Multilateral Exchange Rate Changes and International Industry Effects

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Abstract

This study examines the impact of multilateral exchange rate changes on international industrial competition in terms of stock performance. The empirical tests find that the exchange rate effect at industry level still plays an insignificant role in explaining the industry performance across boarders. Alternatively, the industry common effects, instead of industry competitive effects, prevail among developed markets and among Asian emerging markets while the results are less prevalent for the latter. More interestingly, the IT industries present the strongest exchange rate effects and common industry effects among Asian markets. On average, the multilateral exchange rate movements and the international industry common effects explain about 5% to 20% of industry performance either among the G7 countries or among those Asian markets. This variation may be caused by different industry characteristics, investor behavior or market institutional factors across nations. The U.S. industry performance and the U.S. currency shocks generally assert the strongest impact over corresponding industry performance in other countries.

JEL classification: E44, G15
Keywords: *common effect, exchange rate risk, industrial structure, international competition*

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1. Introduction

Since the breakdown of the fixed exchange rate regime, international markets have been characterized by significant exchange rate volatility. A large body of literature in the field of international economics documents that the purchasing power parity theory does not hold. When PPP does not hold, investors that use different currencies for consumption face different investment opportunity sets, and exchange rate risk becomes priced, which has an important bearing on stock returns. However, the empirical results in relation to the effect of exchange rates on firm value and its implications have not been as strong or as consistent as expected. One possibility is that multilateral exchange rate effects and industry competitions are not fully considered in the analysis.

Recent research examines the bilateral exchange rate shock in the relationships of industry returns across a pair of markets. However, when examining whether the value of a firm changes as a result of exchange rate shock through changing industrial competition, we need to evaluate the changing competitive advantages over different countries at the same time. After all, the competing counterparts for any firm in any industry usually come from not only one but several countries. It is thus appropriate to consider them all simultaneously.

Accordingly, to understand the economic significance of exchange rate effects on the international competitions, this study examines the impact of multilateral exchange rate shocks on stock performance at industry level while considering the international industrial common/competitive effects. In addition, as studying both developed and emerging markets, one may observe possibly different results due to varying investor behaviors, abilities in operating and financial hedging tools, or other institutional factors.

The focus of this study is to examine the impact of exchange rate changes on international competition through competitive industry effects cross boarders. This project attempts to answer the following questions. First, we like to know whether the exchange rate shocks contribute significantly to the industry performance and whether the significance varies across industries and across markets. To work with multilateral exchange rate shocks, this study applies the decomposition method suggested by Vassalou (2000) for the exchange rates. The impact from common exchange rate component and residual exchange rate component are then be investigated separately. Next, within this multilateral framework, this study also tries to find whether the industry effect is dominated by a common industry effect across markets or a competitive effect due to exchange rate changes or other factors. Furthermore, this project tests the relevant effects for various lengths of holding period horizon as exchange rate risk may vary accordingly.

Since this study addresses the exchange rate effect on stock performance at industry level, a group of industry indexes well defined across different countries will be convenient for the purpose. This paper, following Griffin and Stulz (2001), takes advantage of the level-six industry indexes provided by *Datastream International*, which use the same definition of industry classifications across the markets. Our empirical results find that the exchange rate effect at industry level, in contrast to the common industry effect, still plays an insignificant role in explaining the industry performance across boarders. The common industry effects across countries are found predominantly positive while controlling for the impact of multilateral exchange rate effects. That is, the industry common effects, instead of industry competitive effects, exist among developed markets and emerging markets while the results are less prevalent among emerging markets. More interestingly, the IT industries present the strongest exchange rate effects and common industry effects among Asian markets. Among major industrial economies, U.S. industry performance and U.S. currency shocks generally assert the strongest impact over corresponding industry performance in other countries. Japanese industry performance however is important in explaining the industry performance of Asian emerging countries but not so much for other developed economies.

The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 describes the research methods and the data. The empirical results are presented and analyzed in Section 4. Section 5 presents our concluding remarks.

2. Literature Review

There have been different approaches to examining the significance of exchange rate changes. The focus of this project is to examine the impact of exchange rate shocks on industry performance across different countries. Related literature is reviewed as follows.

2.1. The Role of Foreign Exchange Rate in International Asset Pricing

The existing empirical results, mostly on developed markets, of the effect of exchange rates on firm value and its implications have not been as strong or as consistent as expected. Much of this literature focuses on U.S. firms and finds weak contemporaneous relationships between exchange rates and stock returns [e.g., Bodnar and Gentry (1993)]. Jorion (1990) showed that a trade-weighted exchange rate risk measure is priced for U.S. multinational firms during the sample period of 1980s. Bodnar and Gentry (1993) find more significant exchange rate exposures for Canada and Japan using industry returns. He and Ng (1998) also find more significant exchange rate exposures in Japanese firms.

Williamson (2000) finds statistically significant competitive effects of exchange rate shocks between Japan and U.S. in a specification that regresses the difference in automotive industry returns between the two countries on the dollar/yen exchange rate return. Another important study by Griffin and Stulz (2001) has examined the question of whether the competitive effects of bilateral exchange rate shocks are economically significant for shareholders. They find that after controlling for marketwide effects, the average impact on U.S. industries of shocks to their foreign counterparts is of little economic importance. However, this industry common effect is several times larger than the competitive effect of exchange rate shocks on U.S. industries after taking into account market-wide effects. For the other countries, the industry and exchange rate effects are larger but still generally small. Using returns measured over longer horizons, the importance of exchange rate shocks increases slightly and the importance of industry common shocks increases more substantially. Furthermore, there is no evidence that the growth of international trade over the period has increased these effects from foreign exchange shocks.

Several potential explanation may be offered for this result of weak relationship between foreign exchange rate risk and stock returns. One is that international trade is simply less important for U.S. firms and thus foreign exchange shocks are simply unimportant in firms' profit margin. Or, it could be that foreign exchange rate shocks are important but that their impact is irrationally ignored by the stock market. Another explanation is that the signal:noise ratio is too low with low-frequency data. Recent work shows for the exchange rate returns [Bartov and Bodnar (1994)] and that this relation may be stronger when measured over longer intervals [Chow, Lee, and Solt (1997)]. It could also be that the stock market is efficient in incorporating the impact of exchange rate shocks on stock prices, but exchange rate shocks are simply not economically important for shareholders. Finally, firms may exercise operational hedging or financial hedging to minimize the effect of foreign exchange rate risk on their value [see Geczy, Minton and Schrand (1997), He and Ng (1998), Allayannis and Weston (2001) and Allayannis and Ofek (2001)].

2.2. International Linkages of Equity Markets and Common Effects

The stock performance of global industries does not only reflect the international industrial competition, but more importantly the global common industry effects. Relevant literature on international linkages is thus important in this regard. Earlier researches studying international linkages via examining the correlations and variance-covariance matrixes among equity returns. Empirical studies in the 70's mostly indicated insignificant interrelationships among world capital markets. More recent studies have found more significant correlations among world equity markets. This might also be attributed to the reduction in investment barriers across boarders, the increasing integration in economic and financial systems, the improved information transmission among international investors, and the issuance of global securities [see Hamao et al. (1990), Lin et al.(1994), Bekaert and Harvey (2000)]. Related studies have generally shown that the correlation structures in world equity markets vary over time [e.g. see Forbes and Rigobon (2002)].

Another part of the literature concerns the magnitude, the efficiency and the persistence of international transmission [e.g., see Becker, Finnerty and Gupta (1990), Hamao, Masulis and Ng, (1990), and Arshanapalli and Doukas (1993)]. King, Sentana and Wadhwani (1994) and Engle et al. (1994) investigate the international comovement in equity return volatilities and find that the stock return variance changes over time. More interestingly, it has been indicated in the literature that the world market is most influenced by the U.S. market [e.g. see Eun and Shim (1989), Hamao et al. (1990), Lin et al. (1994), and Karolyi and Stulz (1996)].

Some studies tried to explain the nature of world stock co-movements with industry factors. Arshanapalli, Doukas and Lang (1997) attempted to explain the common volatility process among world markets. They applied common ARCH-feature test and find the existence of intra-industry common volatility among the major geographic regions of the world economy. This result is consistent with the earlier study by Roll (1992), which study attributed cross-national return volatility to the industrial structure of national stock exchange indices. Simply speaking, empirical results, even though still limited, implicate that industry factors may be significant in explaining the co-movement of world market indices.

3. Methodology

3.1. Measures of Exchange Rate Effects and Industry Effects

An appropriate measure of exchange rate risk has to be defined in testing the relationship between foreign exchange shocks and stock returns. The assumption of martingale for exchange rates has become a standard in most studies on the exchange rate shocks and security pricing. The innovation of exchange rate is then implicitly or explicitly defined as the first difference of exchange rates during a certain time interval [Hodder (1982), Adler and Dumas (1984), Jorion (1990), Bodnar and Gentry (1993), Chow, Lee and Solt (1997), and He and Ng (1998)].

If exchange rate effects are important for some industries, they should affect the performance of these industries after controlling for common factors across industries within a country captured by that country's market return. Earlier studies have used market model to purge the market effect from the industry performance. However, the foreign exchange rate and the market portfolio return are indeed endogenously determined and the possibility of multicollinearity between these two variables may cause problems. We thus follow Griffin and Stulz (2001) and subtract the local market index return from the industry return and use this industry excess return as dependent variable. We denote $r_{c,i}$ as the excess return of industry i in market c. The effect of exchange rate shocks on industry returns across boarders are evaluated by incorporating in the regression the corresponding industry excess return of the counterpart country ($r_{c2,i}$). That is,

$$r_{c1,i} = \alpha_i + b_i R_{FX} + d_i r_{c2,i} + \eta_i \text{ for } i = 1, \ldots I \qquad (1)$$

In the equation, R_{FX} is defined as the first order difference of logarithmic nominal exchange rates, and b_i estimates the average impact of the exchange rate movement on the return of industry i in country c, assuming that all of this impact is incorporated into stock prices contemporaneously. If the estimated b_i is negative, it then suggests that an unexpected appreciation of the exchange rate ($R_{FX} > 0$) makes industry i worse off relative to the market $c1$. In this equation, a negative coefficient ($d_i < 0$) on the foreign industry return ($r_{c2,i}$) means that the domestic industry's performance relative to the domestic market is worse ($r_{c1,i} < 0$) when the foreign industry does better relative to its market ($r_{c2,i} > 0$).

3.2. Decomposition and Indexing Foreign Exchange Rates

Griffin and Stulz (2001) apply the bi-lateral model discussed above to examine the role of exchange rate shock in the relationships of industry returns across a pair of markets. However, when examining whether the value of a firm value changes as a result of exchange rate shock through changing industrial competition, we need to evaluate the changing competitive advantages over different countries at the same time.[1] We apply the decomposition method by Vassalou (2000) to avoid the multi-collinearity problem and to reduce the dimensionality in estimation.

In her test for the pricing of exchange rate and foreign inflation risk in equities, Vassalou (2000) combines information for a cross-section of exchange rates into two indexes, *the common component index*, which measures movements which tend to be common across all exchange rates, and *the residual component index*, which captures the fluctuations which are specific to the individual exchange rates. The results find that at least part of the exchange rate risk premium in equities is attached to the residual component of exchange rates which were overlooked in previous studies.

Vassalou's indexing procedure has the following advantages. First, it resolves the multicollinearity problem. Because exchange rates tend to move together to a large extent, the inclusion of changes of several exchange rates in the same regression model creates severe multicollinearity problems. Second, it reduces the dimensionality of exchange rates. This indexing procedure minimizes the number of exchange rate risk premiums to be estimated while including more information about changes in exchange rates than the single index method.

The decomposition and indexing procedure by Vassalou is stated as follows. First stage is the decomposition procedure. We project the changes in each of the *L* exchange rates on the changes of the remaining *L-1* exchange rates through the following regression:

$$R_{FX,j,t} = \delta_{0j} + \sum_{1 \le l \le L, l \ne j} \delta_{lj} R_{FX,l,t} + \varepsilon_{jt} \quad (2)$$

[1] For example, for a hi-tech firm in Taiwan, its firm value may change due to NT exchange rate shock relative to various countries. The Taiwanese firm may gain some foreign exchange rate advantage over Korea but lose some advantage against Malaysia.

where E(ε_{jt}) = 0; cov($R_{FX,j,t}$, ε_{jt}) = 0, $\forall$ 1 ≤ l ≤ L. The *residual component* of $R_{FX,j}$, ε_j, represents the component of $R_{FX,j}$ that is not explained by the changes in the remaining exchange rates. The *common component* (k_j) of the L exchange rates is defined as:

$$k_{jt} = R_{FX,jt} - \delta_{0j} - \varepsilon_{jt} = \sum_{1 \le l \le L, l \ne j} \delta_{lj} R_{FX,lt} \tag{3}$$

Next step is then the indexing procedure. We construct two equally weighted indexes of the residual component and common components above. The equally weighted index of residual component is the average of residual component of changes in all L exchange rates, i.e.,

$$e_t = \frac{1}{L} \sum_{j=1}^{L} \varepsilon_{jt} \tag{4}$$

The equally weighted index of common component is the average common component shared by changes in the exchange rates relative to the same currency, i.e.,

$$\lambda_t = \frac{1}{L} \sum_{j=1}^{L} \eta_{jt} \tag{5}$$

where the deviation of the common component of the L exchange rates from its time series mean ($\bar{k}_j$) is $\eta_{jt} = k_{jt} - \bar{k}_j$. By construction, E($\eta_{jt}$) =0; cov(ε_{jt} , η_{jt})=0. Even though this step of indexing procedure gives rise to some loss of information as some of the information has been averaged out in the indexes, however, the creation of the two indexes is necessary in order to minimize the number of exchange rate betas and risk premiums that need to be estimated. Vassalou finds that the common component is highly correlated with the equally weighted foreign exchange index, indicating that the common component index is virtually identical to the equally weighted index of all exchange rates.

This decomposing/indexing procedure is performed for every reference currency, i.e., the currency of the domestic market. Meanwhile, the same decomposing/indexing procedure is performed for each industry for all markets with the same industry. We shall then denote λ_{FX} and e_{FX} as the common component index and residual component index for the reference (home) currency, and denote λ_i and e_i as the common component index and residual component index for industry *i*.

3.3. A Multilateral Model

This study improves over the methodology used by Griffin and Stulz (2001) by considering not only one counterpart country but all the sampled countries in the study. This method then accommodates the possibility that the industry performance of a country is in fact a result of the international competitions with more than one single foreign country. The composite effect from multiple international competitors is considered simultaneously in this study.

In particular, the following regression is performed for home country *k* and industry *i*:

$$r_{k,i,t} = a_{k,i} + c_{k,i} \cdot \lambda_{FX,k,t} + b_{k,i} \cdot \sum_{k=1}^{K} e_{FX,k,t} + \sum_{k=1,k\neq j}^{J} d_{k,j,i} \cdot r_{j,i,t} + \eta_{k,i,t} \quad \text{for } i = 1,\ldots \mathrm{I} \qquad (6)$$

Based on the estimated coefficients, we may then observe the relative importance of the common-component exchange rate effect (c_i), the residual-component exchange rate effect (b_i), and the international industry effect that is unrelated with exchange rate changes (d_i). This multi-lateral approach will compensate the earlier bi-lateral approach for the missed information regarding other competitors in the world market.

3.4. Data

This project uses two groups of sample markets. One is the developed markets, including the G7 countries: the U.S., the U.K., Canada, Japan, Germany, France and Italy. Another group is the Asian emerging markets. Weekly returns for the industries, market returns, and exchange rates are collected from Datastream International from 1980 to 2002 for developed markets and from 1985 to 2002 for emerging markets. A major strength of this data source is that Datastream applies the same criteria for defining industries across countries. This minimizes the risk of misclassification of industries for worldwide firms. Datastream classifies indices into one of six levels. At each additional level there are more disaggregated industry definitions until the most disaggregated industry classification, level six. Since not all countries have the same group of level 6 industry indexes, we need to match industries for any pair of markets in the bi-lateral analysis and for the group of markets under study in the case of multi-lateral analysis.

4. Results and Analysis

The results of this multilateral analysis may be summarized based on i) the multilateral exchange rate effects on international industrial competitions at industry level (i.e., net of country effect), and ii) the international industrial common / competitive effects net of those introduced by exchange rate movements. The former exchange rate effects and the latter industry effects are respectively measured by coefficients b_i and d_i in equation (6). The results are summarized as follows.

First, the empirical results find that the exchange rate effect at industry level, in contrast to the common industry effect, still plays an insignificant role in explaining the industry performance across boarders. There are only about 10% to 15% of level-6 industries demonstrating significant exchange rate effects at industry level for G7 markets, and about 5% to 20% of industries for Asian emerging markets. It however should be noted that the exchange rate exposure is a form of 'residual exposure' after we controlled for the local market effect. In addition, these exposures are evaluated at industry level instead of firm level. That is, the full impact of exchange rate risk on individual firms may differ from those numbers listed in the table.

[Insert Table 1 Here]

[Insert Table 2 Here]

Second, the common industry effects across countries are found predominantly positive while controlling for the impact of multilateral exchange rate effects. The most prominent phenomenon is that net of multilateral exchange rate effects, the industry performance across boarders generally move in the same direction, as implicated from the observed positive d_i coefficients. That is, the industry common effects, instead of industry competitive effects, exist among developed markets and emerging markets while the results are less prevalent among emerging markets. More interestingly, the IT industries present the strongest exchange rate effects and common industry effects among Asian markets.

Third, among the G7 countries, the adjusted R-squares indicate that the exchange rate effects combined with international industry common effects could explain on average only 4.6% of Japanese industry performance (net of country effect) or 7.9% of U.S. industry performance, but they could explain as high as 19.3% and 21% of French and

Canadian industry performance, respectively. Among those Asian emerging markets, the multilateral exchange rate effects and industry effects altogether only explain from 7% to 15% of industry performance, with Taiwan showing the greatest number. This may be caused by varying industry characteristics across nations.

[Insert Table 3 Here]

Last, among major industrial economies, U.S. industry performance and U.S. currency shocks generally assert the strongest impact over corresponding industry performance in other countries. Japanese industry performance however is important in explaining the industry performance of Asian emerging countries but not so much for other developed economies. We also examine whether the impact differ across industries. The results are summarized in Table 3 the currency and industry impact from Japan and U.S. onto our sampled developed markets in Panel A and Asia-Pacific markets in Panel B. We aggregate the level-six results based on level-three classifications. Thus, the regression coefficients shown are averages of all level-six industry results in the same level-3 industry classification. The Resources industry and the IT industry of U.S. market show the strongest impact on matching industries of developed markets. However, the industry impact seems trivial for Asian markets, perhaps due to the aggregation's averaging effect.

5. Summary

This study contributes in the related literature in the following aspects. First, with the exchange rate decomposition suggested by Vassalou (2000), this study is able to examine the multilateral industrial competition effects due to exchange rates. Second, this study again does not find, at the industry level, strong impacts from exchange rate shocks on the relative industry performance across boarders in either developed markets or emerging markets. Third, the evidence however shows that the significance of exchange rate effects does change across industries. This implies that the degree of international industry competition, the degree of domestic competition, or industrial development of local markets matters in the relationship between exchange rate shocks and stock return performance. Last, the evidence generally support that most of the observed industry effect is in the category of common industry effects across countries instead of a competitive effect due to exchange rate movements.

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Table 1 Multilateral Analysis of International Industrial Competitive/Common Effects for G7 Countries

This table presents the multilateral analysis of international industry competition effect and exchange rate risk effect on level-6 industries of G7 countries. The following regression is performed for home country *k* and industry *i*:

$$r_{k,i,t} = a_{k,i} + c_{k,i} \cdot \lambda_{FX,k,t} + b_{k,i} \cdot \sum_{k=1}^{K} e_{FX,k,t} + \sum_{k=1,k\neq j}^{J} d_{k,j,i} \cdot r_{j,i,t} + \eta_{k,i,t} \quad \text{for } i = 1,\dots \text{I} \qquad (6)$$

Based on the estimated coefficients, we may then observe the relative importance of the common-component exchange rate effect (c_i), the residual-component exchange rate effect (b_i), and the international industry effect that is unrelated with exchange rate changes (d_i). This multi-lateral approach will compensate the earlier bi-lateral approach for the missed information regarding other competitors in the world market. ***, **, * denote 1%, 5%, and 10% significance level, respectively.

		US	*Japan*	*Canada*	*France*	*U.K.*	*Germany*	*Italy*
US	$\|b_1\|$	-	0.049	0.017	0.012	0.024	0.003**	0.101*
			(0.990)	(1.061)	(1.278)	(1.138)	(1.985)	(1.759)
	d_1	-	-0.178	0.190**	0.081	0.217*	0.058	0.029
			(-1.381)	(2.125)	(0.646)	(1.732)	(0.490)	(0.463)
Japan	$\|b_2\|$	0.003	-	0.007	0.003	0.003	0.007	0.011
		(0.988)		(0.862)	(1.226)	(1.167)	(1.202)	(1.579)
	d_2	-0.087	-	0.068	-0.001	0.058	0.041	-0.038
		(-1.425)		(1.201)	(-0.000)	(0.560)	(0.632)	(-0.258)
Canada	$\|b_3\|$	0.021	0.049	-	0.014	0.023	0.005	0.179**
		(1.274)	(0.964)		(1.088)	(0.845)	(1.469)	(2.226)
	d_3	0.178*	0.179	-	0.226**	0.198	0.201*	-0.020
		(1.884)	(1.313)		(2.129)	(1.495)	(1.766)	(-0.153)
France	$\|b_4\|$	0.028	0.029	0.014	-	0.031	0.022	0.202**
		(0.898)	(0.656)	(0.849)		(0.952)	(1.089)	(2.095)
	d_4	0.049	0.010	0.182**	-	0.256**	0.177*	0.139
		(0.635)	(0.108)	(2.147)		(2.297)	(1.902)	(1.558)
UK	$\|b_5\|$	0.007	0.014	0.014	0.010	-	0.004	0.036*
		(0.948)	(0.799)	(0.919)	(1.231)		(1.809)	(1.748)
	d_5	0.112*	0.057	0.095	0.208**	-	0.082	0.030
		(1.694)	(0.570)	(1.442)	(2.452)		(0.995)	(0.391)
Germany	$\|b_6\|$	0.017	0.066	0.011	0.013	0.031	-	0.263***
		(1.029)	(1.404)	(0.901)	(1.034)	(1.029)		(2.269)
	d_6	0.025	0.063	0.136*	0.175*	0.099	-	0.058
		(0.349)	(0.579)	(1.689)	(1.910)	(0.913)		(0.742)
Italy	$\|b_7\|$	0.028*	0.118	0.019	0.033**	0.020	0.015	-
		(1.749)	(0.997)	(0.892)	(2.417)	(1.292)	(1.086)	
	d_7	0.034	-0.041	0.006	0.158*	0.045	0.099	-
		(0.298)	(-0.356)	(-0.118)	(1.717)	(0.406)	(0.747)	
Adj.R^2		0.079	0.046	0.210	0.193	0.169	0.179	0.071

Table 2 Multilateral Analysis of International Industrial Competitive/Common Effects for Asian Markets

T This table presents the multilateral analysis of international industry competition effect and exchange rate risk effect on level-6 industries of Asian markets. The following regression is performed for home country *k* and industry *i*:

$$r_{k,i,t} = a_{k,i} + c_{k,i} \cdot \lambda_{FX,k,t} + b_{k,i} \cdot \sum_{k=1}^{K} e_{FX,k,t} + \sum_{k=1,k\neq j}^{J} d_{k,j,i} \cdot r_{j,i,t} + \eta_{k,i,t} \quad \text{for } i = 1,\ldots \mathrm{I} \qquad (6)$$

Based on the estimated coefficients, we may then observe the relative importance of the common-component exchange rate effect (c_i), the residual-component exchange rate effect (b_i), and the international industry effect that is unrelated with exchange rate changes (d_i). This multi-lateral approach will compensate the earlier bi-lateral approach for the missed information regarding other competitors in the world market. ***, **, * denote 1%, 5%, and 10% significance level, respectively.

		CCI	**|CCI|**	**JP**	**TA**	**SG**	**HK**	**KO**	**MY**	**TH**	**PH**	**ID**	**US**	**Adj.R^2**
Japan	Coef.	-0.0039	0.0058		0.2356*	0.1256	0.0730	0.0912	0.0177	0.0230	0.0237	0.1270	0.0429	0.0784
	t	(-0.6767)	(1.0658)		(1.7733)	(1.2600)	(0.8974)	(1.0351)	(0.1681)	(0.2760)	(0.3733)	(0.8412)	(0.5965)	
	N+**	0	11		6	6	9	9	5	0	1	2	11	
	N-**	11	0		0	0	0	0	1	0	1	0	0	
	N	67	67		14	25	33	33	30	21	15	20	65	
Taiwan	Coef.	-0.0021	0.0056	0.2356*		0.0954	0.0871	0.0465	-0.0343	-0.0229	0.0223	0.1569	0.0238	0.1494
	t	(-0.3604)	(0.9704)	(1.7733)		(1.4355)	(1.0675)	(0.8368)	(-0.2891)	(-0.2105)	(0.5559)	(1.5135)	(0.6021)	
	N+**	0	2	6		3	4	4	1	0	0	1	2	
	N-**	2	0	0		0	0	0	1	0	0	0	0	
	N	14	14	14		7	10	11	8	7	3	5	12	
Singapore	Coef.	-0.0020	0.0040	0.1758	0.0954		0.0260	0.0548	0.0416	0.0209	0.0074	0.1348	0.0382	0.0993
	t	(-0.6412)	(0.9393)	(1.5041)	(1.4355)		(0.5262)	(0.7770)	(0.4562)	(0.2652)	(0.2551)	(1.2623)	(0.3700)	
	N+**	0	3	6	3		3	3	4	0	0	2	3	
	N-**	3	0	0	0		0	0	1	0	0	0	0	
	N	29	29	25	7		15	14	17	11	9	10	29	
Hong Kong	Coef.	-0.0062	0.0082	0.1578	0.0935	0.0260		0.0631	0.0044	0.0356	0.0385	0.1181	0.0410	0.1062
	t	(-0.6786)	(1.1081)	(1.4102)	(1.1812)	(0.5262)		(0.8676)	(-0.1031)	(0.5164)	(0.6232)	(1.0498)	(0.4797)	
	N+**	0	5	10	4	3		4	2	0	0	2	5	
	N-**	5	0	0	0	0		0	1	0	0	10	27	
	N	33	33	33	10	15		17	19	13	9	12	32	

		CCI	|CCI|	JP	TA	SG	HK	KO	MY	TH	PH	ID	US	Adj.R^2
Korea	Coef.	-0.0023	0.0049	0.1735	0.0875	0.0625	0.0631		0.0041	-0.0125	0.0561	0.1044	0.0493	0.0931
	t	(-0.6730)	(1.0294)	(1.3959)	(1.1701)	(0.8888)	(0.8676)		(0.0321)	(-0.1855)	(0.8163)	(0.9104)	(0.8373)	
	N+**	0	6	10	5	4	4		2	0	1	1	7	
	N-**	6	0	0	0	0	0		1	0	0	0	0	
	N	34	34	33	11	14	17		21	13	11	9	33	
Malaysia	Coef.	-0.0025	0.0036	0.1393	0.0780	0.0338	0.0613	0.0041		0.0063	0.0522	0.1478	0.0558	0.0781
	t	(-0.6598)	(0.9416)	(1.2334)	(1.2876)	(0.4179)	(0.7329)	(0.0321)		(-0.0316)	(0.7656)	(0.9421)	(0.5895)	
	N+**	0	3	8	4	4	5	2		0	1	1	6	
	N-**	3	0	0	0	0	0	1		0	0	0	0	
	N	32	32	30	8	17	19	21		12	12	13	31	
Thailand	Coef.	-0.0006	0.0028	0.1955	0.1352	0.0564	0.0794	0.0008	0.0063		0.0473	0.1124	0.0165	0.1242
	t	(-0.4043)	(0.8878)	(1.6204)	(1.9915)	(1.0029)	(1.1415)	(0.0864)	(-0.0316)		(0.7657)	(0.8825)	(0.3295)	
	N+**	0	1	6	5	4	4	1	0		0	2	2	
	N-**	1	0	0	0	0	0	1	0		0	0	0	
	N	22	22	21	7	11	13	13	12		8	12	22	
Philippine	Coef.	-0.0012	0.0024	0.1152	0.0743	0.0123	0.1260	0.0162	0.0301	0.0473		0.1142	0.0420	0.1150
		(-0.5312)	(0.8606)	(1.0417)	(1.3606)	(0.1406)	(1.4975)	(0.2103)	(0.3294)	(0.7657)		(1.0596)	(0.6325)	
	N+**	0	1	4	1	1	4	1	1	0		1	3	
	N-**	1	0	1	0	0	0	1	0	0		0	0	
	N	15	15	15	3	9	9	11	12	8		9	15	
Indonesia	Coef.	-0.0012	0.0026	0.1609	0.0602	0.0027	0.0687	-0.0068	0.0090	0.0233	-0.0104		0.0320	0.0958
	t	(-0.7449)	(1.1380)	(1.4324)	(1.1428)	(0.1479)	(0.9994)	(-0.1209)	(-0.0285)	(0.4113)	(-0.0026)		(0.2881)	
	N+**	0	4	5	2	1	3	0	0	1	0		2	
	N-**	4	0	0	0	0	0	1	0	0	0		0	
	N	20	20	20	5	10	12	9	13	12	9		19	

***,**,* denote 1%, 5%, and 10% significance level, respectively.

Table 3

International Industry Effects and Exchange Rate Effects Relative to U.S. / Japanese Markets
- Analysis by Industry Groups -

This table presents average coefficient estimates, t-statistics, and adjusted R^2 for local currency denominated excess returns (measured as the industry return minus the local market return) regressed on the exchange rate with U.S. dollar and Japanese Yen as well as industry excess returns of these two countries. The sample period is from January, 1 1980 to December, 31 2002.

$$r_{i,k} = a_i + b_{1,i} \cdot FX_{JP/i} + b_{2,i} \cdot FX_{US/i} + d_{1,i} \cdot r_{JP,k} + d_{2,i} \cdot r_{US,k} + \eta_{i,k},$$

FX represents the exchange rate of the amount of Japanese yen or U.S. dollar can be obtained for each i currency. $r_{k,i,t}$ is the excess returns of industry k in country i . Here, $b_{1,i}$ and $b_{2,i}$ are exposure from bilateral exchange rates with Japan and U.S., respectively. We also provide the absolute values of exposure. Moreover, $d_{1,i}$ and $d_{2,i}$ measure the international industry effect for market i relative to Japan and U.S., respectively.

Panel A: Developed Markets

		Japan			U.S.			
	Freq.	b_1	$\|b_1\|$	d_1	b_2	$\|b_2\|$	d_2	Adj.R^2
Resources	Monthly	-0.0161	0.1396	0.0605	-0.0975	0.3371*	0.4618***	0.2272
(N=12)		(-0.0953)	(1.0364)	(0.7979)	(-0.7487)	(1.6647)	(6.2249)	
	N+**	0	0	3	1	4	11	
	N-**	0	0	0	3	0	0	
General Ind.	Monthly	0.0409	0.1552	0.1016	0.0744	0.2281	0.1954*	0.0584
(N=30)		(0.2942)	(0.8309)	(0.7480)	(0.0181)	(0.9911)	(1.7880)	
	N+**	2	3	3	1	1	15	
	N-**	1	0	0	0	0	1	
Non-cycl	Monthly	-0.0050	0.0897	0.0810	-0.0560	0.2295	0.2595***	0.0972
Consumer		(-0.0519)	(0.6161)	(1.0281)	(0.0236)	(1.0877)	(3.1991)	
Goods	N+**	1	2	5	3	5	25	
(N=38)	N-**	1	0	0	2	0	0	
Non-	Monthly	0.0596	0.1957	0.0939	0.0908	0.3100	0.3004***	0.0753
Cyclical		(0.4013)	(0.8652)	(1.1539)	(0.3255)	(1.1269)	(2.6048)	
Services	N+**	1	1	7	5	5	16	
(N=26)	N-**	0	0	0	0	0	0	
Information	Monthly	0.0612	0.2856	0.2750	0.0761	0.5958	0.3933**	0.1700
Technology		(-0.2930)	(0.9280)	(1.6605)	(-0.0697)	(1.0390)	(2.1427)	
(N=12)	N+**	0	1	5	1	2	6	
	N-**	1	0	0	1	0	0	
Basic Ind.	Monthly	0.0159	0.1150	0.0623	-0.0191	0.1697	0.2078**	0.0735
(N=38)		(0.1566)	(0.8308)	(0.7257)	(-0.1640)	(0.8451)	(2.5531)	
	N+**	3	4	7	0	0	22	
	N-**	1	0	2	0	0	0	
Cyclical	Monthly	0.0317	0.1903	0.0905	-0.0266	0.3784	0.1664*	0.0446
Consumer		(0.2728)	(1.1302)	(0.6798)	(-0.0394)	(1.1530)	(1.8474)	
Goods	N+**	3	3	4	1	3	10	
	N-**	0	0	1	2	0	0	
Cyclical	Monthly	0.1118	0.2010	0.0447	-0.1129	0.3128	0.0726	0.0241
Services		(0.4018)	(0.8865)	(0.4627)	(-0.2841)	(1.0450)	(0.7631)	
(N=71)	N+**	3	5	8	4	9	18	
	N-**	2	0	0	5	0	2	
	N-**	0	0	0	1	0	0	
Utility	Monthly	0.0011	0.0845	0.0910**	0.0241	0.2807	0.2043*	0.0868
(N=6)		(0.1272)	(0.6660)	(2.0741)	(0.1957)	(1.2529)	(1.8222)	
	N+**	0	0	3	1	2	2	
	N-**	0	0	0	1	0	0	
Financial	Monthly	0.0046	0.1037	0.0403	0.0343	0.1769	0.1985**	0.0429
(N=32)		(0.0020)	(0.7559)	(0.5017)	(0.2429)	(0.9228)	(2.2392)	
	N+**	0	2	5	2	3	16	
	N-**	2	0	1	1	0	0	

Panel B: Asia-Pacific Markets

		Japan			U.S.			
	Freq.	b_1	$\|b_1\|$	d_1	b_2	$\|b_2\|$	d_2	Adj.R^2
Resource	Monthly	-0.0572	0.1706	0.0477	0.7957	1.1575	0.1375	0.0620
(N=14)		(-0.0930)	(0.6139)	(0.3561)	(0.0572)	(1.0936)	(1.3910)	
	N+**	0	0	2	0	1	5	
	N-**	0	0	0	1	0	0	
General Ind.	Monthly	-0.0209	0.2069	-0.0494	-0.6029	0.9129	0.1097	0.0186
(N=28)		(-0.0299)	(1.0960)	(0.0011)	(-0.6731)	(1.1820)	(0.7095)	
	N+**	1	3	3	1	5	3	
	N-**	2	0	3	4	0	0	
Non-Cycl	Monthly	0.0359	0.1725	0.0735	0.3109	1.1457	0.1657	0.0469
Consumer		(0.2153)	(0.6755)	(0.5578)	(0.6209)	(1.3792)	(1.2766)	
Goods	N+**	2	3	2	8	9	8	
(N=31)	N-**	1	0	0	1	0	0	
Non-	Monthly							
Cyclical		0.0367	0.2049	0.0322	-2.3543	2.9650	0.0985	0.0521
Services	N+**	(-0.0041)	(0.8357)	(0.4244)	(0.4840)	(1.2233)	(1.1635)	
(N=27)	N-**	0	1	3	5	7	8	
Information	Monthly	0.1881	0.5862	0.1373	-0.4090	2.5992	0.2255	0.0488
Technology		(0.1853)	(1.4623)	(0.8823)	(-0.5868)	(1.0333)	(1.2750)	
(N=10)	N+**	1	2	1	0	1	3	
	N-**	1	0	0	1	0	0	
Basic Ind.	Monthly	0.0602	0.2145	0.0757	0.8717	1.4383	0.0830	0.0410
(N=29)		(0.3264)	(0.7805)	(0.4136)	(-0.0951)	(1.3476)	(0.8546)	
	N+**	2	2	2	4	7	8	
	N-**	0	0	0	3	0	0	
Consumer	Monthly	0.1626	0.2595	0.0757	0.8942	1.4944	0.0351	0.0369
Goods		(0.4820)	(0.8334)	(0.3017)	(-0.4568)	(1.2665)	(0.5196)	
(N=15)	N+**	1	1	1	0	3	2	
	N-**	0	0	0	3	0	0	
Cyclical	Monthly	0.0314	0.2232	0.0727	0.4335	1.0684	0.0571	0.0377
Services		(0.0579)	(0.8499)	(0.6019)	(0.0639)	(0.9236)	(0.4321)	
(N=57)	N+**	3	5	6	2	4	7	
	N-**	2	0	0	2	0	1	
Utility	Monthly	-0.0205	0.1333	0.1330	-0.4616	0.7739	0.1731	0.0783
(N=8)		(0.1829)	(0.7361)	(1.8688)	(0.0503)	(0.8173)	(0.8814)	
	N+**	0	0	4	0	0	1	
	N-**	0	0	0	0	0	0	
Financial	Monthly	0.1539	0.2252	0.0302	-0.5447	1.0246	0.0575	0.0496
(N=42)		(0.4946)	(0.9053)	(0.4204)	(-0.8287)	(1.5609)	(0.4803)	
	N+**	2	2	3	2	12	6	
	N-**	0	0	1	10	0	1	