Is currency risk priced in the stock return - evidence from AEC markets

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When investors from different countries invest abroad in the same destination country and same asset is invested, they may achieve different foreign asset return or value after converting back to the home currency in each country, in other words, the value of such investment and its return could differ from what they retain in the that foreign currency. This phenomenon leads to the risk called “currency risk”. The currency risk could also be seen in several different ways such as economic risk, transaction risk as so on. Considering the value of the asset return after converting back to home currency, as the value of such return varies across countries, it means investors who is risk averse should require a compensation.

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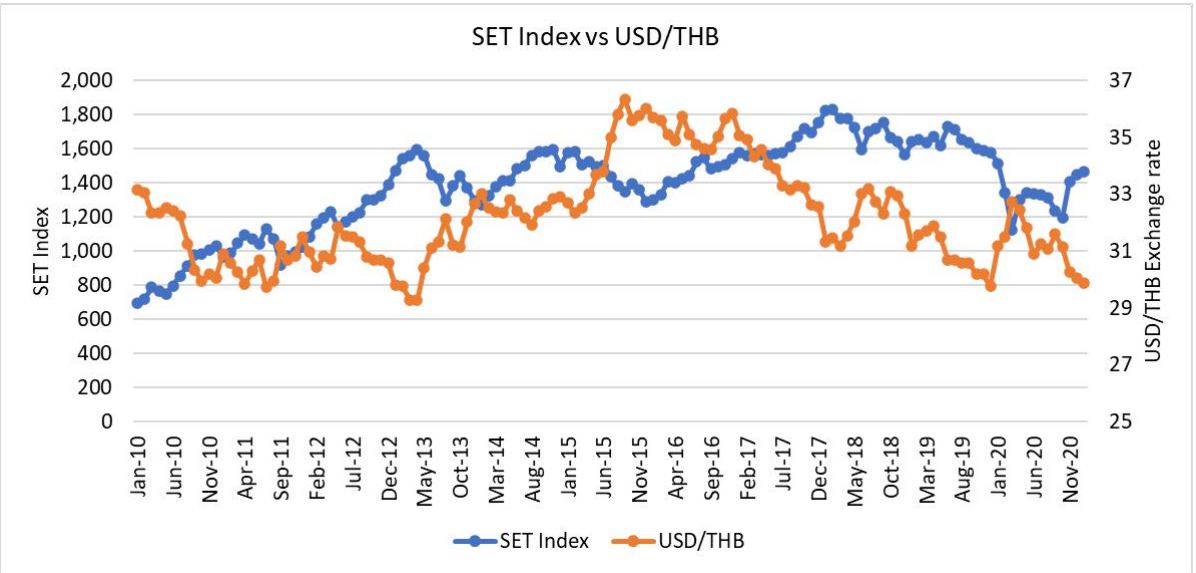
1. Introduction

1.1 Background and significance of the problem

When investors from different countries invest abroad in the same destination country and same asset is invested, they may achieve different foreign asset return or value after converting back to the home currency in each country, in other words, the value of such investment and its return could differ from what they retain in the that foreign currency. This phenomenon leads to the risk called “currency risk”. The currency risk could also be seen in several different ways such as economic risk, transaction risk as so on. Considering the value of the asset return after converting back to home currency, as the value of such return varies across countries, it means investors who is risk averse should require a compensation. (Sercu, 1980, Adler, and Dumas, 1983). The inverse effect between currency movement and stock market index variation can be seen with Thai stock market as an example in the below figure.



From literatures, the currency risk has been justified with the notion that it is mainly constituted by the power purchasing parity deviation (Solnik, 1974), and the effect is significant in the emerging market while less in deviation is seen in the major industrialised (Taylor and Taylor, 2004). Considering common model asset pricing in the industry, the currency risk premium seems to be a missing factor in risk premium that the investor should think of. It may be part of the cost of capital which reflects the opportunity cost those investors expect to achieve from investing in a fund, or other else with similar risk profile. The higher the cost of capital, the higher the return that the target investment is expected. The understatement in the cost of capital estimation could lead to the wrong investment decision.

In the AEC region, supporting the notion of PPP invalidity as the main driver of currency risk, the national import and export amount rises

significantly overtime and constitutes to a significant portion of their GDP. Due to the different currencies that are used to trade goods internationally, the foreign exchange rate therefore poses as a factor that determines trading gain/loss where the majority of the currency being traded is USD whose volatility affects the AEC more than other currencies (Wang et al, 2018).

From the historical foreign exchange between AEC currency and USD, the domestic currency of each country has depreciated against USD in long run. Despite the increased volume of hedging tools are used, there are consistent from several central banks of AEC countries that the tools are not effectively utilised and not widely adopted (e.g., Chuaprapaisilp et al, 2018). It can be implied that the exposure of those countries to currency fluctuation should be higher in recent years. Given the aforementioned findings, currency risk is therefore suspected to be one of the hidden factors that affect the effectiveness of the cost of capital calculation for investors in this region without doubt. The findings from this study will show the effectiveness and results of the increased hedging activities of companies in this region and indirectly measure the stimulus policy from the central bank of each country whether its policy achieve to alleviate the currency risk or not, since this issue has been broadly tested to be systematic in the regional level, implying the imperfect diversification, while more empirical evidence is required (Karolyi

and Wu, 2020). This study therefore aims to provide more evidence to better understand such literature gap.

To determine the currency risk premium, since the past to date, it has been seen from the industry practice that the currency risk has not been popularly explicitly included in the cost of equity estimation; otherwise, indirectly included in other factor such as country risk where all the firms are unavoidably punished with country-specific effects (Pinto et el, 2020, Damodaran, 2003). The exclusion or mistreating of this risk could also adversely affect the expected cost of equity especially for the country (e.g., Thailand) whose market integration and PPP invalidity degree are not as perfect as the major industrialised countries (Mike and Kızılkaya, 2019) and not many investors are likely not to possess the ability to well diversify their portfolio or pass it to their customers, in terms of the currency, on average.

As described above, the practices adopted in the market at the moment are understood to be significantly influenced from the US and the other industrialised countries' practice where the degree of currency risk is small in degree compared to the whole amount of the cost of equity (Sercu 2009, Koller et al, 2015, Dolde et al, 2012); it is typically suggested to be neglected in asset pricing (Koller et al (2015)). Therefore, this study examines the roles of currency risk in the determination of the stock return focusing on the firms in AEC region. For simplicity, the common CAPM is used as a

baseline plus with the additional currency risk factor. From Hou et al (2011), firms' cash flow is found as the linkage between the currency risk and stock return. As the currency sensitive stocks should have higher required return given its additional currency risk than the insensitive, Fama-French's factor mimicking portfolio approach (1992) is implemented utilising such notion to measure the effect of such risk to the stock return in the each individual country of AEC markets where significant positive risk premium is expected.

The results of this study will provide awareness to the equity investor that the currency risk may still prevail to the investment portfolio due to imperfect diversification, the broad understanding of the currency risk sensitivity at the firm level in each country, the regional-specific evidence for practitioners who fully adopt the US practice for cost of equity estimation, and more empirical evidences of the currency risk from one of the emerging regions for the academics focusing in this area. The policy implemented in each country to promote currency hedging will also be indirectly observed as a supplementary whether it can effectively help firms in its country over time or not.

1.2 Research objective

To investigate whether the currency risk is priced on average by individual country in the AEC market.

2. Literature Review

2.1. Concept and Theory

2.1.1. Purchasing Power Parity and residual currency risk at firm level

The PPP has been observed to be valid to a significant extent in long term among the major industrialised countries e.g., US, UK, etc (Taylor and Taylor, 2004). However, several literatures including Mike and Kızılkaya (2019) observed significant degree of long-term PPP invalidity in several emerging market countries and non-US firms such as Thailand and India. When the PPP does not hold, disparity of the inflation between two currencies will not offset the difference in the real term of return. The real return converted back to the home currency will differ country by country which provides different purchasing power.

Applying this concept to the asset pricing, we can imply that the greater the correlation between the foreign asset and the exchange rate, the higher the risk to which foreign asset will be subjected. Motivated by Solnik (1974), assuming if the commodity consumption is the same for all people in a country and if the central bank succeeds in stabilising the domestic currency price with respect to its domestic currency consumption bundle, this leads to the fact that all exchange risk is the real return and all changes in the exchange rate represents the pure deviation of the PPP. A rational risk-

averse investor, who cannot well diversify their investment portfolio to eliminate the currency fluctuation, should require a risk premium as a compensation for such encounter (Adler and Dumas, 1983, Solnik, 1974, Du and Hu, 2014).

When the PPP does not hold, and firm is exposed to the currency risk, the subsequent question is whether the firm can fully eliminate this or not, because the currency risk gain/loss will eventually reflect in the firm performance and the stock price in the end. Normally, firms mitigate this currency risk exposure by implementing currency hedging. But there is no perfect strategy, and the approach varies across firms. It is still also affected by other internal factors such as manager compensation scheme (Kim and Chance, 2018) where managers have more incentives to risk using hedging to game their performance indicator. Some firms even try to time the market in hedging activity or do the speculation which contradicts to the stated hedging policy (Cheng, I., Xiong, W., 2014). In summary, hedging cannot fully insulate the firm from currency risk (Starks and Wei, 2005).

2.1.2. Dependence of foreign trade in AEC market and exposure to currency risk

In the AEC region, globalisation has driven the countries group to go out and participate more in the international trades. During the past 20 years, statistics shows that national import and export amount rises significantly

overtime and constitutes to a significant portion of AEC countries' GDP. Due to the different currencies that are used to trade goods internationally, the foreign exchange rate therefore poses as a factor that determines trading gain/loss where the majority of the currency being traded is USD whose volatility affects the AEC more than other currencies (Wang et al, 2018). It seems that only the companies holding foreign currency must be susceptible to the currency risk but, in fact, the domestic-trading-based firms are also subjected to it as the competitors may come from foreign countries or having foreign capital cost which is used to create competitive advantages in the country they do the business (Shapiro, 1975).

Another driving factor of the depreciating currency in this region is the political risk (Hui, 2021), so far, political unrest across individual AEC country has provided incentive for the investors to modify their currency holding portfolio from holding domestic currency to the safer foreign currencies. From the historical foreign exchange between AEC currency and USD, the domestic currency of each countries is overall observed to depreciate overtime against USD, combining those mentioned effects. Despite the increased volume of hedging tools used, there are consistent evidences from several central banks of AEC countries that the tools are not effectively utilised and still not adequate to create impact on the aggregated level (e.g., Chuaprapaisilp et al, 2018).

2.2. Relevant research

This subsection presents a brief overview of the capital asset pricing model focusing on the CAPM. Then the progress and development of such model will be discussed to w the market anomaly issues and finally the currency risk will be discussed why it should be concerned.

2.2.1. Capital Asset Pricing Model (CAPM) development and currency risk extension

Since the past, CAPM (Sharpe, 1964) has been developed to measure the market risk premium which assumes that only the market risk is systematically captured and priced. Due to its simplicity, among today practitioners, one of the most common cost of equity model used in the field is still the CAPM-based model (Koller et al, 2015), which is in-line with a survey conducted in the US (Harvey, 2005, and Bruner et al., 1998).

After the rise of CAPM, there have been a number of empirical evidences from the financial behaviouralist side that the original CAPM may not be always valid and cannot fully capture the risk premium. The CAPM has been in popular under the efficient market hypothesis until the first evidence from Basu (1977) that the high E/P stocks tend to perform better than what is predicted by the CAPM. After his triggering study, voluminous literatures have been conducted aiming that there might be more factors that can explain the market anomalies that CAPM cannot capture. Followingly,

Fama and French (1996) observed that the average return of the long-short portfolio of the stocks with high-to-low book-to-market ratio and small-to-large size were likely to help partially the systematic risk other than the sole market risk.

The extension of CAPM has then started to be developed such as Fama-French's three-factor model, which includes the high-minus-low and small-minus-big factors, representing the market anomalies that makes the model to better explain the stock price. Carhart (1997) also found that the high performing stock is likely to perform better compared to the low performing which can partially explain the systematic risk in a higher degree beyond the Fama-French three-factor model, leading to his four-factor model. Recently, there have been several emerging CAPM-based models to challenge with the original CAPM and the existing extended versions in the market. The differences among those models are mainly the additional factors that the academic, who creates the model, believes that it can explain the market more effectively than the original one.

Recent literatures found several evidences of the currency risk (Lustig, Roussanov, and Verdelhan, 2018) which could be one of the systematic market anomalies that has not been captured. This issue has been observed to be systematic globally while the difference is on the degree of exposure. Empirical evidence suggests that this risk has not been well considered and

left from the stock pricing even among the US analysts. In one study, the error in the asset pricing conducted among the US analysts, compared to the actual price, can be partially systematically explained with the currency risk premium (Tuan Hoa et al, 2020). Karolyi and Wu (2020) also point out that this risk premium is observed to be systematic globally and should be priced by investors in almost every region including South East Asia; however, not many studies have been conducted and more empirical evidence is required for further understanding. This is considered the literature gaps by recent studies (Giurda and Tzavalis, 2020 and Karolyi and Wu, 2020).

The CAPM has been developed to account for such factor and led to more than 10 CAPM-based models by practitioners and academics (Harvey, 2005). Some of which that are also widely used such as the original CAPM, Global-CAPM, CAPM with country-risk, International-CAPM and Local CAPM. Even though several CAPM-based models are developed, it can be seen that one of the most popular models is still the original CAPM with extension that is not relevant to the currency risk. Ejara et al (2020) reveal that model selection can lead to noticeable differences among emerging market countries which is implied to be from country-specific characteristics and the underlying assumptions of the individual model.

Based on the existing models in the market, the currency risk premium measurement can be mainly divided into two categories based on the proxy used to measure currency risk as follows:

- Non-accounting-factor-based models (Sercu 1980, Stulz, 1995); and
- Accounting-factor-based models (Balvers and Klien, 2013, Du and Hu, 2014, Francis et al, 2008).

Noticeably, the popular models adopted among practitioners are the macro-factor-based model which does not reflect the firm-related characteristic to this risk, or the global CAPM with market integration assumption which still neglect the currency risk.

From the front-row practitioners' point of view, Koller et al (2015) still suggest the Global-CAPM, which changes the market portfolio to be global market and does not add a separates currency risk premium, should be the most suitable model given the market integration assumption, and suggest neglecting the risk premium since the degree has been proven to be negligible in US practice, which is also in-line with the several empirical researches in US and European countries. Also, the suggested approach by the CFA institute (Pinto et al, 2020) and several academics in the international financial management field (Eun et al, 2008) is to account it as part of the country risk added on top of the equity risk premium. This approach therefore

punishes the currency-insensitive firms unavoidably and cannot capture the firm specific characteristics.

The exclusion of the currency risk or implicitly accounting in other non-accounting- based factor therefore could bias such cost especially for the country whose degree of market integration and PPP are not perfect to the significant extent such as Thailand. Based on the above discussion, this practice seems to be influenced from the US' practice, one of the industrialised countries, where the degree of currency risk is small in degree compared to the whole amount of the cost of equity as a number of the listed firms are international and have operations globally. All of which can be implied that the natural hedge is achieved from the firm level.

2.2.2. Unique characteristic of AEC market and the evidence shortage

Among the literatures on this issue, AEC is one of the areas that is lack of the empirical evidence and testing. One key difference from the developed market is also the exchange rate policy adopt by the government, that is, countries in this region tend to implement the managed-float system rather than the pure float in the developed, which could lead to the different currency movement characteristics and may not reflect the natural response with respect to the demand and supply. Supporting this notion, Barguellil et al. (2018) presented that the fixed and float exchange rate regimes lead to

different currency risk while the fixed exchange rate regime tends to provide more exposure; however, the volatility is more harmful when it is the float rate system. The managed-float exchange rate system in the AEC regions is therefore in a middle of both system and the associated risk is expected to be different (Coudert and Cécile, 2009). The market integration aspect also showed that the AEC region has higher market integration within the region than with the global market (Lee and Jinho, 2016).

To put this issue into perspective, there has not been adequate evidence to confirm that such practice is applicable in AEC region where the economic structure, the company's degree of internationalisation, market integration, foreign currency exposure and PPP are importantly different from the developed. Moreover, Gopinath et al. (2010) documented that the firms in emerging market have to bear more exchange rate risk than those in the developed market if they are the counter trading parties, of around four times. These observations therefore lead to the objectives of this study. From the recent literature, this risk has also been broadly tested to be systematic in the regional level while more empirical evidence is required where the inability to test such effect was due to the insufficient time horizon (Francesco and Tzavalis, 2020).

2.2.3. Selected currency risk premium model

Cash flow has been discussed to be one of the effective proxies for being the linking factor between the currency sensitivity and the stock performance (Hou, Karolyi and Kho, 2011). The CAPM-based model with currency risk premium of this study has been motivated by the risk premium model that uses cash flow as the proxy for the currency risk premium (Du and Hu, 2014). The portfolio approach used by Du and Hu provides the benefit of nonlinear and time-varying currency risk exposure. In addition, supporting evidence shows that the cross-sectional return has been generated by the exchange rate risk exposure, and such exposure is consistent with the cash flow (Bartram and Botnar, 2012). Nevertheless, the existing model in the market typically use the non-accounting-factor-based model such as dollar exchange rate with respect to the home country, and country risk factor which cannot capture the firm-specific characteristics (e.g., importer, export, or neither). The accounting-factor-based model is therefore adopted for the analysis.

2.2.4. Empirical testing methodologies of CAPM

To test the asset pricing model, common methodologies in the literature back to either of the two ideas, time-series (e.g., Gibbons et al, 1989) or cross-sectional (e.g., Fama and Macbeth, 1973, Cochrane, 2009 and Fama, 2015).

First, considering the time-series approach, it starts with the assumptions in the original CAPM version of Sharpe (1964) and Lintner (1965). Two of the key assumptions, which later pose as a weakness of the time-series approach, are unrestricted risk-free borrowing and lending, and the market portfolio that is mean-variance efficient. The first assumption implies that there is an existence of risk-free asset which, after deducting with the return of the asset return, shall be fully explained by the market risk premium. It means the Jensen's alpha should be zero for all assets and the Sharpe-Lintner CAPM is saying that the intercept of the CAPM equation shall be the risk-free rate.

However, the recent literature conducted later shown that the estimated risk-free rate from the regression is found consistently higher than the average risk-free asset as assumed by the original model (Fama and MacBeth, 1973 and Fama and French, 1992). In addition, time-series test for the asset pricing model such as that developed by Gibbons et al (1989) (the 'GRS test') aims to test the hypothesis whether the intercept of all assets is zero or not. This leads to the problem of the GRS test that the results are likely to vary with respect to the test asset portfolio and the risk-free rate adopted.

The second approach is the cross-sectional test, rather than the Sharpe-Lintner version of CAPM, the cross-sectional approach adopts the Black's version (Black, 1972). The key differences are the risk-free asset and

short-selling un-restriction. To be specific on the risk-free asset, Black did not assume that the risk-free rate exists but the asset portfolio that is uncorrelated with the market portfolio instead. This specification of risk free unlocks the risk-free rate problem of the Sharpe-Lintner CAPM. It can be implied that the risk-free asset can have higher return than the risk-free asset.

Beyond the risk-free asset determination, the Fama-Macbeth two-pass regression is designed so that the risk-free asset is not required to test an asset pricing model. The first pass is for the beta determination for all assets and the second pass tests the risk premium from the averaged betas gotten from the first pass as a proxy for market premium. This methodology provides the advantage that the risk-free asset is not required, and the beta can be period-by-period varying which is unable by the time-series approach.

3. Analytical framework

Fama-Macbeth two-pass cross-sectional regression is adopted for the test given the pros and cons elaborated above. In the first pass, to test the exposure degree of each asset in respect to the currency risk factor (SMI), time-series regression will be conducted for individual asset over the entire sample period, depending on each specific country. The time-series performance of the model is measured through the absolute average and the averaged standard error of the intercept value, following the standard literatures (Hou, Karolyi and Kho, 2011). The rolling regression is deployed to

obtain the time-varying results where the timeframe is set at 5 years, typical central bank's governor term of service (Francis et al, 2008). The explanatory power of the model is further estimated based on the mean adjusted R square and F-test statistics.

To evaluate the currency risk premium of the constructed factor, in the second pass, the individual sensitivity of each stock will be averaged one another to form the cross sectional or portfolio sensitivity which represents the risk premium of the currency risk on average. Then, the risk premium will be undergone the statistical test whether it is linearly proportional to the excess return of the portfolio, in other word, to test the price level of risk. The following subsections present the process of factor construction and testing of the risk premium.

3.1 Construction of currency risk premium factor

Since the stocks that are sensitive to currency have higher volatility from the additional exchange rate fluctuation, it can be intuitively implied that the required return of the currency sensitive stock shall be higher than those insensitive. From the Fama French portfolio mimicking approach (1992), zero-investment portfolio which longs the currency-sensitive stocks and short the currency-insensitive stocks should generate excess return in long term. To measure the effect of such risk on the stock return, the long-short portfolio of currency sensitive minus currency insensitive can be expressed as:

$$SMI_i = \left(\frac{PS_i + NS_i}{2}\right) - IP_i \#(1)$$

Where the PS_i, NS_i, and IP_i are the quarterly return on positive sensitivity, negative sensitivity, and the insensitive value-weighted portfolio, respectively. The sensitive-minus-insensitive portfolio (the 'SMI') is defined subsequently from the above factors expected to explain the anomaly that CAPM could not have captured.

To assess the currency sensitivity of each stock to the home country's trade weighted currency index, the quarterly EBITDA of sample stocks of each sample countries, scaled with the total asset, will be regressed against the trade weighted currency index of such country. The equation is elaborated as follows:

$$\Delta\frac{EBITDA_{i.t}}{Total\ Asset_{i,t}} = a_i + b_i\Delta TCI_t + e_{i,t} \#(2)$$

Where the $\Delta\frac{EBITDA_t}{Total\ Asset_i}$ is the changes in quarterly scaled cash flow, ΔTCI_i is the quarterly percentage changes in country-specific trade weighted currency index, and b_i represents the currency sensitivity of the firm i.

Next, the stocks in each country will be ranked with respect to the sensitivity degree from highest to lowest. The sensitivity breakpoints used are the 30th and 70th percentiles to judge whether each stock is sensitive to the

currency movement or not. The ranking will be re-evaluated quarterly to capture the dynamic currency variation due to seasonality.

Since the stock that is sensitive to the currency movement can be sensitive in either negative or positive side compared to the TCI_i, the currency long-short portfolio uses the average return regardless of the sign for the positive and negative return from the positive sensitivity portfolio and negative sensitivity portfolio

3.2 Risk premium testing

To test our hypothesis, the Fama-French three-factor asset pricing model with currency risk extension for the currency risk to be used is:

$$r_{i,\ t,j} = a_i + b_{i,MKT}MKT_{t,j} + b_{i,SMI}SMI_{t,j} + b_{i,SMB}SMB_{t,j} + b_{i,HML}HML_{t,j} + e_{i,t} \#(3)$$

Where the i is the order of each stock, t is the number of periods, $b_{i,MKT}$ is the exposure factor, MKT is the market risk premium, calculated by value-weighing all applicable stocks of the country and deduct the representative return with the quarterly risk-free rate, j represents the country, SMI is the currency risk premium or 'sensitive-minus-insensitive', SMB represents the so-called "small minus big" and the HML represents "high minus low".

Based on the Fama-MacBeth's two-pass cross-sectional regression (Fama and MacBeth, 1973), first, the time-series regression is used over the

whole timeframe as applicable per the criteria set in the Section 5 for each stock in each country. The model performance will be assessed through the standard error, adjusted R-square, and the F-test statistics.

Second, to evaluate how much asset return will increase when a risk factor's beta of such asset increases one unit, all returns of each asset from the first regression will be regressed against their betas from the first steps for each specific time period. The risk premium will be determined of each stock for further hypothesis test.

$$r_j = \lambda_i + \lambda_{MKT,j} b_{i,MKT} + \lambda_{SMI,j} b_{i,SMI} + \lambda_{SMB,j} b_{i,SMB} + \lambda_{HML,j} b_{i,HML} + \varepsilon_i \#(4)$$

Where the beta is from the market and currency sensitivity factors for each country j. Followingly, the coefficients got from the Fama-Macbeth regressions are averaged to get the risk premium of each factor, then the t-statistic will be used to test the significance of risk premium with the following hypotheses for each country.

$$H_0 : \lambda_{SMI,j} = 0$$

$$H_a : \lambda_{SMI,j} \neq 0$$

The currency risk premium is expected to be positive. It means that the market takes into account the sensitivity of the currency-sensitive portfolio and compensate for it beyond that from holding in-sensitive stock portfolio, in

other word, abnormal return is achievable for the zero-investment portfolio by longing the currency sensitive portfolio and shorting the insensitive portfolio. Further implication to the regulator is that the hedging activity and tools may not be effectively stimulated by government, or the knowledge of hedging is not advance enough to reduce the firms' risk to such exposure. The negative

4. Data

To construct the currency long-short portfolio, the trade weighted currency index (the 'TCI'), of 5 countries out of the AEC with the sampling period described in the below table.

Item	Country	Sampling period	Number of firms eligible for analysis
1.	Malaysia	2011 – 2020	433
2.	Philippines		116
3.	Singapore		159
4.	Thailand		278
5.	Vietnam		94

The data sampling criteria and assumption adopted are as follows:

1. The sampling period shall cover at least one business cycle;

2. The sampling period shall not cover the period where the number of listed stocks in the market is below 200, assuming that the number of listed stocks implies good market liquidity;
3. The sampling period shall start from at least three years away from the change of national exchange rate system of a country or the financial crisis in case of partial business cycle coverage, assuming that the three years period can perfectly excludes the effect from nearest financial crisis that is not within the full business cycle;
4. The financial crisis is excluded (i.e., the Global Financial Crisis in Asia lasts until the first quarter of 2010); and
5. The time period is designed to make all countries' equal to achieve comparability among countries.

Based on the above criteria, the timeframe for the study is 10 years in total, covering at least one business cycle according to the US' National Bureau of Economics (NBER). The remaining countries, namely Myanmar, Laos, Cambodia and Brunei, are excluded from the sample set, due to its limited number of listed company and the liquidity shortage.

The cash flow of sample stocks is retrieved considering the quarterly frequency and timeframe and also the trade weighted currency index for the sensitivity testing in the next section. The trade weighted currency indies are

based on the JP Morgan nominal effective exchange rate. For clarity, the trade weighted currency index is calculated based on the following formula.

$$Index_i = 100 \prod_{i=1}^{n} \left(\frac{e_{it}}{e_{ib}}\right)^{w_{ib}}$$

Where $\prod$ denotes the product over the n foreign currencies in the index. e_{it} is the number of units for currency i per the index currency at time t. e_{ib} is the number of units for currency i per the index currency at the base year. w_{ib} is the weight assigned to currency at time t.

The EBITDA, scaled with total asset, will be used as a proxy for cash flow to exclude the effects from other irrelevant activities. The following firm-level data are then required for the EBITDA calculation:

- Net profit;
- Interest;
- Tax;
- Depreciation and amortisation; and
- Total asset.

The quarterly market total return index and individual stock total return index are further collected for the MKT where the 1-year risk-free rate will be used as a risk-free rate of return. All the parameters are downloaded from the Thomson Reuter Datastream.

Regarding SMB and HML, two factors are retrieved from the Kenneth French website which provides the historical three factors for the emerging markets.

In terms of the data screening, the stocks with extreme return, penny stocks and the illiquid are excluded from the analysis according to Hou, Karolyi and Kho (2011) to minimise bias from those factors. For example of Thailand, the stock with price lower than one baht is therefore excluded.

Following the analytical framework using the data collected from the aforementioned sources,

Table 1: Average return of the PS, IP, NS and the SMI portfolio

Country	Number of firms quarters	Average return			
		PS	IP	NS	SMI
Malaysia	17,320	3.5%	2.1%	4.6%	2.0%
Philippines	6,360	5.3%	2.6%	4.1%	2.0%
Singapore	6,360	4.3%	3.6%	2.1%	-0.4%
Thailand	11,120	3.9%	3.2%	2.9%	0.2%
Vietnam	3,760	4.3%	2.7%	3.8%	1.3%

Table 1 reports the average return of the stock portfolios for PS (Positive sensitivity portfolio), IP (Insensitive portfolio), NS (Negative sensitivity) and SMI (Sensitive-minus-insensitive portfolio)

Table 2: Descriptive statistics – SMI portfolio return, January 2011 to December 2020

Countries	Malaysia	Philippines	Singapore	Thailand	Vietnam
Mean	2.01%	2.03%	-0.41%	0.20%	1.34%
Median	0.79%	2.34%	-1.58%	-1.14%	1.42%
Maximum	19.50%	22.47%	25.39%	20.71%	14.42%
Minimum	-13.92%	-46.57%	-9.75%	-10.03%	-12.33%
Standard deviation	6.61%	10.80%	8.01%	6.46%	5.90%
Skewness	0.68	-2.13	1.54	1.40	0.22
Kurtosis	1.28	9.95	2.59	2.26	-0.08
Positive exposure	25	27	15	15	22
Negative exposure	15	13	25	25	18

Table 3: Summary statistics - time-series regression, January 2011 to December 2020

Countries	Alpha	MKT	SMI	SMB	HML	R^2
Malaysia	0.007 (3.677)	1.081 (38.240)	0.604 (22.147)	-1.474 (-7.135)	0.399 (3.042)	0.254
Philippines	0.035 (9.388)	0.869 (21.684)	0.184 (5.200)	1.192 (2.455)	0.785 (2.586)	0.227
Singapor	0.006 (2.429)	1.284 (34.566)	0.030 (0.897)	0.703 (2.100)	-0.579 (-2.650)	0.300

e						
Thailand	0.031 (16.325)	0.910 (44.166)	0.553 (16.801)	0.013 (0.051)	0.359 (2.286)	0.305
Vietnam	-0.014 (-4.197)	0.764 (31.779)	0.586 (11.016)	0.033 (0.083)	1.191 (4.664)	0.305

Table 3 reports the summary statistics for the CAPM with extension for the currency risk factor. MKT is the excess market return, SMI is the return of the currency sensitivity mimicking portfolio, SMB and HML are the Fama French “Small minus big” and “High minus low”. The summary statistics include the average absolute intercepts, factor loading and their t-statistics as well as the adjusted R square.

Table 4: Summary statistics - time-series regression of subfactor and full model, January 2011 to December 2020

Countries	Fama-French 3-factor model					Fama-French 3-factor model with SMI extension					
	Alpha	MKT	SMB	HML	R^2	Alpha	MKT	SMI	SMB	HML	R^2
Malaysia	0.025 (14.844)	1.386 (54.765)	-1.788 (-8.467)	0.149 (1.110)	0.208	0.007 (3.677)	1.081 (38.240)	0.604 (22.147)	-1.474 (-7.135)	0.399 (3.042)	0.254
Philippines	0.037 (9.917)	0.833 (20.398)	0.694 (1.409)	0.949 (3.038)	0.191	0.035 (9.388)	0.869 (21.684)	0.184 (5.200)	1.192 (2.455)	0.785 (2.586)	0.227
Singapore	0.006 (2.376)	1.280 (34.633)	0.712 (2.127)	-0.532 (-2.511)	0.279	0.006 (2.429)	1.284 (34.566)	0.030 (0.897)	0.703 (2.100)	-0.579 (-2.650)	0.300
Thailand	0.033 (17.200)	1.018 (50.863)	1.522 (6.022)	0.311 (1.939)	0.267	0.031 (16.325)	0.910 (44.166)	0.553 (16.801)	0.013 (0.051)	0.359 (2.286)	0.305
Vietnam	-0.004 (-1.216)	0.820 (34.154)	0.015 (0.036)	0.767 (2.979)	0.261	-0.014 (-4.197)	0.764 (31.779)	0.586 (11.016)	0.033 (0.083)	1.191 (4.664)	0.305

Table 5 reports the summary statistics for the CAPM, CAPM with extension for the currency risk factor and the sole currency risk factor. MKT is the excess market return and SMI is the return of the currency sensitivity mimicking portfolio. The summary statistics include the average absolute intercepts, factor loading and their t-statistics as well as the adjusted R square.

Table 5: Summary statistics – cross-sectional regression, January 2011 to December 2020

Countries	Malaysia	Philippines	Singapore	Thailand	Vietnam
Alpha	-0.025 (-7.873)	0.008 (1.052)	-0.005 (-0.943)	0.024 (5.842)	-0.047 (-7.013)
MKT	0.011 (4.982)	0.015 (1.975)	0.018 (4.265)	-0.004 (-1.041)	0.026 (3.335)
SMI	0.012 (8.620)	0.006 (1.365)	0.024 (5.740)	0.022 (12.245)	-0.004 (-0.985)
SMB	-0.002 (-5.960)	0.002 (3.533)	0.001 (2.024)	0.001 (3.455)	-0.000 (-0.358)
HML	0.002 (5.144)	-0.002 (-1.911)	0.002 (2.896)	-0.004 (-4.211)	0.001 (1.184)
SIGNIF	0.700	0.205	0.300	0.650	0.450
F-stat	23.557	17.253	3.115	19.851	7.887
Adjusted R^2	0.122	0.091	0.059	0.093	0.182

Table 6 reports the summary statistics for the Fama Macbeth's second pass regression of the CAPM with extension for the currency risk factor. MKT is the market risk premium and SMI is the risk premium of the currency sensitivity mimicking portfolio. The summary statistics include the average absolute intercepts, factor loading, percentage of firms with significant SMI at 10% significant level (SIGNIF), average F-test and their t-statistics as well as the adjusted R square.

Table 6: Descriptive statistics – cross-sectional regression, January 2011 to December 2020

Countries	Malaysia	Philippines	Singapore	Thailand	Vietnam
Market exposure coefficient					
Mean	0.011	0.015	0.009	-0.004	0.026
Minimum	-0.142	-0.446	-0.567	-0.364	-0.295
Maximum	0.433	0.591	0.315	0.374	0.503
Median	0.005	0.017	0.011	-0.001	0.017
Standard deviation	0.083	0.138	0.117	0.124	0.147
Skewness	3.174	0.981	-2.633	-0.281	0.541
Kurtosis	17.031	10.010	16.211	3.746	1.895
Positive exposure	22	21	22	19	26
Negative exposure	18	19	18	21	14
Currency sensitivity exposure coefficient					
Mean	0.012	0.006	0.019	0.022	-0.004
Minimum	-0.162	-0.114	-0.077	-0.051	-0.186
Maximum	0.284	0.260	0.343	0.244	0.193
Median	-0.001	-0.002	-0.010	0.002	-0.001
Standard deviation	0.074	0.061	0.095	0.071	0.076
Skewness	2.047	1.845	2.497	2.041	0.236
Kurtosis	7.134	7.599	5.879	3.994	0.892

Positive exposure	19	17	18	21	19
Negative exposure	21	23	22	19	21
Small minus big coefficient					
Mean	-0.002	0.002	-0.001	0.001	-0.000
Minimum	-0.047	-0.007	-0.034	-0.042	-0.025
Maximum	0.013	0.039	0.032	0.026	0.026
Median	0.000	-0.001	0.001	0.001	-0.001
Standard deviation	0.010	0.011	0.011	0.011	0.011
Skewness	-2.570	2.655	-0.336	-1.022	0.465
Kurtosis	9.266	6.894	2.775	5.834	0.981
Positive exposure	22	16	20	22	16
Negative exposure	18	23	20	18	24
High minus low coefficient					
Mean	0.002	-0.002	-0.002	-0.004	0.001
Minimum	-0.037	-0.057	-0.049	-0.076	-0.042
Maximum	0.061	0.050	0.042	0.048	0.066
Median	0.001	-0.002	-0.001	-0.003	0.000
Standard deviation	0.016	0.021	0.019	0.025	0.018
Skewness	1.726	-0.457	-0.254	-0.945	0.891
Kurtosis	6.409	1.484	0.982	2.297	4.033
Positive exposure	20	16	17	17	21

Negative exposure	20	23	23	23	19

Table 7 reports the descriptive statistics for the risk premium of all individual stocks obtained from the Fama Macbeth's second pass regression.

5. Empirical results and discussions

This section presents the empirical results and discussion with respect to each hypothesis. The results of sensitivity test for each stock in each selected country will be shown along with the average return of the constructed SMI portfolio. Followingly, the results and performance from Fama-Macbeth two-pass regression. The statistical significance and descriptive statistics of all the stocks in each regression pass will be discussed for in-depth insights and implications.

5.1 Sensitivity test and SMI portfolio construction

As discussed earlier, the sensitivity of each stock is obtained by regressing the changes in EBITDA, scaled by total asset, against the changes in trade weight currency index in the past 60 quarters. The stocks are then ranked based on their sensitivity and classified into 3 portfolios, PS, NS and IP for SMI portfolio construction.

Table 1 shows the annual mean return and other relevant summary of the SMI portfolio. As expected from the literatures review, stock portfolios that are sensitive to the currency movement usually exhibit higher return those being insensitive.

The average long-term return of major SMI portfolios still exhibit a risk premium on currency risk, implying that longing the sensitive stock portfolio while shorting the insensitive stock portfolio can create abnormal return. Out of the sample countries, Singapore shows the different pattern in the SMI value, that is, the SMI is negative resulted from the low return for the NS

portfolio. From Fang and Miller (2009), given the currency depreciation is used as an export stimulus for Singapore, engineering the depreciation is considered as the tool by Singaporean authority. However, the recent study shows that the primary cause may be the currency fluctuation instead of the currency depreciation which leads to the low NS. Even though the SMI for Singapore turns out to be negative from the time-series regression, it is expected that the positive sensitivity portfolio factor loading will outperform the negative and leads to positive premium in the Second pass when varying beta is allowed. When the SMI is priced, the factor is expected to be applicable in the cross-section as well.

To understand the characteristic of the SMI for each country, the descriptive statistics are presented in the . Comparing means and medians, all countries exhibit the same pattern that the median is negative and below the mean value, except only Philippines and Vietnam. The quarters with positive SMI are more than those negative for Malaysia, Philippines and Vietnam. Out of 40 quarters, Malaysia, Philippines and Vietnam have positive SMI fairly higher than the quarters with negative value, around 60% to 70%. On the other hand, Singapore and Thailand seem to have lower number of quarter with positive SMI to the negative, around 38% for both.

Even though the numbers of negative quarters of Singapore and Thailand are high, the quarters with positive SMI have a significantly high returns which outweigh the negative. We can see that the maximum return of the SMI are in the range of 14.42% to 25.39% while the minimum lies between 46.57%(one

off) to 9.75% and considering the standard deviation, the SMI variability is somewhat huge and requires attention. Philippines is the only country which has negative skewness while others are moderately skewed.

5.2 Main results from Fama-Macbeth regression

Table 3 summaries the results from the first pass or the time-series regression of all countries and their statistical performance indicator as a country.

From the results, even without time variation in exchange rate exposure, significant exposures are observed in Singapore, Malaysia, Vietnam, followed by the Thailand and Philippines. The time-series risk premium of MKT is highest for Malaysia and lowest for Singapore, at 1.284 and 0.764 with significant t-stat values. The SMI is priced highest by Malaysia and least by Singapore. For the SMB and HML of Fama-French 3 factors model, SMB is not priced by Thailand and Vietnam and negatively contributed to the stock return for Malaysia, while only Philippines and Singapore's stocks account such factor. HML is significant for all countries and the risk premium ranges from -0.579 to 1.191. The factor lowest or negatively contributes to Singapore stock return and priced highest by Vietnam at the values of -0.579 and 1.191.

These findings of all ASEAN countries for the currency risk factor are in line with the increase in international trade over the last 10 years. The interesting country is Singapore where the financial instrument market is the most advance, but also has the exposure to SMI in a huge degree.

To further understand how significant the additional SMI factor in explaining the asset return cross-sectionally is, Table 6 shows the summary statistics of the typical Fama-French 3-factor asset pricing models with and without the SMI extension, which supplements Table 3 with more detailed comparison.

Based on the original Fama-French 3-factor model, the market risk premium is statistically significant for all countries. The premium is highest for Malaysia and lowest for Vietnam, ranging from 0.820 to 1.386. The t-statistics are between 20.398 to 54.765. The SMB is significant for majority of the countries except for Vietnam. The SMB is observed to be lowest or negative for Malaysia and highest for Thailand. The premium ranges from -1.788 to 1.522 with t-statistics between -8.467 and 6.022. The HML is not priced by Malaysia and negative for the stock return for Singapore. The explanatory power for the model lies between 0.191 and 0.268 which are in-lien with the literatures that test the model on company level.

After adding SMI extension to the Fama-French 3-factor, the explanatory power of the model fairly increases for all countries. The adjusted r-square ranges from 0.227 to 0.305. Alphas of major countries are reduced, implying that the SMI can help capture the return premium. Considering the SMI factor added, the factors are significant for Malaysia, Philippines, Thailand and Vietnam, with the premiums of 1.081, 0.869, 1.284 and 0.764. The presence of SMI also reduce the premium contributed by the MKT for

Malaysia, Thailand and Vietnam, from 1.386 to 1.081, 1.018 to 0.910 and 0.820 to 0.764.

Another observation is that adding SMI can help increase the significance degree of SMB and HML, meaning that the additional factor can help capture the residual variability in the return that the existing factors cannot. For example, HML is not significant for Malaysia in the Fama-French 3-factor model and so does the SMB for Philippines at the t-statistics of 1.110 and 1.409 respectively. In the proposed model containing SMI extension, the t-statistics for those factors increase to 3.042 and 2.455, emphasising the usefulness of the SMI in ASEAN markets' asset pricing practice.

From the above findings, the first pass regression therefore confirms the incremental performance of the model after adding SMI through the explanatory indicator. SMI factor can perform well over the course selected period and effectively capture the asset return. In order to see how the performance changes after allowing beta to vary with time, I run the Second pass regression to see the risk premium during 2011 to 2020 at the company level. Table 6 and Table 7 respectively provide the summary statistics and descriptive statistics of the sample companies.

For the descriptive statistics, out of all countries with significant SMI exposure (Malaysia, Thailand and Singapore), the quarterly risk premium lies in the range of 1.2% to 2.2%. Of the samples, Thailand possesses the highest risk premium (2.2%) while the lowest belongs to Malaysia (0.5%).

Interestingly for all countries except Thailand, regardless of the significance of SMI factor, the numbers of quarters with positive premium are slightly less than those being negative, that is, the quarters with positive and negative SMI are around 21-23 quarters to those negative of 17-19 quarters. However, despite less in numbers, the years with positive premium can return significantly high figures and outweigh the years with negative premium, resulted in positive averaged SMI. Among all countries with significant SMI, the minimum premiums are between -16.2% to -7.7% while the maximum range is between 24.4% to 34.3%. Malaysia and Singapore's premiums have high positive skewness, 2.047 and 2.497; nevertheless, those for Philippines, Thailand and Vietnam are 1.845, 2.041 and 0.236.

From the summary results of the second pass, evidences show that Malaysia, and Singapore have significance exposure to both MKT and SMI. The MKT premiums are 0.011 and 0.018, and the average t-stats for MKT of both countries are 4.982 and 4.265. The SMI premiums are 0.012 and 0.022, and the averaged t-stats for the SMI are 8.620 and 5.740. The result is interesting as Singapore is the market with the most advanced development in financial instrument, referring to the government's currency management scheme that tries to manipulate the exchange rate to stimulate the export, this study subsequently shows that the scheme may have adverse effect and increase the uncertainty of the return. The return priced in the Singapore's stock return is hugest for the currency risk compared to others, which is considered a major findings of the hidden anomaly. Assuming the long-short portfolio validity, on a quarterly basis, the magnitude of the risk currency risk

premiums are observed to exceed that of the market premium. The factors are observed negative such as HML for Malaysia. It is noted that the factor with negative risk premium is not materially different or reliable from zero.

For Philippines, the results show that currency risk does not play a significant role toward the stock return pricing, with t-stat of 1.365, and MKT still contributes the highest risk premium among factors. Other than the MKT, it can be clearly seen that SMI can best explain the stock return than other factors in the original Fama-French 3-factor model. While the result is in-line with the literatures in the same area, this study adds another finding from the alternative testing to verify the anomaly when beta can be time-varying. We can also see that HML premium is an attenuate, meaning that the high B//M ratio stocks can perform well than the low B/M ratio stocks during the recession.

Considering Thailand, the MKT and SMI possess a t-stat of -1.041 and 12.245. Risk premium figures show a significant exposure of SMI and it outweighs the MKT which is found slight negative, 0.023 to -0.004. It means the SMI may have captured the majority of return contributed by the MKT already and subsequently made the MKT insignificant. The factor is also materially able to explain the stock return and outperforms all the remaining factors. This interesting finding is in line with Lewellen et al (2010) and it hints that the main factor driving behind the Thai stock return can be the currency risk with opposite correlation that eventually makes the MKT negative on a cross-sectional basis.

While other countries provide the outcomes in line with the expectation, Vietnam's results shows that the currency fluctuation does not lead to the significant risk premia. The results also support the findings from Corcoran (2009), which was conducted during the time when the stock market in Vietnam possessed low number of stocks, that its equity return seems not to be materially affected by the exchange rate volatility, but the domestic interest rate. The risk is therefore outweighed by the MKT.

Overall, Malaysia, Philippines, and Thailand satisfy the First and Second hypothesis, while Philippines, Thailand and Vietnam satisfy one hypothesis, the Second for hypothesis 1 and First for hypothesis 2 respectively as illustrated in the Table 7.

Table 7: Summary results of the study against hypotheses

Countries	Hypothesis 1	Hypothesis 2
Malaysia	Significant	Significant
Philippines	Significant	Insignificant
Singapore	Significant	Significant
Thailand	Insignificant	Significant
Vietnam	Significant	Insignificant

An implication of the results is that, given a fair number of stocks in each country are exposed to the currency sensitivity with significant currency risk priced in, it implies the hedging tools for the overall market level may not

be effectively adopted or encouraged by the domestic government authority. It may be due to the fact that not much companies in these emerging markets are not big so that they possess a good understanding of the tools and some companies may not know that the risk is economically significant so that they have to put in more focus. Another interpretation on the other way around is that firms may intentionally misuse the hedging instrument for abnormal gain, by speculating the currency risk and using hedging instruments in order to make capital gain, which is not the main purpose of the instruments.

6. Conclusion

This study presents the investigation of the stock return pricing model considering the currency sensitivity exposure of stocks in ASEAN market, comprising Malaysia, Philippines, Thailand, Singapore and Vietnam based on the currency sensitivity mimicking portfolio method as proposed by Du and Hu (2016). The study hypothesised that the standard models may miss the risk factor related to the currency given such risk is not significant in the industrialised countries where their asset pricing practice has influenced the emerging ones. It also hypothesises that market risk should be priced in the stock return for ASEAN market and the implementation is conducted using the CAPM with extension of the currency risk factor.

The study focuses on the stocks which have been present during 2010 to 2020 whether the currency risk was priced in their returns on average. The data used comprises firm EBITDA, total asset, stock return, stock prices, and the traded weighted nominal effective exchange rate. All data are obtained from the Thomson Reuters Datastream software.

To test the asset pricing model, the study adopts the standard Fama-Macbeth two-pass regression approach which is able to capture the time-effect by allowing varying beta. The test is conducted on the firm level and does not account for the other factors given the limited number of stock available after portfolio sorting.

For the time-series regression, the market risk is priced in all countries while the currency risk factor is not priced in by Singapore. The addition of

currency risk factor to the original Fama-French 3-factor increases the model's explanatory indicator for all countries. The residual of other factors are also absorbed, resulting in lower alphas and higher t-stat.

Empirically, the results show that the currency risk is priced based on the significant statistical test for 3 countries namely, Malaysia, Thailand and Singapore at 1.2%, 2.2%, and 2.4% on a quarterly basis, which satisfy the hypothesis, except for Philippines and Vietnam. For the market risk, interestingly, even though the risk is significant in the time-series regression, the risk is not priced by Thailand after allowing beta to vary while the currency risk still show a significant exposure, which implies that the currency risk may be the hidden anomaly that drives the market return. Although the results are satisfactory, it cannot completely explain the stock return which requires further study to explore for other potential factors or models. The interesting finding from the return premium is that, the highest premium is observed for Singapore which has been suspected that it has contributed adverse effect from its exchange rate management. Despite its advanced market development and instrument, the drawback of policy design should consider this finding.

This study provides 3 contributions to the literatures. First, it provides the supporting evidence that currency risk plays a significant role in ASEAN market which was neglected in the asset pricing model in the major industrialised countries. Second, the study reveals the potential primary driver of market return especially for Singapore Thailand by showing that the

currency risk premium is statistically more important than the market risk premium, where further study is suggested to be conducted with longer investment horizon and other market anomalies. Third, the study adds more evidences of the importance of currency risk through varying beta testing approach which fulfils the gaps for several ASEAN countries that this effect has not been well studied.

The implication can be considered in 2 ways. First, the adoption of the hedging instrument as encouraged by each country has not effectively reduced the exposure of their domestic firms to the exchange rate volatility such as Singapore in this study which has the most advanced market and Thailand which should consider more on the effect of currency fluctuation on the stock return. Another one is the other way around that firms may use hedging instrument to gambler for the abnormal return which misuses the main purpose of hedging instrument.

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