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Exposure to the Chinese Yuan:

An analysis of United States and European sectors

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Abstract

This paper studies the exposure of United States and European sectors to the Chinese Yuan. The research is conducted by using the methodological framework of OLS and MLS regression analysis by segmenting the United States and the European market into 40 sectors and regressing multiple currency returns on their excess returns. The research is focused mainly on the Chinese Yuan. The empirical evidence for the OLS regression suggests that United States sector returns are generally exposed to a Chinese Yuan devaluation while the European sectors tend to gain from it. The research also concludes that the market portfolio tends to absorb much of the currency exposure when controlling for it. The significance of the exposure is thus reduced considerably for the United States, with European sectors being only moderately affected by the inclusion of the market portfolio. In addition to these findings, the paper does not find any systematic change in exposure when a trade pattern shift occurs.

Keywords: Currency Exposure, Chinese Yuan, Exchange Rate Regime, Sector Exposure, Trade Pattern, United States, Europe.

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1. Introduction

The purpose of this paper is to research how domestic United States and European sectors are exposed to currency exposure. According to financial theory, the change in exchange rates impacts the value of a corporation and thus a sector. Depending on the exchange rate characteristics, such as for example volatility, political stability or interest rate differentials, corporations face an exchange rate risk. The exchange rate risk is an uncertainty of whether the currency a corporation buys or sells in will appreciate or depreciate in the future. For most corporations, this risk arises due to a globalized economy and the flow of trade between countries. A big international corporation might have sales in multiple currencies and be affected by multiple currency fluctuations, depending on the flow of trade (export or import). While a corporation may have no foreign sales, they will still be affected by exchange rate risk if a competitor in the market has chosen to import goods or services and thus offering more competitive prices. Exchange rate exposure is even relevant if a corporation uses suppliers that buy their goods or services from foreign corporations, thus indirectly affecting the supplied corporation through a second order effect.

Our aim is to find out if the Chinese Yuan might have a significant effect on the value of United States and European sectors. To do this, we use equity portfolios for 40 sectors to measure the effect of exchange rate exposure, looking for a significant change in value for manufacturers, service providers and financial services. This is important because China has risen as a major player not only on the economic stage, but also on the political one. We also want to measure the effect of the Chinese Yuan unpegging itself, and if it manifests in currency exposure, as the trade thereafter also has increased in magnitude. Much of the literature done for currency exposure risk is done for developed markets such as Europe, U.S., Canada, U.K., Australia and Japan. These place an extended focus on the Dollar, Euro and Yen instead of the Yuan. We found little research that used the Yuan as a factor of exposure, and those doing so have analysed it regarding Chinese corporations. This may not be that surprising given that the Chinese Yuan has been pegged until 2005 and allegedly kept fluctuation from occurring during the financial crisis of 2008. However, we want to find the exposure between China and Europe, and between China and the U.S. in the period following the unpegging of the Yuan.

We consider that our research can help United States and European companies in these sectors hedging their exposure against the Chinese Yuan and Chinese operations. Although Chinese capital controls remain largely binding to current Chinese practices, an increased demand for derivatives such as offshore Yuan futures (USD/CNH) trading on the Hong Kong Stock Exchange and the CME group could contribute in mitigating Chinese Yuan exposure.

To address the topic of exchange rate exposure, we will be measuring it by using regression analysis of exchange rate returns on sector returns. The types of regression analyses used to derive the exposure coefficients include simple OLS regressions and MLS regressions with the independent variables being currency return and market return vectors. In addition to this we

test for multicollinearity. Throughout the research, we find that United States sector returns are in general exposed to a Chinese Yuan devaluation for the simple OLS model while the European returns tend to gain from it. The results from the MLS regression analysis experience a loss in significance because the market absorbs much of the exposure. The drop in the significance of the exposure is felt harder by the United States economy and to a lesser extent in the European one. Multicollinearity between the currency pairs tested against European sectors do suggest that including multiple currencies is inadequate.

This paper will start discussing the background and literature relevant to our topic in chapter 2 by displaying a model of the international financial system as well as previous research relating to international finance and currency exposure. Chapter 3 will place a focus on what makes the Chinese Yuan different and the relationship between China and the United States and between China and Europe. In chapter 4 we cover the data that is being used in chapter 5 where the methodological process is described. Finally, we analyse our empirical findings in chapter 6 and conclude them in chapter 7.

2. Background and Literature

2.1. Background

2.1.1. Currency Exposure

Foreign exchange risk exposure arises based on the fundamental principle that foreign currency exchange rate variations are random and unpredictable; that there are unanticipated changes in the exchange rates reflecting the equilibrium of exchange rate mechanics. In pure floating regimes, these mechanics should be determined by market equilibrium, but empirically, countries have either a managed floating currency regime with central bank interference (United States) or are pegged to a reserve currency (Hong Kong) or a basket of currencies (Singapore). The exchange rate risk is a risk that involves multinational corporations and businesses dealing with the import/export of goods and services and engaging in various foreign operations. Investors with investments in countries other than their home country also face this kind of risk. The foreign exchange risk exposure/currency risk exposure theory separates two main types of foreign exchange risks, the *accounting risk* and the *economic risk* exposure. The accounting risk exposure is measured by transaction exposure and translation exposure (Levi, 2005).

Transaction exposure is the change in the outstanding debt value that is obtained before the change in exchange rate variation and settled after the variation in exchange rates. This makes transaction exposure a measure of change in cash flows from the contractual debt incurred. Research of the emerging market currency crisis of the 1990s (Mishkin, 1999) analysed this type of exposure where currency devaluations of emerging markets resulted in higher contractual debt repayment obligation denominated in US dollars. Because many of these obligations could not be upheld, many institutions defaulted resulting into a full-fledged financial crisis encouraging speculative outflows in a self-reinforcing pattern. By early 1998, the currencies of Malaysia, Philippines, Korea and Thailand have fallen by over 30 percent and the Indonesian rupiah fell by over 75 percent.

Translation exposure is the change of the accounting value of an owner's equity as a result of owning subsidiary corporations in other countries. They will therefore need to convert their cash flows from their home currency to the parent corporation's currency for consolidated statements. If the cashflow is intended to be transferred back to the home country, this cashflow could experience translation currency exposure. Hagelin (2003) conducted an empirical study in the *transaction* and *translation* currency risk exposure field where the use of currency derivatives as hedging mechanism were examined. It was concluded that these two types of risks tend to affect firms differently. Firms hedging against transaction exposure have (i) high human capital investments, (ii) lower institutional ownership and (iii) high market-to-book ratios. No evidence was found in achieving value maximisation resulting from hedging translation risk, so a motive for this should be provided for engaging in this type of hedging.

The *economic risk* exposure is also called *operational exposure* or *strategic exposure* and is a measure of the difference in the present value of the firm resulting from the change in value of

cashflows again as a result of the change in exchange rates. This type of exposure often concerns the future cashflows and is going to vary contingent to the exchange rate variance associated with multinational competition. As businesses become more global, activities such as importing and exporting, and cross-border sourcing become practices that a firm should pay significant consideration towards. While exposure to inflation and interest rates have been analysed extensively¹, Jorion (1990) proceeded further into analysing the foreign exchange exposure of US multinationals using cross-sectional data. Companies were segmented by their foreign involvement and it was concluded that the exposure is positively and significantly correlated with the degree of foreign involvement.

2.2. A Survey of Exchange Rate Models and Relationships

2.2.1. Exchange Rate Regimes

Most countries fall on the spectrum between free floating and pegged regimes. When a country adopts an exchange rate regime and monetary policy, it must evaluate different types of trade-offs. Based on the uncovered interest rate hypothesis and empirical studies, the “Impossibility Trilemma” states that a country can only adopt a policy between the following alternatives: *full capital controls* comprised of a fixed exchange rate and an independent monetary policy (ex. China), a *pegged regime* comprised of free capital mobility and a fixed exchange rate (ex. Hong Kong) and a *managed float* comprised of free capital mobility and an independent monetary policy (ex. United States, Europe and Japan) (Obstfeld, Shambaugh and Taylor, 2010). The relationship is illustrated in Fig.1.

Figure 1: The Impossibility Trilemma

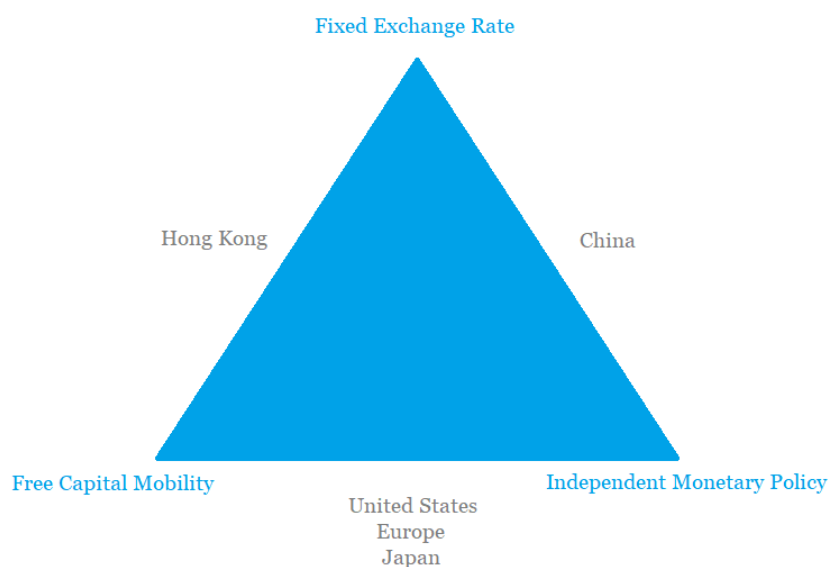


Illustration of the “Impossibility Trilemma” and the implications of monetary balance.

¹ See for example Bernard (1986) and Sweeney and Warga (1986)

2.2.2. Exchange Rate Mechanics under Free Capital Mobility

Exchange rates are part of the international monetary system which provides financial institutions, investors and corporations with a way of exchanging their home currency for another currency. In the post-war international monetary system, two international institutions were established for the supervision of reliable lending and investing in foreign countries, the International Monetary Fund and the World Bank. These replaced the existing private financial intuitions. The monetary systems themselves have changed over time, from the gold standard, Bretton Woods system/gold exchange standard and its breakdown in 1971. A detailed timeline of the Exchange rate evolution is summarized in table 1.

Table 1: The Evolution of the Monetary System in the Developed Market

Time	Exchange Rate Era	Cross-Border Political Economy	Implication	Practice
1860 - 1914	The Gold Standard	Growing openness in trade, with growing, but limited capital mobility	Trade dominates the capital in total influence of exchange rates	Pegging to Gold \$20/ounce of gold £4/ounce of gold Implied Rate: \$5/£
1914 - 1945	The Inter-War Years	Protectionism and Isolation	Rising barriers to the movement of both trade and Capital	Increased fluctuations made only the dollar convertible.
1945 - 1971	The Bretton Woods Era	Rising barriers in the movement of trade and capital	Era dominated by capital, ends with capital flows	Under Bretton Woods only the dollar remained convertible at \$35/ounce of gold.
1971 - 1997	The Floating Era	Developed nations open and emerging states restricted capital flows to maintain economic control	Capital flows dominate trade; emerging nations suffer devaluation	Overhang of dollars and removal of the Gold Standard in 1971 under Nixon. Free floating Currencies
1997 – present	The Emerging Era	More and more emerging nations open their markets to capital and increased independence	Capital flows increasingly drive economic growth and health	Embracement of several major emerging market currencies – beginning with the Chinese Yuan

Source: Eiteman, D., Stonehill, A. and Moffett, M. (2016). *Multinational business finance*. 14th ed

The exchange rate is a supply/demand driven price of one currency relative to another currency and is quoted in the spot market, with the deliverance happening during a short timeframe. The

forward exchange rate is designed as a contract where the parties agree on exchanging currencies at a future date based on a pre-specified price. In the foreign exchange markets, we often observe currencies being quoted in two different ways; the direct quotation and the indirect quotation. By quoting the currencies in the direct quotation way, we find the price of one foreign currency unit by paying in units of a home currency:

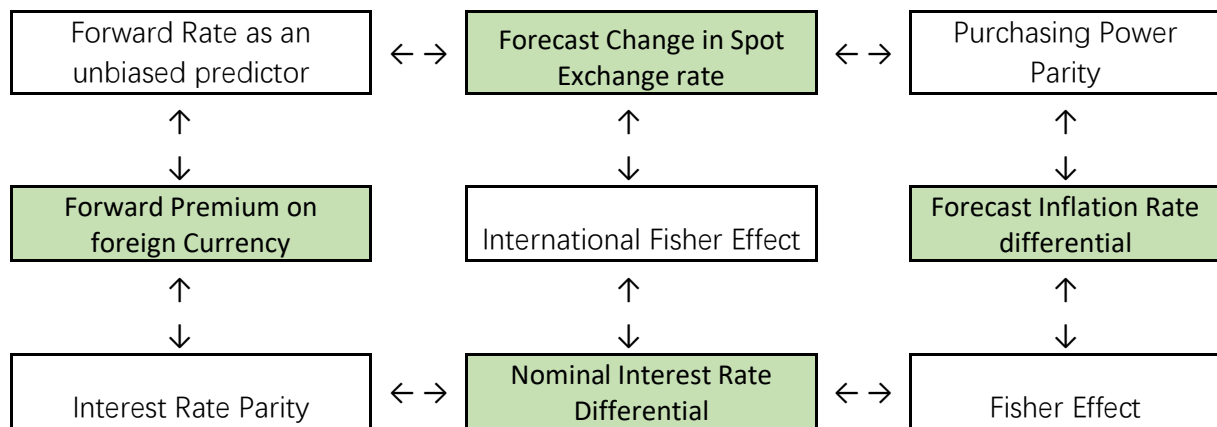
$$\frac{\text{Home Currency (HC)}}{\text{Foreign Currency(FC)}} \quad (1)$$

or in a text-based convention HC/FC. The opposite is true for the indirect way of quoting currencies where we get the home currency unit price by paying using an amount of foreign currency and is given FC/HC. For most trading centres and currency exchange markets, the usual quotation method is direct quotes for all currencies, except for the Euro and the British pound which are quoted in indirect terms. The currency going in the nominator and denominator depends on the view of the investor. Throughout our analysis we will use the direct method with the US dollar (USD) for US sectors and the Euro (EUR) for European sectors as our home currencies. Foreign currencies used in our analysis are the Chinese Yuan (CNY) and Japanese Yen (JPY). When we talk about the USDCNY pair, it is through the left to right convention or direct way, meaning one USD buys “X” units of the Chinese currency; it takes “X” units of the Chinese Yuan to buy a US dollar (Eiteman, Stonehill and Moffett, 2016).

Even though we have defined the exchange rate price as a function of the international currency market supply and demand, there are some variables interacting with these exchange rates. Inflation and interest rates are key variables affecting the value of exchange rates. We expect the home currency of a country to appreciate if it has a low level of inflation, assuming the country in question has a lower level of inflation relative to the other country. The inflation rate is also highly correlated to the interest rates, meaning that a higher inflation will lead to a higher interest rate, as investors ask for higher returns.

Exchange rate literature encompasses many determinants of exchange rates. Within this we have the law of one price, purchasing power parity (PPP), interest rate parity (IRP), the Fisher effect and international Fisher effect. Fig. 2. illustrates the holistic relationship between how exchange rate mechanics interact under a free-floating currency regime.

Figure 2: Holistic relationship of Exchange Rate Mechanics



Different factors affecting exchange rates at the same time. Source: Eiteman, D., Stonehill, A. and Moffett, M. (2016). Multinational business finance. 14th ed

2.2.3 Purchasing Power Parity (PPP)

The law of one price dictates the fact that if two currencies/commodities are traded across multiple markets they should be priced the same in all markets, if the market is efficient and arbitrage free. Purchasing Power Parity (PPP) theory suggests that two exchange rates being compared should equal the ratio of a fixed basket of goods and services and its price level. If two countries have the same price level, following PPP we can say that the exchange rates are in equilibrium, and based on the law of one price. This means that as the domestic prices increase, the exchange rate must depreciate in order to reach parity in purchasing power. This isn't the only version of PPP, as there is also the relative PPP which states that appreciation is the difference in inflation of the base country and foreign country.

$$\frac{S(e_{t+1})}{S(e_t)} = \frac{E(\pi_f)}{E(\pi_h)} \quad (2)$$

It follows that we are isolating the percentage change in the spot by:

$$\frac{E[S(e_{t+1})] - S(e_t)}{S(e_t)} = \frac{[1 + E(\pi_f)] - [1 + E(\pi_h)]}{[1 + E(\pi_h)]} \quad (3)$$

Which gives us the approximation:

$$\frac{E[S(e_{t+1})] - S(e_t)}{S(e_t)} = [1 + E(\pi_f)] - [1 + E(\pi_h)] = E(\pi_f) - E(\pi_h) \quad (4)$$

Where:

$[E[S(e_{t+1})]]$ is the expected spot price of foreign currency per home currency

$S(e_t)$ is the spot price of foreign currency per home currency

$E(\pi_h)$ is the expected home currency inflation and;

$E(\pi_f)$ is the expected foreign currency inflation

2.2.4 Fisher Effect

The Fisher effect decomposes the nominal interest rate into a real return component and an inflationary component by:

$$i_h = r_h + \pi_h \quad (5)$$

Where for the home country:

i_h is the nominal interest rate component

r_h is the real return or interest rate component and;

π_h is the inflation component

This shows the correlation between inflation and interest rates, as inflation increases, so should interest rates.

2.2.5 The International Fisher Effect

The international Fisher effect is an extension of the domestic interest rate relationship of the international currency markets.

$$\frac{E[S(e_{t+1})] - S(e_t)}{S(e_t)} = \frac{[(1 + i_f) - (1 + i_h)]}{(1 + i_h)} = \frac{i_f - i_h}{(1 + i_h)} \quad (6)$$

Where:

$[E[S(e_{t+1})]]$ is the expected spot price of foreign currency per home currency

$S(e_t)$ is the spot price of foreign currency per home currency

i_h is the nominal interest rate component

Now if capital seeks higher rates of returns r or real interest rates, participants will engage in the carry trade resulting in the rates of returns between the currencies to be equated since investors are seeking the highest return ($r_h = r_f$). By decomposing $i_h = r_h + \pi_h$ and $i_f = r_f + \pi_f$ and assuming the rates of the exchange rate being equated following no arbitrage, the above formula can be written as:

$$\frac{E[S(e_{t+1})] - S(e_t)}{S(e_t)} = \pi_f - \pi_h \quad (7)$$

Where:

π_h is the home inflation component

π_f is the foreign inflation component

The difference between the international Fisher Effect and the PPP being that the PPP is ex post (expected inflation) and the international Fisher Effect being ex ante.

2.2.5 Interest Rate Parity

The interest rate parity results from the covered interest rate arbitrage where an investor will exchange the home currency for a foreign currency in the spot market and buy/sell a forward contract to lock in a future exchange rate in order to convert it back into the home currency. Assuming there are no arbitrage opportunities in the market we get the equation:

$$\frac{F_t(e_{t+1})}{S(e_t)} = \frac{(1 + i_f)}{(1 + i_h)} \quad (8)$$

Followed up by:

$$\frac{F_t(e_{t+1}) - S(e_t)}{S(e_t)} = \frac{(i_f + i_h)}{(1 + i_h)} \quad (9)$$

Where:

$F_t(e_{t+1})$ is the forward rate of foreign currency per home currency

$S(e_t)$ is the spot price of foreign currency per home currency

i_h is the nominal interest rate component of the home currency

i_f is the nominal interest rate component of the foreign currency

2.2.5.1 Forward rate as an unbiased predictor

The forward rate as an unbiased predictor links both the forward rate with the future expected spot rate and must satisfy the regression:

$$S(e_{t+1}) - S(e_t) = \alpha + \beta[F_t(e_{t+1}) - S(e_t)] + \epsilon \quad (10)$$

For H_a :

$$\alpha = 0$$

$$\beta = 1 \text{ and};$$

$$\epsilon \sim N(0,1)$$

Where:

$F_t(e_{t+1})$ is the forward rate of foreign currency per home currency

$S(e_{t+1})$ is the actual spot price of foreign currency per home currency at time $t+1$

$S(e_t)$ is the spot price of foreign currency per home currency

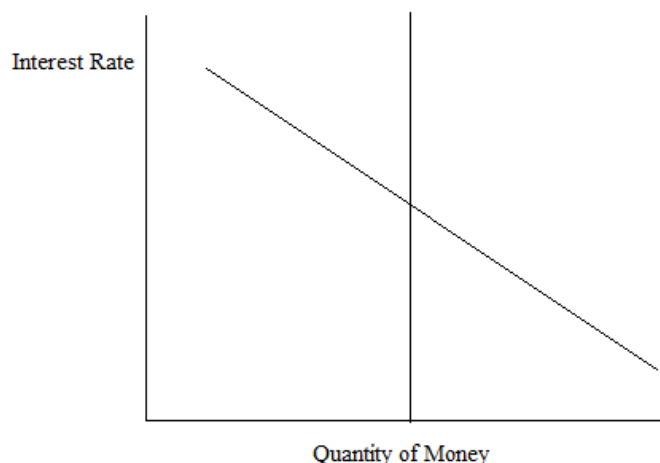
If the H_a holds, the assumption for forward rates as an unbiased predictor holds, if it is rejected it doesn't. Although there is no consensus of rejection of the null hypothesis, some empirical research suggests that the slope coefficient of the OLS regression to be biased and inconsistent, thereby rejecting the null hypothesis. ²

2.2.6 Monetary Interference

Central banks often participate in markets to ensure the stability of the financial system. We have previously stated that **inflation** and **interest rates** are key inputs in defining exchange rate movements. Because exchange rates are relative to each other, we must look at both countries monetary policies. Central banks have a variety of tools in their arsenal to ensure market stability.

² (Yangru and Hua, 1997)

Figure 3: Supply and Demand of Money



Consider Fig. 3. depicting the supply and demand for money. On the x -axis we have the quantity of money and on the y-axis, we have the price of money or interest rate. The supply curve is a vertical line consisting of the supply of money in existence. Although there are different measures of money, we will focus on the **M2** measure of money defined as:

M2 Components

Currency (MB)

+Travelers checks

+Demand Deposits

+Other Checkable Deposits

+Small-Denomination Time Deposits

+Saving Deposits and money market deposit accounts

+Money market mutual fund shares

Money has the property of being a *Medium of Exchange* by removing the “Double Coincidence of Wants” and promoting specialisation, a *Unit of Account* by measuring economic value and a *Store of Value* by saving purchasing power over time and providing liquidity.

The demand curve is downwards sloping and at the intersection with the vertical money supply curve, the equilibrium interest rate is given. The movement of the money supply line is correlated with the money creation process at the central bank, with the supply curve shifting to the right for monetary expansion and shifting to the left for monetary contraction. The money demand is caused to shift to the right by inflation as the demand for money increases with higher price levels. This is in line with the previously discussed Fisher Effect where an increase in inflation causes the nominal interest rate to increase as well. In addition to a price level increase, economic growth or development will also increase the demand for money due to more goods and services being produced. The central bank has a set of tools including expanding the *money supply*, *selling and buying foreign reserves*, setting the *required reserve ratio* for member banks and engaging in *open market activities* in order to achieve a target level of inflation and interest rates.

2.2.7 Fiscal Interference

When talking about exchange rates, the balance of payments is also important, as it records the international transactions over three accounts. The balance of payment is a bookkeeping system for international trade, where a deposit from a foreign country is entered as credit and payment to a foreign country entered as debit. This means export is a credit entry and imports are a debit entry. The three accounts are described as follows:

The current account keeps track of the trade in goods, services, and primary and secondary income between countries. When measuring trade in goods, their value is based on “free on board” and “cost-insurance freight” for both exports and imports. Trade in services is trickier, as each service has its own definition, i.e. travel services recorded in credit is for foreign visitors spending money in the home territory, and the debit side is for home nationals spending money in the foreign territory. Travel services is an account for travellers who stay in the relevant territory for more than a year. Transportation services are defined as the movement of people across borders. The travel services therefore include only goods bought by foreign nationals, and transport services is a measure for how much they travel across borders. Primary income measures the movement of money for workers and people traveling across borders. It measures the movement of the salary earned on foreign territory, on investments in foreign investing assets and on rent, taxes, or other primary income. The secondary income measure are monetary transfers that cannot be classified as capital movement such as insurance premiums, government social programs etc.

The capital account measures monetary transactions between a country and the rest of the world. This account is split into direct investment, portfolio investment and other investments. The direct investment account is money being invested across national borders, the portfolio account is investments in foreign stocks and bonds and other services include deposits, currency investments etc.

The reserves account is officially tracked assets such as foreign currencies, Special Drawing Rights (SDR) and gold. These accounts, due to the principles of double-entry bookkeeping will have opposite values in all cases, as all payments must equal all receipts. The Balance of Payments (BOP) is a useful account to read information from when we are talking about currencies, as it can tell us something about the current supply/demand for a currency. If a country has a BOP deficit (Imports > Exports), we could infer that there is excess demand for the foreign currency. In other words, a BOP deficit would mean the country’s currency would depreciate and a surplus would lead to an appreciation of the same currency.

Standard economic theory of supply and demand suggests that if a home currency appreciates relative to a foreign currency, home import demand increases while home export demand decreases. As the home import demand increases, more goods are being imported to the home country which results in the selling of the home currency to simultaneously buy the foreign

currency. As this happens, the home currency will depreciate to the levels before the appreciation, *ceteris paribus*.

Assuming a perfect elastic relationship between currency movements and import quantity, goods prices remaining unchanged and a change in quantity equalling 1 for all movements, we get the following chain of events:

Situation 1: $e_{\uparrow} \rightarrow X_0$ and $M_{\uparrow} \rightarrow e_{\downarrow} \Rightarrow e_0$

Situation 2: $e_{\uparrow} \rightarrow X_{\downarrow}$ and $M_0 \rightarrow e_{\downarrow} \Rightarrow e_0$

Situation 3: $e_{\downarrow} \rightarrow X_{\uparrow}$ and $M_0 \rightarrow e_{\uparrow} \Rightarrow e_0$

Situation 4: $e_{\downarrow} \rightarrow X_0$ and $M_{\downarrow} \rightarrow e_{\uparrow} \Rightarrow e_0$

With e representing the base currency (for e.g. USDCNY based on the left to right convention, USD appreciation relative to the Yuan), X the base currency export quantity and M the base currency import quantity. For the subscripts, \uparrow implies the appreciation of the base currency/increase in quantity, \downarrow the depreciation of base currency/decrease in quantity, 0 no change and \Rightarrow the net effect from before the first appreciation/depreciation.

2.3 A Survey of Exchange Rate Exposure Literature

There are several empirical studies trying to determine the exchange rate exposure, however most of them have done so by looking at firm level returns. For sector analysis, the firms are grouped together and then compared in a panel data format. Looking at currency exposure not pertinent to the United States, we find differing results. For Europe, there has been a documented exchange rate exposure for different member countries according to Bertram (2004), Nydahl (1999) and El-Masry, et. al. (2007). They all find that exchange rate exposure is present to a higher degree in European firms (usually 20% of firms for both Germany and Sweden and 26% of firms for UK), however less because of an effect of currency movements and more because of other exchange rate exposure determinants (ratios based on leverage, foreign sales, etc.). After the introduction of the Euro, Bartram & Karolyi (2006) document that there has been a reduction of the market risk exposure of firms not only in Europe, but also for firms outside Europe, given that they had sales or assets in any European country. Moreover, research has been conducted on currency exposure in Asia, done by He and Ng (1998), Du, et. al. (2014), Zhao (2014) and Aggarwal, et. al. (2011). While He and Ng (1998) find similar results for Japan using multiple bilateral exchange rates in an index, they found that up to 50 % of multinational corporations to have significant exposure depending on the time period. Du, et. al (2014) find that Taiwan has a lower currency exposure significance and argues that this is an effect of the currency exposure puzzle for developing markets. The empirical findings from Aggarwal, et. al. (2011) and from Chen, et. al. (2015) who tested for dynamic exchange rate exposure seem to support this argument for OLS measured exposure but find higher exposure when using a dynamic model. The results for currency exposure of Chinese firms is also at a lower level than that of European and United States firms.

Exchange rate exposure is usually measured by using two different methods, either through the movement of corporate cash flows or through the change in the stock price. The initial research on exposure that focused on cash flows was done by Flood and Lessard (1986), Hodder (1982), Shapiro (1975) and Martin and Laurence (2003) by modeling the cash flows of firms. However, this is harder to do because the cash flow of a firm is more difficult to come by according to Bodnar and Wong (2003). As an alternative to cash flow modeling, Adler & Dumas (1984) pointed out that using firm value as an approximation of cash flows works as well, since the firm value is simply the sum of expected future cash flows. This means that currency exposure can be measured from the movement of firm values. Exchange rate exposure is therefore a measurement of the effect of exchange rate variations on the market value of a corporation. This approach allows for testing exchange rates on equity portfolios as done by Jorion (1990), followed by Allayannis (1997) and Bodnar and Gentry (1993). Exchange rate exposure can therefore be measure on a broader scale than only at a firm level.

Prior research found bilateral currency movements and currency indices movements to be less determinant of currency exposure than other factors. He and Ng (1998) found ratios based on export levels and proxies for hedging ratios (mainly based on debt ratios and liquidity ratios) to be more determinant. Bodnar and Gentry (1993) also used an export ratio coefficient and found it to support exchange rate to influence returns (appreciation of dollar lead to a reduction in firm value). Allayannis (1996) studied currency exposure and used a trade ratio (export and import on total sales) as a determinant. Most of the results from these tests gave the same answer; export shares and other ratios were important in determining currency exchange exposure. This was however mainly done for currency exposure on the firm level, and not sector portfolio levels. The analysis for portfolios is done using ratios like exports to GDP shown by Bodnar & Gentry (1993), or exports/imports divided on total shipments as an approximation to total sales by Priestly and Ødegaard (2004). Bartram (2007) also proved market capitalization to be a determinant, where larger capitalization meant more significant exposure.

The literature background traces back to Adler and Dumas (1983) where they argue that even firms with no foreign operations, i.e. not exposed to the operational risk specifics covered in chapter 2, are generally exposed to foreign currency risks. They show that foreign currency exposure can be measured by regressing the exchange rate returns on the portfolio returns. The argument presented in the paper is that instruments used for hedging in practice have contractually fixed maturity dates, so neutralising the exposure is limited by a time interval. In addition to the currency exposure, a firm's own future cash flow faces uncertainty, so exposure could be further magnified. A solution to this issue has been emphasized in the form of decomposing the foreign exchange rate into regression coefficients by splitting them into two components, an exposure component who can virtually be hedged and a non-exposure component with random characteristics.

While the regression exposure coefficient offers a comprehensive measure of the sensitivity to an exchange rate, other variables such as inflation and interest rates also affect market portfolio

returns and exchange rates. This issue is acknowledged by Blanchard, et. al., (1984) where they state that exposure might reveal a simultaneous impact of monetary factors on both exchange rates and stock portfolio returns. Jorion (1990) presents in the article “The Exchange Rate-Exposure of U.S. Multinationals” the methodological regression approach we are going to use throughout our thesis, but with minor deviations. He argues that returns should be regressed on a basket of currencies like for e.g. the IMF’s Multilateral exchange Rate Model (MERM) consisting of 15 currencies. Moreover, in our methodology we only use three specific currencies.

Priestly and Ødegaard (2007) argue that specific coefficients could be biased due to an omitted variable problem. In addition to this issue, an additional problem arises when adding the market portfolio to the regression analysis. If one sector has the same exposure as the market portfolio to the currencies in question, the conclusion would be that that sector would have a currency exposure of zero. It is further expressed in Priestley’s and Ødegaard’s methodology that both portfolio and market returns should be orthogonalized, as opposed to just portfolio returns, methodologically employed in the case of Jorion (1990). Later empirical findings conducted by Liu, et. al., (2015) argue that orthogonalizing the market return on the exchange rate as done in the case of Jorion could in fact lead to flawed inference. When both portfolio and market returns are orthogonalized the process does not help nor harm the results.

3. What makes the Chinese Yuan Different?

The foreign currency exposure component affecting firms has lately occupied a central stage in the discussion of trading between countries, especially considering the emerging trade war between the United States and China. Developments in the geopolitical sphere indicate a political shift towards nationalization with the imposition of new trade barriers that could further impact United States and European industries (Stiglitz, 2018). With much of the empirical research directed towards studying relationships by segmenting industries by their size, value and profitability (Fama and French, 1993), it is important to shed a light on how United States and European sectors are exposed to the currencies of major trading partners such as China.

The United States, the European Union and China rank amongst both the three largest exporting and importing jurisdictions in the world (Cia.gov., 2019). Furthermore, tensions have been building up following the imposition of trade tariffs on China caused by alleged unfair trade practices. So far, the United States has imposed tariffs on \$250 billion worth of Chinese goods with the intention of imposing \$267 billion more. China, in response to this, has set tariffs on \$110 billion worth of American goods (Wong and Koty, 2019).

According to the CME group, the popularity of the Chinese Yuan future contracts has surged since the middle of 2018, with open interest increasing by 490 percent (CME Group, 2019). While there are capital control measures in place for the onshore Yuan (CNY), the offshore Yuan (CNH) is more accessible to foreign participants. Research in the price discovery field concluded that there is an absence in price discovery between the onshore (CNY) and the offshore Chinese Yuan (CNH). It was further stated that there is a presence of price discovery between the onshore Yuan and offshore Yuan non-deliverable forward rates (NDF), with these rates acting as futures on the underlying onshore spot rate. This means that much of the exposure could be mitigated with the help of futures (Ding, Tse and Williams, 2012). Fig. 4 illustrates the price of onshore (CNY) and offshore (CNH) Chinese Yuan in terms US dollars (USD). While there are price discrepancies present in our time series, the rates have an almost perfect correlation with no observable major deviations.

Figure 4: Exchange rate movements between the U.S. Dollar and the chinese yuan (offshore and onshore)



Onshore (CNY) and offshore (CNH) price of one US dollar for the period 2010 to 2019, based on monthly frequency of their prices. Source: Reuters DataStream

3.1 Brief History of the Chinese Yuan since the 70s

After its economic reform in the 70s, the exchange rate policy of China was officially linked to a basket of currencies. The regime was based on the social policies of the Soviet Union and ran under a centrally planned economy which held the CNY fixed. In the late 1970s, China decided to reform the way it handled its exchange rate due to increased importance in the context of global trade and capital flows across borders.

During the 80s, China established a branch under the Bank of China to manage exchange rates and established a dual-exchange-rate-system.³ This meant that there was an official rate for non-trading transactions, and an internal settlement rate for China's current account transactions. This was changed in 1985, where the internal settlement rate was discontinued in favour of the official settlement rate after the IMF criticized China's practices (at 2.8 CNY to one US dollar). As the introduction of the special economic zones took place, China went back to a dual exchange rate system in 1986, allowing the trade between foreign enterprises and Chinese enterprises in these special economic zones. This was done through Foreign Exchange Adjustment Centres (FEACs) which allowed the trade of foreign exchange between the centres themselves. This attempt was directed towards spurring foreign direct investment growth. Furthermore, it led to the development of a market outside the officially set central plan, providing market-based exchange rates in contrast to the officially set exchange rate (set to 5.7

³ (Huang & Wang, 2004).

CNY to the dollar). In addition, the markets were somewhat incomplete in the early 1990s and combined with imperfect mechanics and a rise in economic activity, they lead to the FEAC rate being nearly double that of the officially set exchange rate, which remained largely unchanged. This was met with calls for the reforming of the structure of the Chinese exchange rate system.

The new exchange rate regime was a managed float regime under a narrow band, implying a single rate for all foreign transactions at the FEAC level and allowing for an adjustment of $\pm 0.25\%$ from the previous days reference rate. Additionally, China created a new trading system in Shanghai called the Foreign Exchange Trading System and established along with it the Shanghai interbank foreign exchange rate. Under this regime, the CNY began appreciating, which operated against the governments intentions as it threatened their export economy. Because the Asian financial crisis also impacted China, the country introduced a stricter band compared to the previous reference. The exchange rate didn't move particularly much until the new managed float exchange rate regime was introduced in 2005.

The exchange rate policy of 2005 was announced to move away from the dollar peg, in the direction of a currency basket. This is the starting point for our regression analysis.

3.2 The Relationship between the United States and China

Considering Table 1 on page 11, striking similarities can be observed between current affairs and the Bretton Woods Era with a shift tending to move towards contraction in the direction of nationalism. While the US dollar is not tied to gold anymore, as in the pre-1971 era, it continues to predominate as the world reserve currency. Data from the IMF shows that the US dollar accounted for 61.69 percent of the worlds official exchange reserve composition by the end of 2018, having decreased from 71.13 percent by the end on the 2000's. Compared to this development, the Euro accounted for 20.69 percent of official foreign exchange reserves by the end of 2018 and the Chinese Yuan for only 1.89 percent (IMF, 2019).

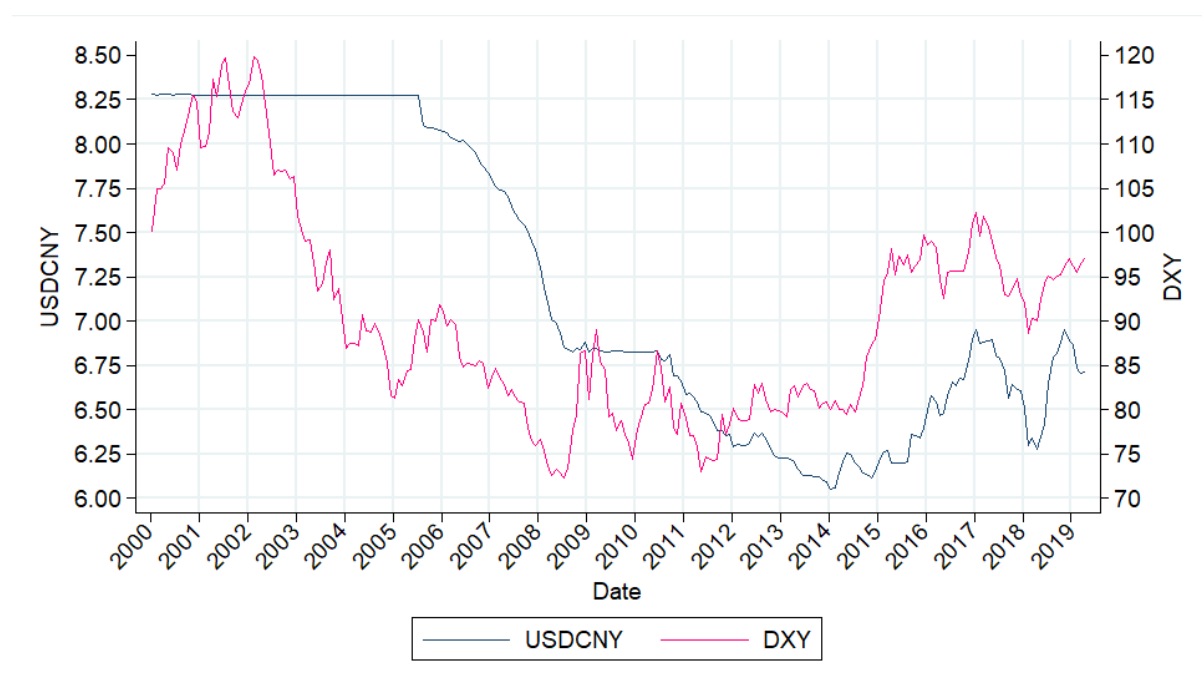
Fig. 5 depicts the exchange rate between the United States and China between January 2000 and April 2019. Until July 2005, the Chinese Yuan was pegged at around 8.28 Chinese Yuan to the dollar and appreciated to 6.84 to the dollar until September 2008 when it changed its regime back to a pegged regime from a managed float. The reason for the re-pegging had to do with the financial crisis started by the housing bubble of 2008, where the PBoC blocked the further appreciation of the Chinese Yuan due to a shrinking trade deficit of the United States, presented in Fig. 6 (Robb, G. 2010). On June 19, 2010 the PBoC removed the peg again issuing the following statement:

On June 19, in view of the recent economic situation and financial market developments at home and abroad and the balance of payments situation in China, the People's Bank of China decide to proceed further with reform of the RMB exchange rate regime and to enhance the RMB exchange rate flexibility. In furthering reform of the RMB

exchange rate regime, continued emphasis would be placed to reflecting market supply and demand with reference to a basket of currencies. The exchange rate floating band will remain the same as previously announced in the inter-bank foreign exchange market.⁴

Following this development, the Yuan continued to appreciate to 6.05 Chinese Yuan to the dollar by mid-January 2014 and since then it has reversed its trend by depreciating to 6.71 Yuan to the dollar by mid-April 2019, all while the trade deficit between the two countries continued to increase. Furthermore, considering Fig. 5, the Dollar Index (DXY) measuring the strength of the dollar with its major trading partners (Euro, Japanese Yen, Pound Sterling, Canadian Dollar, Swedish Krona and Swiss Franc), we see that not only the dollar appreciated relative to the Chinese Yuan, but also against its major trading partners. It is unclear if the increasing deficit can be sustained despite an appreciating dollar and how the currency exposure, especially the one to the Chinese Yuan will impact domestic sectors.

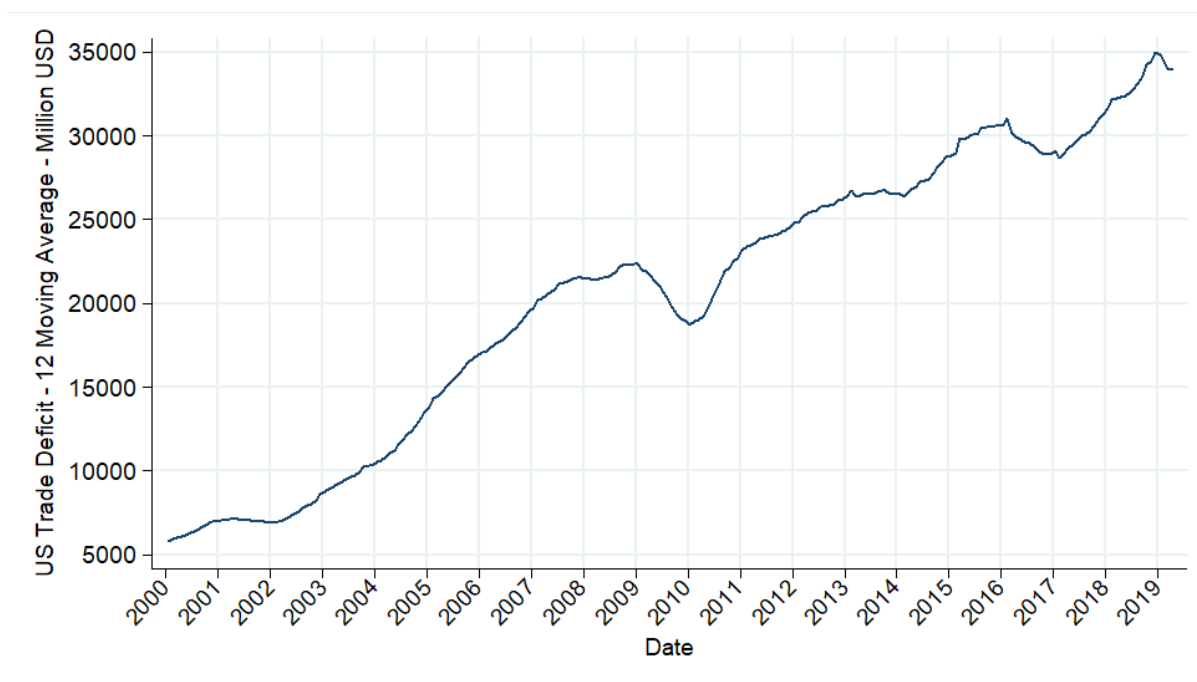
Figure 5: Price movement of USD/CNY and the dollar index (DXY)



This table shows the price movement of the bilateral exchange rate USDCNY and the dollar index DXY over the period January 2000 to April 2019, based on monthly frequencies. Data Source: Reuters DataStream.

⁴ PBoC. (2010).

Figure 6: Cumulative trade balance between U.S. and China



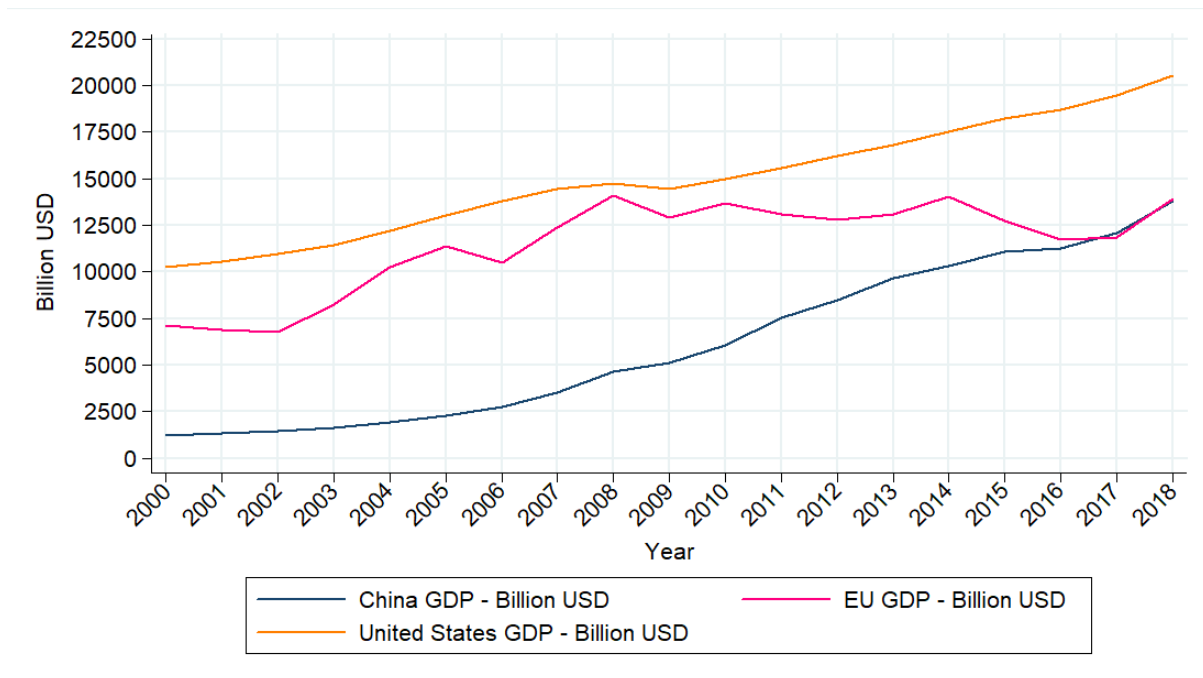
Cumulative US Trade Deficit with China, calculated as Imports minus Exports, values in USD Million, 12 period Moving Average, monthly frequency over the period February 2000 to April 2019. Data Source: Reuters DataStream.

3.3 The Relationship between Europe and China

The Integrated European Economic Model, considering the member countries adopting the Euro as their national currency can be somewhat compared to the United States model, however, there is one major difference or flaw built into the system. While the United States has only one Treasury and Central Bank, the European Monetary Union (EMU) has one Central Bank but many treasuries issuing bonds for each country. This implies a heterogeneity in the borrowing cost of each member countries with bond yields usually varying between the countries located at the centre of the EMU (e.g. Germany and France) and countries at the periphery (e.g. Italy and Greece) (IWM, 2019).

Fig. 7. down below illustrates the yearly GDP value for the United States, Europe and China between 2000 and 2019. After the financial crisis of 2008 we see that the European GDP became stagnant and lacking growth while the United States and Chinese GDPs have an appreciating trend. By the end of 2017, The Chinese GDP denominated in US dollars had surpassed the European one with China becoming the second largest economy in the world. It is still to be seen if further growth can be stimulated in the European union, considering the ECB's arsenal being limited due to already negative interest rates.

Figure 7: GDP of China, Europe, & U.S.



GDP growth of Europe, U.S. & China for February 2000 to December 2018. Values in billions USD. Data Source: Reuters DataStream.

The Chinese Yuan and the Euro price movement follow the same general trend as the United States dollar. After China released their currency, it started depreciating the following years before appreciating until 2008. After 2008 it experienced a sharp drop, probably as an effect of the global economic crisis, before recovering again to another peak in 2010. After 2010 the Yuan has depreciated against the euro with local peaks, reaching a bottom in 2015. Unlike the USD, the Euro exchange rate didn't flatten out during the 2008 financial crisis and inhibits a more volatile walk over the time period.

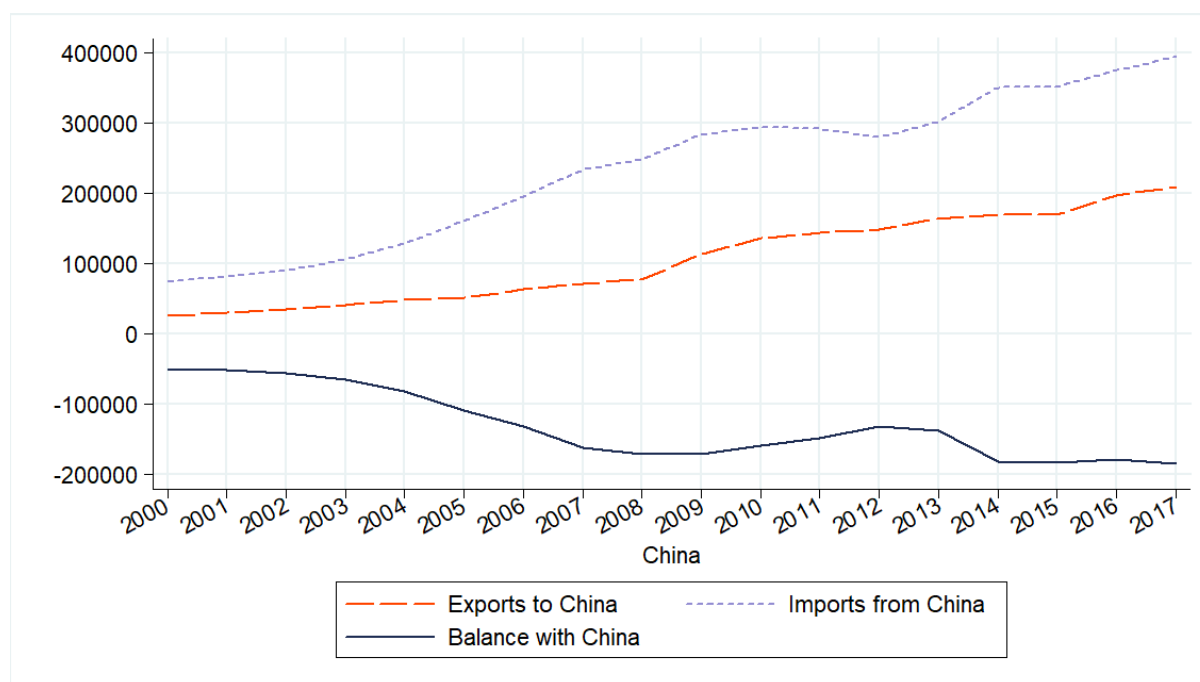
Figure 8: EUR/CNY - Euro to Chinese Yuan Price Movement



The price movement of the bilateral exchange rate EUR/CNY over the period January 2005 – April 2019. Based on monthly exchange rates. Source: Thomson Reuters DataStream

The trade between Europe and China has steadily increased ever since 2000 (see Fig. 9), with imports always being above exports. The imports increased at a greater rate after 2003 until 2009 where it stagnated for four years. After 2014 the imports began to pick up pace again growing at a stable rate. Export between China and Europe increased at a steady pace until 2008, where the financial crisis worsened the condition in Europe. At this point, the Euro depreciated against the Chinese Yuan, and the exports also jumped up in value. This trend continued until 2011, where the growth started to mellow out and stabilize after 2015. The trade balance between China and Europe has decreased over the time period of our analysis starting from the year 2005. The trade balance only decreased after 2019 when exports picked up, for a period of 3 years. Since this it has been staying stable thanks to imports and exports growing at a similar rate. It was not until 2014 that Europe and China had a way to trade currencies directly without using the US dollar as a proxy (WSJ, 2014).

Figure 9: Trade Accounts Between Europe and China in Millions of Euro, Exports, Imports, and Trade Balance



European and Chinese trade measured in billions of Euros for the period January 2000 to December 2018. Based on yearly trade balance. Export and Import are both measured in positive values, trade balance is defined as Exports – Import. A positive trade balance implies net export, a negative trade balance implies net import between Europe and China. Source: Eurostat

4. Data

Most countries issue their own currency and these currencies are traded in the global foreign exchange market marking them inherently volatile. Currencies are traded in pairs, for example USDCNY as presented in Fig. 5 and EURCNY as presented in Fig. 8. They are a direct link between two economies. Buying a currency implies the simultaneous sale of the other and vice-versa. The economies can be broken down into different sectors that have their own degree of exposure to different currencies based on competition and input factors, with imports often being a major component of these inputs. For our data we used monthly observations. The reason for doing so has to do with capturing real volatility and reducing noise. For daily observations for instance, movements might only be explained by random fluctuations. This is why we use monthly frequencies in our analysis.

4.1 Industry Portfolio Excess Returns

Our data collection process starts by breaking down economies based on sectors from equity portfolios. For our analysis of the United States and Europe we have collected data for 40 sectors constituted at the fourth level of DataStream indices following the Industry Classification Benchmark (ICB) taxonomy ⁵. The data for these indices comes in a monthly frequency format and the chosen time period to measure the exposure is from January 2005 until April 2019. This is because currency fluctuations for the official Chinese Yuan were only observed after the de-pegging in 2005. In addition to this, the data accounts for dividends, being the total return index; implying that these dividends were reinvested in the same index. In our methodological analysis, these indices will be the dependent variable such that the currency exposure will be inferred on them. In addition to this, the returns are excess returns, having removed the monthly risk-free rate from them, described in further detail in the under 4.3. Presented in Table 2 and Table 3 are the summary outputs for these returns for the United States and European portfolios respectively.

Table 2: Summary Statistics of the excess returns of US sector portfolios:

US Sectors	Mean (%)	Volatility (%)	Min (%)	Max (%)
Oil and Gas Production	0.70	6.31	-17.63	16.03
Oil Services Distribution	0.65	7.48	-28.17	19.83
Alternative Energy	1.68	16.94	-40.27	70.70
Chemicals	0.96	6.56	-23.14	27.81
Forestry and paper	0.96	10.90	-39.62	74.27
Industrial Metal and Mines	0.72	10.55	-37.53	38.55
Mining	0.54	10.25	-34.96	28.79
Construction and Materials	0.80	7.03	-28.68	21.90

⁵ The definitions of what counts as industry, sector, & subsector classifications can be found in the ICB rulebook, published by FTSE Russell (2019)

Aero Defense	1.16	5.71	-22.13	17.65
General Industrials	0.45	6.62	-25.13	23.60
Electronic and Electrical Equipment	0.90	6.45	-22.53	20.07
Industrial Engineering	1.05	7.80	-26.83	25.30
Industrial Transportation	1.02	6.11	-17.08	17.82
Support Services	0.93	4.64	-16.18	12.70
Auto and Parts	0.59	8.72	-35.42	48.18
Beverages	0.80	3.79	-16.55	12.29
Food Producers	0.52	3.79	-14.47	7.87
Household goods and Home Construction	0.54	4.19	-13.99	11.30
Leisure Goods	0.61	5.96	-24.84	16.35
Personal Goods	0.81	4.56	-19.40	11.56
Tobacco	1.17	5.18	-18.36	12.95
Healthcare Equipment Services	0.95	4.96	-19.89	13.65
Pharma and Bio	0.83	4.41	-14.56	14.46
Food and Drug Retailers	0.68	4.94	-15.53	14.72
General Retailers	0.93	4.81	-14.21	16.20
Media	0.71	5.68	-19.97	16.95
Travel and Leisure	0.87	6.04	-19.04	20.78
Fixed Line Telecommunications	0.60	4.63	-11.71	13.84
Mobile Telecommunications	0.45	8.11	-30.29	24.62
Electricity	0.69	4.18	-16.44	10.00
Gas Water and Multi Utilities	0.92	4.33	-17.62	11.88
Banks	0.41	8.55	-34.55	32.94
Non-Life Insurance	0.49	4.69	-15.80	15.94
Life Insurance	0.78	9.54	-41.15	38.77
Real Estate Inv Services	0.59	9.48	-31.51	50.34
REITs	0.84	7.56	-34.41	42.30
Financials	0.60	6.82	-26.50	26.37
Equity Investment instruments	0.67	8.86	-24.85	26.51
Software and Computer Services	0.99	5.28	-17.91	16.04
Tech and Hardware Equipment	0.98	6.26	-19.06	22.12
Market	0.70	4.68	-16.95	15.79

The table provides Monthly Mean, Standard Deviation, Minimum Values and Maximum Values on the Excess Returns for 40 United State Sectors from Reuters DataStream over the period Jan 2005 to Apr 2019. N=171, Numbers in Whole Percentages and calculated over the whole period.

Our main analysis is focused on interpreting the regression coefficients of these sectors and are followed up in the methodological part. From Table 2. we can observe that the sectors have a considerable volatility difference with Industrial related sectors experiencing the largest volatility in the excess returns and “Utilities” and “Electricity” the lowest one. In Table 3 we find that the sector portfolios with the highest excess returns are “Aero and defence”, “Industrial engineering”, “Beverages” and “Personal goods”. The lowest returns can be found in “Oil services and distribution”, “Fixed line Telecommunications”, “Banks” and “Real estate investment services”.

Table 3: Summary Statistics of the excess returns of European sector portfolios

EU Sectors	Mean (%)	Volatility (%)	Min (%)	Max (%)
Oil and Gas Production	0.48	5.70	-16.00	13.48
Oil Services Distribution	0.26	8.08	-35.24	16.57
Alternative Energy	0.33	10.84	-46.75	32.08
Chemicals	0.82	5.37	-18.07	12.84
Forestry and paper	0.54	6.50	-20.35	27.34
Industrial Metal and Mines	0.44	8.99	-41.95	25.29
Mining	0.58	9.02	-37.85	27.63
Construction and Materials	0.47	5.68	-19.92	19.64
Aero Defense	0.86	5.21	-14.71	12.38
General Industrials	0.57	6.17	-27.26	17.46
Electronic and Electrical Equipment	0.79	6.11	-25.49	17.95
Industrial Engineering	0.87	6.03	-23.53	16.03
Industrial Transportation	0.54	4.65	-20.04	13.64
Support Services	0.64	4.59	-13.51	13.18
Auto and Parts	0.64	7.47	-28.32	18.97
Beverages	0.91	4.63	-18.58	12.57
Food Producers	0.80	3.39	-12.51	8.71
Household goods and Home Construction	0.75	4.37	-16.85	9.58
Leisure Goods	0.77	6.21	-23.23	16.96
Personal Goods	0.94	4.90	-15.18	12.14
Tobacco	0.76	5.01	-18.60	11.01
Healthcare Equipment Services	0.78	3.64	-11.97	9.53
Pharma and Bio	0.67	3.79	-15.15	9.02
Food and Drug Retailers	0.30	4.05	-14.34	10.80
General Retailers	0.61	4.96	-13.46	14.87
Media	0.33	4.39	-16.69	9.93
Travel and Leisure	0.39	4.81	-18.66	13.82
Fixed Line Telecommunications	0.05	4.20	-12.21	12.07
Mobile Telecommunications	0.42	4.30	-11.99	12.36
Electricity	0.37	4.72	-14.61	9.58
Gas Water and Multi Utilities	0.33	4.84	-18.86	10.47
Banks	-0.18	7.19	-29.90	26.68
Non-Life Insurance	0.65	5.52	-23.12	15.07
Life Insurance	0.35	7.46	-39.61	24.86
Real Estate Inv Services	0.27	5.03	-24.87	14.96
REITs	0.32	5.46	-22.74	14.51
Financials	0.63	5.18	-17.90	16.76
Equity Investment instruments	0.54	4.00	-18.37	11.11
Software and Computer Services	0.73	4.94	-21.13	13.34
Tech and Hardware Equipment	0.34	6.50	-25.91	16.77
Market	0.45	4.44	-15.71	12.07

The table provides Monthly Mean, Standard Deviation, Minimum Values and Maximum Values on the Returns for 40 European Sectors from DataStream over the period Jan 2005 – Apr 2019. N=171, Numbers in Whole Percentages and calculated over the whole period.

4.2 Bilateral Currencies

The main bilateral exchange rates we test against our excess sector returns are USDCNY, USDJPY and USDEUR belonging to our US Sector excess returns and EURCNY, EURJPY and USDEUR belonging to the European sector excess returns. The first three characters represent our base currency and the last three characters our quoted currency following the ISO 4217 currency standardization convention (ISO, 2019). Notice that USDEUR and EURUSD are reciprocals with a correlation coefficient of -1.

Our data sample time period is matched with the data sample period from the 40 sector excess returns. The exchange rates have been collected from WM/Reuters through Reuters DataStream and account for the period between January 2005 and the Start of April 2019 at a monthly frequency. As a final step in the data processing step, we converted the time series into monthly logarithmic returns, giving us the option to take the reciprocal of the currency if needed.

While currency exposure often is measured in the form of currency baskets, our primary analysis, unlike other approaches⁶, focuses on isolating the Chinese Yuan from these baskets in order to measure the sole exposure of our sectors to this particular currency. The reason why we do this has to do with the cancellation effect being inherently present in currency baskets, explained as follows,

Assuming an equally weighted basket between two currency pairs with identical appreciation/depreciation movements, the net effect becomes 0 because the exposures cancel each other out,

$$e_{\uparrow}^a \text{ and } e_{\downarrow}^b \Rightarrow e_0^t ;$$

and vice-versa.

With e^a representing the base currency against the quoted currency “a”, e^b the base currency against the quoted currency “b” and e^t the total equally weighted basket. “ \uparrow ” implies the appreciation of the base currency, “ \downarrow ” the depreciation of base currency, “0” no change and “ \Rightarrow ” the net effect.

The summary statistics for both sets of currencies are illustrated down below in table 4, with the most volatile currency pair being the EURJPY and the least volatile being USDCNY.

⁶ See Jorion (1990), Section 2.3

Table 4: Summary statistics for the Currencies

Currency	Mean (%)	Volatility (%)	Min (%)	Max (%)
USDCNY	-0.12	0.82	-3.38	3.62
USDJPY	0.05	2.72	-6.48	8.99
USDEUR	0.11	2.86	-9.86	9.30
EURCNY	-0.23	2.74	-9.45	8.96
EURJPY	-0.06	3.60	-15.78	10.68
EURUSD	-0.11	2.86	-9.30	9.86

The table provides Mean, Standard Deviation (Volatility), Minimum and Maximum Values of the bilateral exchange rate returns over the whole period February 2005 – April 2019. USDCNY is the change between the dollar and the yuan, USDJPY is the change of the dollar and the yen, USDEUR is the change of the dollar and the euro. EURCNY is the change of the Euro and the yuan, EURJPY is the change in euro and yen, EURUSD is the change in the euro to the dollar and is reciprocal of USDEUR. Monthly frequencies. Source: Reuters DataStream

Consider the correlation matrix in table 5 down below, where we see that the United States and European markets have a correlation coefficient between themselves of their returns of 0.85. This tells us that the two markets move in the same direction in 85 percent of cases.

Table 5: Correlation Matrix of Currency pairs.

	USDCNY	USDJPY	USDEUR	EURCNY	EURJPY	EURUSD	US Market	EU Market
USDCNY	1.00							
USDJPY	0.13	1.00						
USDEUR	0.29	0.17	1.00					
EURCNY	0.00	-0.14	-0.96	1.00				
EURJPY	-0.13	0.62	-0.67	0.66	1.00			
EURUSD	-0.29	-0.17	-1.00	0.96	0.67	1.00		
US Market	-0.18	0.23	-0.47	0.44	0.55	0.47	1.00	
EU Market	-0.10	0.30	-0.24	0.22	0.41	0.24	0.85	1.00

The table provides the correlation coefficients of the bilateral exchange rate returns and market portfolio excess returns over the whole period February 2005 to April 2019. USDCNY is the change between the dollar and the yuan, USDJPY is the change of the dollar and the yen, USDEUR is the change of the dollar and the euro. EURCNY is the change of the Euro and the yuan, EURJPY is the change in euro and yen, EURUSD is the change in the euro to the dollar and is reciprocal of USDEUR. Monthly frequencies. Source: Reuters DataStream

There can be seen a spurious correlation coefficient of 0.96 between EURUSD and EURCNY that might be explained by the fact that a direct trading link between the Euro and the Chinese Yuan has only been established by late 2014. This meant that the US dollar was an intermediary currency for European buyers wanting to buy Chinese Yuan and vice-versa (WSJ, 2014).

4.3 Risk-free Rate for Excess Return Calculation

In order to only capture the excess returns, described earlier under section 4.1, we had to subtract the monthly risk-free rate. Furthermore, because our returns had a monthly sampling frequency, a corresponding 1-month risk-free rate had to be selected. For our United States monthly risk-free rate, we used the risk-free rate from the Kenneth R. French Data library used in the factor model returns because of its accessibility. We were able to get the monthly risk-free rates used for the United States market during the period January 2005 throughout April 2019⁷. The risk-free rate for Europe is collected from Eurostat (2019) collecting the interest rates given by ECB for the three-month, one month, and day to day rates. Since we use monthly frequencies for our portfolios, we also use monthly interest rates to generate excess returns for the European market portfolio and European sector portfolios.

4.4 Trade Data

To measure the amount of trade, data has been collected from Eurostat for Europe and the U.S. Census Bureau and the US Bureau for Economic Analysis (BEA) for the United States. The trade between U.S. and China and the trade between Europe and China uses the export and import and balance data. Regarding the equity portfolios and attributing trade data, a few sectors were hard to attribute data to due to the nature of business defined by the portfolio. The sectors that couldn't be attributed any trade data to at a two-digit or four-digit CPA 2.1/NAICS classification were mostly services, retail related, and utilities.

4.4.1 United States Trade Data

Export and Import data for United States goods has been collected between January 2005 throughout April 2009 with a yearly frequency with the help of the Trade Data Tool from the U.S. Census Bureau website. The data classification corresponds to the North American Industry Classification System (NAICS) (Census.gov, 2019) and we have matched this data to correspond to our Industry Classification Benchmark (ICB) standard used in the slicing of our sectors. For United States Services Export and Import data, we collected our sample from the BEA between 2005 and 2017 with an annual frequency (Apps.bea.gov, 2019).

Table 6: Trade between the United States and China

United States Sectors	Period	Average Yearly Trade		
		Export	Import	Balance
Oil and Gas Production	2005 - 2018	1 559	157	1 402
Oil Services Distribution	-	-	-	-

⁷ (Mba.tuck.dartmouth.edu, 2019), Eurostat (2019)

Alternative Energy	-	-	-	-
Chemicals	2005 - 2018	9 002	11 139	-2 137
Forestry and paper	2005 - 2018	3 731	6 776	-3 045
Industrial Metal and Mines	2005 - 2018	1 820	4 288	-2 468
Mining	2005 - 2018	1 533	285	1 248
Construction and Materials	2005 - 2018	1 964	24 347	-22 383
Aero Defense	2005 - 2018	10 794	2 985	7 809
General Industrials	2005 - 2018	5 800	49 010	-43 210
Electronic and Electrical Equipment	2005 - 2018	2 049	23 116	-21 067
Industrial Engineering	2005 - 2018	6 174	22 032	-15 857
Industrial Transportation	2005 - 2017	3 883	4 091	-208
Support Services	2005 -2018	7 130	2 644	4 486
Auto and Parts	2005 -2018	6 549	10 408	-3 859
Beverages	2005 - 2018	526	50	476
Food Producers	2005 - 2018	16 539	6 033	10 505
Household goods and Home Construction	2005 - 2018	1 413	37 034	-35 621
Leisure Goods	2005 - 2018	441	18 151	-17 709
Personal Goods	2005 - 2018	1 748	69 352	-67 605
Tobacco	2005 - 2018	2	14	-12
Healthcare Equipment Services	2005 - 2018	5 364	9 446	-4 082
Pharma and Bio	2005 - 2018	1 657	1 853	-197
Food and Drug Retailers	2005 - 2018	2 871	3 136	-265
General Retailers	-	-	-	-
Media	-	-	-	-
Travel and Leisure	2005 - 2017	14 907	3 522	11 386
Fixed Line Telecommunications	-	-	-	-
Mobile Telecommunications	2006 - 2017	433	899	-466
Electricity	-	-	-	-
Gas Water and Multi Utilities	-	-	-	-
Banks	-	-	-	-
Non-Life Insurance	2005 - 2017	172	53	119
Life Insurance	-	-	-	-
Real Estate Inv Services	-	-	-	-
REITs	-	-	-	-
Financials	2006 - 2017	1 867	297	1 570
Equity Investment instruments	-	-	-	-
Software and Computer Services	2005 - 2011	22	3	19
Tech and Hardware Equipment	2005 - 2018	10 090	118 667	-108 578
Total Average Trade		120 040	429 789	-309 749

The trade numbers are average yearly trade posts for export, import and trade balance between U.S. and China for the years of their specified periods, all numbers are in millions of US dollars, both exports and import are reported in positive values. Numbers reflect trade in both services and in goods combined for total trade. Trade balance is given by the formula Exports-Imports, a positive sign in trade balance means a sector is a net exporter

and a negative sign means net importer. Data Sources: U.S. Census Bureau and BEA. The total average is the sum of the average trade for 28 sectors.

4.4.2 European Trade Data

For goods traded between Europe and China, we chose the CPA 2.1 classification from (Eurostat, 2019), and attributed it to the suitable ICB classified sector. When distributing trade in services we use the databases BPM5 and BPM6 from Eurostat. We had to use two databases due to a change in definition of how to classify trade in services in 2013. All data on services from (Eurostat, 2019) are based on the total economy sector data, collected from the current account. No seasonal adjustment is done since the used data is based on yearly values. BPM5 is used between the years 2005 to 2013, with EU27 and EU28 being the sources we base service trade data on. BPM6 is used from 2013 to 2018, and only reports data for EU 28 for trade in services.

The period of measurement for trade data in both goods and services is from 2005 to 2018, as data from 2019 isn't released for some posts in Eurostat at the time of writing.

Table 7: Average Yearly Trade in Goods and Services between Europe and China

European Sectors	Average Yearly Trade		
	Export	Import	Balance
Oil and Gas Production	1 356	202	1 154
Oil Services Distribution	-	-	-
Alternative Energy	-	-	-
Chemicals	9 224	8 845	379
Forestry and paper	2 336	4 412	-2 076
Industrial Metal and Mines	6 390	6 836	-446
Mining	3 101	824	2 277
Construction and Materials	3 080	10 977	-7 897
Aero Defense	7 652	812	6 840
General Industrials	330	1 205	-875
Electronic and Electrical Equipment	16 081	47 425	-31 343
Industrial Engineering	57 090	48 806	8 285
Industrial Transportation	7 615	8 068	-453
Support Services	10 085	6 197	3 888
Auto and Parts	43 988	9 440	34 548
Beverages	1 139	39	1 100
Food Producers	4 640	5 344	-704
Household goods and Home Construction	3 756	30 536	-26 779
Leisure Goods	1 220	20 013	-18 794
Personal Goods	3 274	51 776	-48 502
Tobacco	18	83	-66
Healthcare Equipment Services	1 359	2 894	-1 535
Pharma and Bio	4 940	3 140	1 800

Food and Drug Retailers	-	-	-
General Retailers	-	-	-
Media	217	923	-707
Travel and Leisure	5 233	2 025	34
Fixed Line Telecommunications	-	-	-
Mobile Telecommunications	233	219	14
Electricity	-	-	-
Gas Water and Multi Utilities	-	-	-
Banks	-	-	-
Non-Life Insurance	326	379	-53
Life Insurance	-	-	-
Real Estate Inv Services	-	-	-
REITs	-	-	-
Financials	6 489	6 819	-330
Equity Investment instruments	-	-	-
Software and Computer Services	2 275	455	1 820
Tech and Hardware Equipment	14 275	166 253	-151 978
Total Average Trade	217 725	444 946	-230 395

The trade numbers are average yearly trade posts for export, import and trade balance between Europe and China between 2005 and 2018, all numbers are in millions of Euros, both exports and import are reported in positive values. Numbers reflect trade in both services and in goods combined for total trade. Trade balance is given by the formula Exports-Imports, a positive sign in trade balance means a sector is a net exporter and a negative sign means net importer. Data Source: Eurostat. The total average is the sum of the average trade for 28 sectors.

Over our period, the trade between Europe and China has been in a deficit for the European Union, as also seen in figure 9. For Europe, 12 sectors have a net exporter position to China, and 16 sectors have a net importer position, out of the 28 sectors we found trade data for. Based on this, an appreciation of the Euro will lead to an expected increase in sector value for 16 importer sectors. And for the 12 exporter sectors an appreciation in the Euro will lead to value loss.

5. Methodology

In the methodology employed, we will use the currency exposure estimation framework developed by Dumas (1978), Adler and Dumas (1984) and Hodder (1982), with it also being used in this specific type of research⁸, by defining currency exposure as the exposure of various domestic sectors to the exchange-rate movement. This exchange exposure will be summarized as a regression coefficient in order to discover the relationship between sector returns and currencies. In addition to analysing the exposure to the Chinese Yuan (CNY), we will use the Japanese Yen (JPY) as an approximate comparison, enabling us to uncover potential differences between the Chinese capital controls regime and the Japanese managed float regime.

5.1 Simple OLS and MLS Model: Model M0 and M1:

In our main analysis, we take the viewpoint of a sector assuming the exposure being the slope coefficient of the exchange rate on sector excess returns as used by Adler & Dumas (1984) and (Jorion, 1990). In other words, our endogenous variable being the excess sector return and our exogenous variable being the logarithmic return of the currency pair in question. Because excess sector returns expressed by R_{it} might experience an increase/decrease based on excess market returns, it comes only naturally, following other empirical research conducted in a similar manner⁹, to control for this variable in our analysis. However, before presenting the regression with the market as a control variable, we want to test the exposures of the currencies without it, with the help of the following simple OLS model;

$$M0: r_{it} - rf_{it} = \alpha + \beta_1 PAIR_{it} + \epsilon_{it}, \quad t = 1, \dots, T \quad (1)$$

with robust standard errors.

After which we switch to the model M1, with the market excess returns as our control variable;

$$M1: r_{it} - rf_{it} = \alpha + \beta_1 PAIR_{it} + \beta_2 Market_{it} + \epsilon_{it}, \quad t = 1, \dots, T \quad (2)$$

where r_{it} is the nominal return of the sector total return index i at time t computed as $r_{it} = \left(\frac{Total\ Return\ Index_t}{Total\ Return\ Index_{t-1}} \right) - 1$. rf_{it} is the monthly risk-free rate. $(r_{it} - rf_{it})$ can be interchangeably used with the term R_{it} , it being the excess percentage total return i at time t . On the right-hand side we have α as our regression constant term, β_1 as our exposure term relative to the endogenous variable; the currency exposure read as a 1 percent logarithmic

⁸ See Allayannis and Ofek (2001)

⁹ (Jorion, 1990)

increase in the $PAIR_{it}$ term implying a β_1 percentage increase on excess returns. In addition, $PAIR_{it}$ represents the logarithmic return of pair i at time t following the left to right convention. Next we have the term $Market_{it}$ representing the excess market returns as in the standard CAPM model and finally, we have ϵ_{it} as our regression error term of industry i at time t , forced to satisfy uncorrelation and homoskedasticity by,

$$E(\epsilon^2 | x_1, x_2, \dots, x_k) = E(\epsilon^2) = \sigma^2,$$

through robust standard error estimation.

Our deviations from Jorion's approach include dividing our data in four sub-samples, after we develop our model in the next steps. Moreover, we will not include a basket of currencies but only maximum of three specific currencies. While Jorion includes a basket of currencies devised by the Multilateral Exchange Rate Model, we will focus on specific currencies, underlining the Chinese Yuan Exposure. The advantage of this approach is that the cancellation effect described in our data selection part for currencies will not be present. One potential drawback with this approach is multicollinearity in model M2 but because we only measure the coefficients of a maximum of three currency pairs, and because they are either (1) differentiated by region and (2) differentiated by currency regime type, the multicollinearity problem is tried to be minimized. We will test this with the Value Inflation Factor ratio.

5.2 MLS including multiple currencies and the market portfolio: Model M2

While model M1 is only concerned with one currency at a time, we expand in by controlling for other currencies as well in the same regression. As pointed out earlier in our literature review, multicollinearity can be a significant issue affecting the significance of the coefficients of this model. Another issue (or multiple) is an omitted variable bias/es that could affect both excess returns and our pairs simultaneously. Our MLS regression model M2 is defined as,

$$M2: R_{it} = \alpha + \beta_1 PAIR1_{it} + \beta_2 PAIR2_{it} + \beta_3 PAIR3_{it} + \beta_4 Market_{it} + \epsilon_{it}, \quad t = 1, \dots, T \quad (3)$$

with robust standard errors.

Where β_4 represents the coefficient sensitive to market movements, implying that a 1 percent increase in the Market portfolio excess returns noted as $Market_{it}$ will increase/decrease our sector excess returns R_{it} by the coefficient β_4 .

Because our pairs belong either to the USD or the EUR set, they might experience multicollinearity between themselves since the foreign currencies are referenced to either the

US Dollar or the Euro. It is in addition argued¹⁰ that since the sector excess returns R_{it} is included in the market portfolio, the exposure of the β_{1-3} coefficients is the exposure over and above that of the excess market returns, being the net effect of the isolated currency exposure from the market, rather than the total one. The idea is that because the market returns are also exposed to currency fluctuations, these coefficients would not give an accurate representation. Empirical research, as discussed in our literature review concludes that the orthogonalizing process would not necessarily yield better results.

To see if multicollinearity is present, we perform a Variance Inflation Factor (VIF) ratio analysis, firstly by regressing the independent variables in relation to each other in the manner,

- (i) $PAIR1_{it} = \alpha_0 + \alpha_2 PAIR2_{it} + \alpha_3 PAIR3_{it} + \alpha_4 Market_{it} + \epsilon_{it}, \quad t = 1, \dots, T$
- (ii) $PAIR2_{it} = \alpha_0 + \alpha_1 PAIR1_{it} + \alpha_3 PAIR3_{it} + \alpha_4 Market_{it} + \epsilon_{it}, \quad t = 1, \dots, T$
- (iii) $PAIR3_{it} = \alpha_0 + \alpha_1 PAIR1_{it} + \alpha_2 PAIR2_{it} + \alpha_4 Market_{it} + \epsilon_{it}, \quad t = 1, \dots, T$
- (iv) $MARKET_{it} = \alpha_0 + \alpha_1 PAIR1_{it} + \alpha_2 PAIR2_{it} + \alpha_3 PAIR3_{it} + \epsilon_{it}, \quad t = 1, \dots, T$

and obtaining the R^2 for regression (i) to (iv).

And finally obtaining the VIF value for each of them with the formula,

$$VIF_i = \frac{1}{1 - R_i^2}$$

We declare that a variable having a VIF value > 5 as one experiencing multicollinearity, while a variable having a VIF value of < 5 as non-multicollinear¹¹.

¹⁰ (Priestley and Ødegaard, 2007)

¹¹ Sheather, Simon (2009)

6. Empirical Results

6.1 Simple OLS Analysis: Model M0

For both the United States and the European sector indices, we report the significance at a 5 percent level for both tail ends. Specific sector exposure can be found in the appendix, see tables 9.1.1 to 9.1.4 for exposure coefficient levels and exposure significance levels for up to 10%. The significant exposure is split into two categories; positive and negative signs. The sign of the sectors matters depending on the sectors net balance. It gives a clue to what type of competition and advantage a sector has in relation to the relevant currency risk. A negative coefficient represents a positive exposure, that is, if the coefficient of USDEUR is -1, this implies that a percentage appreciation in the USDEUR pair (USD appreciating against the Euro by 1 percent or the Euro depreciating against the dollar by 1 percent) results in a 1 percent reduction in the excess returns for a particular sector.

6.1.1 United States

The currency exposure results for the United States without any control variables are summed up in table 8. While there is no surprise that most of the industries have significant exposure to the USDEUR pair, there is a spurious surprise that there are more significant results for the Chinese Yuan pair than the Japanese one considering that Japan has a managed float regime and China has a closed currency regime.

Table 8: OLS Regression Analysis on simple Currency returns for US sectors.

US Sector	Trade Balance with China	Linear Currency Exposure		
		USDCNY	USDJPY	USDEUR
Oil and Gas Production	1 402	-1.03**	0.34	-0.89***
Oil Services Distribution	-	-1.39**	0.41	-1.13***
Alternative Energy	-	-4.38***	0.43	-2.14***
Chemicals	-2 137	-1.36***	0.43*	-1.09***
Forestry and paper	-3 045	-1.68***	0.55	-1.38***
Industrial Metal and Mines	-2 468	-2.81***	0.29	-2.03***
Mining	1 248	-2.05***	-0.66*	-1.58***
Construction and Materials	-22 383	-1.32**	0.63**	-1.01***
Aero Defense	7 809	-1.14**	0.30	-0.73***
General Industrials	-43 210	-0.99**	0.39	-0.96***
Electronic and Electrical Equipment	-21 067	-1.53***	0.51**	-0.95***
Industrial Engineering	-15 857	-1.68***	0.52*	-1.35***
Industrial Transportation	-208	-1.34**	0.51**	-0.70***
Support Services	4 486	-1.08***	0.46***	-0.68***
Auto and Parts	-3 859	-1.30**	0.70**	-1.07***

Beverages	476	-0.52	0.14	-0.54***
Food Producers	10 505	-0.27	0.15	-0.45***
Household goods and Home Construction	-35 621	-0.62	0.22	-0.46***
Leisure Goods	-17 709	-0.84	0.59***	-0.69***
Personal Goods	-67 605	-1.01**	0.24	-0.71***
Tobacco	-12	-0.33	0.16	-0.57***
Healthcare Equipment Services	-4 082	-0.93**	0.37	-0.60***
Pharma and Bio	-197	-1.00**	0.14	-0.55***
Food and Drug Retailers	-265	-0.75*	0.42**	-0.49***
General Retailers	-	-0.89*	0.41***	-0.54***
Media	-	-0.96	0.44**	-0.85***
Travel and Leisure	11 386	-1.13**	0.43**	-0.90***
Fixed Line Telecommunications	-	-0.30	0.23	-0.44***
Mobile Telecommunications	-466	0.36	0.70***	-0.74***
Electricity	-	-0.11	0.031	-0.38***
Gas Water and Multi Utilities	-	-0.34	0.12	-0.46***
Banks	-	-0.83	0.72**	-1.00***
Non-Life Insurance	119	-0.61	0.40**	-0.61***
Life Insurance	-	-1.46*	0.65	-1.55***
Real Estate Inv Services	-	-1.11*	0.77**	-0.86***
REITs	-	-1.00	0.14	-1.01***
Financials	1 570	-1.31**	0.86***	-1.02***
Equity Investment instruments	-	-2.33***	0.46*	-0.76***
Software and Computer Services	19	-1.35***	0.52***	-0.76***
Tech and Hardware Equipment	-108 578	-1.16**	0.52**	-0.68***

Currency	Significant Coefficient from Simple Regressions		
	Positive	Negative	Total
USDCNY	0	23	23 (57.5%)
USDJPY	17	0	17 (42.5%)
USDEUR	0	40	40 (100%)

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

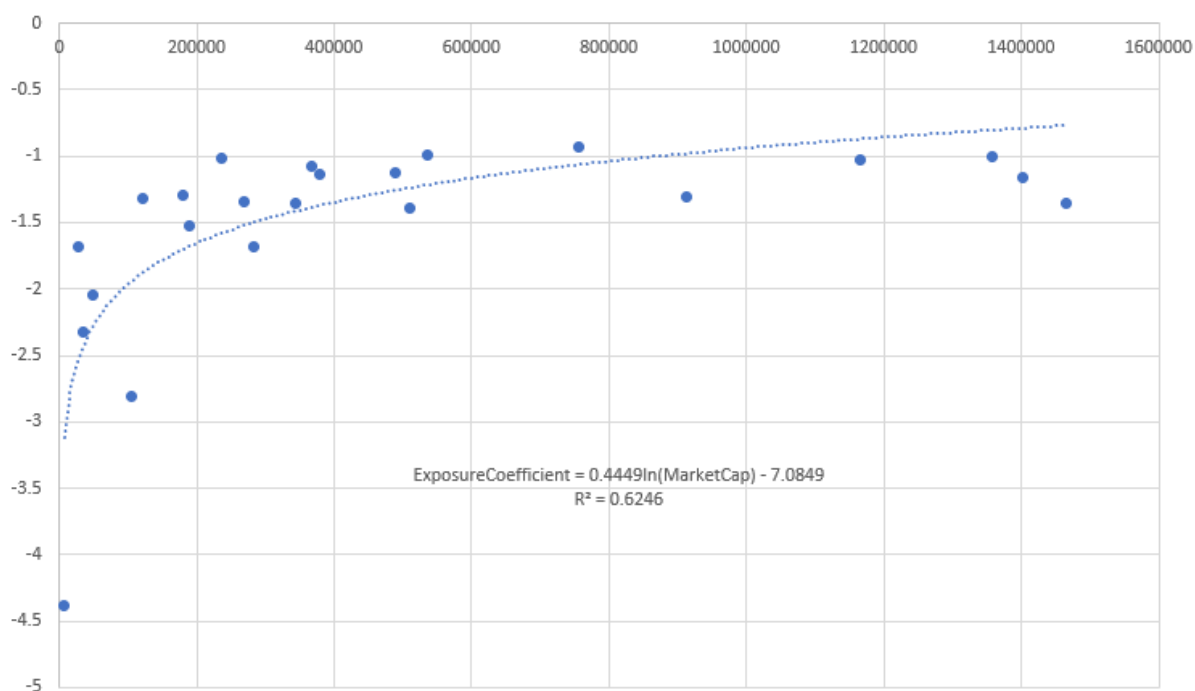
Simple separate OLS Regression analysis with monthly US sector excess returns as the dependent variable and logarithmic monthly currency pair returns as the independent variable. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019. Data for the sector returns has been constructed from the Total Return Index where there has been an account for dividend reinvestment. A coefficient of -1 means that if the USD increases relative to the other currency, the sector will experience an excess return of -1 percent. Also included is a summary of the number of significant coefficients at the 5% level and their signs from the OLS regressions counted by the exchange rates. Data Source: Reuters DataStream

Consider summary table 8. We observe that for our simple regression model M0, most regression coefficients for the USDCNY and USDEUR are negative implying lower expected excess returns, should the USD rise against the foreign currency. The opposite is true for the USDJPY pair where spuriously enough expected excess returns rise should the USD

appreciate. The most impacted industries are “Alternative Energy”, “Industrial Metals and Mines” and “Equity investment Instruments”. The fact that “Alternative Energy” has such a high sensitivity to an appreciating dollar vis-à-vis to the Chinese Yuan might have to do with the market capitalisation of this sector. The “Alternative Energy” Sector is the smallest sector of all the 40 sectors with a total market capitalization of 5.6 billion dollars out of 28.5 trillion at the start of April 2019. In addition to this, the ethanol tariff China imposes on the United States is at 70 percent with talks only picking up recently in the reduction of this retaliatory tax (Reuters, 2019).

To test if the pattern is persistent, we will illustrate the relationship between our significant coefficients and market capitalization by running a nonlinear regression analysis. We can observe a pattern forming where an increase in market capitalization reduces the exposure to the Chinese Yuan.

Figure 10: Cross-sectional Regression analysis between Sector exposure coefficient and Market Capitalization



$N = 23$

Cross-sectional logarithmic regression analysis. The numbers on the x-axis are average weekly market capitalization values in the period Jan 2005 and April 2019, all numbers are in millions of dollars. On the y-axis we represent the coefficients from table 8 and each dot on the graph represents a sector where these coefficients were significant at a 5% level. The regression analysis performed in a logarithmic one to reflect a higher R sq. Data Source: Reuters DataStream.

Furthermore, we want to test the relationship between trade and excess sector returns, looking on how an increase in exports, respectively imports affects the cross-sectional returns. What we find is that a one billion dollar increase in monthly exports increases the cross-sectional

excess returns by 0.2 percent significant at a 10 percent level, the effect of the imports is strongly insignificant. The results are summarized in the table 9.

Table 9: Cross-sectional excess sector returns and import/export regression analysis.

Export β	p-value	Constant	p-value	R sq.
0.19*	0.1	0.76***	0	0.11
Import β	p-value	Constant	p-value	R sq.
0.27	0.92	1.29	0.56	0

$N=20$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Cross-sectional monthly regression analysis between average US Sector Excess Returns and average monthly Export/ Import for the period Jan 2005 to Apr 2019. Total of 20 sectors where the trade data was available and exposure coefficients are significant at a 5 percent level. Yearly trade figures have been transformed by dividing by 12 and converted into billions of dollars. Beta coefficient is interpreted as a 1 billion increase in Exports/ Imports implying a β increase in excess returns for the period of one month. Data Source: Reuters DataStream.

Finally, as the relationship between the coefficients and market capitalization and the relationship between returns and trade have been examined, it follows only naturally to present the relationship between trade and market capitalization summarized in table 10.

Table 10: Export, Import and total trade ratios for U.S. sectors based on market capitalization

Sector	<u>Exports</u> <u>Market Cap</u>	<u>Imports</u> <u>Market Cap</u>	<u>(Exports + Imports)</u> <u>Market Cap</u>	USDCNY Exposure Coefficient
Oil and Gas Production	0.00	0.00	0.00	-1.03**
Chemicals	0.03	0.03	0.06	-1.36***
Forestry and paper	0.13	0.24	0.37	-1.68***
Industrial Metal and Mines	0.02	0.04	0.06	-2.81***
Mining	0.03	0.01	0.04	-2.05***
Construction and Materials	0.02	0.20	0.22	-1.32**
Aero Defense	0.03	0.01	0.04	-1.14**
General Industrials	0.01	0.09	0.10	-0.99**
Electronic and Electrical Equipment	0.01	0.12	0.13	-1.53***
Industrial Engineering	0.02	0.08	0.10	-1.68***
Industrial Transportation	0.01	0.02	0.03	-1.34**
Support Services	0.02	0.01	0.03	-1.08***
Auto and Parts	0.04	0.06	0.09	-1.30**
Beverages	0.00	0.00	0.00	-0.52
Food Producers	0.05	0.02	0.07	-0.27
Household goods and Home Construction	0.00	0.12	0.12	-0.62
Leisure Goods	0.01	0.23	0.24	-0.84

Personal Goods	0.01	0.30	0.30	-1.01**
Tobacco	0.00	0.00	0.00	-0.33
Healthcare Equipment Services	0.01	0.01	0.02	-0.93**
Pharma and Bio	0.00	0.00	0.00	-1.00**
Food and Drug Retailers	0.01	0.01	0.02	-0.75*
Travel and Leisure	0.03	0.01	0.04	-1.13**
Mobile Telecommunications	0.01	0.01	0.02	0.36
Non-Life Insurance	0.00	0.00	0.00	-0.61
Financials	0.00	0.00	0.00	-1.31**
Software and Computer Services	0.00	0.00	0.00	-1.35***
Tech and Hardware Equipment	0.01	0.08	0.09	-1.16**

Average Import/Export and Total Trade ratios based on average market cap monthly data for the period Jan 2005 to Apr 2019. Import and Export are average values of yearly observations between 2005 and 2018. Total of 28 US sectors where trade data was available. Exposure coefficients from Table 6.1.1 A. Data Source: U.S. Census Bureau, BEA and Reuters DataStream.

The two largest exporters to market capitalization sectors are “Forestry and Paper” and “Food Producers”. While it is lately claimed that food producers might get hit hardest by the latest trade war developments (Reuters, 2019), the industry has been experiencing a trade surplus in excess of 10 billion US dollars and no significant exposure coefficient is observed. Looking at the export to market capitalization ratios, the largest importing sectors are “Personal Goods”, “Leisure Goods” and “Forestry and Paper”. The first and last sectors have significant currency exposure against the Chinese Yuan that might be explained by that if the dollar rises against the Chinese Yuan, companies using materials by these producing sectors, might purchase them from Chinese companies, as the buying power of the dollar relatively increased against the one of the Chinese Yuan.

6.1.2 Europe

Table 11: OLS Regression Analysis on simple Currency returns for European sectors.

EU Sector	Trade Balance with China	Linear Currency Exposure		
		EURCNY	EURJPY	EURUSD
Oil and Gas Production	1 154	0.40**	0.49***	0.38**
Oil Services Distribution	-	0.76**	0.83***	0.74**
Alternative Energy	-	1.02**	1.02***	1.07***
Chemicals	379	0.49**	0.62***	0.53***
Forestry and paper	-2 076	0.067	0.36**	0.10
Industrial Metal and Mines	-446	1.01***	1.07***	1.06***
Mining	2 277	0.88***	0.78***	0.95***
Construction and Materials	-7 897	0.53***	0.66***	0.54***
Aero Defense	6 840	-0.19	0.23	-0.15
General Industrials	-875	0.55***	0.70***	0.55***
Electronic and Electrical Equipment	-31 343	0.55**	0.75***	0.58***

Industrial Engineering	8 285	0.56**	0.71***	0.61***
Industrial Transportation	-453	0.38**	0.45***	0.40**
Support Services	3 888	0.14	0.39***	0.16
Auto and Parts	34 548	0.31	0.61***	0.41**
Beverages	1 100	0.026	0.21	0.07
Food Producers	-704	-0.1	0.07	-0.08
Household goods and Home Construction	-26 779	-0.08	0.25**	-0.06
Leisure Goods	-18 794	0.30	0.55***	0.33
Personal Goods	-48 502	0.35*	0.47***	0.37**
Tobacco	-66	-0.27	-0.07	-0.26*
Healthcare Equipment Services	-1 535	-0.1	0.13	-0.07
Pharma and Bio	1 800	-0.20*	-0.02	-0.18*
Food and Drug Retailers	-	0.11	0.27**	0.12
General Retailers	-	0.20	0.44***	0.20
Media	-707	0.20	0.40***	0.20
Travel and Leisure	34	0.20	0.48***	0.20
Fixed Line Telecommunications	-	0.29**	0.36***	0.28**
Mobile Telecommunications	14	0.14	0.27***	0.14
Electricity	-	0.48***	0.49***	0.49***
Gas Water and Multi Utilities	-	0.34**	0.32***	0.35***
Banks	-	0.79***	0.93***	0.78***
Non-Life Insurance	-53	0.49**	0.61***	0.50**
Life Insurance	-	0.77**	0.93***	0.77***
Real Estate Inv Services	-	0.39**	0.40**	0.39**
REITs	-	0.30	0.42**	0.33*
Financials	-330	0.42**	0.63***	0.45***
Equity Investment instruments	-	-0.05	0.32**	0.018
Software and Computer Services	1 820	0.27	0.51***	0.28
Tech and Hardware Equipment	-151 978	0.26	0.61***	0.31*

Currency	Significant Coefficient from Simple Regressions		
	Positive	Negative	Total
EURCNY	19	0	19 (47.5%)
EURJPY	34	0	34 (85%)
EURUSD	21	0	21 (52.5%)

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Trade balance is included and represents the average trade between the sector and China over the period January 2005 to December 2018. The trade balance is given Exports – Imports, a negative value indicates the sector is a net importer and a positive value indicates the sector is a net exporter. We have a total of 28 EU sectors where trade data was available. The table is a summary of the exposure coefficients of 40 sectors based on a simple OLS regression with one currency at a time, reporting the exposure of the EURCNY, EURJPY and EURUSD. Also included is a summary table for sectors that have significant exposure at the 5% and 1% level, counted by total and the sign of the coefficient for all 40 sectors.

Measuring currency exchange exposure using the bilateral exchange rate return as the only explanatory variable gives us a total of 21 out of 40 (52.5%) statistically significant coefficients for the equity portfolios at the 10 percent level when looking at the exposure to the Yuan. Of these 21 exposure coefficients, 20 of them are positive and only one is negative (“Pharma and

Bio”) meaning we don’t find the expected sign for the exposure coefficients. At the 5 percent significance level relating to the European portfolio exposure to the Yuan, we find 19 out of 40 (47.5%) portfolios being negatively exposed, which is still a high number. However, all these exposures are negative, where again, we would expect some negative coefficients. The highest significant exposure found in this regression is (1.01) for “Alternative Energy”, and the lowest exposure is (-0.2) for “Pharma and Bio”.

For our control currencies, there are more significant variables for the Japanese Yen than for the Chinese Yuan. The yen has significance in 34 out of 40 (85%) portfolios, all of them having a positive sign. The yen is significant at a 1 percent level for 28 out of these portfolios, and only five portfolios are significant at a 5 percent level. For the Yen, the highest significant exposure is (1.07) for “Industrial Metal and mining”, and the lowest is 0.25 found in “Food Producers”. The U.S. dollar is significant in 25 out of 40 portfolios (62.5%) at the 10 percent level and below, with eight portfolios being significant at the 5 percent level, and 13 portfolios at the 1 percent level. The dollar has similar signs for the coefficients as the Yuan and the Yen, with only two significant coefficients being negative (“Tobacco” and “Pharma and Bio”). 23 portfolios have a positive exposure to the dollar, the same as we found in Yen and Yuan.

These results imply a 1 percent movement in the yuan will lead to an increase in portfolio values across the board, with only a few exceptions. E.g. if we assume the yuan return is 1 percent, the value of the portfolio of “Industrial Metal and Mining” (highest coefficient) will go up 1.01%. Also, for “Personal Goods”, a 1 percent increase in the Yuan will lead to a 0.35 percent increase in the sector return. Only for the “Pharma and Bio” portfolio will a 1 percent increase lead to a decrease in portfolio value. The opposite is also true, a 1 percent decrease in EURCNY will lead to a decrease in the value of the 20 portfolios that are statistically significant at the 10 percent level and increase the value of the “Pharma and Bio” portfolio.

When comparing the significant exposure between currencies, it is clear the Chinese Yuan has the least influence on the value of our portfolios compared to the Japanese Yen and the U.S. dollar. It has the lowest number of significant coefficients, with the Japanese Yen being more important for the values of these portfolios (in fact for 85 percent of the portfolios). It is also important to notice that all coefficients are positive, with one or two negative values being the exception. This means that accounting for a sectors net trade position does not matter. A 1 percent increase in the EURCNY will lead to an increase in the value of most portfolios, contradicting our expectations based on previous financial theory.

6.2 MLS Currency Exposure including Market Portfolio: M1

It is important to note that while the excess market return control variable included in the results should explain some of the variation, this market variable, as a collection of all sectors, might itself be exposed to the various currencies. Consider table 12 where a simple OLS regression analysis is run, comparable to that of model M0, of the various currencies on the returns of both United States and European excess market returns.

Simple OLS Regression analysis of currency returns on American and European Market returns.

Table 12: Exposure of the U.S. and European markets

	USDCNY β	USDJPY β	USDEUR β
US Market Excess Returns	-1.02***	0.40**	-0.77***
	EURCNY β	EURJPY β	EURUSD β
EU Market Excess Returns	0.35**	0.51***	0.37**

N = 171, p < 0.1 = *, p < 0.05 = **, p < 0.01 = ***

Simple OLS regression analysis with market excess returns as the dependent variable and currency logarithmic returns as the independent one. The presented coefficients represent the currency exposure on the market returns themselves, read as e.g. A one percent increase in USD relative to the CNY reduces the US market excess return by 1.02 percent. Data accounts for the period Jan 2005 to Apr 2019, the market portfolio includes all corporations found in the different sector portfolios. Data Source: Reuters DataStream.

While an orthogonalization analysis is excluded because of later empirical literature suggesting it won't improve results (Liu, et. al., 2015), attention should be placed to the fact that the market as a control variable is not neutral to currency exposure but subjected to it as well. This implies that there might be an interference in our results when controlling for the market returns, however we still find it necessary to include the market variable, as it explains the sector return variation at a significant level. The tables in this section thus will control from market excess returns.

6.2.1 United States

Table 13:MLS regression using Model M1 for U.S. sectors

US Sector	Trade Balance with China	Linear Currency Exposure		
		USDCNY	USDJPY	USDEUR
Oil and Gas Production	1 402	-0.038	-0.063	-0.17
Oil Services Distribution	-	-0.20	-0.068	-0.28
Alternative Energy	-	-2.98**	-0.18	-1.30***
Chemicals	-2 137	-0.11	-0.073	-0.18*
Forestry and paper	-3 045	0.12	-0.18	-0.040
Industrial Metal and Mines	-2 468	-1.09	-0.43*	-0.90***
Mining	1 248	-1.06	-1.13***	-1.02***
Construction and Materials	-22 383	0.0014	0.11	-0.0082
Aero Defense	7 809	-0.078	-0.14	0.10
General Industrials	-43 210	0.29	-0.12	0.0022
Electronic and Electrical Equipment	-21 067	-0.26	-0.0016	0.015
Industrial Engineering	-15 857	-0.19	-0.083	-0.27**
Industrial Transportation	-208	-0.25	0.072	0.17
Support Services	4 486	-0.15	0.097**	0.041
Auto and Parts	-3 859	0.19	0.11	0.067
Beverages	476	0.014	-0.079	-0.18*
Food Producers	10 505	0.38	-0.11	0.036
Household goods and Home Construction	-35 621	0.046	-0.053	0.055
Leisure Goods	-17 709	0.12	0.22	0.047
Personal Goods	-67 605	-0.21	-0.084	-0.13
Tobacco	-12	0.32	-0.11	-0.11
Healthcare Equipment Services	-4 082	-0.026	0.014	0.11
Pharma and Bio	-197	-0.28	-0.16**	0.00039
Food and Drug Retailers	-265	0.024	0.12	0.12
General Retailers	-	-0.030	0.067	0.15*
Media	-	0.14	0.0040	-0.026
Travel and Leisure	11 386	0.029	-0.029	-0.035
Fixed Line Telecommunications	-	0.32	-0.013	0.025
Mobile Telecommunications	-466	1.46**	0.29	0.076
Electricity	-	0.37	-0.16	-0.037
Gas Water and Multi Utilities	-	0.26	-0.13	-0.0088
Banks	-	0.61	0.16	0.099
Non-Life Insurance	119	0.28	0.053	0.062
Life Insurance	-	0.36	-0.078	-0.23
Real Estate Inv Services	-	0.43	0.17	0.38*
REITs	-	0.28	-0.38**	-0.075
Financials	1 570	0.062	0.33***	0.023
Equity Investment instruments	-	-1.43**	0.094	-0.058
Software and Computer Services	19	-0.39	0.14	-0.028
Tech and Hardware Equipment	-108 578	-0.016	0.071	0.24**

Currency	Significant Coefficient from Simple Regressions		
	Positive	Negative	Total
USDCNY	1	2	3 (7.5%)
USDJPY	2	3	5 (12.5%)
USDEUR	1	4	5 (12.5%)

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Multiple Regression analysis with monthly US sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables. One currency at the time with excess returns in each regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. A coefficient of -1 means that if the USD increases relative to the other currency, the sector will experience an excess return of -1 percent. Data Source: Reuters DataStream. Also included is a summary table of statistically significant sectors at the 5% and the 1% level,

While including the market portfolio, much of the significance from the regression analysis without the market portfolio has vanished, suggesting that market influences the returns much more than our currency pairs. For United States Sectors we see a major reduction in significant coefficients with “Alternative Energy”, “Telecommunications” and “Equity Investment Instruments” persisting.

Another factor in addition to the markets non-neutral exposure is an omitted variable bias like for example interest rates. In this case an increase in domestic interest rates could lower the returns while increasing our currency pair since they are quoted in the buying power of one dollar relative to a Chinese Yuan, respectively a Japanese Yen. While our returns are shielded from interest rates because they are excess returns, the currency pair might not be, but this is only the case for interest rates.

An example of omitted variable is the inflation rate, with the inflation differential covered by the international Fisher Effect (Eq. 7, section 2.2.5). The Inflation differential between the United States and Japan is mostly positive; a decrease in the differential should increase our USDJPY pair and increases our returns, while an increase in the differential reduces our USDJPY pair and our returns. Consider the comparison between the inflation differentials “United States – China” and “United States – Japan” in figure 11.

Figure 11: Inflation differentials

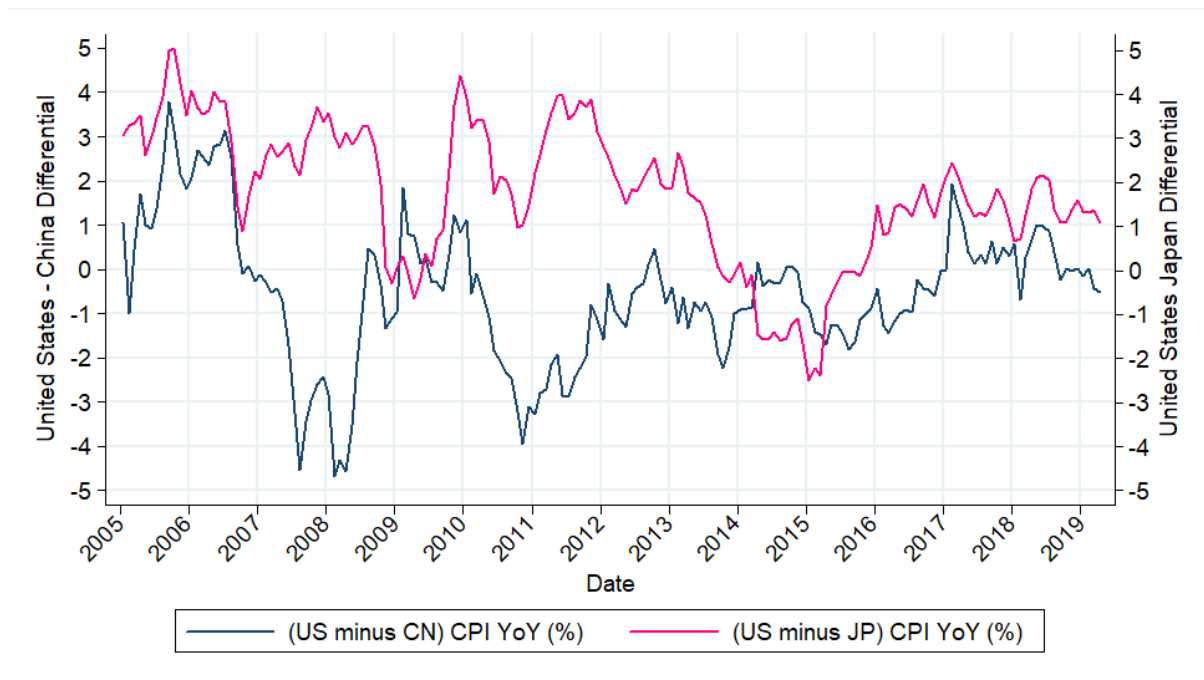


Figure representing the inflation rate differentials measured in yearly CPI year over year measured at a monthly interval. Data in annual percentages illustrated between the period Jan 2005 to April 2019. The differentials are calculated as US CPI minus the Chinese CPI and Japanese CPI respectively. Data Source: Reuters DataStream.

The average inflation differential during our analysis period between the United States and China is -0.53 percent. The average differential between the United States and Japan is 1.75 percent. By regressing the change in the differential on both our currency pairs we can determine see if inflation explains the currency movements,

$$PAIR_{it} = \alpha + \beta_1 INFDIF_{it} + \epsilon_{it}$$

with robust standard errors.

where $PAIR_{it}$ is our currency pair i return at time t and $INFDIF_{it}$ is the interest rate differential i at time t .

Table 14: Inflation differential regression

	Constant α	Inflation Differential β_1	Adj. R. sq.
USDCNY	-0.08	0.08 **	0.02
USDJPY	0.11	-0.04	0.00

$N=171$, monthly frequency.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Simple OLS regression analysis with currency pair returns as the dependent variable and US-China and US Japanese inflation differentials as the independent one. Data consists of monthly datapoints between Jan 2005 and Apr 2019 and is interpreted as a 1 percentage increase in annual differential increasing the monthly currency returns by the β_1 coefficient. Source: Reuters DataStream

The table shows that when the inflation differential increases between the United States and China, the United States dollar appreciates relative to the Chinese Yuan. This stands in contradiction to standard economic theory but might have been cancelled out due to other omitted variables. While we see the right sign in the differential coefficient for the USDJPY pair, this coefficient is not significant at a 5 percent significance level.

6.2.2 Europe

Table 15: MLS regression using Model M1 for European sectors

Sector	Trade Balance with China	Linear Currency Exposure		
		EURCNY	EURJPY	EURUSD
Oil and Gas Production	1 154	0.047	-0.02	0.021
Oil Services Distribution	-	0.27	0.12	0.23
Alternative Energy	-	0.46*	0.22	0.49**
Chemicals	379	0.11	0.079	0.14*
Forestry and paper	-2 076	-0.36**	-0.27**	-0.34**
Industrial Metal and Mines	-446	0.47**	0.31**	0.50***
Mining	2 277	0.41**	0.096	0.48***
Construction and Materials	-7 897	0.12	0.078	0.11
Aero Defense	6 840	-0.54***	-0.28***	-0.52***
General Industrials	-875	0.11	0.076	0.097
Electronic and Electrical Equipment	-31 343	0.12	0.17**	0.14
Industrial Engineering	8 285	0.14	0.12	0.17*
Industrial Transportation	-453	0.042	-0.04	0.051
Support Services	3 888	-0.20***	-0.085*	-0.18***
Auto and Parts	34 548	-0.15	-0.049	-0.068
Beverages	1 100	-0.27**	-0.23***	-0.24**
Food Producers	-704	-0.29***	-0.22***	-0.29***

Household goods and Home Construction	-26 779	-0.37***	-0.18**	-0.37***
Leisure Goods	-18 794	-0.10	-0.031	-0.094
Personal Goods	-48 502	0.017	-0.0049	0.027
Tobacco	-66	-0.49***	-0.42***	-0.49***
Healthcare Equipment Services	-1 535	-0.32***	-0.21***	-0.31***
Pharma and Bio	1 800	-0.40***	-0.34***	-0.39***
Food and Drug Retailers	-	-0.15*	-0.1	-0.14*
General Retailers	-	-0.13	-0.042	-0.15*
Media	-707	-0.11**	-0.047	-0.13**
Travel and Leisure	34	-0.13*	0.022	-0.15**
Fixed Line Telecommunications	-	0.073	0.062	0.063
Mobile Telecommunications	14	-0.094	-0.061	-0.092
Electricity	-	0.18***	0.062	0.17***
Gas Water and Multi Utilities	-	0.046	-0.11	0.053
Banks	-	0.29***	0.25***	0.26**
Non-Life Insurance	-53	0.13	0.09	0.12
Life Insurance	-	0.25**	0.21	0.23**
Real Estate Inv Services	-	0.082	-0.061	0.068
REITs	-	-0.014	-0.047	-0.00099
Financials	-330	0.029	0.074**	0.042
Equity Investment instruments	-	-0.30***	-0.1	-0.29***
Software and Computer Services	1 820	-0.056	0.053	-0.060
Tech and Hardware Equipment	-151 978	-0.16	0.018	-0.13

Currency	Significant Coefficient from Simple Regressions		
	Positive	Negative	Total
EURCNY	5	11	16
EURJPY	4	8	12
EURUSD	6	12	18

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Multiple Regression analysis with monthly EU sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables. One currency at the time with excess returns in each regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. A coefficient of -1 means that if the EUR increases relative to the other currency, the sector will experience an excess return of -1 percent. Also included is a summary table of the significant exposures at the 5% and 1% level and the sign of these coefficients. Data Source: Reuters DataStream

For the Yuan, we find significant exposure in 16 out of 40 portfolios (40% of portfolios), a reduction in significant portfolios from using model M0. Of these, there are five portfolios with significant positive exposure; “Industrial metals and mining”, “Mining”, “Electricity”, “Banks” and “Life Insurance”. The other 11 significant portfolios have negative exposure to the Chinese yuan. At the 10% level of statistical significance there is exposure in 19 sector portfolios (47,5%) when looking at the Chinese Yuan. The three additional sectors are “Food and Drug

retailers”, “Alternative Energy” and “Travel and Leisure”. These results show that there is still high significance in the exposure to Chinese Yuan, more than previously found by Bodnar & Gentry (1993), and in line with He and Ng (1998) for exposure when the firm isn’t U.S.-based. The Japanese yen holds a 5 percent statistical significance in 12 of 40 portfolios (32.5%) where 8 of the significant portfolios have a negative coefficient, and 4 have a positive coefficient. At the 10 percent level, the Japanese Yen is statistically significant for 14 equity portfolios. The U.S. dollar has statistical significance in 18 out of 40 portfolios (45%), inhibiting a little more currency exposure than the Chinese Yuan. For the dollar, 12 of the 40 portfolios has a negative coefficient, and 6 with a positive exposure coefficient. When using the market variable to control for macroeconomic movements, most currency exposure coefficients that are significant go from being positive to being negative. For the Yuan this has meant going from 100% positive to 31.25% positive statistically total significant coefficients.

All three currencies do also lose some significance, with the Japanese Yen being hit the hardest when controlling for the market portfolio, losing significance in 22 of the sectors, going from significance in 34 to a significance in only 12. The exposure to the Yuan and the dollar only loses three significant portfolios each. However, this is just when counting for their number, looking at the exposed industries, only seven sectors remain statistically significant at a ten percent level, and five remain significant at a five percent level between regressions. These sectors are “Alternative Energy”, “Industrial Metals and Mining”, “Mining”, and “Pharma and Bio”, “Electricity”, “Banks” and “Life insurance” at ten percent. For five percent significance the sectors are “Industrial Metals and Mining”, “Mining”, “Electricity”, “Banks”, and “Life Insurance”. It is also found that adding the market movement gave significance to twelve sectors that weren’t already significant in our simple regression at the 10 percent level, eleven of them also being significant at the 1 percent significance level. 14 sectors lost significance in their coefficients using this method, indicating that their significance from the simple linear regression is more affected by the market returns than the currency returns. Over the measuring period, there are also seven sectors that didn’t inhibit any currency exposure at the ten percent significance level or below, with or without the market returns. These sectors are “Auto and Parts”, “Leisure Goods”, “General retail”, “Mobile telecom”, REITs, “Software and Computer services” and “Technology Hardware and equipment”. Seen from the export and/or import perspective, the seven sectors with no exposure whatsoever contain three of the sectors with highest trade between Europe and China; “Auto and Parts”, “Leisure goods” and “Tech and Hardware equipment”.

To reiterate for the coefficients in table 15, according to financial theory, we expect the home currency to depreciate should there be an increase in imports and thus increasing the returns for our sectors with positive currency exposure (negative coefficient) and decrease the ones with negative exposure (positive coefficient). If there is however an increase in exports, the home currency should appreciate and thus decreasing returns for the sectors with positive exposure and decrease the ones with negative exposure. From figure 8 we see that the EURCNY bilateral exchange rate has depreciated over the period of measurement. It would be to our expectation that the majority of importing sectors would therefore have a negative coefficient sign and exporting sectors a positive one.

From our seven net import sectors with significant exposure, one sector (“Industrial Metal and Mining”) is negatively exposed, and six sectors (“Forestry and paper”, “Food Producers”, “Household Goods”, “Tobacco”, “Healthcare equipment and services” and “Media”) are positively exposed. *Ceteris paribus*, a one percent increase in the EURCNY exchange rate will lead to a 0.46% increase in the value of the “Industrial Mining and Metals” sector with these coefficients. Likewise, for sectors such as “Household Goods”, a one percent increase in EURCNY exchange rate will lead to a 0.37% decrease in the value of this sector portfolio. The sector with the highest negative effect for net importers can be found in the “Tobacco” portfolio, where a 1% increase in the EURCNY exchange rate will lead to a value reduction of 0.47%. Statistically significant net exporting sectors of our dataset consist of five sectors. Out of these five sectors, one sector (“Mining”) has a positive coefficient, and the other sectors (“Support services”, “Beverages”, “Pharma and Bio” and “Travel and leisure”) inhibit negative coefficients. This means, *ceteris paribus*, a one percent increase in the EURCNY exchange rate will lead to a one percent increase in the value of the “Mining” sector, contrary to all other sectors. For negatively exposed sectors such as “Aero and defence” that has the highest exposure coefficient of all the sectors import or export, a one percent increase in EURCNY will lead to a reduction in value of 0.54%. For travel and leisure with the lowest magnitude of exposure, a 1% increase in EURCNY will lead to a 0.12% reduction in portfolio value.

All in all, our findings yield mixed results regarding trade. While our net importers have most of the positive exposure and align with standard international finance theory, our net exporters do also have a positive exposure suggesting an asymmetry between European and Chinese trade.

6.3 Multivariate MLS Regression: Model M2

In the multivariate regression analysis, we measured the exposure of all three currency pairs in one single regression both for the United States and Europe. Because currencies may cancel each other out, we wanted to test if the hypothesis of them experiencing multicollinearity is true and if exposure significance drops from the previous model M1.

6.3.1 States United

Consider the multivariate regression analysis for the United States presented in table 16.

Table 16: MLS regression using model M2 for U.S. sectors

US Sector	Trade Balance with China	Linear Currency Exposure		
		USDCNY	USDJPY	USDEUR
Oil and Gas Production	1 402	0.100	-0.015	-0.17
Oil Services Distribution	-	-0.0028	0.020	-0.29
Alternative Energy	-	-2.25	0.32	-1.24**
Chemicals	-2 137	0.035	-0.020	-0.18*
Forestry and paper	-3 045	0.22	-0.19	0.0070
Industrial Metal and Mines	-2 468	-0.40	-0.16	-0.81***
Mining	1 248	-0.0098	-0.91***	-0.72**
Construction and Materials	-22 383	-0.037	0.13	-0.048
Aero Defense	7 809	-0.099	-0.19*	0.17**
General Industrials	-43 210	0.35	-0.15	0.025
Electronic and Electrical Equipment	-21 067	-0.29	0.0030	0.035
Industrial Engineering	-15 857	0.011	-0.0019	-0.27**
Industrial Transportation	-208	-0.41	0.035	0.19*
Support Services	4 486	-0.23*	0.10**	0.024
Auto and Parts	-3 859	0.11	0.098	0.026
Beverages	476	0.17	-0.033	-0.18*
Food Producers	10 505	0.42	-0.15*	0.054
Household goods and Home				
Construction	-35 621	0.033	-0.078	0.078
Leisure Goods	-17 709	0.0055	0.23	-0.032
Personal Goods	-67 605	-0.10	-0.045	-0.11
Tobacco	-12	0.46	-0.096	-0.11
Healthcare Equipment Services	-4 082	-0.10	-0.017	0.12
Pharma and Bio	-197	-0.24	-0.17**	0.075
Food and Drug Retailers	-265	-0.099	0.091	0.095
General Retailers	-	-0.16	0.030	0.15
Media	-	0.17	0.0078	-0.042
Travel and Leisure	11 386	0.066	-0.023	-0.032
Fixed Line Telecommunications	-	0.33	-0.034	0.012
Mobile Telecommunications	-466	1.40**	0.25	-0.11
Electricity	-	0.48	-0.19	-0.011
Gas Water and Multi Utilities	-	0.34	-0.15	0.017
Banks	-	0.53	0.12	0.018

Non-Life Insurance	119	0.24	0.030	0.034
Life Insurance	-	0.57	-0.028	-0.26
Real Estate Inv Services	-	0.14	0.055	0.35
REITs	-	0.49	-0.41***	0.027
Financials	1 570	-0.080	0.37***	-0.094
Equity Investment instruments	-	-1.53**	0.18	-0.0029
Software and Computer Services	19	-0.45*	0.18*	-0.053
Tech and Hardware Equipment	-108 578	-0.20	0.0052	0.25**

Currency	Significant Exposure from Multivariate Regressions		
	Positive	Negative	Total
<i>Yuan</i>	1	1	2 (5%)
<i>Yen</i>	2	3	5 (12.5%)
<i>Euro</i>	2	4	6 (15%)

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

MLS regression analysis with monthly US sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables. All currencies regressed simultaneously with excess returns in the regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. A coefficient of -1 means that if the USD increases relative to the other currency, the sector will experience an excess return of -1 percent. Also included is a summary table of the statistically significant exposures at a 5% and 1% level and their signs. Data Source: Reuters DataStream

We see that the significance relating to the Yuan is largely unchanged and that the sectors, “Telecom” and “Equity Investment instruments” are still inhibiting negative exposure with “Mobile Telecom” exposure still being positive. However, the exposure coefficient for “Alternative Energy” is no longer significant at a 5 percent level, but at a 10 percent level. Yen sector exposure is also unchanged in both sectors affected and their signs, the only change happening is for the Euro. The Euro exposure for M2 regression analysis loses significance in “Beverages” and in “Consumer Goods” and gains a positive exposure in “Aero and defence”.

In order to test for multicollinearity a value inflation factor test has been conducted in order to clarify the relationship.

Table 17: Multicollinearity Test for U.S. variables

Multicollinearity Test		
Variable	VIF	1/VIF
MARKET	1.52	0.66
USDEUR	1.50	0.66
USDJPY	1.17	0.85
USDCNY	1.11	0.90
Mean VIF	1.33	0.75

$N=171$, Multicollinearity if $VIF > 5$.

VIF Multicollinearity Test based on currency pair data and excess market returns on a monthly frequency. All data in percentages. The analysis is linked to the regression performed in table 6.3.1 and accounts for the period Jan 2005 to Apr 2019. A VIF value of < 5 implies multicollinearity isn't present, > 5 implies multicollinearity between variables, and if $VIF > 10$ the multicollinearity is high. Data for the market returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. Data Source: Reuters DataStream

For the United States, the VIF coefficient for all four independent variables is below 5, the standard for declaring significant multicollinearity. As a result, they don't interfere much with each other thus not violating the 4th assumption of the multiple regression model and we see that adding all three currencies in the same regression doesn't produce multicollinearity nor reduces significance dramatically.

6.3.2 Europe

Table 18: MLS regression using model M2 for European sectors

EU Sector	Trade Balance with China	Linear Currency Exposure		
		EURCNV	EURJPY	EURUSD
Oil and Gas Production	1 154	0.33	-0.066	-0.23
Oil Services Distribution	-	0.43	-0.014	-0.15
Alternative Energy	-	-0.39	-0.066	0.91
Chemicals	379	-0.39*	0.018	0.49**
Forestry and paper	-2 076	-0.16	-0.15	-0.086
Industrial Metal and Mines	-446	-0.43	0.080	0.83
Mining	2 277	-0.62	-0.26	1.24**
Construction and Materials	-7 897	0.12	0.028	-0.025
Aero Defense	6 840	-0.28	0.011	-0.26
General Industrials	-875	0.18	0.034	-0.092
Electronic and Electrical Equipment	-31 343	-0.26	0.16*	0.25
Industrial Engineering	8 285	-0.33	0.059	0.42*
Industrial Transportation	-453	-0.059	-0.11**	0.19
Support Services	3 888	-0.16	0.032	-0.066
Auto and Parts	34 548	-1.01***	0.015	0.85**
Beverages	1 100	-0.29	-0.16	0.15
Food Producers	-704	-0.015	-0.11	-0.19
Household goods and Home				
Construction	-26 779	-0.13	0.046	-0.28
Leisure Goods	-18 794	-0.15	0.034	0.011
Personal Goods	-48 502	-0.099	-0.031	0.14
Tobacco	-66	0.031	-0.26**	-0.32
Healthcare Equipment Services	-1 535	-0.12	-0.068	-0.15
Pharma and Bio	1 800	-0.057	-0.21*	-0.18
Food and Drug Retailers	-	0.0030	-0.041	-0.12

General Retailers	-	0.18	0.064	-0.36
Media	-707	0.20	0.036	-0.34*
Travel and Leisure	34	0.088	0.17*	-0.36
Fixed Line Telecommunications	-	0.14	0.046	-0.10
Mobile Telecommunications	14	0.00084	-0.015	-0.081
Electricity	-	0.11	-0.060	0.12
Gas Water and Multi Utilities	-	0.0100	-0.24*	0.23
Banks	-	0.27	0.17	-0.11
Non-Life Insurance	-53	0.093	0.040	0.0026
Life Insurance	-	0.21	0.13	-0.065
Real Estate Inv Services	-	0.24	-0.18*	-0.019
REITs	-	-0.12	-0.076	0.17
Financials	-330	-0.18	0.093**	0.14
Equity Investment instruments	-	-0.17	0.10*	-0.22
Software and Computer Services	1 820	-0.0013	0.15*	-0.17
Tech and Hardware Equipment	-151 978	-0.35	0.16	0.062

Currency	Significant Coefficient from Multivariate Regressions		
	Positive	Negative	Total
EURCNY	0	1	1 (2.5%)
EURJPY	1	2	3 (7.5%)
EURUSD	3	0	3 (7.5%)

$N=171$, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

MLS Regression analysis with monthly EU sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables. All currencies regressed simultaneously with excess returns in the regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. A coefficient of -1 means that if the EUR increases relative to the other currency, the sector will experience an excess return of -1 percent. Also included is a summary table for statistically significant exposure at the 5% and 1% level and the sign of these coefficients. Data Source: Reuters DataStream

With all three currencies affecting the value of our 40 equity portfolios at the same time, we find a significant reduction in the exposure magnitude. For the Chinese Yuan, there are only two significant coefficients left at 5 percent of the total sample, namely for “Chemicals” and “Auto and Parts”. “Chemicals” being significant at the 10 percent level, and “Auto and Parts” being significant at the 1 percent level, with both having a negative sign. The Japanese Yen is once again the currency where we can find the most statistical significance in the coefficients, with 10 significant coefficients to the 40 portfolios (25%) at a p-value of 10% and lower, thus implying significance. Of these, five have a negative sign (“Industrial Transportation”, “Tobacco”, “Pharma and Bio”, “Gas Water and Utilities” and “Real Estate investment services” and five with a positive sign (“Electronic and electrical equipment”, “Travel and leisure”, “Financials”, “Equity investment Instruments” and “Software and computer services”).

For the U.S. dollar, exposure is also less than it was with only single currencies as there are only five significant exposures (12.5%) left at the-value of 10% and below, and three of them being at the 5% level of significance. Of the 5% level of significance, all of them inhibit a positive sign towards our sector portfolios.

Ceteris paribus, a 1 percent increase in the value of the EURCNY exchange rate will lead to a reduction in the value of 1.01% for the “Auto and Parts” portfolio. If the EURJPY increases by 1%, ceteris paribus, we will see a value increase of 0.093% in “Financials” or a decrease in “Tobacco” of 0.26%. While for the U.S. dollar, we will see an increase of 1.24% if the EURUSD exchange rate goes up by one percent. Looking at overlapping exposures, only one sector has statistical significance in more than two currencies at once. “Chemicals” is exposed to the EURCNY at the 10% level, and the EURUSD at the 5% level. This means if both the EURCNY and the EURUSD go up by 1% at the same time, ceteris paribus, we will see a net value increase of 0.1% [0.49+ (-0.39)].

However, since we found the magnitude of the dependent variables losing significance for the three currencies, where before it was upwards of 20 statistically significant exposures, we suspect there is multicollinearity between the currencies. This can be seen in table 5, which has the correlation coefficient between the EURCNY and the EURUSD at 0.96. This is an extremely high correlation and will lead to errors in the regressions if these two variables are used together. To confirm this, we have used a VIF test to check for multicollinearity. A value of >5 for the VIF test means there is multicollinearity in our sample, and a value of >10 means there is high multicollinearity in the sample. Since two of our coefficients for VIF are measured above 10, it is safe to say that there is multicollinearity in this regression. This leads to higher standard errors, and errors in the measure of significance and beta coefficients. These results should be interpreted with this multicollinearity analysis in mind.

Table 19: VIF test for Multicollinearity for the European regression

Multicollinearity Test		
Variable	VIF	1/VIF
EURUSD	12.64	0.08
EURCNY	13.38	0.07
EURJPY	2.08	0.48
Market	1.21	0.83
Mean VIF	7.08	0.14

N=171, the VIF test is based on the European multivariate regression where all currencies are included. This is a VIF Multicollinearity test based on currency pair data and excess market returns on a monthly frequency. All data in percentages. The analysis is linked to the regression performed in table 6.3.2 and accounts for the period Jan 2005 to Apr 2019. A VIF value of <5 implies multicollinearity isn't present, >5 implies multicollinearity between variables, and if $VIF >10$ the multicollinearity is high. Data for the market returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. Data Source: Reuters DataStream

6.4 Sub-sample exposure based on currency movements

To see how the exposure has changed during our entire period defined as Jan 2005 to Apr 2019, the entire sample has been fragmented into four smaller sub-samples. The first period accounts for the period between Feb 2005 and Oct 2008, the second one between Nov 2008 and Oct 2010, the third one between Nov 2010 until Feb 2014 and the last one from Mar 2014 until Apr 2019. The reason these sub-samples were divided in this manner has to do with the pattern in the movement of the USDCNY pair. Consider figure 5. In the first period we see a sharp depreciation of the US dollar against the Chinese Yuan. In period two, the Chinese Yuan has been re-pegged to the US dollar because of the financial crisis and the monetary stimulus focusing on decreasing interest rates and increasing inflation in order to stimulate consumer spending. During the third period we have a further depreciation of the US dollar and during the fourth period tides reverse and the Chinese Yuan starts depreciating against the US Dollar. The market portfolio has been included as a control variable. The European regressions have been divided into the same sub-samples in order to be easily comparable to the United States sectors. During this analysis two points are of interest, (1) the change in the significance and magnitude, and (2), the shift in the Trade balance between the United States, respectively Europe and China (Exports minus Imports).

6.4.1 United States sub-sample analysis

The results for the United States are presented in the following table 20.

Table 20: MLS regressions for periods one, two, three, and four for the U.S. sectors

US Sector	1.2.2005 - 1.10.2008		1.11.2008 - 1.10.2010	
	Trade Balance	USDCNY	Trade Balance	USDCNY
Oil and Gas Production	-399	-0.69	267	1.45
Oil Services Distribution		-1.78		0.02
Alternative Energy		-4.3		-5.29
Chemicals	156	-2.69**	254	2.17
Forestry and paper	-4 234	0.56	-2 957	5.38
Industrial Metal and Mines	-4 956	-4.81**	-1 169	0.17
Mining	338	-5.27	1 272	-0.93
Construction and Materials	-16 739	-1.70*	-16 807	3.05*
Aero Defense	3 978	1.41*	4 908	0.24
General Industrials	-40 176	-0.56	-39 030	1.68
Electronic and Electrical Equipment	-13 209	-0.99	-14 598	-0.65
Industrial Engineering	-11 801	-2.13**	-8 887	0.035
Industrial Transportation	-1 901	-2.15*	146	1.85
Support Services	3 991	-0.38	5 658	-1.17
Auto and Parts	-4 027	0.42	-3 077	4.42
Beverages	-10	1.04	321	2.02

Food Producers	3 884	1.06	10 184	1.73*
Household goods and Home Construction	-28 309	-0.21	-27 875	1.04
Leisure Goods	-18 941	0.4	-19 058	0.65
Personal Goods	-56 435	0.54	-63 358	-0.32
Tobacco	-5	1.07	-7	0.41
Healthcare Equipment Services	-3 279	1.07	-3 371	-1.08
Pharma and Bio	-542	0.018	-975	-1.12
Food and Drug Retailers	-388	-0.55	-284	-1.73
General Retailers		-1.33		-1.16
Media		0.31		0.53
Travel and Leisure	831	1.35	4 424	-0.65
Fixed Line Telecommunications		0.1		-1.44
Mobile Telecommunications	-335	2.54	-740	0.62
Electricity		0.84		2.46*
Gas Water and Multi Utilities		-0.15		1.28
Banks		3.93		-0.31
Non-Life Insurance	34	1.30*	51	-0.9
Life Insurance		1.06		2
Real Estate Inv Services		0.77		7.60*
REITs		0.033		-1.04
Financials	543	1.23	1 533	-0.38
Equity Investment instruments		-0.18		-1.51
Software and Computer Services	32	-0.56	48	-0.85
Tech and Hardware Equipment	-67 568	-0.65	-86 663	-0.85

US Sector	1.11.2010 - 1.2.2014		1.3.2014 - 1.4.2019	
	Trade Balance	USDCNY	Trade Balance	USDCNY
Oil and Gas Production	1 039	-0.86	3 514	0.65*
Oil Services Distribution		2.29*		0.34
Alternative Energy		-6.32		-2.05
Chemicals	-2 633	0.19	-4 631	0.21
Forestry and paper	-1 939	-0.53	-2 793	-0.35
Industrial Metal and Mines	-944	-1.76	-1 911	-0.85
Mining	2 481	-3.84	1 226	-0.74
Construction and Materials	-23 307	-0.43	-28 575	0.15
Aero Defense	7 459	1.32	12 244	-0.36
General Industrials	-40 954	0.15	-48 663	0.33
Electronic and Electrical Equipment	-22 008	2.89**	-29 375	-0.40**
Industrial Engineering	-15 281	0.62	-22 236	-0.061
Industrial Transportation	710	1.05	618	-0.041
Support Services	7 436	-0.71	2 643	-0.068
Auto and Parts	-2 588	-0.012	-4 800	-0.23
Beverages	818	-0.94	722	-0.12
Food Producers	16 749	-0.58	12 185	0.48
Household goods and Home Construction	-34 663	-1.58	-45 143	0.12

Leisure Goods	-16 048	-0.32	-17 181	-0.0033
Personal Goods	-75 064	-0.92	-73 764	-0.18
Tobacco	-9	-1.66	-22	0.68
Healthcare Equipment Services	-3 924	-0.058	-5 105	-0.15
Pharma and Bio	-311	-0.40	459	-0.062
Food and Drug Retailers	329	0.044	-516	0.61
General Retailers		0.44		0.050
Media		0.55		0.053
Travel and Leisure	12 186	-0.32	24 821	-0.26
Fixed Line Telecommunications		-0.30		0.49
Mobile Telecommunications	-1 063	-2.23	-102	1.37***
Electricity		-0.48		0.14
Gas Water and Multi Utilities		0.14		0.15
Banks		-1.63		0.48
Non-Life Insurance	73	0.34	242	0.069
Life Insurance		-1.29		0.25
Real Estate Inv Services		3.13		-0.30
REITs		-0.50		0.20
Financials	1 969	-0.23	2 167	-0.33
Equity Investment instruments		0.20		-1.97***
Software and Computer Services	16	0.54		-0.55**
Tech and Hardware Equipment	-124 386	0.86	-140 666	-0.17

$P1 N=45, P2 N= 24, P3 N = 40, P4 N = 62, p < 0.1 = *, p < 0.05 = **, p < 0.01 = ***$

Multiple Regression analysis with monthly US sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables USDCNY with market excess returns in each regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019 divided in four sub-samples. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. Trade figures are the average annual export/import numbers for the sectors. A coefficient of -1 means that if the USD increases relative to the other currency, the sector will experience an excess return of -1 percent. Data Source: Reuters DataStream

During the first period we have three significant sectors exposed to the Chinese Yuan experiencing a rather large level of exposure. These are “Chemicals” “Industrial Metals and Mines” and “Industrial Engineering” with coefficients of respectively (-2.69%), (-4.81%) and (-2.13%).

Moving to the second period, exposure loses its significance, but we see a shift in the trade pattern of the “Oil and Gas Production” sector moving from a deficit of -399 million USD to a surplus of 267 million on average. The United States shifts between these two periods from being a net importer of oil with China to become a net exporter due to a large jump in oil reserves (IER, 2012).

During the third period, the analysis picks up only one significant exposure coefficient (2.89) which is positive implying that an increase in dollar returns would positively affect the “Electronic and Electrical Equipment” sector. In trade we observe that the trend for oil export from the United States to China persists but that the “Chemicals” Sector moves on average from being a net exporter with China to becoming a net importer from a surplus of 254 million

to a deficit of 2.6 billion US dollars on average. Imports in “Tech and Hardware Equipment” does also increase steeply by 43 percent due to competitive advantages in Chinese technology manufacturing. An interesting increase in the United States exports are is found in “Financials” increasing by almost a third just after the crisis.

In the fourth period we pick up significance across four sectors including “Electronic and Electrical Equipment”, “Mobile Telecommunications”, “Equity and Investment instruments” and surprisingly “Software and Computer Services” with exposures of (-0.4), (1.37), (-1.94) and (-0.55) respectively. Between the first and the fourth period, the biggest impact on trade has been in the “Oil and Gas Production sector” with the US shifting from being a net importer to a considerable exporter of oil to China from an average annual deficit of -399 million to an average annual surplus of 3.5 billion US dollars. While we see the trend shifting even before the lifting of the oil export ban, signed by congress in 2015 (Cook, 2015), we cannot conclude that there is a significant exposure in this sector vis-à-vis to the Chinese Yuan depreciation for the entire sample. The biggest development in trade between the first and last period has been in “Tech and Hardware Equipment”. Between the third and fourth period we also see significance in the coefficient of (-1.94) picking up in “Equity investment Instruments” because of a steep plunge in Chinese equities of almost 19 percent in 2018 indicating that many US investors are invested by owning Chinese equity index funds, with them being exposed not only to a Chinese Stock market decline, but also a Chinese Yuan devaluation (Dhanraj, 2019).

6.4.2 European sub-sample analysis

Table 21: MLS regressions for periods one, two, three and four for European sectors

EU Sector	1.2.2005 - 1.10.2008		1.11.2008 - 1.10.2010	
	Trade Balance	EURCNY	Trade Balance	EURCNY
Oil and Gas Production	7	0.42*	252	-0.16
Oil Services Distribution	-	0.80**	-	-0.030
Alternative Energy	-	0.86*	-	0.64
Chemicals	-529	0.28*	1 204	0.32*
Forestry and paper	-2 602	-0.51	-2 915	-0.54
Industrial Metal and Mines	-3 573	1.34***	327	0.16
Mining	60	0.99**	816	-0.084
Construction and Materials	-5 927	-0.044	-6 203	0.21
Aero Defense	3 952	-0.65***	4 573	-0.73**
General Industrials	-582	0.24	-871	0.30
Electronic and Electrical Equipment	-21 970	-0.014	-28 947	0.51*
Industrial Engineering	5 579	0.43***	12 953	0.37**
Industrial Transportation	-436	-0.086	-1 322	0.089
Support Services	2 978	-0.13	3 896	-0.33***
Auto and Parts	7 162	-0.31	22 031	-0.29
Beverages	285	-0.20	602	-0.19
Food Producers	-2 889	-0.41***	-2 709	-0.15

Household goods and Home Construction	-20 283	-0.41**	-22 825	-0.40**
Leisure Goods	-20 104	0.021	-19 860	-0.29
Personal Goods	-39 717	-0.028	-48 302	0.23
Tobacco	-36	-0.44**	-72	-0.60*
Healthcare Equipment Services	-1 555	-0.20	-1 395	-0.28*
Pharma and Bio	-412	-0.32**	-89	-0.37*
Food and Drug Retailers	-	-0.30	-	-0.077
General Retailers	-	0.079	-	0.063
Media	-635	-0.22*	-754	-0.043
Travel and Leisure	-30	-0.20	-13	0.0042
Fixed Line Telecommunications	-	-0.33*	-	0.55***
Mobile Telecommunications	-21	0.15	7	0.12
Electricity	-	0.21	-	0.045
Gas Water and Multi Utilities	-	0.042	-	-0.067
Banks	-	-0.18	-	0.028
Non-Life Insurance	-5	-0.34*	-1 322	0.36
Life Insurance	-	-0.16	-	0.32
Real Estate Inv Services	-	0.23	-	0.077
REITs	-	-0.76*	-	0.18
Financials	-97	0.076	-45	-0.037
Equity Investment instruments	-	-0.16*	-	-0.51**
Software and Computer Services	400	-0.13	1 344	-0.15
Tech and Hardware Equipment	-107 866	-0.24	-131 453	-0.16

EU Sector	1.11.2010 - 1.2.2014		1.3.2014 - 1.4.2019	
	Trade Balance	EUR/CNY	Trade Balance	EUR/CNY
Oil and Gas Production	826	0.018	2 630	0.21
Oil Services Distribution	-	-0.39	-	0.69**
Alternative Energy	-	1.03	-	-0.54
Chemicals	972	-0.017	421	-0.062
Forestry and paper	-1 918	0.12	-1 414	-0.32
Industrial Metal and Mines	-257	0.11	1 635	-0.15
Mining	1 333	-0.051	5 201	0.38
Construction and Materials	-7 493	0.069	-10 391	0.25**
Aero Defense	6 890	-0.069	10 027	-0.26
General Industrials	-777	-0.15	-1 168	0.10
Electronic and Electrical Equipment	-34 115	0.0062	-38 137	0.045
Industrial Engineering	17 441	-0.21	3 088	0.10
Industrial Transportation	-976	0.026	195	0.16*
Support Services	4 981	-0.26**	3 957	0.070
Auto and Parts	47 231	0.065	53 855	0.13
Beverages	1 298	-0.53**	1 834	-0.14
Food Producers	-1 082	-0.37*	2 073	-0.067
Household goods and Home Construction	-26 165	-0.38***	-33 927	-0.17
Leisure Goods	-16 424	-0.36	-18 741	0.22
Personal Goods	-51 553	0.16	-53 779	-0.12

Tobacco	-75	-0.65***	-81	0.15
Healthcare Equipment Services	-1 458	-0.33**	-1 514	-0.12
Pharma and Bio	1 631	-0.38	4 428	-0.28
Food and Drug Retailers	-	-0.091	-	-0.019
General Retailers	-	-0.27	-	-0.061
Media	-836	0.017	-571	-0.16
Travel and Leisure	61	-0.21*	88	-0.23
Fixed Line Telecommunications	-	0.57***	-	-0.081
Mobile Telecommunications	38	-0.088	78	-0.13
Electricity	-	0.30*	-	0.29*
Gas Water and Multi Utilities	-	0.041	-	0.14
Banks	-	0.35*	-	0.20
Non-Life Insurance	-976	0.29*	195	-0.26*
Life Insurance	-	0.56**	-	-0.23
Real Estate Inv Services	-	0.030	-	0.038
REITs	-	0.050	-	-0.012
Financials	195	0.054	-169	0.16*
Equity Investment instruments	-	-0.36***	-	-0.25***
Software and Computer Services	1 374	0.17	2 408	0.12
Tech and Hardware Equipment	-154 638	0.34	-193 880	-0.35*

*P1 N=45, P2 N= 24, P3 N = 40, P4 N = 62, $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$*

MLS regression analysis with monthly EU sector excess returns as the dependent variable and logarithmic monthly currency pair returns and excess market returns as the independent variables EURCNY with market excess returns in each regression. All data in percentages. The regression accounts for the period Jan 2005 to Apr 2019 divided in four sub-samples. Data for the sector returns has been constructed from the Total Return index where there has been an account for dividend reinvestment. Trade figures are the average annual export/import numbers for the sectors. A coefficient of -1 means that if the EUR increases relative to the other currency, the sector will experience an excess return of -1 percent. Data Source: Reuters DataStream

In the first period from February 2005 to October 2008 we find exposure to the yuan in 17 of 40 portfolios (42.5%) at the 10% or below level. Of these exposures seven have a negative coefficient, ten have a positive coefficient. At the 5% level of these exposures, we have nine out of 40 that is significant at the 5% or below level (22.5%), with four having a positive sign (“Oil equipment services and distribution”, “Industrial Metal and mining”, “Mining” and “Industrial engineering”) and five have a negative sign (“Aero and defense”, “Food producers”, “Household goods and home construction”, “Tobacco” and “Pharma and Bio”).

For the second period, from November 2008 to October 2010, we find statistical significance in 11 of our 40 portfolios (27.5%) at the 10% or below level. Of these results, four have a positive sign, and seven have a negative sign. At the 5% level and below of significance, we find six portfolios being exposed. Of these six, two are negatively exposed (“Industrial Engineering” and “Fixed Line Telecommunications”) and four are positively exposed (“Aero and defense”, “Support Services”, “Household goods and Home construction” and “Equity investment instruments”).

Moving from period one to period two, seven portfolios keep their significance at 10% or below across time; “Chemicals”, “Aero and defense”, “Industrial engineering”, “Household goods

and Home construction”, “Tobacco”, “Pharma and bio”, “Fixed Line Telecommunications” and “Equity investment Services”. What is interesting to notice is that “Fixed Line Telecommunications”, where it gains in significance (from 10% to 1% statistical significance) does also change its sign from negative to positive. Unfortunately, we didn’t collect any trade data for “Fixed Line Telecommunications” at the level we looked at for trade between Europe and China, so it is unsure if this is due to change in trade balance or other factors. The highest exposure is in “Aero and Defense” at (-0.74), and the highest positive coefficient is found in “Fixed Line Telecommunications” at (0.55).

In the period three from November 2010 to February 2014, there is an increase in statistically significant portfolios, from 11 in period two, to 13 in period three when counting at the 10% level, and eight cases of significant exposure counting at the significance of 5% and below. At the 10% level of statistical significance, there is a shift in the nature of exposure going from majorly negative to majorly positive coefficients. In period three, looking at the 10% level of significance, we find that 13 portfolios are exposed. When looking at the 5% level of significance we find the exposure to be majority positive instead, with the only two negative exposures being in “Fixed Line Telecommunications” and “Life insurance”, and six other sectors having positive exposure (“Support services”, “Beverages”, “Food producers”, “Household Goods and Home construction”, “Tobacco”, “Healthcare equipment and services”, and “Equity Investment instruments”). There are six portfolios that have kept their significance across measurement periods, where four have been significant for all three measurement periods (“Household goods and Home construction”, “Tobacco”, “Fixed line Telecommunications” and “Equity Investment instruments”). the highest exposure can be found in “Tobacco”, at (-0.65). The highest negative exposure is (0.57) for “Fixed Line Telecommunications” like the previous period.

In the fourth period, March 2014 to April 2019, there is significantly less sector exposure to the Chinese Yuan at both the five and ten percent level. For exposure at the 10% level there are only eight portfolios that have significant exposure. For the 5% level, we only find exposure in three portfolios, where two are negatively exposed (“Oil equipment services and distribution” and “Construction materials”) and one positive exposure (“Equity investment instruments”). This makes the 2014 to 2019 period the period with the least amount of exposure to the Chinese Yuan, even if the trade between the two countries has kept rising. Period four also gave significance to a portfolio we earlier haven’t observed any significance to when looking at the Chinese Yuan (for the simple regressions and the multivariate regression), the “Tech hardware and equipment portfolio”, even though it is only at the 10% level.

Between period three and four we find that only three portfolios keep their significance between measurements. Of those three, only one is significant at the 5% level being “Equity Investment instruments” which has been significant over all four measurement periods, while the others that were previously significant over periods 1-3 have fallen off. Interestingly, “Equity investment Instruments” was only significant in one of the regression models we did previously for Europe, in model M1 but insignificant in models M0 and M2 (see tables 10, 15,

and 18). For all four periods, the “Equity Investment” portfolio was exposed, with the exposure ranging from its highest coefficient in period two at (-0.52) to its coefficient of (-0.25) in 2014.

6.5 Sub samples based on trade shift

In order check for a better measure of change in the nature of the sign of our coefficients and their relationship with a shift from our home countries being net importers/ net exporters to net exporters/ net importers in the trade with China, we sliced our subsamples for when the trade shifts actually occurred.

6.5.1 U. S Sectors

In the United States we see a shift in trade for four sectors between Jan 2005 and Dec 2018. These Sectors are “Oil and Gas Production”, “Chemicals”, “Beverages” and “Pharma and Bio”.

Table 22: Sub-period sampling based on trade shift for American Sectors

Sectors	Exposure to the Chinese Yuan			
	Period 1		Period 2	
	USDCNY	p-value	USDCNY	p-value
Oil and Gas Production	-0.13	(0.94)	0.39	(0.22)
Chemicals	-1.87	(0.14)	-0.011	(0.97)
Beverages	-0.42	(0.60)	0.045	(0.88)
Pharma and Bio	-0.46	(0.39)	-0.086	(0.76)

$p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Coefficients and p-values in parenthesis for the subsample regressions that was split based on a shift in the nature of trade for the sectors. All three sectors in Europe went from being net importers in Period 1 to being net exporters in Period 2.

Oil and Gas Production N1 = 47 N2=120

Chemicals N1 = 35 N2= 132

Beverages N1 = 35 N2= 132

Pharma and Bio N1 = 96 N2=71

For the oil and gas production sector, the trade shift occurred in 2009 so we divided the sample between 2005 to 2008 and 2009 to 2018. During the first period the US dollar depreciated against the Chinese Yuan while appreciating in the second period. The shift in this sector was from net importing to net exporting. When dividing the subsample when the trade shift occurred, and controlling for market excess returns, the exposure coefficients shifted sign but because they are both insignificant, we cannot determine an exact relationship.

The US “Chemicals” sectors shifted from being a net exporter to becoming a net importer in 2008, so the subsample division is between the periods 2005-2007 and 2008-2018. Here we see again a deduction in the exposure of a Chinese Yuan depreciation, but the coefficients are insignificant at our 10% thresholds, so a clear relationship cannot be determined. During the first period we saw a depreciation of the US dollar while during the second period the Yuan appreciated against the dollar.

The “Beverages” sector does also experience a reduction in the exposure for a Chinese Yuan depreciation from period one to period two. The first period stretches between 2005 and 2007 while the second one stretches between 2008 and 2018. The trade shift for the beverages sector being a net importer to becoming a net exporter occurred in 2008. The exposure coefficients have been reduced but are not significant.

The “Pharma and Bio” sector shifted from being a net importer to becoming a net exporter in 2013. The first period occurs between 2005 and 2012 and the second period between 2013 and 2018. While the exposure to the depreciation of the Chinese Yuan decreases, the p-values of both coefficients are very high, implying that they cannot be differentiated from 0.

Conclusionary, while a trade shift from net export/net import to net import/ net export occurs between the United States and China, we cannot determine a clear shift in exposure from these patterns.

6.5.2 European Sectors

Table 23: Sub-period sampling based on trade shift for European sectors

Sectors	Exposure to the Chinese Yuan			
	Period 1		Period 2	
	EURCNY	p-value	EURCNY	p-value
Food Producers	-0.12	(0.35)	-0.34***	(0.00)
Pharma and Bio	-0.50***	(0.00)	-0.28**	(0.01)
Travel and Leisure	-0.16**	(0.05)	-0.12	(0.39)

$p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$

Coefficients and p-values in parenthesis for the subsample regressions that was split based on a shift in the nature of trade for the sectors. All three sectors in Europe went from being net importers in Period 1 to being net exporters in Period 2.

Food Producers $N1 = 72$ $N2 = 95$

Pharma and Bio $N1 = 96$ $N2 = 71$

Travel and Leisure $N1 = 108$ $N2 = 59$

The portfolio “Food producers” was a net importing sector from Jan 2005 until Dec 2012 and net exporters from Jan 2013 until Dec 2018 which will be our two subperiods for this sector. The currency movement for these periods are read from figure 8, where we see that the

EURCNY has depreciated over this period. After 2012 it continued to depreciate until 2015 where it started to appreciate again. The 2012 – 2018 period is still a net depreciation period for the exchange rate.

The results from our regression shown in table 23 reveal “Food producers” being exposed for both periods. Even if the trade for this portfolio changed from being a net importer to net exporter, we didn’t find any change in the sign and nature of exposure. The only change is that it gained significance in period two and increased the value of the exposure coefficient.

“Pharma and bio” was a net importing sector from Jan 2005 until Dec 2010 and after 2010 it shifts from being a net importer to be a net exporter. Thus, period one is defined from Jan 2005 to Dec 2010 and period 2 is defined from Jan 2011 to Dec 2018. The currency movement over period 1 and 2 is of the same nature over both periods, as we see the EURCNY depreciating as seen in figure 8.

Our results show, as seen in table 23, that “Pharma and bio” is also exposed to the Chinese Yuan for both periods. Neither in this portfolio did we find a change in the sign of the coefficient as we would expect, however the exposure is significant for both periods in this case. Unlike “Food producers”, “Pharma and bio” lost some value in its exposure coefficient over the two periods.

The “Travel and Leisure” sector is also a net importer in its first period, from Jan 2005 to Dec 2009, after this it changes from net importing to net exporting for the period Jan 2010 to Dec 2018. Thus, period one for “Travel and Leisure” proves to be Jan 2005 to Dec 2009 and period two will be Jan 2010 to Dec 2018. The currency exchange rates over these two periods is defined by currency depreciation for both, as observed in figure 8.

Additionally, in “Travel and Leisure” we do find exposure for both periods, but not a change in the sign of the exposure coefficient as we expect. It also loses significance and value in its exposure coefficient (like “Travel and Leisure” for) in period two.

Overall, measuring regressions on subperiods split by the change in trade position, in the case of all European sectors, where they went from being net importers to becoming net exporters, proves not to give us the expected results. There is no change in the sign of the exposure coefficient for any of the sectors and the exposures we found were positive. Reading from table 13 we can see that all three portfolios were also positively exposed in this case, with “Pharma and bio” and “Travel and Leisure” being net exporters over the period 2005 to 2019 on average. “Food producers” was a net importer over the period 2005 to 2019 on average.

7 Conclusion

This paper has analysed and brought to light empirical evidence in how the United States and European markets, which have been subdivided into 40 sectors each, have been exposed to the Chinese Yuan between January 2005 and April 2019. In addition to the Chinese Yuan exposure, we also measured the exposure of the Japanese Yen on all sectors in both markets and the United States Dollar exposure on European sectors, respectively the Euro exposure on United States sectors. We also examined how the exposure reacted when adding a market portfolio as a control variable and when including multiple currency returns. Empirical evidence has been found for multicollinearity when accounting for multiple currency exposures in the same regression for the European market, supporting findings in previous studies suggesting that exchange rate exposure should be measured in relation to individual currencies.

When measuring exposure independently, without controlling for market returns, our results show that in general, United States sector returns are exposed to a Chinese Yuan devaluation, tend to gain from a Japanese Yen devaluation and are exposed to lose from a Euro devaluation. In addition to this, we found that as the market capitalization for a sector increases, the exposure to a Chinese Yuan devaluation tends to decrease. Furthermore, while United States exports towards China increase, so do, in general, United State sector returns. However, this relationship has only a weak significance and cannot say with enough certainty that export sectors tend to gain from exporting more to China. For the European sectors, our results show that, a depreciation in either of the three foreign currencies tends to increase sectors returns in the European market. The largest exposure has been measured for both the United States and Europe in the sector with the lowest market capitalization, but while the United States “Alternative energy” sector tends to lose from a Chinese Yuan devaluation, the European one tends to gain from it. Both the United States and Europe are exposed to each other’s currency devaluations.

The inclusion of a market portfolio in the currency exposure regression tends to reduce the significance of the Chinese Yuan exposure, the Japanese Yen exposure as well as the exposure for the Euro, respectively the United States dollar. This effect is more dramatic for the United States sectors and affects to a lesser extend the European ones, because of the fact that their market portfolios themselves absorb much of the currency exposure. Interestingly enough, while United States market returns tend to lose from a Chinese Yuan and Euro devaluation while gaining from a Japanese Yen devaluation, European market returns tend to gain from all Chinese Yuan, Japanese Yen and United States dollar devaluations. In addition to the market absorbing currency exposure, there is also a danger of omitted variable bias.

Multicurrency regression analysis fails to uncover multicollinearity between our currency pairs for the United States analysis but does so for our European analysis, supporting previous claims that currency baskets do not necessarily yield better results because of multicollinearity and a movement cancellation effect. Furthermore, while subsampling the data for the entire period, we discover that sectors do not tend to change their behaviours from a shift in trading patterns, suggesting that these patterns might be more intimately related to other factors.

8. References

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9. Appendix

9.1 Regression tables

9.1.1 Simple Regression Analysis Without Market Variable

9.1.1.1 *United States*

US Sectors	lnUSDCNY		constant	R-sq
Oil and Gas Production	-1.03**	(0.05)	0.0057	(0.24) 0.01
Oil Services Distribution	-1.39**	(0.02)	0.0048	(0.41) 0.02
Alternative Energy	-4.38***	(0.00)	0.011	(0.37) 0.04
Chemicals	-1.36***	(0.00)	0.0079	(0.12) 0.02
Forestry and paper	-1.68***	(0.00)	0.0075	(0.37) 0.01
Industrial Metal and Mines	-2.81***	(0.00)	0.0038	(0.64) 0.04
Mining	-2.05***	(0.00)	0.0029	(0.72) 0.02
Construction and Materials	-1.32**	(0.01)	0.0064	(0.24) 0.02
Aero Defense	-1.14**	(0.03)	0.010**	(0.02) 0.02
General Industrials	-0.99**	(0.03)	0.0033	(0.52) 0.01
Electronic and Electrical Equipment	-1.53***	(0.00)	0.0072	(0.14) 0.03
Industrial Engineering	-1.68***	(0.00)	0.0084	(0.16) 0.03
Industrial Transportation	-1.34**	(0.01)	0.0086*	(0.07) 0.03
Support Services	-1.08***	(0.01)	0.0080**	(0.03) 0.03
Auto and Parts	-1.30**	(0.02)	0.0043	(0.52) 0.01
Beverages	-0.52	(0.14)	0.0074**	(0.01) 0.01
Food Producers	-0.27	(0.48)	0.0048	(0.11) -0.00
Household goods and Home				
Construction	-0.62	(0.16)	0.0046	(0.16) 0.01
Leisure Goods	-0.84	(0.18)	0.0051	(0.27) 0.01
Personal Goods	-1.01**	(0.01)	0.0068*	(0.05) 0.03
Tobacco	-0.33	(0.44)	0.011***	(0.01) -0.00
Healthcare Equipment Services	-0.93**	(0.04)	0.0083**	(0.03) 0.02
Pharma and Bio	-1.00**	(0.03)	0.0071**	(0.04) 0.03
Food and Drug Retailers	-0.75*	(0.09)	0.0058	(0.13) 0.01
General Retailers	-0.89*	(0.07)	0.0082**	(0.03) 0.02
Media	-0.96	(0.12)	0.0059	(0.19) 0.01
Travel and Leisure	-1.13**	(0.02)	0.0073	(0.11) 0.02
Fixed Line Telecommunications	-0.30	(0.48)	0.0057	(0.12) -0.00
Mobile Telecommunications	0.36	(0.58)	0.0049	(0.43) -0.00
Electricity	-0.11	(0.77)	0.0068**	(0.04) -0.01
Gas Water and Multi Utilities	-0.34	(0.39)	0.0087**	(0.01) -0.00
Banks	-0.83	(0.28)	0.0031	(0.65) 0.00
Non-Life Insurance	-0.61	(0.14)	0.0041	(0.26) 0.01
Life Insurance	-1.46*	(0.05)	0.0060	(0.42) 0.01
Real Estate Inv Services	-1.11*	(0.09)	0.0045	(0.53) 0.00
REITs	-1.00	(0.11)	0.0072	(0.21) 0.01
Financials	-1.31**	(0.02)	0.0044	(0.40) 0.02
Equity Investment instruments	-2.33***	(0.00)	0.0038	(0.56) 0.04
Software and Computer Services	-1.35***	(0.01)	0.0082**	(0.04) 0.04

Tech and Hardware Equipment	-1.16**	(0.02)	0.0084*	(0.08)	0.02
US Sectors	lnUSDJPY		constant		R-sq
Oil and Gas Production	0.34	(0.13)	0.0068	(0.15)	0.02
Oil Services Distribution	0.41	(0.12)	0.0063	(0.27)	0.02
Alternative Energy	0.43	(0.46)	0.017	(0.20)	-0.00
Chemicals	0.43*	(0.05)	0.0094*	(0.06)	0.03
Forestry and paper	0.55	(0.18)	0.0093	(0.26)	0.01
Industrial Metal and Mines	0.29	(0.43)	0.0071	(0.38)	-0.00
Mining	-0.66*	(0.05)	0.0057	(0.47)	0.02
Construction and Materials	0.63**	(0.02)	0.0077	(0.14)	0.05
Aero Defense	0.30	(0.21)	0.011***	(0.01)	0.01
General Industrials	0.39	(0.14)	0.0043	(0.39)	0.02
Electronic and Electrical Equipment	0.51**	(0.04)	0.0088*	(0.07)	0.04
Industrial Engineering	0.52*	(0.08)	0.010*	(0.08)	0.03
Industrial Transportation	0.51**	(0.02)	0.0100**	(0.03)	0.05
Support Services	0.46***	(0.01)	0.0091***	(0.01)	0.07
Auto and Parts	0.70**	(0.01)	0.0056	(0.40)	0.04
Beverages	0.14	(0.36)	0.0080***	(0.01)	0.00
Food Producers	0.15	(0.37)	0.0051*	(0.08)	0.01
Household goods and Home					
Construction	0.22	(0.19)	0.0053	(0.10)	0.01
Leisure Goods	0.59***	(0.00)	0.0059	(0.19)	0.07
Personal Goods	0.24	(0.19)	0.0080**	(0.02)	0.02
Tobacco	0.16	(0.40)	0.012***	(0.00)	0.00
Healthcare Equipment Services	0.37	(0.10)	0.0093**	(0.01)	0.04
Pharma and Bio	0.14	(0.40)	0.0082**	(0.02)	0.00
Food and Drug Retailers	0.42**	(0.01)	0.0066*	(0.08)	0.05
General Retailers	0.41***	(0.01)	0.0091**	(0.01)	0.05
Media	0.44**	(0.04)	0.0069	(0.11)	0.04
Travel and Leisure	0.43**	(0.05)	0.0085*	(0.06)	0.03
Fixed Line Telecommunications	0.23	(0.13)	0.0059*	(0.10)	0.01
Mobile Telecommunications	0.70***	(0.01)	0.0042	(0.50)	0.05
Electricity	0.031	(0.86)	0.0069**	(0.03)	-0.01
Gas Water and Multi Utilities	0.12	(0.52)	0.0091***	(0.01)	-0.00
Banks	0.72**	(0.03)	0.0038	(0.55)	0.05
Non-Life Insurance	0.40**	(0.04)	0.0047	(0.18)	0.05
Life Insurance	0.65	(0.13)	0.0075	(0.30)	0.03
Real Estate Inv Services	0.77**	(0.03)	0.0056	(0.43)	0.04
REITs	0.14	(0.67)	0.0083	(0.16)	-0.00
Financials	0.86***	(0.00)	0.0057	(0.25)	0.11
Equity Investment instruments	0.46*	(0.10)	0.0065	(0.34)	0.01
Software and Computer Services	0.52***	(0.01)	0.0097**	(0.01)	0.06
Tech and Hardware Equipment	0.52**	(0.01)	0.0096**	(0.04)	0.05

US Sectors	lnUSDEUR		constant		R-sq
Oil and Gas Production	-0.89***	(0.00)	0.0079*	(0.07)	0.16
Oil Services Distribution	-1.13***	(0.00)	0.0077	(0.13)	0.18
Alternative Energy	-2.14***	(0.00)	0.019	(0.12)	0.13
Chemicals	-1.09***	(0.00)	0.011**	(0.02)	0.22
Forestry and paper	-1.38***	(0.00)	0.011	(0.16)	0.13
Industrial Metal and Mines	-2.03***	(0.00)	0.0094	(0.16)	0.30
Mining	-1.58***	(0.00)	0.0071	(0.31)	0.19
Construction and Materials	-1.01***	(0.00)	0.0091*	(0.06)	0.16
Aero Defense	-0.73***	(0.00)	0.012***	(0.00)	0.13
General Industrials	-0.96***	(0.00)	0.0055	(0.23)	0.17
Electronic and Electrical Equipment	-0.95***	(0.00)	0.010**	(0.03)	0.17
Industrial Engineering	-1.35***	(0.00)	0.012**	(0.02)	0.24
Industrial Transportation	-0.70***	(0.00)	0.011**	(0.01)	0.10
Support Services	-0.68***	(0.00)	0.010***	(0.00)	0.17
Auto and Parts	-1.07***	(0.00)	0.0070	(0.26)	0.12
Beverages	-0.54***	(0.00)	0.0086***	(0.00)	0.16
Food Producers	-0.45***	(0.00)	0.0056**	(0.04)	0.11
Household goods and Home					
Construction	-0.46***	(0.00)	0.0058*	(0.06)	0.09
Leisure Goods	-0.69***	(0.00)	0.0069	(0.11)	0.10
Personal Goods	-0.71***	(0.00)	0.0088***	(0.00)	0.20
Tobacco	-0.57***	(0.00)	0.012***	(0.00)	0.09
Healthcare Equipment Services	-0.60***	(0.00)	0.010***	(0.00)	0.12
Pharma and Bio	-0.55***	(0.00)	0.0089***	(0.01)	0.12
Food and Drug Retailers	-0.49***	(0.00)	0.0073**	(0.05)	0.07
General Retailers	-0.54***	(0.00)	0.0099***	(0.01)	0.10
Media	-0.85***	(0.00)	0.0080**	(0.04)	0.18
Travel and Leisure	-0.90***	(0.00)	0.0097**	(0.02)	0.18
Fixed Line Telecommunications	-0.44***	(0.00)	0.0065*	(0.06)	0.07
Mobile Telecommunications	-0.74***	(0.00)	0.0053	(0.38)	0.06
Electricity	-0.38***	(0.00)	0.0073**	(0.02)	0.06
Gas Water and Multi Utilities	-0.46***	(0.00)	0.0096***	(0.00)	0.09
Banks	-1.00***	(0.00)	0.0052	(0.40)	0.11
Non-Life Insurance	-0.61***	(0.00)	0.0055*	(0.10)	0.14
Life Insurance	-1.55***	(0.00)	0.0094	(0.15)	0.21
Real Estate Inv Services	-0.86***	(0.00)	0.0068	(0.33)	0.06
REITs	-1.01***	(0.00)	0.0095*	(0.08)	0.14
Financials	-1.02***	(0.00)	0.0071	(0.13)	0.18
Equity Investment instruments	-0.76***	(0.00)	0.0075	(0.26)	0.05
Software and Computer Services	-0.76***	(0.00)	0.011***	(0.00)	0.16
Tech and Hardware Equipment	-0.68***	(0.00)	0.011**	(0.02)	0.09

9.1.1.2 Europe

Sectors	lnEURCNY		constant		R-sq
Oil and Gas Production	0.40**	(0.03)	0.0057	(0.19)	0.04
Oil Services Distribution	0.76**	(0.01)	0.0043	(0.46)	0.07
Alternative Energy	1.02**	(0.02)	0.0057	(0.47)	0.07
Chemicals	0.49**	(0.01)	0.0093**	(0.02)	0.06
Forestry and paper	0.067	(0.72)	0.0056	(0.26)	0.00
Industrial Metal and Mines	1.01***	(0.01)	0.0068	(0.29)	0.10
Mining	0.88***	(0.00)	0.0078	(0.24)	0.07
Construction and Materials	0.53***	(0.00)	0.0059	(0.15)	0.07
Aero Defense	-0.19	(0.28)	0.0082**	(0.04)	0.01
General Industrials	0.55***	(0.01)	0.0069	(0.13)	0.06
Electronic and Electrical Equipment	0.55**	(0.02)	0.0092**	(0.04)	0.06
Industrial Engineering	0.56**	(0.01)	0.0100**	(0.02)	0.07
Industrial Transportation	0.38**	(0.04)	0.0063*	(0.06)	0.05
Support Services	0.14	(0.37)	0.0068*	(0.05)	0.01
Auto and Parts	0.31	(0.14)	0.0071	(0.21)	0.01
Beverages	0.026	(0.87)	0.0091**	(0.01)	0.00
Food Producers	-0.1	(0.40)	0.0078***	(0.00)	0.01
Household goods and Home Construction	-0.08	(0.58)	0.0073**	(0.03)	0.00
Leisure Goods	0.30	(0.16)	0.0084*	(0.07)	0.02
Personal Goods	0.35*	(0.05)	0.010***	(0.01)	0.04
Tobacco	-0.27	(0.12)	0.0070*	(0.06)	0.02
Healthcare Equipment Services	-0.1	(0.46)	0.0076***	(0.01)	0.01
Pharma and Bio	-0.20*	(0.07)	0.0062**	(0.03)	0.02
Food and Drug Retailers	0.11	(0.43)	0.0033	(0.29)	0.01
General Retailers	0.20	(0.16)	0.0065*	(0.09)	0.01
Media	0.20	(0.17)	0.0038	(0.26)	0.02
Travel and Leisure	0.20	(0.26)	0.0043	(0.23)	0.01
Fixed Line Telecommunications	0.29**	(0.04)	0.0012	(0.72)	0.04
Mobile Telecommunications	0.14	(0.31)	0.0045	(0.18)	0.01
Electricity	0.48***	(0.00)	0.0048	(0.17)	0.08
Gas Water and Multi Utilities	0.34**	(0.01)	0.0041	(0.26)	0.04
Banks	0.79***	(0.00)	-0.000019	(1.00)	0.09
Non-Life Insurance	0.49**	(0.02)	0.0077*	(0.06)	0.06
Life Insurance	0.77**	(0.01)	0.0053	(0.33)	0.08
Real Estate Inv Services	0.39**	(0.03)	0.0036	(0.32)	0.05
REITs	0.30	(0.15)	0.0039	(0.34)	0.02
Financials	0.42**	(0.02)	0.0073*	(0.06)	0.05
Equity Investment instruments	-0.05	(0.98)	0.0054*	(0.08)	0.00
Software and Computer Services	0.27	(0.15)	0.0080**	(0.03)	0.02
Tech and Hardware Equipment	0.26	(0.17)	0.0040	(0.42)	0.01

Sectors	lnEURUSD		_cons		R-sq
Oil and Gas Production	0.38**	(0.02)	0.0053	(0.22)	0.04
Oil Services Distribution	0.74**	(0.01)	0.0034	(0.57)	0.07
Alternative Energy	1.07***	(0.01)	0.0045	(0.57)	0.08
Chemicals	0.53***	(0.00)	0.0088**	(0.03)	0.08
Forestry and paper	0.10	(0.57)	0.0055	(0.27)	0.00
Industrial Metal and Mines	1.06***	(0.00)	0.0056	(0.38)	0.11
Mining	0.95***	(0.00)	0.0068	(0.30)	0.09
Construction and Materials	0.54***	(0.00)	0.0053	(0.20)	0.07
Aero Defense	-0.15	(0.36)	0.0084**	(0.03)	0.01
General Industrials	0.55***	(0.00)	0.0062	(0.17)	0.07
Electronic and Electrical Equipment	0.58***	(0.01)	0.0085*	(0.06)	0.07
Industrial Engineering	0.61***	(0.00)	0.0093**	(0.03)	0.08
Industrial Transportation	0.40**	(0.02)	0.0058*	(0.09)	0.06
Support Services	0.16	(0.25)	0.0066*	(0.06)	0.01
Auto and Parts	0.41**	(0.03)	0.0068	(0.23)	0.02
Beverages	0.07	(0.66)	0.0092**	(0.01)	0.00
Food Producers	-0.08	(0.43)	0.0079***	(0.00)	0.01
Household goods and Home					
Construction	-0.06	(0.67)	0.0074**	(0.03)	0.00
Leisure Goods	0.33	(0.10)	0.0081*	(0.08)	0.02
Personal Goods	0.37**	(0.02)	0.0097***	(0.01)	0.05
Tobacco	-0.26*	(0.10)	0.0073*	(0.05)	0.02
Healthcare Equipment Services	-0.07	(0.53)	0.0077***	(0.01)	0.00
Pharma and Bio	-0.18*	(0.06)	0.0065**	(0.02)	0.02
Food and Drug Retailers	0.12	(0.34)	0.0031	(0.31)	0.01
General Retailers	0.20	(0.14)	0.0063*	(0.10)	0.01
Media	0.20	(0.15)	0.0035	(0.29)	0.02
Travel and Leisure	0.20	(0.23)	0.0041	(0.26)	0.01
Fixed Line Telecommunications	0.28**	(0.02)	0.00081	(0.80)	0.04
Mobile Telecommunications	0.14	(0.24)	0.0043	(0.19)	0.01
Electricity	0.49***	(0.00)	0.0042	(0.22)	0.09
Gas Water and Multi Utilities	0.35***	(0.01)	0.0037	(0.31)	0.04
Banks	0.78***	(0.00)	-0.00099	(0.85)	0.10
Non-Life Insurance	0.50**	(0.01)	0.0071*	(0.08)	0.07
Life Insurance	0.77***	(0.01)	0.0043	(0.42)	0.09
Real Estate Inv Services	0.39**	(0.03)	0.0031	(0.40)	0.05
REITs	0.33*	(0.09)	0.0036	(0.39)	0.03
Financials	0.45***	(0.01)	0.0068*	(0.08)	0.06
Equity Investment instruments	0.018	(0.92)	0.0054*	(0.08)	0.00
Software and Computer Services	0.28	(0.10)	0.0076**	(0.04)	0.03
Tech and Hardware Equipment	0.31*	(0.09)	0.0037	(0.45)	0.02

Sectors	lnEURJPY		_cons		R-sq
Oil and Gas Production	0.49***	(0.00)	0.0051	(0.22)	0.09
Oil Services Distribution	0.83***	(0.00)	0.0031	(0.59)	0.14
Alternative Energy	1.02***	(0.00)	0.0039	(0.61)	0.11
Chemicals	0.62***	(0.00)	0.0086**	(0.02)	0.17
Forestry and paper	0.36**	(0.02)	0.0056	(0.25)	0.04
Industrial Metal and Mines	1.07***	(0.00)	0.0051	(0.41)	0.19
Mining	0.78***	(0.00)	0.0063	(0.34)	0.10
Construction and Materials	0.66***	(0.00)	0.0051	(0.20)	0.18
Aero Defense	0.23	(0.10)	0.0087**	(0.03)	0.03
General Industrials	0.70***	(0.00)	0.0061	(0.16)	0.16
Electronic and Electrical Equipment	0.75***	(0.00)	0.0084**	(0.05)	0.20
Industrial Engineering	0.71***	(0.00)	0.0091**	(0.03)	0.18
Industrial Transportation	0.45***	(0.00)	0.0057*	(0.09)	0.12
Support Services	0.39***	(0.00)	0.0067**	(0.05)	0.10
Auto and Parts	0.61***	(0.00)	0.0068	(0.22)	0.09
Beverages	0.21	(0.12)	0.0092***	(0.01)	0.03
Food Producers	0.07	(0.38)	0.0081***	(0.00)	0.01
Household goods and Home					
Construction	0.25**	(0.01)	0.0077**	(0.02)	0.04
Leisure Goods	0.55***	(0.00)	0.0081*	(0.07)	0.10
Personal Goods	0.47***	(0.00)	0.0096***	(0.01)	0.12
Tobacco	-0.07	(0.65)	0.0076**	(0.05)	0.00
Healthcare Equipment Services	0.13	(0.22)	0.0079***	(0.00)	0.02
Pharma and Bio	-0.02	(0.80)	0.0067**	(0.02)	0.00
Food and Drug Retailers	0.27**	(0.01)	0.0032	(0.29)	0.06
General Retailers	0.44***	(0.00)	0.0063*	(0.08)	0.10
Media	0.40***	(0.00)	0.0035	(0.27)	0.11
Travel and Leisure	0.48***	(0.00)	0.0042	(0.22)	0.13
Fixed Line Telecommunications	0.36***	(0.00)	0.00072	(0.81)	0.10
Mobile Telecommunications	0.27***	(0.01)	0.0043	(0.18)	0.05
Electricity	0.49***	(0.00)	0.0040	(0.24)	0.14
Gas Water and Multi Utilities	0.32***	(0.01)	0.0035	(0.33)	0.06
Banks	0.93***	(0.00)	-0.0013	(0.80)	0.22
Non-Life Insurance	0.61***	(0.00)	0.0069*	(0.08)	0.16
Life Insurance	0.93***	(0.00)	0.0041	(0.43)	0.20
Real Estate Inv Services	0.40**	(0.02)	0.0029	(0.42)	0.08
REITs	0.42**	(0.02)	0.0035	(0.39)	0.08
Financials	0.63***	(0.00)	0.0067*	(0.06)	0.19
Equity Investment instruments	0.32**	(0.02)	0.0056*	(0.06)	0.08
Software and Computer Services	0.51***	(0.00)	0.0076**	(0.03)	0.14
Tech and Hardware Equipment	0.61***	(0.00)	0.0038	(0.42)	0.11

9.1.2 Simple Regression Analysis with Market Portfolio: Model M1

Market Excess Return Regression on excess returns

	USMARKET	USMARKET	USMARKET	EUMARKET	EUMARKET	EUMARKET
USDCNY	-1.02*** (0.01)					
USDJPY		0.40** (0.03)				
USDEUR			-0.77*** (0.00)			
EURCNV				0.35** (0.03)		
EURJPY					0.51*** (0.00)	
EURUSD						0.37** (0.01)
_cons	0.0043 (0.23)	0.0054 (0.13)	0.0064** (0.04)	0.0054 (0.10)	0.0049 (0.12)	0.0049 (0.13)
N	171	171	171	171	171	171
adj. R-sq	0.03	0.05	0.21	0.04	0.16	0.05

p-values in parentheses

="*

p<0.1

** p<0.05

*** p<0.01"

9.1.2.1 United States

Sectors	lnUSDCNY	Market	_cons	Adj. R. sq
Oil and Gas Production	-0.038 (0.91)	0.99*** (0.00)	0.0000095 (1.00)	0.53
Oil Services Distribution	-0.20 (0.63)	1.18*** (0.00)	-0.0021 (0.60)	0.55
Alternative Energy	-2.98** (0.05)	1.39*** (0.00)	0.0034 (0.78)	0.18

Chemicals	-0.11	(0.69)	1.24***	(0.00)	0.00072	(0.75)	0.79
Forestry and paper	0.12	(0.78)	1.78***	(0.00)	-0.0028	(0.58)	0.58
Industrial Metal and Mines	-1.09	(0.12)	1.71***	(0.00)	-0.0061	(0.25)	0.60
Mining	-1.06	(0.16)	0.99***	(0.00)	-0.0029	(0.70)	0.21
Construction and Materials	0.0014	(1.00)	1.31***	(0.00)	-0.0012	(0.67)	0.76
Aero Defense	-0.078	(0.82)	1.06***	(0.00)	0.0040*	(0.07)	0.75
General Industrials	0.29	(0.29)	1.27***	(0.00)	-0.0040*	(0.09)	0.79
Electronic and Electrical Equipment	-0.26	(0.18)	1.25***	(0.00)	-0.00012	(0.95)	0.84
Industrial Engineering	-0.19	(0.62)	1.48***	(0.00)	-0.00018	(0.95)	0.80
Industrial Transportation	-0.25	(0.53)	1.08***	(0.00)	0.0023	(0.38)	0.70
Support Services	-0.15	(0.21)	0.92***	(0.00)	0.0026**	(0.05)	0.88
Auto and Parts	0.19	(0.64)	1.48***	(0.00)	-0.0043	(0.29)	0.62
Beverages	0.014	(0.96)	0.53***	(0.00)	0.0043*	(0.07)	0.42
Food Producers	0.38	(0.18)	0.64***	(0.00)	0.0011	(0.58)	0.60
Household goods and Home Construction	0.046	(0.90)	0.66***	(0.00)	0.00076	(0.74)	0.54
Leisure Goods	0.12	(0.81)	0.95***	(0.00)	-0.00042	(0.90)	0.55
Personal Goods	-0.21	(0.45)	0.79***	(0.00)	0.0022	(0.29)	0.67
Tobacco	0.32	(0.42)	0.65***	(0.00)	0.0075**	(0.03)	0.33
Healthcare Equipment Services	-0.026	(0.90)	0.90***	(0.00)	0.0031	(0.15)	0.72
Pharma and Bio	-0.28	(0.31)	0.72***	(0.00)	0.0029	(0.19)	0.59
Food and Drug Retailers	0.024	(0.93)	0.76***	(0.00)	0.0014	(0.59)	0.52
General Retailers	-0.030	(0.92)	0.85***	(0.00)	0.0033	(0.13)	0.69
Media	0.14	(0.69)	1.09***	(0.00)	-0.00044	(0.84)	0.80
Travel and Leisure	0.029	(0.92)	1.15***	(0.00)	0.00066	(0.76)	0.79
Fixed Line Telecommunications	0.32	(0.33)	0.62***	(0.00)	0.0021	(0.48)	0.37
Mobile Telecommunications	1.46**	(0.01)	1.10***	(0.00)	-0.0014	(0.78)	0.38
Electricity	0.37	(0.32)	0.48***	(0.00)	0.0040	(0.17)	0.27
Gas Water and Multi Utilities	0.26	(0.48)	0.60***	(0.00)	0.0052*	(0.06)	0.41
Banks	0.61	(0.24)	1.43***	(0.00)	-0.0052	(0.27)	0.60
Non-Life Insurance	0.28	(0.22)	0.88***	(0.00)	-0.00099	(0.60)	0.75
Life Insurance	0.36	(0.44)	1.81***	(0.00)	-0.0045	(0.20)	0.78
Real Estate Inv Services	0.43	(0.26)	1.54***	(0.00)	-0.0044	(0.34)	0.56
REITs	0.28	(0.57)	1.26***	(0.00)	-0.00015	(0.97)	0.60
Financials	0.062	(0.80)	1.36***	(0.00)	-0.0035*	(0.08)	0.87
Equity Investment instruments	-1.43**	(0.03)	0.89***	(0.00)	-0.0013	(0.82)	0.25
Software and Computer Services	-0.39	(0.13)	0.95***	(0.00)	0.0027	(0.22)	0.73
Tech and Hardware Equipment	-0.016	(0.96)	1.13***	(0.00)	0.0018	(0.50)	0.71

Sectors	lnUSDJPY	Market	_cons	Adj. R. sq			
Oil and Gas Production	-0.063	(0.59)	1.00***	(0.00)	0.000016	(1.00)	0.53
Oil Services Distribution	-0.068	(0.65)	1.20***	(0.00)	-0.0019	(0.64)	0.55
Alternative Energy	-0.18	(0.73)	1.50***	(0.00)	0.0063	(0.60)	0.16
Chemicals	-0.073	(0.45)	1.26***	(0.00)	0.00079	(0.73)	0.79
Forestry and paper	-0.18	(0.26)	1.80***	(0.00)	-0.0030	(0.55)	0.58
Industrial Metal and Mines	-0.43*	(0.09)	1.80***	(0.00)	-0.0052	(0.32)	0.60

Mining	-1.13***	(0.00)	1.17***	(0.00)	-0.0023	(0.74)	0.29
Construction and Materials	0.11	(0.27)	1.30***	(0.00)	-0.0011	(0.68)	0.76
Aero Defense	-0.14	(0.17)	1.08***	(0.00)	0.0040*	(0.06)	0.76
General Industrials	-0.12	(0.21)	1.27***	(0.00)	-0.0044*	(0.06)	0.79
Electronic and Electrical Equipment	-0.0016	(0.98)	1.26***	(0.00)	0.00015	(0.94)	0.84
Industrial Engineering	-0.083	(0.44)	1.50***	(0.00)	-0.000029	(0.99)	0.80
Industrial Transportation	0.072	(0.55)	1.08***	(0.00)	0.0025	(0.33)	0.70
Support Services	0.097**	(0.02)	0.91***	(0.00)	0.0028**	(0.03)	0.88
Auto and Parts	0.11	(0.45)	1.46***	(0.00)	-0.0044	(0.27)	0.62
Beverages	-0.079	(0.41)	0.54***	(0.00)	0.0043*	(0.07)	0.42
Food Producers	-0.11	(0.14)	0.64***	(0.00)	0.00070	(0.72)	0.60
Household goods and Home Construction	-0.053	(0.55)	0.67***	(0.00)	0.00068	(0.76)	0.54
Leisure Goods	0.22	(0.15)	0.92***	(0.00)	-0.00042	(0.89)	0.56
Personal Goods	-0.084	(0.32)	0.81***	(0.00)	0.0024	(0.25)	0.67
Tobacco	-0.11	(0.39)	0.65***	(0.00)	0.0071**	(0.03)	0.33
Healthcare Equipment Services	0.014	(0.88)	0.90***	(0.00)	0.0031	(0.15)	0.72
Pharma and Bio	-0.16**	(0.04)	0.75***	(0.00)	0.0031	(0.15)	0.60
Food and Drug Retailers	0.12	(0.15)	0.75***	(0.00)	0.0014	(0.58)	0.52
General Retailers	0.067	(0.49)	0.84***	(0.00)	0.0033	(0.13)	0.69
Media	0.0040	(0.95)	1.08***	(0.00)	-0.00058	(0.77)	0.80
Travel and Leisure	-0.029	(0.71)	1.15***	(0.00)	0.00062	(0.77)	0.79
Fixed Line Telecommunications	-0.013	(0.91)	0.61***	(0.00)	0.0017	(0.55)	0.37
Mobile Telecommunications	0.29	(0.14)	1.01***	(0.00)	-0.0028	(0.59)	0.37
Electricity	-0.16	(0.18)	0.49***	(0.00)	0.0035	(0.22)	0.27
Gas Water and Multi Utilities	-0.13	(0.27)	0.61***	(0.00)	0.0049*	(0.07)	0.41
Banks	0.16	(0.38)	1.39***	(0.00)	-0.0057	(0.22)	0.59
Non-Life Insurance	0.053	(0.50)	0.86***	(0.00)	-0.0012	(0.51)	0.75
Life Insurance	-0.078	(0.70)	1.81***	(0.00)	-0.0049	(0.16)	0.78
Real Estate Inv Services	0.17	(0.35)	1.50***	(0.00)	-0.0047	(0.30)	0.56
REITs	-0.38**	(0.03)	1.30***	(0.00)	-0.00062	(0.86)	0.61
Financials	0.33***	(0.00)	1.32***	(0.00)	-0.0034*	(0.06)	0.89
Equity Investment instruments	0.094	(0.73)	0.92***	(0.00)	0.00017	(0.98)	0.24
Software and Computer Services	0.14	(0.19)	0.95***	(0.00)	0.0032	(0.15)	0.74
Tech and Hardware Equipment	0.071	(0.54)	1.12***	(0.00)	0.0019	(0.48)	0.71

Sectors	lnUSDEUR		Market		_cons		Adj. R. sq
Oil and Gas Production	-0.17	(0.17)	0.94***	(0.00)	0.00058	(0.87)	0.54
Oil Services Distribution	-0.28	(0.12)	1.11***	(0.00)	-0.0010	(0.80)	0.56
Alternative Energy	-1.30***	(0.00)	1.11***	(0.00)	0.010	(0.39)	0.19
Chemicals	-0.18*	(0.05)	1.20***	(0.00)	0.0014	(0.55)	0.80
Forestry and paper	-0.040	(0.84)	1.76***	(0.00)	-0.0028	(0.56)	0.58
Industrial Metal and Mines	-0.90***	(0.00)	1.48***	(0.00)	-0.0023	(0.65)	0.64
Mining	-1.02***	(0.00)	0.73***	(0.00)	0.0013	(0.85)	0.27

Construction and Materials	-0.0082	(0.95)	1.31***	(0.00)	-0.0012	(0.68)	0.76
Aero Defense	0.10	(0.18)	1.09***	(0.00)	0.0038*	(0.09)	0.76
General Industrials	0.0022	(0.98)	1.26***	(0.00)	-0.0043*	(0.07)	0.79
Electronic and Electrical Equipment	0.015	(0.84)	1.27***	(0.00)	0.00010	(0.96)	0.84
Industrial Engineering	-0.27**	(0.01)	1.41***	(0.00)	0.00083	(0.75)	0.81
Industrial Transportation	0.17	(0.14)	1.14***	(0.00)	0.0020	(0.45)	0.70
Support Services	0.041	(0.37)	0.94***	(0.00)	0.0027*	(0.05)	0.87
Auto and Parts	0.067	(0.68)	1.49***	(0.00)	-0.0047	(0.24)	0.62
Beverages	-0.18*	(0.05)	0.48***	(0.00)	0.0048**	(0.03)	0.43
Food Producers	0.036	(0.66)	0.64***	(0.00)	0.00065	(0.74)	0.59
Household goods and Home Construction	0.055	(0.59)	0.68***	(0.00)	0.00054	(0.81)	0.54
Leisure Goods	0.047	(0.73)	0.96***	(0.00)	-0.00068	(0.84)	0.55
Personal Goods	-0.13	(0.12)	0.76***	(0.00)	0.0029	(0.16)	0.68
Tobacco	-0.11	(0.39)	0.61***	(0.00)	0.0075**	(0.03)	0.33
Healthcare Equipment Services	0.11	(0.28)	0.93***	(0.00)	0.0028	(0.19)	0.72
Pharma and Bio	0.00039	(1.00)	0.73***	(0.00)	0.0032	(0.15)	0.59
Food and Drug Retailers	0.12	(0.26)	0.80***	(0.00)	0.0010	(0.70)	0.52
General Retailers	0.15*	(0.10)	0.90***	(0.00)	0.0028	(0.20)	0.69
Media	-0.026	(0.75)	1.08***	(0.00)	-0.00050	(0.80)	0.80
Travel and Leisure	-0.035	(0.70)	1.14***	(0.00)	0.00074	(0.73)	0.79
Fixed Line Telecommunications	0.025	(0.81)	0.61***	(0.00)	0.0017	(0.57)	0.37
Mobile Telecommunications	0.076	(0.72)	1.07***	(0.00)	-0.0032	(0.55)	0.36
Electricity	-0.037	(0.71)	0.45***	(0.00)	0.0037	(0.21)	0.26
Gas Water and Multi Utilities	-0.0088	(0.92)	0.59***	(0.00)	0.0050*	(0.07)	0.40
Banks	0.099	(0.60)	1.44***	(0.00)	-0.0061	(0.19)	0.59
Non-Life Insurance	0.062	(0.42)	0.89***	(0.00)	-0.0015	(0.43)	0.75
Life Insurance	-0.23	(0.22)	1.73***	(0.00)	-0.0042	(0.24)	0.78
Real Estate Inv Services	0.38*	(0.08)	1.63***	(0.00)	-0.0060	(0.18)	0.57
REITs	-0.075	(0.74)	1.23***	(0.00)	-0.00020	(0.96)	0.60
Financials	0.023	(0.76)	1.37***	(0.00)	-0.0036*	(0.08)	0.87
Equity Investment instruments	-0.058	(0.80)	0.92***	(0.00)	0.00031	(0.96)	0.23
Software and Computer Services	-0.028	(0.76)	0.96***	(0.00)	0.0032	(0.16)	0.73
Tech and Hardware Equipment	0.24**	(0.01)	1.20***	(0.00)	0.0011	(0.68)	0.72

9.1.2.2 Europe

Sectors	lnEURCNY	Market	_cons	Adj. R. sq			
Oil and Gas Production	0.046	(0.68)	0.99***	(0.00)	0.00046	(0.87)	0.60
Oil Services Distribution	0.27	(0.11)	1.38***	(0.00)	-0.0031	(0.45)	0.62
Alternative Energy	0.46*	(0.06)	1.58***	(0.00)	-0.0028	(0.65)	0.46
Chemicals	0.11	(0.16)	1.07***	(0.00)	0.0036*	(0.07)	0.80
Forestry and paper	-0.36**	(0.01)	1.20***	(0.00)	-0.00088	(0.77)	0.64
Industrial Metal and Mines	0.46**	(0.01)	1.54***	(0.00)	-0.0015	(0.73)	0.65

Mining	0.41**	(0.02)	1.32***	(0.00)	0.00073	(0.89)	0.47
Construction and Materials	0.12	(0.14)	1.16***	(0.00)	-0.00028	(0.87)	0.85
Aero Defense	-0.54***	(0.00)	0.99***	(0.00)	0.0029	(0.21)	0.68
General Industrials	0.11	(0.21)	1.23***	(0.00)	0.00032	(0.88)	0.81
Electronic and Electrical Equipment	0.13	(0.29)	1.19***	(0.00)	0.0028	(0.24)	0.77
Industrial Engineering	0.14	(0.12)	1.19***	(0.00)	0.0036	(0.10)	0.80
Industrial Transportation	0.042	(0.48)	0.95***	(0.00)	0.0012	(0.43)	0.84
Support Services	-0.20***	(0.00)	0.94***	(0.00)	0.0017	(0.28)	0.80
Auto and Parts	-0.15	(0.37)	1.30***	(0.00)	0.00014	(0.97)	0.58
Beverages	-0.27**	(0.01)	0.83***	(0.00)	0.0047**	(0.04)	0.60
Food Producers	-0.29***	(0.00)	0.55***	(0.00)	0.0048**	(0.01)	0.50
Household goods and Home Construction	-0.37***	(0.00)	0.83***	(0.00)	0.0029	(0.15)	0.68
Leisure Goods	-0.11	(0.37)	1.16***	(0.00)	0.0022	(0.42)	0.68
Personal Goods	0.017	(0.86)	0.94***	(0.00)	0.0051**	(0.01)	0.73
Tobacco	-0.49***	(0.00)	0.62***	(0.00)	0.0037	(0.26)	0.31
Healthcare Equipment Services	-0.32***	(0.00)	0.64***	(0.00)	0.0041**	(0.03)	0.59
Pharma and Bio	-0.40***	(0.00)	0.56***	(0.00)	0.0033	(0.16)	0.43
Food and Drug Retailers	-0.14*	(0.08)	0.71***	(0.00)	-0.00056	(0.78)	0.59
General Retailers	-0.13	(0.13)	0.95***	(0.00)	0.0015	(0.50)	0.69
Media	-0.11**	(0.04)	0.89***	(0.00)	-0.0010	(0.54)	0.79
Travel and Leisure	-0.13*	(0.08)	0.93***	(0.00)	-0.00064	(0.76)	0.72
Fixed Line Telecommunications	0.077	(0.37)	0.60***	(0.00)	-0.0020	(0.43)	0.41
Mobile Telecommunications	-0.091	(0.27)	0.64***	(0.00)	0.0010	(0.67)	0.42
Electricity	0.18***	(0.01)	0.85***	(0.00)	0.00024	(0.91)	0.69
Gas Water and Multi Utilities	0.048	(0.66)	0.82***	(0.00)	-0.00026	(0.92)	0.57
Banks	0.29***	(0.00)	1.40***	(0.00)	-0.0075***	(0.00)	0.80
Non-Life Insurance	0.13	(0.21)	1.04***	(0.00)	0.0021	(0.39)	0.72
Life Insurance	0.25**	(0.04)	1.46***	(0.00)	-0.0025	(0.36)	0.79
Real Estate Inv Services	0.080	(0.42)	0.88***	(0.00)	-0.0011	(0.66)	0.62
REITs	-0.014	(0.91)	0.90***	(0.00)	-0.00092	(0.76)	0.53
Financials	0.029	(0.56)	1.11***	(0.00)	0.0013	(0.27)	0.92
Equity Investment instruments	-0.30***	(0.00)	0.85***	(0.00)	0.00081	(0.53)	0.84
Software and Computer Services	-0.057	(0.56)	0.92***	(0.00)	0.0030	(0.16)	0.67
Tech and Hardware Equipment	-0.16	(0.14)	1.20***	(0.00)	-0.0024	(0.43)	0.65

Sectors	lnEURJPY	Market	_cons	Adj. R. sq			
Oil and Gas Production	-0.022	(0.81)	1.00***	(0.00)	0.00028	(0.92)	0.60
Oil Services Distribution	0.13	(0.42)	1.38***	(0.00)	-0.0036	(0.39)	0.61
Alternative Energy	0.23	(0.27)	1.57***	(0.00)	-0.0036	(0.56)	0.46
Chemicals	0.081	(0.25)	1.05***	(0.00)	0.0035*	(0.08)	0.80
Forestry and paper	-0.28**	(0.02)	1.25***	(0.00)	-0.00042	(0.89)	0.64
Industrial Metal and Mines	0.31**	(0.04)	1.50***	(0.00)	-0.0022	(0.62)	0.64
Mining	0.095	(0.60)	1.34***	(0.00)	-0.00027	(0.96)	0.46

Construction and Materials	0.078	(0.22)	1.15***	(0.00)	-0.00047	(0.79)	0.85
Aero Defense	-0.28***	(0.00)	1.01***	(0.00)	0.0039	(0.11)	0.64
General Industrials	0.077	(0.29)	1.22***	(0.00)	0.00015	(0.94)	0.80
Electronic and Electrical Equipment	0.17**	(0.02)	1.15***	(0.00)	0.0028	(0.22)	0.77
Industrial Engineering	0.12	(0.12)	1.17***	(0.00)	0.0034	(0.12)	0.80
Industrial Transportation	-0.040	(0.42)	0.97***	(0.00)	0.00097	(0.51)	0.84
Support Services	-0.085*	(0.09)	0.95***	(0.00)	0.0021	(0.20)	0.79
Auto and Parts	-0.046	(0.77)	1.29***	(0.00)	0.00048	(0.90)	0.58
Beverages	-0.23***	(0.01)	0.87***	(0.00)	0.0050**	(0.03)	0.61
Food Producers	-0.22***	(0.00)	0.59***	(0.00)	0.0052***	(0.01)	0.50
Household goods and Home Construction	-0.17**	(0.02)	0.84***	(0.00)	0.0036*	(0.09)	0.65
Leisure Goods	-0.036	(0.68)	1.16***	(0.00)	0.0024	(0.36)	0.68
Personal Goods	-0.0056	(0.93)	0.94***	(0.00)	0.0051**	(0.01)	0.73
Tobacco	-0.41***	(0.00)	0.69***	(0.00)	0.0042	(0.19)	0.31
Healthcare Equipment Services	-0.21***	(0.00)	0.67***	(0.00)	0.0046**	(0.01)	0.57
Pharma and Bio	-0.34***	(0.00)	0.62***	(0.00)	0.0037	(0.10)	0.43
Food and Drug Retailers	-0.10	(0.13)	0.73***	(0.00)	-0.00036	(0.86)	0.59
General Retailers	-0.041	(0.57)	0.94***	(0.00)	0.0018	(0.42)	0.69
Media	-0.047	(0.37)	0.89***	(0.00)	-0.00078	(0.64)	0.78
Travel and Leisure	0.021	(0.75)	0.91***	(0.00)	-0.00021	(0.92)	0.71
Fixed Line Telecommunications	0.064	(0.36)	0.59***	(0.00)	-0.0021	(0.40)	0.41
Mobile Telecommunications	-0.059	(0.42)	0.65***	(0.00)	0.0012	(0.63)	0.42
Electricity	0.062	(0.35)	0.85***	(0.00)	-0.00015	(0.94)	0.68
Gas Water and Multi Utilities	-0.11	(0.26)	0.86***	(0.00)	-0.00063	(0.80)	0.57
Banks	0.25***	(0.01)	1.35***	(0.00)	-0.0078***	(0.00)	0.80
Non-Life Insurance	0.090	(0.36)	1.02***	(0.00)	0.0019	(0.43)	0.72
Life Insurance	0.21*	(0.10)	1.42***	(0.00)	-0.0028	(0.32)	0.79
Real Estate Inv Services	-0.066	(0.44)	0.91***	(0.00)	-0.0015	(0.56)	0.62
REITs	-0.048	(0.63)	0.91***	(0.00)	-0.00098	(0.74)	0.53
Financials	0.074**	(0.05)	1.09***	(0.00)	0.0014	(0.23)	0.92
Equity Investment instruments	-0.10	(0.13)	0.84***	(0.00)	0.0015	(0.30)	0.81
Software and Computer Services	0.052	(0.50)	0.90***	(0.00)	0.0033	(0.13)	0.67
Tech and Hardware Equipment	0.015	(0.89)	1.17***	(0.00)	-0.0019	(0.52)	0.65

Sectors	lnEURUSD	Market	_cons	Adj. R. sq			
Oil and Gas Production	0.020	(0.85)	0.99***	(0.00)	0.00036	(0.90)	0.60
Oil Services Distribution	0.23	(0.15)	1.38***	(0.00)	-0.0035	(0.40)	0.62
Alternative Energy	0.50**	(0.04)	1.56***	(0.00)	-0.0033	(0.60)	0.47
Chemicals	0.14*	(0.06)	1.06***	(0.00)	0.0036*	(0.07)	0.80
Forestry and paper	-0.34**	(0.01)	1.21***	(0.00)	-0.00044	(0.88)	0.64
Industrial Metal and Mines	0.50***	(0.00)	1.53***	(0.00)	-0.0020	(0.65)	0.65
Mining	0.48***	(0.01)	1.30***	(0.00)	0.00037	(0.94)	0.48
Construction and Materials	0.11	(0.14)	1.16***	(0.00)	-0.00044	(0.80)	0.85
Aero Defense	-0.52***	(0.00)	0.99***	(0.00)	0.0035	(0.12)	0.68

General Industrials	0.098	(0.28)	1.23***	(0.00)	0.00016	(0.94)	0.80
Electronic and Electrical Equipment	0.14	(0.20)	1.18***	(0.00)	0.0027	(0.25)	0.77
Industrial Engineering	0.17*	(0.05)	1.19***	(0.00)	0.0035	(0.11)	0.80
Industrial Transportation	0.050	(0.37)	0.95***	(0.00)	0.0011	(0.44)	0.84
Support Services	-0.19***	(0.01)	0.95***	(0.00)	0.0020	(0.22)	0.80
Auto and Parts	-0.065	(0.68)	1.29***	(0.00)	0.00046	(0.91)	0.58
Beverages	-0.24**	(0.02)	0.83***	(0.00)	0.0051**	(0.03)	0.60
Food Producers	-0.29***	(0.00)	0.56***	(0.00)	0.0052***	(0.01)	0.51
Household goods and Home Construction	-0.37***	(0.00)	0.84***	(0.00)	0.0033*	(0.09)	0.68
Leisure Goods	-0.097	(0.40)	1.16***	(0.00)	0.0023	(0.39)	0.68
Personal Goods	0.026	(0.77)	0.94***	(0.00)	0.0051**	(0.01)	0.73
Tobacco	-0.49***	(0.00)	0.63***	(0.00)	0.0043	(0.19)	0.31
Healthcare Equipment Services	-0.31***	(0.00)	0.65***	(0.00)	0.0045**	(0.01)	0.59
Pharma and Bio	-0.39***	(0.00)	0.56***	(0.00)	0.0037	(0.10)	0.43
Food and Drug Retailers	-0.14*	(0.07)	0.72***	(0.00)	-0.00040	(0.85)	0.59
General Retailers	-0.15*	(0.09)	0.95***	(0.00)	0.0016	(0.46)	0.70
Media	-0.13**	(0.02)	0.89***	(0.00)	-0.00091	(0.58)	0.79
Travel and Leisure	-0.15**	(0.03)	0.94***	(0.00)	-0.00051	(0.80)	0.72
Fixed Line Telecommunications	0.064	(0.42)	0.60***	(0.00)	-0.0021	(0.40)	0.41
Mobile Telecommunications	-0.092	(0.27)	0.64***	(0.00)	0.0011	(0.64)	0.42
Electricity	0.17***	(0.01)	0.85***	(0.00)	0.000020	(0.99)	0.69
Gas Water and Multi Utilities	0.054	(0.62)	0.81***	(0.00)	-0.00030	(0.91)	0.57
Banks	0.26***	(0.01)	1.40***	(0.00)	-0.0079***	(0.00)	0.80
Non-Life Insurance	0.12	(0.21)	1.04***	(0.00)	0.0019	(0.42)	0.72
Life Insurance	0.23**	(0.04)	1.45***	(0.00)	-0.0028	(0.31)	0.79
Real Estate Inv Services	0.065	(0.50)	0.88***	(0.00)	-0.0012	(0.63)	0.62
REITs	-0.0014	(0.99)	0.90***	(0.00)	-0.00088	(0.77)	0.53
Financials	0.042	(0.38)	1.11***	(0.00)	0.0013	(0.26)	0.92
Equity Investment instruments	-0.30***	(0.00)	0.85***	(0.00)	0.0012	(0.37)	0.84
Software and Computer Services	-0.061	(0.51)	0.92***	(0.00)	0.0031	(0.16)	0.67
Tech and Hardware Equipment	-0.14	(0.20)	1.20***	(0.00)	-0.0022	(0.47)	0.65

9.1.3 Model M2

9.1.3.1 United States

Sectors	lnUSDCNY	lnUSDJPY	lnUSDEUR
Oil and Gas Production	0.100	(0.79)	-0.015 (0.90)
Oil Services Distribution	-0.0028	(0.99)	0.020 (0.90)
Alternative Energy	-2.25	(0.11)	0.32 (0.56)
Chemicals	0.035	(0.90)	-0.020 (0.84)
Forestry and paper	0.22	(0.60)	-0.19 (0.30)

Industrial Metal and Mines	-0.40	(0.54)	-0.16	(0.51)	-0.81***	(0.00)
Mining	-0.0098	(0.99)	-0.91***	(0.00)	-0.72**	(0.02)
Construction and Materials	-0.037	(0.91)	0.13	(0.22)	-0.048	(0.70)
Aero Defense	-0.099	(0.77)	-0.19*	(0.07)	0.17**	(0.04)
General Industrials	0.35	(0.21)	-0.15	(0.13)	0.025	(0.82)
Electronic and Electrical Equipment	-0.29	(0.16)	0.0030	(0.97)	0.035	(0.67)
Industrial Engineering	0.011	(0.98)	-0.0019	(0.99)	-0.27**	(0.01)
Industrial Transportation	-0.41	(0.25)	0.035	(0.76)	0.19*	(0.09)
Support Services	-0.23*	(0.09)	0.10**	(0.01)	0.024	(0.62)
Auto and Parts	0.11	(0.79)	0.098	(0.56)	0.026	(0.89)
Beverages	0.17	(0.56)	-0.033	(0.72)	-0.18*	(0.06)
Food Producers	0.42	(0.12)	-0.15*	(0.05)	0.054	(0.51)
Household goods and Home Construction	0.033	(0.93)	-0.078	(0.40)	0.078	(0.47)
Leisure Goods	0.0055	(0.99)	0.23	(0.17)	-0.032	(0.83)
Personal Goods	-0.10	(0.70)	-0.045	(0.60)	-0.11	(0.23)
Tobacco	0.46	(0.23)	-0.096	(0.42)	-0.11	(0.36)
Healthcare Equipment Services	-0.10	(0.64)	-0.017	(0.87)	0.12	(0.27)
Pharma and Bio	-0.24	(0.42)	-0.17**	(0.05)	0.075	(0.46)
Food and Drug Retailers	-0.099	(0.75)	0.091	(0.26)	0.095	(0.38)
General Retailers	-0.16	(0.63)	0.030	(0.79)	0.15	(0.13)
Media	0.17	(0.66)	0.0078	(0.90)	-0.042	(0.64)
Travel and Leisure	0.066	(0.82)	-0.023	(0.79)	-0.032	(0.73)
Fixed Line Telecommunications	0.33	(0.35)	-0.034	(0.78)	0.012	(0.92)
Mobile Telecommunications	1.40**	(0.02)	0.25	(0.25)	-0.11	(0.62)
Electricity	0.48	(0.20)	-0.19	(0.17)	-0.011	(0.92)
Gas Water and Multi Utilities	0.34	(0.37)	-0.15	(0.24)	0.017	(0.88)
Banks	0.53	(0.28)	0.12	(0.50)	0.018	(0.92)
Non-Life Insurance	0.24	(0.28)	0.030	(0.72)	0.034	(0.67)
Life Insurance	0.57	(0.24)	-0.028	(0.90)	-0.26	(0.18)
Real Estate Inv Services	0.14	(0.74)	0.055	(0.77)	0.35	(0.13)
REITs	0.49	(0.29)	-0.41***	(0.01)	0.027	(0.90)
Financials	-0.080	(0.73)	0.37***	(0.00)	-0.094	(0.21)
Equity Investment instruments	-1.53**	(0.02)	0.18	(0.55)	-0.0029	(0.99)
Software and Computer Services	-0.45*	(0.07)	0.18*	(0.07)	-0.053	(0.55)
Tech and Hardware Equipment	-0.20	(0.51)	0.0052	(0.97)	0.25**	(0.02)

Market		_cons		Adj. R sq.
0.94***	(0.00)	0.00068	(0.85)	0.53
1.10***	(0.00)	-0.00098	(0.80)	0.55
1.01***	(0.00)	0.0080	(0.51)	0.20
1.20***	(0.00)	0.0014	(0.55)	0.79
1.81***	(0.00)	-0.0028	(0.56)	0.57
1.52***	(0.00)	-0.0030	(0.55)	0.64

0.94***	(0.00)	-0.000043	(0.99)	0.31
1.28***	(0.00)	-0.0010	(0.72)	0.76
1.13***	(0.00)	0.0034	(0.13)	0.76
1.29***	(0.00)	-0.0041*	(0.08)	0.79
1.26***	(0.00)	-0.00025	(0.90)	0.84
1.41***	(0.00)	0.00084	(0.76)	0.80
1.13***	(0.00)	0.0015	(0.55)	0.70
0.91***	(0.00)	0.0025*	(0.06)	0.88
1.47***	(0.00)	-0.0044	(0.27)	0.62
0.49***	(0.00)	0.0050**	(0.03)	0.43
0.67***	(0.00)	0.00094	(0.65)	0.60
0.69***	(0.00)	0.00046	(0.84)	0.53
0.91***	(0.00)	-0.00032	(0.92)	0.56
0.77***	(0.00)	0.0027	(0.21)	0.67
0.63***	(0.00)	0.0079**	(0.02)	0.33
0.93***	(0.00)	0.0026	(0.22)	0.72
0.76***	(0.00)	0.0026	(0.24)	0.60
0.77***	(0.00)	0.0010	(0.70)	0.52
0.89***	(0.00)	0.0027	(0.23)	0.69
1.08***	(0.00)	-0.00028	(0.90)	0.80
1.14***	(0.00)	0.00079	(0.72)	0.79
0.63***	(0.00)	0.0020	(0.50)	0.37
1.03***	(0.00)	-0.0010	(0.84)	0.38
0.50***	(0.00)	0.0041	(0.18)	0.27
0.63***	(0.00)	0.0052*	(0.06)	0.41
1.42***	(0.00)	-0.0053	(0.25)	0.59
0.88***	(0.00)	-0.0011	(0.55)	0.75
1.74***	(0.00)	-0.0035	(0.34)	0.78
1.62***	(0.00)	-0.0057	(0.20)	0.57
1.33***	(0.00)	-0.00022	(0.95)	0.61
1.28***	(0.00)	-0.0032*	(0.10)	0.89
0.86***	(0.00)	-0.0013	(0.82)	0.25
0.91***	(0.00)	0.0029	(0.18)	0.74
1.20***	(0.00)	0.00085	(0.75)	0.72

9.1.3.2 Europe

EU Sectors	Market	lnEURCNY	lnEURJPY	lnEURUSD
Oil and Gas Production	1.01*** (0.00)	0.33 (0.34)	-0.066 (0.62)	-0.23 (0.47)
Oil Services Distribution	1.39*** (0.00)	0.43 (0.40)	-0.014 (0.95)	-0.15 (0.77)
Alternative Energy	1.58*** (0.00)	-0.39 (0.56)	-0.066 (0.79)	0.91 (0.16)
Chemicals	1.05*** (0.00)	-0.39* (0.09)	0.018 (0.85)	0.49** (0.02)
Forestry and paper	1.24*** (0.00)	-0.16 (0.66)	-0.15 (0.28)	-0.086 (0.80)

Industrial Metal and Mines	1.51***	(0.00)	-0.43	(0.45)	0.080	(0.71)	0.83	(0.15)
Mining	1.36***	(0.00)	-0.62	(0.32)	-0.26	(0.34)	1.24**	(0.05)
Construction and Materials	1.16***	(0.00)	0.12	(0.60)	0.028	(0.70)	-0.025	(0.90)
Aero Defense	0.99***	(0.00)	-0.28	(0.32)	0.011	(0.91)	-0.26	(0.33)
General Industrials	1.23***	(0.00)	0.18	(0.46)	0.034	(0.70)	-0.092	(0.70)
Electronic and Electrical Equipment	1.15***	(0.00)	-0.26	(0.36)	0.16*	(0.05)	0.25	(0.34)
Industrial Engineering	1.17***	(0.00)	-0.33	(0.15)	0.059	(0.61)	0.42*	(0.05)
Industrial Transportation	0.98***	(0.00)	-0.059	(0.77)	-0.11**	(0.04)	0.19	(0.33)
Support Services	0.94***	(0.00)	-0.16	(0.39)	0.032	(0.58)	-0.066	(0.72)
Auto and Parts	1.28***	(0.00)	1.01***	(0.01)	0.015	(0.93)	0.85**	(0.01)
Beverages	0.86***	(0.00)	-0.29	(0.40)	-0.16	(0.15)	0.15	(0.67)
Food Producers	0.58***	(0.00)	-0.015	(0.95)	-0.11	(0.14)	-0.19	(0.43)
Household goods and Home Construction	0.83***	(0.00)	-0.13	(0.56)	0.046	(0.60)	-0.28	(0.23)
Leisure Goods	1.16***	(0.00)	-0.15	(0.61)	0.034	(0.75)	0.011	(0.97)
Personal Goods	0.95***	(0.00)	-0.099	(0.70)	-0.031	(0.69)	0.14	(0.57)
Tobacco	0.68***	(0.00)	0.031	(0.94)	-0.26**	(0.03)	-0.32	(0.43)
Healthcare Equipment Services	0.66***	(0.00)	-0.12	(0.62)	-0.068	(0.39)	-0.15	(0.56)
Pharma and Bio	0.61***	(0.00)	-0.057	(0.85)	-0.21*	(0.07)	-0.18	(0.54)
Food and Drug Retailers	0.72***	(0.00)	0.0030	(0.99)	-0.041	(0.64)	-0.12	(0.61)
General Retailers	0.94***	(0.00)	0.18	(0.47)	0.064	(0.52)	-0.36	(0.14)
Media	0.89***	(0.00)	0.20	(0.31)	0.036	(0.63)	-0.34*	(0.07)
Travel and Leisure	0.90***	(0.00)	0.088	(0.74)	0.17*	(0.06)	-0.36	(0.12)
Fixed Line Telecommunications	0.59***	(0.00)	0.14	(0.66)	0.046	(0.65)	-0.10	(0.73)
Mobile Telecommunications	0.65***	(0.00)	0.00084	(1.00)	-0.015	(0.88)	-0.081	(0.78)
Electricity	0.86***	(0.00)	0.11	(0.67)	-0.060	(0.50)	0.12	(0.63)
Gas Water and Multi Utilities	0.87***	(0.00)	0.0100	(0.98)	-0.24*	(0.07)	0.23	(0.53)
Banks	1.36***	(0.00)	0.27	(0.38)	0.17	(0.16)	-0.11	(0.71)
Non-Life Insurance	1.03***	(0.00)	0.093	(0.72)	0.040	(0.77)	0.0026	(0.99)
Life Insurance	1.43***	(0.00)	0.21	(0.52)	0.13	(0.44)	-0.065	(0.84)
Real Estate Inv Services	0.92***	(0.00)	0.24	(0.40)	-0.18*	(0.06)	-0.019	(0.95)
REITs	0.91***	(0.00)	-0.12	(0.71)	-0.076	(0.54)	0.17	(0.59)
Financials	1.09***	(0.00)	-0.18	(0.27)	0.093**	(0.03)	0.14	(0.36)
Equity Investment instruments	0.83***	(0.00)	-0.17	(0.26)	0.10*	(0.09)	-0.22	(0.15)
Software and Computer Services	0.89***	(0.00)	-0.0013	(1.00)	0.15*	(0.08)	-0.17	(0.45)
Tech and Hardware Equipment	1.16***	(0.00)	-0.35	(0.29)	0.16	(0.22)	0.062	(0.85)

<u>_cons</u>	<u>R-sq</u>
0.00073	(0.80) 0.60
-0.0029	(0.49) 0.62
-0.0038	(0.54) 0.47
0.0031	(0.10) 0.81
-0.00076	(0.80) 0.65

-0.0025	(0.58)	0.65
-0.00063	(0.90)	0.49
-0.00026	(0.89)	0.85
0.0032	(0.17)	0.68
0.00042	(0.85)	0.81
0.0025	(0.29)	0.77
0.0031	(0.16)	0.80
0.00098	(0.51)	0.84
0.0018	(0.27)	0.80
-0.00083	(0.83)	0.59
0.0046*	(0.07)	0.61
0.0051***	(0.01)	0.51
0.0032	(0.11)	0.68
0.0022	(0.43)	0.68
0.0050**	(0.02)	0.73
0.0041	(0.21)	0.33
0.0043**	(0.03)	0.59
0.0035	(0.14)	0.45
-0.00043	(0.84)	0.59
0.0019	(0.39)	0.70
-0.00063	(0.70)	0.79
-0.00027	(0.90)	0.73
-0.0019	(0.47)	0.41
0.0011	(0.64)	0.42
0.00011	(0.96)	0.69
-0.00048	(0.85)	0.58
-0.0074***	(0.00)	0.80
0.0021	(0.40)	0.72
-0.0025	(0.39)	0.80
-0.0011	(0.67)	0.63
-0.0011	(0.71)	0.53
0.0012	(0.33)	0.92
0.0010	(0.41)	0.85
0.0032	(0.15)	0.68
-0.0025	(0.41)	0.65

9.1.4 Sub period Regression analysis

9.1.4.1 *United States*

Period: 1.2.2005 – 1-10-2008

Sectors	lnUSDCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	-0.69	(0.68)	0.93***	(0.00)	0.011	(0.31)	0.18
Oil Services Distribution	-1.78	(0.39)	1.15***	(0.01)	0.0056	(0.64)	0.25
Alternative Energy	-4.30	(0.46)	0.56	(0.55)	0.033	(0.21)	-0.01
Chemicals	-2.69**	(0.03)	0.99***	(0.00)	-0.0058	(0.39)	0.54
Forestry and paper	0.56	(0.70)	0.96***	(0.00)	-0.0017	(0.89)	0.17
Industrial Metal and Mines	-4.81**	(0.04)	2.17***	(0.00)	-0.0099	(0.48)	0.50
Mining	-5.27	(0.12)	1.40**	(0.03)	-0.0049	(0.80)	0.17
Construction and Materials	-1.70*	(0.07)	1.56***	(0.00)	-0.0014	(0.86)	0.59
Aero Defense	1.41*	(0.07)	1.10***	(0.00)	0.012**	(0.02)	0.64
General Industrials	-0.56	(0.61)	1.02***	(0.00)	-0.0081	(0.21)	0.45
Electronic and Electrical Equipment	-0.99	(0.19)	1.40***	(0.00)	-0.0022	(0.62)	0.76
Industrial Engineering	-2.13**	(0.02)	1.69***	(0.00)	-0.0040	(0.47)	0.76
Industrial Transportation	-2.15*	(0.09)	1.08***	(0.00)	-0.0014	(0.85)	0.41
Support Services	-0.38	(0.35)	1.01***	(0.00)	-0.0016	(0.67)	0.71
Auto and Parts	0.42	(0.80)	1.37***	(0.00)	-0.0079	(0.37)	0.44
Beverages	1.04	(0.26)	0.35*	(0.06)	0.0096*	(0.09)	0.13
Food Producers	1.06	(0.12)	0.50***	(0.00)	0.0050	(0.24)	0.32
Household goods and Home Construction	-0.21	(0.85)	0.73***	(0.01)	0.00034	(0.96)	0.27
Leisure Goods	0.40	(0.74)	1.24***	(0.00)	-0.0030	(0.62)	0.57
Personal Goods	0.54	(0.50)	0.57***	(0.00)	0.0064	(0.21)	0.32
Tobacco	1.07	(0.19)	0.32**	(0.05)	0.015**	(0.02)	0.05
Healthcare Equipment Services	1.07	(0.16)	0.65***	(0.00)	0.0061	(0.22)	0.39
Pharma and Bio	0.018	(0.98)	0.55***	(0.00)	0.00044	(0.94)	0.25
Food and Drug Retailers	-0.55	(0.30)	0.74***	(0.00)	0.0042	(0.46)	0.28
General Retailers	-1.33	(0.22)	0.91***	(0.00)	-0.0086	(0.16)	0.44
Media	0.31	(0.68)	0.98***	(0.00)	-0.0051	(0.30)	0.61
Travel and Leisure	1.35	(0.11)	1.44***	(0.00)	0.0031	(0.58)	0.69
Fixed Line Telecommunications	0.10	(0.91)	1.27***	(0.00)	0.0031	(0.59)	0.63
Mobile Telecommunications	2.54	(0.19)	1.74***	(0.00)	0.0016	(0.87)	0.46
Electricity	0.84	(0.40)	0.70***	(0.00)	0.0085	(0.30)	0.24
Gas Water and Multi Utilities	-0.15	(0.87)	0.73***	(0.00)	0.0055	(0.45)	0.28
Banks	3.93	(0.18)	0.40	(0.45)	0.013	(0.31)	0.07
Non-Life Insurance	1.30*	(0.08)	0.92***	(0.00)	0.00088	(0.86)	0.57
Life Insurance	1.06	(0.14)	1.21***	(0.00)	0.0065	(0.15)	0.71
Real Estate Inv Services	0.77	(0.47)	1.53***	(0.00)	-0.00051	(0.95)	0.52
REITs	0.033	(0.98)	1.07***	(0.00)	0.0049	(0.53)	0.39
Financials	1.23	(0.23)	1.58***	(0.00)	-0.0029	(0.55)	0.75
Equity Investment instruments	-0.18	(0.96)	0.87	(0.14)	-0.016	(0.34)	0.03
Software and Computer Services	-0.56	(0.58)	1.16***	(0.00)	-0.0016	(0.78)	0.53
Tech and Hardware Equipment	-0.65	(0.47)	1.69***	(0.00)	-0.0029	(0.60)	0.74

Period: 1.11.2008 – 1.10.2010

Sectors	lnUSDCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	1.45	(0.35)	0.88***	(0.00)	-0.0029	(0.71)	0.83
Oil Services Distribution	0.020	(0.99)	1.19***	(0.00)	0.00059	(0.96)	0.72
Alternative Energy	-5.29	(0.20)	1.52***	(0.00)	-0.0078	(0.79)	0.53
Chemicals	2.17	(0.13)	1.37***	(0.00)	0.0098	(0.26)	0.89
Forestry and paper	5.38	(0.20)	2.50***	(0.00)	0.018	(0.54)	0.68
Industrial Metal and Mines	0.17	(0.94)	1.86***	(0.00)	0.015	(0.25)	0.87
Mining	-0.93	(0.71)	1.25***	(0.00)	0.0089	(0.58)	0.68
Construction and Materials	3.05*	(0.06)	1.36***	(0.00)	-0.0034	(0.74)	0.87
Aero Defense	0.24	(0.84)	1.10***	(0.00)	0.0021	(0.80)	0.86
General Industrials	1.68	(0.33)	1.43***	(0.00)	-0.0012	(0.91)	0.87
Electronic and Electrical Equipment	-0.65	(0.60)	1.20***	(0.00)	0.0045	(0.53)	0.91
Industrial Engineering	0.035	(0.98)	1.51***	(0.00)	0.013	(0.16)	0.91
Industrial Transportation	1.85	(0.19)	1.08***	(0.00)	0.0049	(0.54)	0.86
Support Services	-1.17	(0.11)	0.81***	(0.00)	0.0019	(0.62)	0.95
Auto and Parts	4.42	(0.13)	1.75***	(0.00)	0.022	(0.28)	0.69
Beverages	2.02	(0.15)	0.65***	(0.00)	0.0073	(0.34)	0.70
Food Producers	1.73*	(0.08)	0.65***	(0.00)	-0.0013	(0.83)	0.82
Household goods and Home Construction	1.04	(0.24)	0.72***	(0.00)	-0.0036	(0.59)	0.82
Leisure Goods	0.65	(0.75)	0.84***	(0.00)	-0.0076	(0.48)	0.64
Personal Goods	-0.32	(0.71)	0.90***	(0.00)	0.0033	(0.54)	0.91
Tobacco	0.41	(0.76)	0.70***	(0.00)	0.0087	(0.16)	0.81
Healthcare Equipment Services	-1.08	(0.46)	0.88***	(0.00)	-0.0029	(0.77)	0.76
Pharma and Bio	-1.12	(0.37)	0.66***	(0.00)	0.0020	(0.80)	0.72
Food and Drug Retailers	-1.73	(0.44)	0.67***	(0.00)	-0.0024	(0.77)	0.71
General Retailers	-1.16	(0.44)	0.78***	(0.00)	0.0026	(0.66)	0.85
Media	0.53	(0.59)	1.12***	(0.00)	0.0051	(0.42)	0.91
Travel and Leisure	-0.65	(0.63)	1.19***	(0.00)	0.010	(0.16)	0.91
Fixed Line Telecommunications	-1.44	(0.28)	0.53***	(0.00)	0.0055	(0.57)	0.55
Mobile Telecommunications	0.62	(0.82)	1.19***	(0.00)	0.0020	(0.92)	0.54
Electricity	2.46*	(0.07)	0.61***	(0.00)	0.0017	(0.81)	0.69
Gas Water and Multi Utilities	1.28	(0.32)	0.74***	(0.00)	0.0051	(0.45)	0.80
Banks	-0.31	(0.92)	1.68***	(0.00)	-0.018	(0.24)	0.83
Non-Life Insurance	-0.90	(0.65)	0.84***	(0.00)	-0.0038	(0.62)	0.81
Life Insurance	2.00	(0.64)	2.21***	(0.00)	0.0038	(0.81)	0.86
Real Estate Inv Services	7.60*	(0.09)	1.66***	(0.00)	0.018	(0.49)	0.53
REITs	-1.04	(0.85)	1.70***	(0.00)	0.0020	(0.89)	0.78
Financials	-0.38	(0.80)	1.37***	(0.00)	-0.0034	(0.59)	0.94
Equity Investment instruments	-1.51	(0.53)	0.69**	(0.02)	-0.0071	(0.71)	0.29
Software and Computer Services	-0.85	(0.42)	0.87***	(0.00)	0.0057	(0.41)	0.87
Tech and Hardware Equipment	-0.85	(0.51)	1.04***	(0.00)	0.0087	(0.25)	0.89

Period: 1.11.2010 – 1-2-2014

Sectors	lnUSDCNY		Market		_cons	Adj. R. sq	
Oil and Gas Production	-0.86	(0.39)	1.23***	(0.00)	-0.0058	(0.22)	0.82
Oil Services Distribution	2.29*	(0.07)	1.33***	(0.00)	0.0011	(0.88)	0.69
Alternative Energy	-6.32	(0.46)	2.04**	(0.02)	-0.047*	(0.08)	0.15
Chemicals	0.19	(0.81)	1.38***	(0.00)	-0.0021	(0.69)	0.84
Forestry and paper	-0.53	(0.67)	1.23***	(0.00)	0.0017	(0.80)	0.68
Industrial Metal and Mines	-1.76	(0.42)	1.82***	(0.00)	-0.027**	(0.01)	0.67
Mining	-3.84	(0.18)	0.93***	(0.00)	-0.037***	(0.00)	0.32
Construction and Materials	-0.43	(0.72)	1.42***	(0.00)	-0.0027	(0.61)	0.80
Aero Defense	1.32	(0.19)	0.94***	(0.00)	0.0084*	(0.08)	0.72
General Industrials	0.15	(0.90)	1.21***	(0.00)	-0.00043	(0.92)	0.82
Electronic and Electrical Equipment	2.89**	(0.02)	1.39***	(0.00)	0.0035	(0.44)	0.78
Industrial Engineering	0.62	(0.64)	1.63***	(0.00)	-0.0065	(0.27)	0.76
Industrial Transportation	1.05	(0.29)	1.15***	(0.00)	0.0017	(0.63)	0.79
Support Services	-0.71	(0.15)	0.94***	(0.00)	0.00098	(0.73)	0.89
Auto and Parts	-0.012	(0.99)	1.36***	(0.00)	-0.0029	(0.73)	0.56
Beverages	-0.94	(0.40)	0.41***	(0.00)	0.0017	(0.74)	0.29
Food Producers	-0.58	(0.34)	0.62***	(0.00)	0.0041	(0.27)	0.64
Household goods and Home Construction	-1.58	(0.11)	0.55***	(0.00)	0.00000010	(1.00)	0.49
Leisure Goods	-0.32	(0.83)	0.93***	(0.00)	0.0030	(0.65)	0.56
Personal Goods	-0.92	(0.40)	0.71***	(0.00)	0.0037	(0.46)	0.55
Tobacco	-1.66	(0.26)	0.56***	(0.00)	0.0026	(0.76)	0.24
Healthcare Equipment Services	-0.058	(0.95)	0.97***	(0.00)	0.0015	(0.71)	0.79
Pharma and Bio	-0.40	(0.69)	0.61***	(0.00)	0.0099**	(0.01)	0.50
Food and Drug Retailers	0.044	(0.94)	0.82***	(0.00)	0.0075**	(0.05)	0.74
General Retailers	0.44	(0.56)	0.77***	(0.00)	0.0056	(0.22)	0.72
Media	0.55	(0.41)	1.13***	(0.00)	0.0081**	(0.02)	0.87
Travel and Leisure	-0.32	(0.81)	1.01***	(0.00)	0.0029	(0.61)	0.72
Fixed Line Telecommunications	-0.30	(0.84)	0.42***	(0.00)	0.0027	(0.70)	0.17
Mobile Telecommunications	-2.23	(0.20)	0.81***	(0.00)	0.00030	(0.98)	0.33
Electricity	-0.48	(0.63)	0.24**	(0.01)	0.0036	(0.45)	0.08
Gas Water and Multi Utilities	0.14	(0.89)	0.49***	(0.00)	0.0069	(0.17)	0.32
Banks	-1.63	(0.35)	1.49***	(0.00)	-0.011*	(0.08)	0.75
Non-Life Insurance	0.34	(0.60)	0.89***	(0.00)	-0.0014	(0.68)	0.83
Life Insurance	-1.29	(0.34)	1.84***	(0.00)	-0.014**	(0.02)	0.84
Real Estate Inv Services	3.13	(0.19)	1.98***	(0.00)	-0.0066	(0.50)	0.67
REITs	-0.50	(0.68)	0.84***	(0.00)	-0.0023	(0.71)	0.51
Financials	-0.23	(0.74)	1.39***	(0.00)	-0.0019	(0.41)	0.93
Equity Investment instruments	0.20	(0.94)	0.83***	(0.01)	0.015	(0.29)	0.15
Software and Computer Services	0.54	(0.58)	0.95***	(0.00)	0.0026	(0.57)	0.77
Tech and Hardware Equipment	0.86	(0.47)	1.00***	(0.00)	-0.00093	(0.88)	0.64

Period 1.3.2014 – 1-4-2019

Sectors	lnUSDCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	0.65*	(0.08)	1.24***	(0.00)	-0.011**	(0.04)	0.49
Oil Services Distribution	0.34	(0.41)	1.25***	(0.00)	-0.014**	(0.01)	0.48
Alternative Energy	-2.05	(0.18)	1.08**	(0.04)	0.0032	(0.84)	0.11
Chemicals	0.21	(0.43)	1.14***	(0.00)	-0.0040	(0.21)	0.73
Forestry and paper	-0.35	(0.31)	1.25***	(0.00)	-0.0041	(0.32)	0.65
Industrial Metal and Mines	-0.85	(0.31)	1.18***	(0.00)	-0.0064	(0.45)	0.30
Mining	-0.74	(0.29)	0.34	(0.32)	0.0045	(0.72)	-0.00
Construction and Materials	0.15	(0.64)	1.14***	(0.00)	-0.0035	(0.31)	0.69
Aero Defense	-0.36	(0.35)	1.09***	(0.00)	0.0042	(0.23)	0.65
General Industrials	0.33	(0.23)	1.14***	(0.00)	-0.0057*	(0.05)	0.77
Electronic and Electrical Equipment	-0.40**	(0.03)	1.22***	(0.00)	-0.00041	(0.87)	0.86
Industrial Engineering	-0.061	(0.89)	1.27***	(0.00)	-0.0023	(0.55)	0.66
Industrial Transportation	-0.041	(0.93)	1.21***	(0.00)	-0.00072	(0.86)	0.64
Support Services	-0.068	(0.59)	1.04***	(0.00)	0.0040**	(0.02)	0.88
Auto and Parts	-0.23	(0.56)	1.16***	(0.00)	-0.0069	(0.14)	0.63
Beverages	-0.12	(0.76)	0.55***	(0.00)	0.0041	(0.27)	0.31
Food Producers	0.48	(0.18)	0.74***	(0.00)	-0.0026	(0.47)	0.45
Household goods and Home Construction	0.12	(0.80)	0.60***	(0.00)	0.0015	(0.67)	0.38
Leisure Goods	-0.0033	(1.00)	1.04***	(0.00)	0.0024	(0.68)	0.41
Personal Goods	-0.18	(0.60)	0.73***	(0.00)	-0.00015	(0.97)	0.50
Tobacco	0.68	(0.21)	0.82***	(0.00)	0.0018	(0.80)	0.22
Healthcare Equipment Services	-0.15	(0.48)	0.93***	(0.00)	0.0063**	(0.03)	0.70
Pharma and Bio	-0.062	(0.83)	1.00***	(0.00)	-0.0011	(0.75)	0.65
Food and Drug Retailers	0.61	(0.11)	0.94***	(0.00)	-0.0083	(0.11)	0.39
General Retailers	0.050	(0.88)	1.01***	(0.00)	0.0063*	(0.05)	0.66
Media	0.053	(0.91)	1.02***	(0.00)	-0.0030	(0.41)	0.61
Travel and Leisure	-0.26	(0.38)	0.94***	(0.00)	0.00071	(0.79)	0.71
Fixed Line Telecommunications	0.49	(0.14)	0.59***	(0.00)	-0.00043	(0.93)	0.21
Mobile Telecommunications	1.37***	(0.01)	0.63***	(0.00)	-0.0019	(0.79)	0.11
Electricity	0.14	(0.77)	0.32**	(0.04)	0.0064	(0.22)	0.05
Gas Water and Multi Utilities	0.15	(0.73)	0.36***	(0.01)	0.0061	(0.19)	0.08
Banks	0.48	(0.36)	1.26***	(0.00)	-0.0032	(0.51)	0.52
Non-Life Insurance	0.069	(0.78)	0.84***	(0.00)	0.0025	(0.29)	0.68
Life Insurance	0.25	(0.63)	1.27***	(0.00)	-0.0058	(0.18)	0.60
Real Estate Inv Services	-0.30	(0.49)	1.20***	(0.00)	-0.0060	(0.26)	0.57
REITs	0.20	(0.66)	0.70***	(0.00)	0.0022	(0.61)	0.34
Financials	-0.33	(0.13)	1.12***	(0.00)	0.00089	(0.73)	0.78
Equity Investment instruments	-1.97***	(0.00)	1.24***	(0.00)	0.0059	(0.37)	0.51
Software and Computer Services	-0.55**	(0.04)	1.01***	(0.00)	0.0056*	(0.07)	0.70
Tech and Hardware Equipment	-0.17	(0.65)	1.14***	(0.00)	0.0054	(0.25)	0.58

9.1.4.2 Europe

Period: 1.2.2005 – 1-10-2008

Sectors	lnEURCNV		Market		_cons		Adj. R. sq
Oil and Gas Production	0.42*	(0.05)	1.17***	(0.00)	0.0046	(0.44)	0.62
Oil Services Distribution	0.80**	(0.01)	1.55***	(0.00)	0.013*	(0.08)	0.66
Alternative Energy	0.86*	(0.09)	1.85***	(0.00)	0.030***	(0.00)	0.64
Chemicals	0.28*	(0.09)	0.99***	(0.00)	0.0088**	(0.02)	0.74
Forestry and paper	-0.51	(0.11)	1.03***	(0.00)	-0.012***	(0.01)	0.71
Industrial Metal and Mines	1.34***	(0.00)	1.69***	(0.00)	0.014	(0.11)	0.64
Mining	0.99**	(0.05)	1.56***	(0.00)	0.011	(0.25)	0.53
Construction and Materials	-0.044	(0.80)	1.35***	(0.00)	-0.00013	(0.97)	0.88
Aero Defense	-0.65***	(0.00)	1.11***	(0.00)	-0.0034	(0.34)	0.83
General Industrials	0.24	(0.27)	1.40***	(0.00)	0.0012	(0.76)	0.84
Electronic and Electrical Equipment	-0.014	(0.92)	1.28***	(0.00)	0.0021	(0.66)	0.77
Industrial Engineering	0.43***	(0.00)	1.49***	(0.00)	0.0087**	(0.02)	0.89
Industrial Transportation	-0.086	(0.63)	0.96***	(0.00)	0.00030	(0.93)	0.78
Support Services	-0.13	(0.62)	0.95***	(0.00)	-0.0032	(0.45)	0.71
Auto and Parts	-0.31	(0.19)	1.14***	(0.00)	0.0052	(0.33)	0.68
Beverages	-0.20	(0.36)	0.79***	(0.00)	0.0034	(0.28)	0.72
Food Producers	-0.41***	(0.01)	0.61***	(0.00)	0.0027	(0.43)	0.62
Household goods and Home Construction	-0.41**	(0.04)	0.97***	(0.00)	-0.0035	(0.43)	0.70
Leisure Goods	0.021	(0.93)	1.20***	(0.00)	-0.0042	(0.36)	0.76
Personal Goods	-0.028	(0.87)	0.97***	(0.00)	-0.0010	(0.75)	0.80
Tobacco	-0.44**	(0.03)	0.48***	(0.00)	0.0080*	(0.08)	0.40
Healthcare Equipment Services	-0.20	(0.21)	0.67***	(0.00)	0.0014	(0.63)	0.69
Pharma and Bio	-0.32**	(0.02)	0.39***	(0.00)	-0.00094	(0.80)	0.36
Food and Drug Retailers	-0.30	(0.21)	0.70***	(0.00)	-0.00036	(0.94)	0.53
General Retailers	0.079	(0.61)	1.03***	(0.00)	-0.0058	(0.13)	0.76
Media	-0.22*	(0.08)	0.95***	(0.00)	0.0097***	(0.00)	0.82
Travel and Leisure	-0.20	(0.33)	1.05***	(0.00)	-0.0055	(0.19)	0.77
Fixed Line Telecommunications	-0.33*	(0.06)	0.54***	(0.00)	-0.0039	(0.39)	0.44
Mobile Telecommunications	0.15	(0.52)	0.75***	(0.00)	-0.00012	(0.98)	0.39
Electricity	0.21	(0.20)	1.02***	(0.00)	0.0090**	(0.02)	0.77
Gas Water and Multi Utilities	0.042	(0.76)	0.85***	(0.00)	0.0074**	(0.04)	0.72
Banks	-0.18	(0.18)	1.09***	(0.00)	-0.0061	(0.12)	0.78
Non-Life Insurance	-0.34*	(0.08)	0.84***	(0.00)	0.0020	(0.64)	0.65
Life Insurance	-0.16	(0.23)	1.23***	(0.00)	-0.0068	(0.12)	0.79
Real Estate Inv Services	0.23	(0.41)	1.09***	(0.00)	-0.0091	(0.11)	0.61
REITs	-0.76*	(0.07)	0.56***	(0.00)	-0.0044	(0.59)	0.27
Financials	0.076	(0.52)	1.29***	(0.00)	0.0013	(0.53)	0.94
Equity Investment instruments	-0.16*	(0.06)	0.85***	(0.00)	-0.00083	(0.67)	0.90
Software and Computer Services	-0.13	(0.43)	0.85***	(0.00)	-0.0029	(0.53)	0.59
Tech and Hardware Equipment	-0.24	(0.40)	1.40***	(0.00)	-0.011*	(0.06)	0.73

Period: 1.11.2008 – 1.10.2010

Sectors	lnEURCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	-0.16	(0.47)	0.92***	(0.00)	-0.0023	(0.77)	0.76
Oil Services Distribution	-0.030	(0.93)	1.50***	(0.00)	0.0059	(0.62)	0.82
Alternative Energy	0.64	(0.15)	1.58***	(0.00)	-0.04***	(0.00)	0.81
Chemicals	0.32*	(0.06)	0.93***	(0.00)	0.0072	(0.31)	0.86
Forestry and paper	-0.54	(0.20)	1.19***	(0.00)	0.0039	(0.75)	0.62
Industrial Metal and Mines	0.16	(0.61)	1.78***	(0.00)	-0.0015	(0.90)	0.87
Mining	-0.084	(0.80)	1.69***	(0.00)	0.011	(0.46)	0.77
Construction and Materials	0.21	(0.31)	1.07***	(0.00)	-0.0014	(0.83)	0.89
Aero Defense	-0.73**	(0.02)	0.91***	(0.00)	0.00048	(0.96)	0.63
General Industrials	0.30	(0.11)	1.09***	(0.00)	0.0088	(0.16)	0.90
Electronic and Electrical Equipment	0.51*	(0.08)	0.96***	(0.00)	0.012	(0.16)	0.83
Industrial Engineering	0.37**	(0.05)	1.01***	(0.00)	0.013*	(0.07)	0.89
Industrial Transportation	0.089	(0.49)	0.92***	(0.00)	0.0011	(0.83)	0.91
Support Services	-0.33***	(0.00)	0.96***	(0.00)	0.0066**	(0.04)	0.95
Auto and Parts	-0.29	(0.48)	1.17***	(0.00)	-0.0074	(0.69)	0.46
Beverages	-0.19	(0.49)	0.80***	(0.00)	0.014*	(0.10)	0.70
Food Producers	-0.15	(0.33)	0.45***	(0.00)	0.0068	(0.26)	0.53
Household goods and Home Construction	-0.40**	(0.04)	0.76***	(0.00)	0.010*	(0.07)	0.80
Leisure Goods	-0.29	(0.35)	1.24***	(0.00)	0.0027	(0.80)	0.74
Personal Goods	0.23	(0.23)	0.79***	(0.00)	0.015***	(0.01)	0.88
Tobacco	-0.60*	(0.05)	0.63***	(0.00)	0.0035	(0.73)	0.37
Healthcare Equipment Services	-0.28*	(0.08)	0.58***	(0.00)	0.0035	(0.63)	0.56
Pharma and Bio	-0.37*	(0.10)	0.53**	(0.02)	0.0013	(0.88)	0.40
Food and Drug Retailers	-0.077	(0.66)	0.64***	(0.00)	0.0053	(0.34)	0.77
General Retailers	0.063	(0.75)	0.79***	(0.00)	0.019**	(0.01)	0.78
Media	-0.043	(0.75)	0.80***	(0.00)	0.0052	(0.29)	0.86
Travel and Leisure	0.0042	(0.98)	0.89***	(0.00)	-0.00035	(0.96)	0.78
Fixed Line Telecommunications	0.55***	(0.01)	0.20	(0.13)	0.0037	(0.55)	0.61
Mobile Telecommunications	0.12	(0.56)	0.42**	(0.03)	0.0066	(0.30)	0.54
Electricity	0.045	(0.73)	0.83***	(0.00)	-0.0093*	(0.09)	0.87
Gas Water and Multi Utilities	-0.067	(0.84)	0.95***	(0.00)	-0.012	(0.17)	0.76
Banks	0.028	(0.91)	1.82***	(0.00)	-0.0100	(0.20)	0.93
Non-Life Insurance	0.36	(0.22)	1.03***	(0.00)	-0.0070	(0.49)	0.80
Life Insurance	0.32	(0.29)	1.65***	(0.00)	-0.0083	(0.46)	0.88
Real Estate Inv Services	0.077	(0.69)	0.95***	(0.00)	-0.0033	(0.71)	0.75
REITs	0.18	(0.26)	1.05***	(0.00)	-0.0031	(0.68)	0.86
Financials	-0.037	(0.76)	1.11***	(0.00)	0.000020	(1.00)	0.96
Equity Investment instruments	-0.51**	(0.02)	1.02***	(0.00)	-0.0014	(0.81)	0.87
Software and Computer Services	-0.15	(0.49)	0.89***	(0.00)	0.0034	(0.66)	0.76
Tech and Hardware Equipment	-0.16	(0.49)	1.11***	(0.00)	-0.0037	(0.71)	0.73

Period: 1.11.2010 – 1-2-2014

Sectors	lnEURCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	0.018	(0.92)	1.09***	(0.00)	-0.0035	(0.39)	0.76
Oil Services Distribution	-0.39	(0.15)	1.66***	(0.00)	-0.011	(0.11)	0.70
Alternative Energy	1.03	(0.16)	1.16**	(0.01)	-0.013	(0.44)	0.28
Chemicals	-0.017	(0.94)	1.19***	(0.00)	0.0028	(0.50)	0.77
Forestry and paper	0.12	(0.56)	1.16***	(0.00)	-0.00070	(0.89)	0.70
Industrial Metal and Mines					-		
Mining	0.11	(0.78)	1.75***	(0.00)	0.021***	(0.00)	0.74
Construction and Materials	-0.051	(0.90)	1.41***	(0.00)	-0.017**	(0.05)	0.55
Aero Defense	0.069	(0.64)	1.17***	(0.00)	-0.00062	(0.87)	0.80
General Industrials	-0.069	(0.78)	0.82***	(0.00)	0.013***	(0.00)	0.58
Electronic and Electrical Equipment	-0.15	(0.50)	1.34***	(0.00)	-0.0015	(0.75)	0.75
Industrial Engineering	0.0062	(0.98)	1.24***	(0.00)	0.0035	(0.44)	0.75
Industrial Transportation	-0.21	(0.44)	1.28***	(0.00)	-0.0020	(0.67)	0.71
Support Services	0.026	(0.76)	0.95***	(0.00)	0.0036	(0.23)	0.83
Auto and Parts	-0.26**	(0.01)	0.95***	(0.00)	0.0057**	(0.01)	0.86
Beverages	0.065	(0.87)	1.58***	(0.00)	0.0047	(0.49)	0.65
Food Producers	-0.53**	(0.02)	0.90***	(0.00)	0.0028	(0.56)	0.51
Household goods and Home Construction	-0.37*	(0.07)	0.50***	(0.00)	0.0063	(0.16)	0.29
Leisure Goods	-0.38***	(0.00)	0.85***	(0.00)	0.0064	(0.10)	0.61
Personal Goods	-0.36	(0.25)	1.21***	(0.00)	-0.0014	(0.83)	0.54
Tobacco	0.16	(0.50)	0.86***	(0.00)	0.0064	(0.22)	0.57
Healthcare Equipment Services	-0.65***	(0.01)	0.53***	(0.00)	0.0039	(0.54)	0.20
Pharma and Bio	-0.33**	(0.05)	0.47***	(0.00)	0.0081**	(0.03)	0.38
Food and Drug Retailers	-0.38	(0.10)	0.50***	(0.00)	0.010**	(0.02)	0.30
General Retailers	-0.091	(0.53)	0.72***	(0.00)	-0.0019	(0.64)	0.51
Media	-0.27	(0.12)	0.87***	(0.00)	0.0056	(0.20)	0.57
Travel and Leisure	0.017	(0.89)	0.88***	(0.00)	0.0051	(0.13)	0.79
Fixed Line Telecommunications	-0.21*	(0.06)	0.92***	(0.00)	0.0046	(0.21)	0.72
Mobile Telecommunications	0.57***	(0.00)	0.53***	(0.00)	-0.0015	(0.74)	0.55
Electricity	-0.088	(0.65)	0.60***	(0.00)	0.0052	(0.31)	0.32
Gas Water and Multi Utilities	0.30*	(0.06)	0.86***	(0.00)	-0.0075*	(0.08)	0.68
Banks	0.041	(0.87)	0.66***	(0.00)	-0.0016	(0.76)	0.38
Non-Life Insurance	0.35*	(0.05)	1.36***	(0.00)	-0.0086*	(0.07)	0.82
Life Insurance	0.29*	(0.07)	1.12***	(0.00)	0.0052	(0.12)	0.86
Real Estate Inv Services	0.56**	(0.05)	1.31***	(0.00)	0.0062	(0.25)	0.79
REITs	0.030	(0.86)	0.61***	(0.00)	0.00066	(0.84)	0.57
Financials	0.050	(0.82)	0.78***	(0.00)	0.0013	(0.77)	0.58
Equity Investment instruments	0.054	(0.58)	1.02***	(0.00)	0.0031	(0.16)	0.90
Software and Computer Services	-0.36***	(0.00)	0.73***	(0.00)	0.0024	(0.13)	0.85
Tech and Hardware Equipment	0.17	(0.38)	0.86***	(0.00)	0.0070*	(0.06)	0.71
	0.34	(0.24)	0.97***	(0.00)	0.0019	(0.80)	0.52

Period 1.3.2014 – 1-4-2019

Sectors	lnEURCNY		Market		_cons		Adj. R. sq
Oil and Gas Production	0.21	(0.34)	1.02***	(0.00)	0.0013	(0.80)	0.43
Oil Services Distribution	0.69**	(0.03)	1.36***	(0.00)	-0.014**	(0.04)	0.43
Alternative Energy	-0.54	(0.21)	1.18***	(0.00)	0.0011	(0.91)	0.33
Chemicals	-0.062	(0.60)	1.16***	(0.00)	-0.0018	(0.42)	0.86
Forestry and paper	-0.32	(0.16)	1.38***	(0.00)	0.0049	(0.32)	0.66
Industrial Metal and Mines	-0.15	(0.64)	1.06***	(0.00)	0.0016	(0.81)	0.37
Mining	0.38	(0.36)	0.89***	(0.00)	0.0021	(0.82)	0.14
Construction and Materials	0.25**	(0.03)	1.08***	(0.00)	0.00043	(0.85)	0.84
Aero Defense	-0.26	(0.17)	1.12***	(0.00)	0.0027	(0.43)	0.72
General Industrials	0.10	(0.53)	1.18***	(0.00)	-0.0026	(0.43)	0.72
Electronic and Electrical Equipment	0.045	(0.78)	1.20***	(0.00)	-0.0013	(0.70)	0.75
Industrial Engineering	0.10	(0.42)	1.09***	(0.00)	0.00032	(0.91)	0.74
Industrial Transportation	0.16*	(0.09)	1.00***	(0.00)	0.000096	(0.96)	0.82
Support Services	0.070	(0.56)	1.06***	(0.00)	0.00036	(0.89)	0.78
Auto and Parts	0.13	(0.51)	1.55***	(0.00)	-0.0058	(0.23)	0.69
Beverages	-0.14	(0.40)	0.93***	(0.00)	0.0024	(0.57)	0.54
Food Producers	-0.067	(0.63)	0.68***	(0.00)	0.0042	(0.17)	0.55
Household goods and Home Construction	-0.17	(0.19)	0.85***	(0.00)	0.0023	(0.41)	0.67
Leisure Goods	0.22	(0.19)	1.23***	(0.00)	0.0084**	(0.03)	0.67
Personal Goods	-0.12	(0.40)	1.00***	(0.00)	0.0053	(0.11)	0.70
Tobacco	0.15	(0.60)	1.09***	(0.00)	-0.0014	(0.83)	0.39
Healthcare Equipment Services	-0.12	(0.37)	0.86***	(0.00)	0.0039	(0.22)	0.66
Pharma and Bio	-0.28	(0.10)	0.83***	(0.00)	0.0018	(0.62)	0.58
Food and Drug Retailers	-0.019	(0.91)	0.81***	(0.00)	-0.0027	(0.41)	0.59
General Retailers	-0.061	(0.70)	1.12***	(0.00)	-0.0027	(0.39)	0.74
Media	-0.16	(0.13)	0.86***	(0.00)	-0.00075	(0.77)	0.72
Travel and Leisure	-0.23	(0.11)	0.78***	(0.00)	0.000057	(0.99)	0.60
Fixed Line Telecommunications	-0.081	(0.64)	0.86***	(0.00)	-0.0040	(0.37)	0.48
Mobile Telecommunications	-0.13	(0.38)	0.80***	(0.00)	-0.0029	(0.37)	0.56
Electricity	0.29*	(0.08)	0.79***	(0.00)	0.0031	(0.38)	0.50
Gas Water and Multi Utilities	0.14	(0.34)	0.77***	(0.00)	0.00041	(0.92)	0.39
Banks	0.20	(0.23)	1.16***	(0.00)	-0.0069	(0.13)	0.60
Non-Life Insurance	-0.26*	(0.10)	0.88***	(0.00)	0.0033	(0.32)	0.66
Life Insurance	-0.23	(0.15)	1.21***	(0.00)	-0.0017	(0.64)	0.72
Real Estate Inv Services	0.038	(0.83)	0.73***	(0.00)	0.0064**	(0.03)	0.55
REITs	-0.012	(0.95)	0.92***	(0.00)	-0.00011	(0.98)	0.60
Financials	0.16*	(0.06)	1.07***	(0.00)	0.0016	(0.42)	0.86
Equity Investment instruments	-0.25***	(0.01)	0.80***	(0.00)	0.0026	(0.19)	0.81
Software and Computer Services	0.12	(0.43)	1.10***	(0.00)	0.0043	(0.21)	0.68
Tech and Hardware Equipment	-0.35*	(0.09)	1.08***	(0.00)	0.0034	(0.40)	0.63

9.1.5 Sub Period Analysis based on trade shift

9.1.5.1 United States

Period Sector	1 2		1 2		1 2		1 2	
	Oil Gas Prod		Chemicals		Beverages		Pharma and Bio	
USDCNY	-0.13 (0.94)	0.39 (0.22)	-1.87 (0.14)	-0.011 (0.97)	-0.42 (0.60)	0.045 (0.88)	-0.46 (0.39)	-0.086 (0.76)
MARKET	0.81*** (0.00)	1.13*** (0.00)	0.88*** (0.00)	1.26*** (0.00)	0.42** (0.02)	0.54*** (0.00)	0.63*** (0.00)	0.99*** (0.00)
_cons	0.014 (0.19)	-0.0078** (0.02)	-0.00083 (0.90)	0.000068 (0.98)	0.0049 (0.35)	0.0039 (0.16)	0.0016 (0.62)	0.0012 (0.70)
N	47	120	35	132	35	132	96	71
adj. R-sq	0.28	0.67	0.41	0.82	0.13	0.44	0.58	0.65

9.1.5.2 Europe

Period Sector	1 2		1 2		1 2	
	Food Producers		Pharma and Bio		Travel and Leisure	
EURCNY	-0.12 (0.35)	-0.34*** (0.00)	-0.50*** (0.00)	-0.28** (0.01)	-0.16** (0.05)	-0.12 (0.39)
MARKET	0.60*** (0.00)	0.54*** (0.00)	0.68*** (0.00)	0.45*** (0.00)	0.90*** (0.00)	0.96*** (0.00)
_cons	0.0037 (0.19)	0.0053* (0.05)	0.0054* (0.06)	-0.00013 (0.97)	0.0024 (0.33)	-0.0050 (0.23)
N	72	95	96	71	108	59
R-sq	0.44	0.52	0.48	0.38	0.68	0.75
