International Journal of Economics and Finance; Vol. 5, No. 11; 2013
ISSN 1916-971X E-ISSN 1916-9728
Published by Canadian Center of Science and Education

Exchange Rate Risk Pricing by US Equity for US Industrial Portfolios

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Received: August 13, 2013 Accepted: September 16, 2013 Online Published: October 26, 2013

doi:10.5539/ijef.v5n11p13 URL: http://dx.doi.org/10.5539/ijef.v5n11p13

Abstract

This article examines the industry wide differences of the exchange rate risk exposure for US industries by estimating Fama-French multifactor model adding exchange rate risk as an additional factor. These time series regressions found statistically significant coefficients of exchange rate risk factor for only seven out of seventeen industries. In addition, the Fama-Macbeth two-stage regression for cross section stock returns found no significant support for existence of risk premium for investors for the exchange rate risk. One possible explanation may be the size of the US equity market, which is so large and offers so many different classes of assets that exchange rate change may be rendered diversifiable. Secondly, the US financial market has extensive forward (future) products for foreign currencies, that it may offer a hedging strategy against sudden exchange rate change. These facets of the US market may explain why, investors do not get any premium in asset market for the exchange rate change risk factor.

Keywords: exchange rate risk, US equity markets, portfolios by US industry, fama-french factors models, fama-macbeth regressions

1. Introduction

Since the advent of flexible exchange rates after the break down of the Breton-Wood system in 1973, foreign exchange markets have been a major concern for both US multinationals and domestic firms. Multinational firms are exposed to exchange rate risk since their supply chain, output markets, and sources of finance are situated in different nations. For US domestic firms, the movement of exchange rates creates risks to the firm value indirectly by influencing their competitiveness with foreign imports and the demand for their goods and services from their customers. Both domestic and multinational firms in the US have extensive hedging strategies to eliminate or reduce the impact of exchange rate risk on the values of firms. But modern portfolio theory states that investors should not pay a premium for active hedging strategies if exchange rate risk is completely diversifiable (Jorion, 1991). On the other hand, the arbitrage pricing theory (Ross, 1976) suggests that an economy can be described by a small number of risk factors, and investors are typically willing to pay a premium to avoid these sources of risk. In this framework, investors may pay a premium if they consider exchange rate movements as one of those risks.

The exchange rate risk of a firm can be defined as the exposure of that firm's value to unexpected depreciation or appreciation of the foreign currency against the domestic currency (Adler & Dumas, 1984). In particular, exchange rate risk is defined as a possible loss in firm's cash flow, asset and liability, net profit and, in turn, its stock value from an unexpected exchange rate movement (Papaioanndou, 2006).

There are three types of exchange rate risks to be considered (Madura, 1989; Shapiro, 1996):

1) *Transaction Risk*: This risk is defined as the effect of currency fluctuations on a firm's value if the firm has contractual cash flow in foreign currencies, to be settled at future date. Transaction risk emerges from the impact of exchange rate movements to export receivables, import payables or repatriation of dividends from foreign countries.

2) *Translation Risk*: This accounting risk results from the effect of exchange rate movements on domestic currency values of a firm's foreign assets and liabilities. Firms with foreign subsidiaries are especially exposed to this risk while consolidating its financial statements. This risk is measured as exchange rate risk exposures to net asset.

3) *Economic Risk*: This risk reflects the potential impact to a firm's present value of future operating cash flow due to exchange rate movement. Of particular concern here is the impact of exchange rate movements on revenues (domestic sales and export), and operating expenses (cost of domestic inputs and imports, etc.), which could affect the market share or competitiveness of a firm.

Transaction risk can be reduced or eliminated by either over the counter (OTC) or exchange traded products. Among OTC products, the currency forwards and cross-currency swaps are most important. For exchange traded products, the main instruments for managing risk are currency options and currency futures, but all of these instruments have both advantages and disadvantages and are expensive (Papaioanndou, 2006). Adler & Dumas (1984) showed that a firm's transaction risk exposure can be completely hedged with a forward contract if the horizon between the cash flow and the hedging strategy is completely matched and there is no randomness in foreign asset prices. So, investors do not need to price transaction risk.

Translation risk is long term and accounting oriented in nature. Its impact is seen on a firm's balance sheet, not on their income statement of a firm. Dalquist & Robertson (2001) argued that translation risk does not affect the current or future cash flows of a firm. Since investors price stocks according to expected future cash flows, translation risk exposures should have no effect on the stock price of a firm. However, to eliminate *translation risk*, it is a common practice for firms to finance the operation of their subsidiaries by borrowings in local currencies.

It is quite difficult to quantify as well as hedge *economic risk* since it is multidimensional and complex. One way to reduce economic risk to a firm's cash flow involves diversifying its product lines, supply chains and final output markets (Papaioanndou, 2006). US firms often follow a natural hedging strategy to reduce economic risk by conducting a large share of production (costs) and sales (revenues) operations in the same foreign currency or by reallocating production facilities in the same foreign country where the final output markets are situated. Nevertheless, where a natural hedging strategy is used, it should be consistent with firms' overall business strategy, and may not be by itself an appropriate business decision for reducing exchange rate risk.

Theoretically, if the impact of exchange rate risk cannot be diversified, then investors price the risk in stock markets. Jorion (1991) estimated the market price of exchange rate risk for the US stocks markets. He used percentage change in the US trade weighted exchange rate as a proxy for exchange rate risk and tested both the unconditional CAPM (Capital Asset Pricing Model) and the multifactor models (Chen, Roll & Ross, 1986), using twenty value-weighted industrial portfolios traded in the NY stock exchange from 1971 to 1987. He also estimated existence of cross sectional exchange rate risk exposures for the US firms, but found that US investors did not get any risk premium for bearing this risk.

A similar work by Carrieri & Mejerbi (2006) on emerging market economics however did find support for pricing exchange risk by stock markets using a data set from 1976 to 1999. Carrieri & Mejerbi (2006) estimated exchange rate risk pricing in emerging market economies like Brazil, India, Mexico, etc., using the international CAPM, where the world market index was used as a market risk factor and deviation from PPP was used as an exchange rate risk factor. They estimated exchange rate risk premium for both value weighted portfolio based on the market size of firms and individual stocks. They also found that exchange rate risk was priced in emerging markets' stock markets but the premium differed across industries and firms.

Since the 1990s, the globalization and the free international trade regime have been dominating international trade and finance flows by lowering trade barriers and liberalizing financial markets. Goods and financial markets across the nations are now highly inter-connected and are strongly correlated. Thus, exchange rate has become more relevant in determining goods and finance flows across the nations. In theory, sudden exchange rate movement should impact export competitiveness and input costs of both domestic and multinational firms in a globalized world more than ever, and stock market should discount exchange rate fluctuations as a risk factors. But firms and financial market also work together to design new financial instruments in order to diversify away all sorts of diversifiable risk, no matter how robust the risk factor is. Consequently, a new study incorporating a post 1990s data set to examine the impact of exchange rate risk to US firms value may prove insightful. This present study estimated a larger and more recent monthly data set of exchange rate from February, 1973 to December, 2012. The objective of this study is to determine whether investors in US stock market perceive unexpected exchange rate movements as a source of un-diversifiable, systematic risk for both domestic and multinational firms. This study will also examine and estimate whether US investors price exchange rate risk in the US stock markets i.e. investors demand risk premia for exchange rate risk since an additional systematic risk would increase the overall risk status of their portfolios. One anticipated outcome is that this study may highlight the importance of exchange rate risk for US firms in the context of present globalized world economy and would help them to design appropriate strategies to eliminate this risk. The remainder of this paper is organized as follows. Section 2.0 describes the data and methodology. Section 3.0 describes the results. Section 4.0 concludes this paper.

2. Method

For the present study, all stocks listed in the US markets have been divided into seventeen industry portfolios (Kenneth French 17-industry portfolios). These seventeen industries are food, mines, oil, clothes, consumer durables, chemicals, consumables, construction, fabricated products, steel, machineries, cars, transportation, utilities, retail, finance, and other. A monthly value weighted return for each these industry portfolios from February 1973 to December 2012 has been calculated.

This study will estimate the exchange rate risk using the Fama-French three factors model (Fama & French, 1993), adding exchange rate fluctuations as a fourth risk factor. In their 1992 & 1993 seminal papers, Eugene Fama and Kenneth French identified three risk factors for stock markets: the market risk (excess market return over the risk free rate), size (market capitalization of a firm), and book to market (book value divided by market value of stocks of a firm). Fama and French (1973) calculated the market risk factor by estimating the value weighted return of all NYSE, AMEX and NASDAQ stocks (collected from CRSP) minus one month Treasury bill return as the risk free rate. For the two other risk factors of size and book value to market value, they created two factor mimicking portfolios: SMB or Small minus Big (market capitalization), and HML or High minus Low (book value to market value). The following methods are used to create these two factor mimicking portfolios:

2.1 Factor Mimicking Portfolios

All stocks on the NYSE, AMEX, and NASDAQ are separated into two groups based on size (i.e. the market value of equity as of June each year). The cutoff point is chosen from the median size of all firms listed in the NYSE. The first group consists of big size firms and the second group consists of small size firms. Next, all stocks of the NYSE, AMEX and NASDAQ are now broken into three groups on the basis of their book value to market value. The break points are defined by the lowest 30% (growth stocks), middle 40% (neutral stocks) and the highest 30% (value stocks) of book value to market value of all firms listed in the NYSE. These two groupings produce six marketable portfolios for every year (S/L, S/M, S/H, B/L, B/M, B/H), where first portfolios contains all stocks that have small size and low book value to market value and the sixth portfolio contains all stocks that have big size and the high book value to market value. Monthly returns for these six portfolios are then estimated for every month of each year. The mimicking portfolio of size factor, which is Small minus Big (SMB), is calculated by taking the difference between the average return of three small portfolios (for three groups of book to market) and the average return of three big portfolios (for three groups of book to market) as illustrated below:

$$SMB = 1/3(SmallValue + SmallNeutral + SmallGrowth) - 1/3(BigValue + BigNeutral + BigGrowth)$$

The second mimicking portfolio of book to market factor, which is High minus Low (HML) is calculated by taking the difference between the average return on the two value portfolios minus the average return on the two growth portfolios (Fama & French, 1993). The process is illustrated in the formula below:

$$HML = 1/2(SmallValue + BigValue) - 1/2(SmallGrowth + BigGrowth)$$

Fama and French (1993) argued that the size and book value to market value of a firm respond to economic fundamentals. These two variables represented the unidentified economic and systematic distress risk for a firm. Smaller and lower book to market firms are more distressed, more vulnerable to the business cycle. Since these risks are un-diversifiable and systematic, investors demand a premium to hold these stocks (Fama & French, 1993). Fama and French (1993) illustrated how firms that have higher book value to market value have higher earnings than firms that have lower book value to market value. By controlling book value to market value, they found that small firms have lower earnings than big firms.

In addition to three risk factors, i.e. the market risk, SMB and HML, the present study will use the percentage change in the monthly US trade weighted exchange rate index (Note 1) with a broad group of major trading partners as a proxy for the exchange rate risk factor. The US trade weighted exchange rate index (Year 1997=100) is calculated by geometrically averaging daily bilateral exchange rates between the US and a broad group of major US trading partner countries. The trade volumes with these countries are accounted for an average of 95% of total US exports and imports. This Broad group of currencies includes the Euro Area, Canada, Japan, Mexico, China, United Kingdom, Taiwan, Korea, Singapore, Hong Kong, Malaysia, Brazil, Switzerland, Thailand, Philippines, Australia, Indonesia, India, Israel, Saudi Arabia, Russia, Sweden, Argentina, Venezuela, Chile and Colombia.

These four risk factors are used as the independent variables for the regression equation; the excess return (over the risk free rate) of the value weighted portfolios formed for the seventeen US industries are dependent variables. For a proxy of the risk free rate, one month US T-bill rate is considered.

2.2 Slope Coefficients (Beta) for Risk Factors

In order to get coefficients or betas of the four risk factors for each industry portfolio, the following linear time series model is to be estimated:

$$R_{it} - rf_t = \alpha + b_{1i}(RM_t - rf_t) + b_{2i}SMB_t + b_{3i}HML_t + b_{4i}S_t + \varepsilon_t \tag{1}$$

Here, *R*= monthly return of seventeen (17) industrial portfolios.

rf= the risk free US one month T-bill rate, RM= return of the market index.

SMB= return of Small (market capitalization) minus Big portfolio.

HML= return of High (book to market) minus Low portfolio.

S= percentage change of monthly US trade weighted exchange rate.

It is expected that the estimated value for alpha (intercept) should be close to zero and statistically insignificant if all risk factors successfully explain the stock return variation.

In order to estimate the above mentioned regression equation (1), two estimation techniques are employed. First, in order to estimate coefficients of risk factors for time series stock return, the Ordinary Least Square estimation technique is used with Newey-West standard error for correcting heteroskedasticity of errors. This OLS technique is commonly used for estimating time series slopes for the Fama-French risk factors (Fama & French, 1993). The present study is interested in determining whether time series slopes or betas for all four risk factors (i.e. market, SMB, HML and exchange rate risk) are statistically significant for each industry.

It would be also interesting to estimate the panel data set. This could be achieved by combining all seventeen time series data sets across the time variable (date) and cross section variable (industry portfolios) to calculate the average (pooled) slopes coefficients of the four risk factors assuming that these slope coefficients remain the same for all industries and for all time periods. Second, the Fama-Macbeth estimation technique for cross section stock returns is used to calculate whether US capital markets investors demand risk premiums for the four risk factors (Fama & Macbeth, 1973).

The Fama-Macbeth estimation technique is widely used for estimating risk premiums for betas using CAPM or multifactor models. To estimate slope coefficients or betas for each risk factor, this method first regress each asset/portfolio time series return against all possible risk factors (regressors). For the present study, 36 months of rolling regressions are used for the estimation of betas. Time series regressions *for each industry portfolio (i)* are as follows:

$$R_t - r_{ft} = \alpha + b_1(RM_t - r_{ft}) + b_2SMB_t + b_3HML_t + b_4S_t + \varepsilon_t \tag{2}$$

Thus, seventeen separate time series regressions are run for seventeen industry portfolio using 36 month excess returns (from February 1973 to January 1976) for each industry portfolio as the dependent variable. Using these time series regressions, slope coefficients (beta) for each risk factor (i.e. Market risk, SMB, HML and the exchange rate change (S)) can be estimated for each of the seventeen industry portfolios.

Second, a cross section regression is estimated for each month(t) for the same 36 month period (from February 1973 to January 1976) using all seventeen (17) industry portfolio monthly returns as dependent variables. These results are then measured against the estimated betas for four risk factors from time regressions as independent variables. The following cross section regression is estimated in the second stage *for each month (t):*

$$R_i - r_f = \gamma_0 + \gamma_1 b_{1i,} + \gamma_2 b_{2i,} + \gamma_3 b_{3i,} + \gamma_4 b_{4i,} + \mu_i \tag{3}$$

The coefficients γ_1, γ_2, γ_3, γ_4 are risk premiums for four betas.

Finally, an average of 36 cross section regression estimates is taken to calculate the average risk premia for each beta : $\hat{\gamma}_k^{avg} = \frac{1}{T}\sum_{t=1}^{T} \hat{\gamma}_{kt}$, and the variance of the cross sectional regressions is estimated to generate sampling errors for the estimated risk premium: $\sigma^2(\hat{\gamma}_k) = \frac{1}{T^2}\sum_{t=1}^{T}(\hat{\gamma}_{kt} - \hat{\gamma}_k)^2$. The entire process is repeated 12 more times for 12 more samples, each one 36 months long except the thirteenth sample (January, 2009 to December, 2012), which is 48 months long.

3. Result

For each industrial portfolio, a time series regression is estimated. Thus a total of seventeen (17) regressions are estimated for seventeen industry portfolios. This study expects that signs of slope coefficients for four risk factors can be either positive or negative based on the co-variance structures between risk factors and returns of industry portfolios. Table-1 summarizes these results.

In Table-1, time series slope coefficients (beta) for the market risk factor are found statistically significant and positive for all seventeen industry portfolios. The utility industry has the lowest market beta (0.64) while the steel industry has the highest market beta (1.27).

With regard to SMB and HML risk factors, findings are mixed. The time series slope coefficient for SMB is found statistically significant for twelve industry portfolios. Only chemical, fabricated product, cars, transports and retail store industry portfolios have statistically insignificant slope coefficients.

Out of twelve industries portfolio which generated statistically significant slope coefficients for SMB, six industries generated negative slope coefficients and the rest generated positive slope coefficients. The Chemical industry portfolio generated maximum statistically significant slope coefficients (0.7) and the Retail industry portfolio generated the lowest statistically significant slope coefficient (-0.06) for SMB. On the other hand, the slope coefficient for HML is statistically significant for sixteen industry portfolios while only the slope coefficients for retail store industry portfolio found statistically insignificant. Out of sixteen statistically significant slope coefficients for HML, only three slope coefficients have negative signs. The highest statistically significant slope coefficient for HML is found for the Car industry portfolio (0.59) and the lowest statistically significant slope coefficient is for the Retail industries portfolio (0.10).

Table 1. Time series estimation of four factors model

Industry Portfolio	Intercept	Market	SMB	HML	Exchange rate
Food	0.72 (-4.86)*	0.78 (-18.15)	-0.21 (-3.44)	0.14 (-2.02)	0.03 (-0.3)
Mines	0.7 (-2.39)	0.94 (-14.21)	0.37 (-3.97)	0.25 -(2.55)	-0.91 (-4.22)
Oil	0.75 (-3.81)	0.86 (-17.05)	-0.24 (-3.15)	0.22 (-2.54)	-0.27 (-1.87)
Cloths	0.19 (1.06)	1.13 (-20.03)	0.39 (-2.84)	0.51 (-5.11)	0.21 (-1.62)
Consumer Durables	-0.003 (-0.03)	1.1 (-28.87)	0.15 (-2.5)	0.32 (-4.61)	-0.04 (-0.34)
Chemicals	0.44 (-2.8)	1.13 (-27.12)	-0.7 (-1.30)	0.36 (-4.58)	-0.29 (-2.59)
Consumable	0.83 (-5.74)	0.79 (-19.22)	-0.46 (-7.67)	-0.16 (-1.93)	0.05 (-0.33)
Construction	0.29 (-2.12)	1.21 (-35.57)	0.25 (-3.97)	0.34 (-5.97)	0.17 (-1.73)
Steel	0.93 (-0.43)	1.27 (-22.43)	0.46 (-6.18)	0.38 (-3.64)	-0.45 (-2.59)
Fabricated	0.39 (-2.64)	1.02 (-24.3)	0.18 (-1.73)	0.3 (-4.03)	-0.13 (-1.33)
Machinery	0.54 (-3.83)	1.16 (-28.29)	0.2 (-3.08)	-0.43 (-6.43)	-0.09 (-0.91)
Cars	0.03 (-0.16)	1.17 (-20.07)	0.16 (-1.89)	0.59 (-5.93)	0.19 (-1.3)
Transports	0.32 (-2.33)	1.11 (-32.05)	0.08 (-0.22)	0.38 (-5.71)	0.2 (-2.08)

Utility	0.5	0.63	-0.19	0.45	-0.05
	(-3.28)	(-15.78)	(-3.43)	(-6.46)	(-0.43)
Retail	0.36	1	0.06	0.1	0.5
	(-2.32)	(-20.44)	(-0.62)	(-1.19)	(-4.39)
Finance	0.5	1.2	-0.12	0.53	0.18
	(-1.42)	(-36.83)	(-2.72)	(-10.41)	(-2.36)
Others	0.45	0.99	0.1	-0.15	0.13
	(-6.75)	(-55.53)	(-3.67)	(-4.92)	(-2.8)

*Parenthesis shows the t-statistics.

Finally, the slope coefficient for exchange rate change is found statistically significant at 5% level for only seven industry portfolios i.e. Mines, Chemicals, Steels, Transports, Retails, Finance and Others. Out of seven statistically significant coefficients for exchange rate change, signs of coefficients were negative for the Mines, Chemicals and Steels industry portfolios but positive for the Transports, Retails, Finance and Others industry portfolios. The highest statistically significant slope coefficient for exchange rate change is found for the Mining industry (-0.91) and the lowest statistically significant slope coefficient is found for the other industry (0.13).

The time series regression results indicate that on average the US stock market may not consider exchange rate change a risk factor for most of the industries or when it does weigh it as a risk, it does so very weakly. So, a longitudinal data analysis (panel data) using fixed effect estimation technique, was performed in order to estimate whether US stock markets consider exchange rate as a risk factor for the economy as a whole .This study assumes beta coefficients are constant across portfolios and time but intercepts vary across portfolios, and the results of the study are summarized in Table -2 summarizes the result.

Table 2. Fixed effect (panel data) estimation of four factors model

	Co-efficient	Standard Error	t-statistics	p-value
Intercept	0.31	0.17	1.82	0.07
Market	1.03	0.009	104.74	0.00
SMB	0.07	0.01	4.69	0.00
HML	0.24	0.01	16.49	0.00
Exchange Rate Change	-0.03	0.03	-1.04	0.30

Fixed effect estimation of the panel data set found that slope coefficients of market, including Small-minus-Big (SMB) and High-minus-Low (HML) risk factors, are statistically significant. On the other hand, the slope coefficient of Exchange Rate change is not found statistically significant. A statistically insignificant coefficient of exchange rate change means the US stock markets, on average do not consider exchange rate change as a systematic risk factor for asset return, and/or they consider this risk factor completely diversifiable. These results have serious cost implications for investors, who have long been worried for possible adverse impact of sudden fluctuations of exchange rate on their portfolio returns; thus they regularly spend large portion of their equity to buy expensive hedging instruments from future and forward market. This study successfully identified those industries which have exposure to sudden exchange rate movement and is needed to eliminate exchange rate risks and those industries which do not have any exposure and needs no currency hedging. As a result, this study can make currency hedging strategies more cost effective for investors.

Factor models of asset pricing predict that if investors consider any risk factor unsystematic and diversifiable, they do not demand risk premium for that factor in the asset market. Thus, we can anticipate that in next section, Fama-Macbeth risk premium estimation technique may not find any significant risk premia for exchange rate change coefficient (beta) in the US stock markets. Table-3 reports the Fama-Macbeth regression results.

Results from Fama-Macbeth regressions in Table-3 show that risk premia for exchange rate beta is found statistically significant for only three out of thirteen sample periods i.e. Jan1976- Dec1978, Jan1982- Dec1984 and Jan1988- Dec1990 and also found insignificant for the entire data i.e. Feb1973 to Dec2012. This result substantiates the conclusion that US stock markets, on average consider exchange rate change an unsystematic risk factor that does not require risk premium. One possible explanation for this type of investor attitude may involve the size of the US stock market, which is so large and offers so many different classes of assets that the exchange rate risk may be rendered completely diversifiable. Another explanation is that the US financial market has deep and multidimensional over-the-counter and exchange markets for forward (future) currency products, that it may offer a complete hedging strategy against sudden exchange rate change. These facets of the US market may explain why, investors do not get any premium in asset market for the exchange rate risk factor.

Table 3. Summary of fama-macbeth estimation of four factors model

			Mean Coefficient	Standard Error	t-statistics	p-value
Sample-1		Intercept	0.99	0.75	1.32	0.19
Time Series	197302-197601	Market Beta	-1.62	0.82	-1.98	0.05
Cross Section	197302-197601	SMB Beta	-0.67	0.93	-0.72	0.48
		HML Beta	0.9	0.73	1.24	0.23
		ER Beta	0.12	0.66	0.18	0.86
Sample-2		Intercept	-0.25	-0.7	-0.36	0.72
Time Series	197601-197812	Market Beta	0.56	0.22	2.57	0.01
Cross Section	197601-197812	SMB Beta	1.04	0.64	1.64	0.11
		HML Beta	0.06	0.49	0.13	0.9
		ER Beta	0.55	0.33	1.68	0.1
Sample-3		Intercept	-0.64	0.86	-0.75	0.46
Time Series	197901-198112	Market Beta	1.19	0.6	1.99	0.05
Cross Section	197901-198112	SMB Beta	-0.01	0.65	-0.02	0.99
		HML Beta	-0.26	0.64	-0.41	0.67
		ER Beta	-0.92	0.67	-1.36	0.18
Sample-4		Intercept	1.01	0.52	1.95	0.05
Time Series	198201-198412	Market Beta	-0.43	0.9	-0.48	0.64
Cross Section	198201-198412	SMB Beta	-0.31	0.55	-0.57	0.57
		HML Beta	0.11	0.56	0.2	0.86
		ER Beta	0.67	0.34	1.98	0.05
Sample-5		Intercept	-0.15	0.85	-0.18	0.86
Time Series	198501-198712	Market Beta	1.16	0.48	2.44	0.02
Cross Section	198501-198712	SMB Beta	-0.24	0.56	-0.43	0.67
		HML Beta	0.08	0.5	0.16	0.87
		ER Beta	-0.14	0.47	-0.3	0.76
Sample-6		Intercept	-0.11	0.7	-0.6	0.87
Time Series	198801-199012	Market Beta	0.61	0.23	2.65	0.01
Cross Section	198801-199012	SMB Beta	-0.64	0.56	-1.14	0.26
		HML Beta	-0.23	0.35	-0.82	0.42
		ER Beta	-0.99	0.38	-2.59	0.01
Sample-7		Intercept	0.62	0.62	1	0.33
Time Series	199101-199312	Market Beta	0.54	0.26	2.05	0.04
Cross Section	199101-199312	SMB Beta	0.72	0.59	1.22	0.23
		HML Beta	0.31	0.53	0.59	0.56
		ER Beta	0.24	0.34	0.74	0.46
Sample-8		Intercept	-0.16	0.66	-0.24	0.82
Time Series	199401-199612	Market Beta	1.2	0.8	1.5	0.14
Cross Section	199401-199612	SMB Beta	-0.94	0.54	-1.76	0.08
		HML Beta	-0.41	0.43	-0.96	0.34
		ER Beta	-0.33	0.35	-0.95	0.34
Sample-9		Intercept	1.77	0.82	2.18	0.03
Time Series	199701-199912	Market Beta	-1.03	0.53	-1.93	0.06
Cross Section	199701-199912	SMB Beta	-0.13	0.96	-0.14	0.89
		HML Beta	-1.43	0.66	-2.17	0.04
		ER Beta	0.52	0.69	0.75	0.46
Sample-10		Intercept	-0.18	0.87	-0.21	0.84
Time Series	200001-200212	Market Beta	-1.04	0.36	-2.87	0
Cross Section	200001-200212	SMB Beta	-0.83	1.48	-0.58	0.56
		HML Beta	1.42	1.08	1.31	0.2
		ER Beta	-0.14	0.33	-0.41	0.68

Sample-11		Intercept	0.86	0.54	1.58	0.12
Time Series	200301-200512	Market Beta	0.32	0.69	0.46	0.65
Cross Section	200301-200512	SMB Beta	0.5	0.6	0.84	0.4
		HML Beta	0.8	0.42	1.93	0.06
		ER Beta	-0.29	0.36	-0.8	0.43
Sample-12		Intercept	0.42	0.46	0.91	0.37
Time Series	200601-200812	Market Beta	-1.17	0.52	-2.26	0.03
Cross Section	200601-200812	SMB Beta	-0.47	0.55	-0.86	0.4
		HML Beta	-0.73	0.52	-1.39	0.17
		ER Beta	-0.12	0.45	-0.26	0.8
Sample-13		Intercept	0.1	0.7	0.15	0.88
Time Series	200901-201212	Market Beta	1.14	0.46	2.49	0.02
Cross Section	200901-201212	SMB Beta	0.56	0.22	2.83	0
		HML Beta	-0.36	0.88	-0.4	0.69
		ER Beta	0.06	0.44	0.13	0.89
Entire Data		Intercept	0.63	0.32	1.96	0.05
		Market Beta	-1.09	0.49	-2.23	0.02
		SMB Beta	-0.06	0.25	-0.23	0.82
		HML Beta	0.03	0.19	0.15	0.88
		ER Beta	-0.14	0.26	-0.52	0.61

4. Conclusion

After the break down of the Bretton-Wood fixed exchange rate regime, world adopted the current flexible exchange rate system where market forces determine the exchange rates among national currencies. Under the current flexible exchange rate system, currency markets can become very volatile and unpredictable due to continuous shocks to supply and demand schedules. Because the US economy is a large and open, this unexpected movement of exchange rates may influence the value of US multinational and domestic firms. This paper examines the industry wide differences of the exchange rate risk exposure for US industries and found the existence of statistically significant coefficients (betas) of exchange rate risk for only seven out of seventeen industries. Investors consider the mining industry most exposed and the utility industry least exposed to exchange rate movement. Nevertheless, where it concerns US industries in stock markets, the Fama-Macbeth two-stage regressions found no significant support for existence of a risk premium for the exchange rate risk. One possible explanation for this type of investor attitude may involve the size of the US stock market, which is so large and offers so many different classes of assets that the exchange rate risk may be rendered completely diversifiable. Another explanation is that the US financial market has deep and multidimensional over-the-counter and exchange markets for forward (future) currency products, that it may offer a complete hedging strategy against sudden exchange rate change.These facets of the US market may explain why, investors do not demand any premium in asset market for the exchange rate change risk factor.

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Note

Note 1. US federal reserve used following formula to calculate US trade weighted exchange rate index at time *t*: $I_t = I_{t-1} \times \prod_{j=1}^{N(t)} (e_{j,t}/e_{j,t-1})^{w_{j,t}}$ where I_t is exchange rate index at time t, N(t) is number of countries, $e_{j,t}$ is nominal exchange rate between US and country *j* at time t, $w_{j,t}$ is weight of currency j at index at time t.