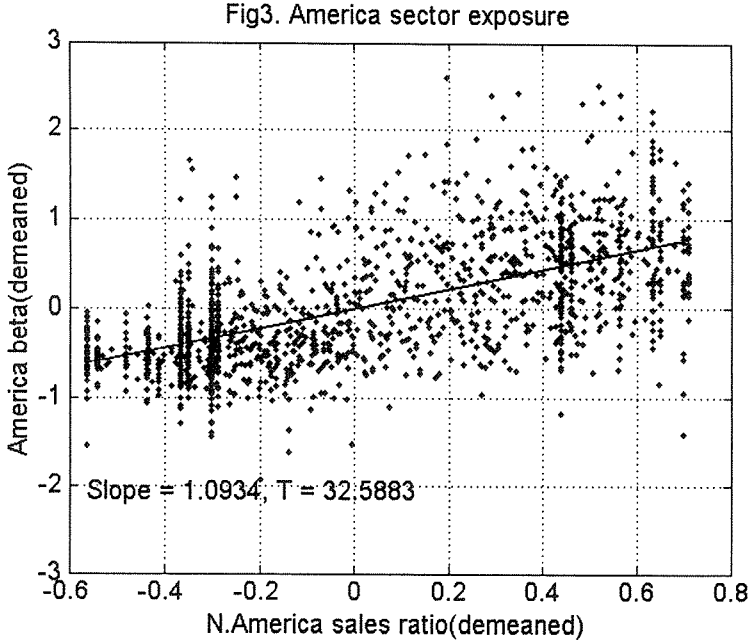
Fig3. America sector exposure
America beta(demeaned)
N.America sales ratio(demeaned)
Slope = 1.0934, T = 32.5883

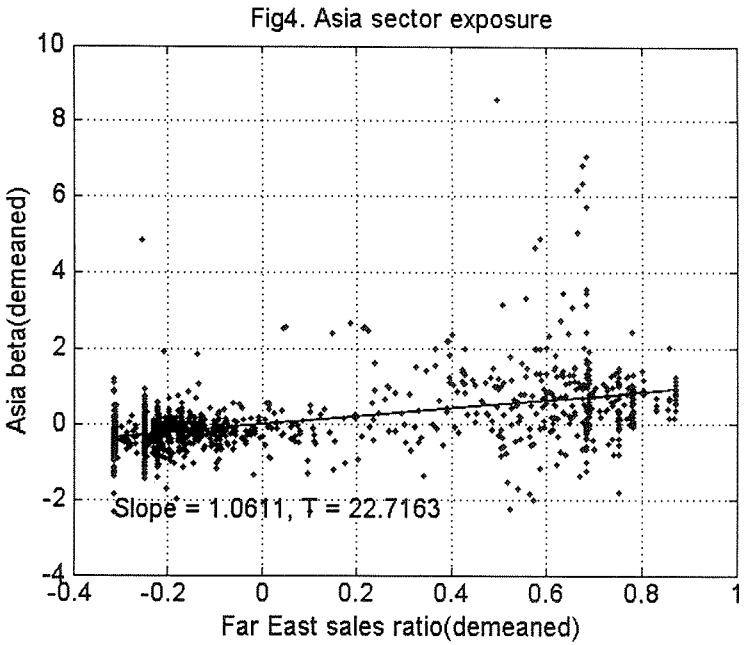
Fig4. Asia sector exposure
Asia beta(demeaned)
Far East sales ratio(demeaned)
Slope = 1.0611, T = 22.7163

Table 4: Analysis of Factor Loadings
Year by Year Cross Section Regressions: Factor Loadings on Sales Ratios

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Global factor (I)	constant	0.98	0.93	0.98	0.98	1.00	0.98	0.97	0.98	0.99	0.97
	se.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	t-stat	-0.90	-3.62	-1.07	-1.03	0.24	-1.09	-1.62	-0.95	-0.68	-1.55
	slope	0.07	0.16	0.05	0.07	0.01	0.08	0.08	0.09	0.04	0.09
	se.	0.05	0.04	0.05	0.05	0.04	0.05	0.04	0.04	0.03	0.04
	t-stat	1.47	3.83	1.19	1.30	0.26	1.63	2.29	2.41	1.21	2.19
Domestic factor (2)	constant	1.00	1.07	0.95	0.99	0.99	1.01	1.03	1.01	1.03	1.02
	se.	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.04	0.04
	t-stat	-0.05	2.01	-0.32	-0.32	-0.44	0.44	1.06	0.47	0.89	0.40
	slope	-0.01	-0.12	0.03	0.00	0.00	-0.03	-0.03	-0.03	-0.06	-0.03
	se.	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.05
	t-stat	-0.22	-2.51	0.65	-0.10	-0.11	-0.76	-0.64	-0.80	-1.38	-0.51
Europe sector factor (3)	slope	0.97	0.93	1.01	1.00	1.10	1.03	1.00	1.05	0.94	0.87
	se.	0.12	0.10	0.08	0.08	0.07	0.08	0.07	0.07	0.07	0.07
	t-stat	7.90	9.46	12.01	11.91	15.48	13.55	13.42	14.40	13.50	11.77
North America sector factor (4)	slope	0.63	0.33	1.09	1.11	1.13	1.14	1.09	1.09	1.13	1.05
	se.	0.13	0.10	0.07	0.05	0.06	0.06	0.05	0.06	0.06	0.06
	t-stat	4.78	3.43	16.67	21.17	19.65	20.80	22.41	19.26	19.43	18.29
Asia sector factor (5)	slope	1.12	0.78	0.97	0.99	0.96	1.02	1.07	1.10	1.01	0.87
	se.	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.06	0.07	0.07
	t-stat	14.24	9.27	12.35	14.95	12.52	13.58	14.29	17.13	14.15	11.70

Notes:
(1) The Global factor betas are regressed on the ratio of total foreign sales to total sales.
We test whether the constant term is different from 1.0; we test whether the slope differs from zero.
(2) The Domestic factor betas are regressed on the ratio of domestic sales to total sales.
We test whether the constant term is different from 1.0; we test whether the slope differs from zero.
(3) The Europe sector betas (in excess of sector means) are regressed on the ratio of European sales to total saies (in excess of sector means).
We test whether the slope differs from zero.
(4) The North America sector betas (in excess of sector means) are regressed on the ratio of North American sales to total sales (in excess of sector means).
We test whether the slope differs from zero.
(5) The Asian sector betas (in excess of sector means) are regressed on the ratio of Asian sales to total sales (in excess of sector means).
We test whether the slope differs from zero.

Table 5: North American Sector Exposure Analysis
Tests for Differential Slopes
Year by Year Cross Sectional Regressions

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Companies domiciled in Europe	slope	-0.46	-0.28	-0.11	0.23	-0.04	-0.11	0.03	0.21	0.15	0.01
	s.e.	0.33	0.24	0.19	0.15	0.17	0.16	0.14	0.16	0.16	0.17
	t-stat	-1.38	-1.18	-0.6	1.54	-0.21	-0.66	0.19	1.28	0.90	0.06
Companies domiciled in North America	slope	0.46	0.43	0.59	0.19	0.69	0.33	0.09	0.25	0.06	-0.02
	se.	0.32	0.23	0.27	0.22	0.24	0.23	0.20	0.23	0.23	0.23
	t-stat	1.41	1.92	2.17	0.86	2.84	1.42	0.43	1.05	0.27	-0.1
Companies domiciled in Asia	slope	-0.05	-0.34	-0.19	-0.35	-0.31	-0.06	-0.07	-0.32	-0.18	0.00
	s.e.	0.48	0.31	0.20	0.16	0.17	0.17	0.14	0.16	0.16	0.16
	t-stat	-0.11	-1.1	-0.95	-2.22	-1.79	-0.34	-0.48	-1.99	-1.09	0.01

Note:
We test whether the coefficient of the interaction term (equation 5a) is significantly different from zero.

Table 6: Asian Sector Exposure Analysis
Tests for Differential Slopes
Year by Year Cross Sectional Regressions

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Companies domiciled in Europe	slope	-0.21	0.33	-0.08	-0.08	-0.28	0.18	0.32	0.18	0.16	0.32
	se.	0.33	0.34	0.28	0.23	0.27	0.27	0.26	0.23	0.26	0.28
	t-stat	-0.65	0.95	-0.29	-0.36	-1.04	0.68	1.22	0.79	0.63	1.15
Companies domiciled in North America	slope	0.20	-0.30	0.06	0.00	0.06	0.10	-0.22	-0.03	0.02	-0.18
	s.e.	0.39	0.42	0.29	0.24	0.27	0.27	0.27	0.23	0.26	0.27
	t-stat	0.51	-0.71	0.22	-0.01	0.21	0.37	-0.81	-0.12	0.08	-0.66
Companies domiciled in Asia	slope	0.22	-0.32	0.06	0.24	0.60	-0.78	-0.27	-0.36	-0.46	-0.32
	s.e.	0.58	0.53	0.48	0.38	0.44	0.44	0.41	0.35	0.41	0.43
	t-stat	0.39	-0.60	0.13	0.62	-1.76	-1.76	-0.65	-1.03	-1.12	-0.76

Note:
We test whether the coefficient of the interaction term is significantly different from zero.

Table 7: European Sector Exposure Analysis
Tests for Differential Slopes
Year by Year Cross Sectional Regressions

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Companies domiciled in Europe	slope	-1.90	0.50	-0.68	0.12	-0.58	0.32	0.29	-0.09	-0.65	-0.67
	se.	0.56	0.45	0.38	0.38	0.31	0.33	0.31	0.29	0.28	0.31
	t-stat	-3.40	-1.12	-1.81	0.33	-1.85	0.97	0.93	-0.32	-2.30	-2.19
Companies domiciled in North America	slope	-0.52	0.49	-0.02	-0.08	0.05	-0.08	-0.07	0.07	0.43	0.26
	se.	0.47	0.36	0.26	0.26	0.22	0.24	0.24	0.23	0.22	0.24
	t-stat	-1.11	1.35	-0.09	-0.33	0.24	-0.33	-0.31	0.29	1.93	1.08
Companies domiciled in Asia	slope	1.30	-0.12	0.35	0.03	0.24	-0.08	-0.09	-0.01	-0.03	0.17
	se.	0.39	0.31	0.26	0.27	0.23	0.24	0.24	0.24	0.23	0.25
	t-stat	3.31	-0.38	1.35	0.10	1.09	-0.36	-0.40	-0.04	-0.14	0.69

Note:
We test whether the coefficient of the interaction term is significantly different from zero.