Foreign exchange exposure of U.S. firms and macroeconomic conditions: is there a link?

Chaieb, Ines; Mazzotta, Stefano

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Ines Chaieb
University of Amsterdam

Stefano Mazzotta
Kennesaw State University*

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ABSTRACT

We examine the foreign exchange exposure of U.S. firms to two currency indices: the major (MJ) currency index and the emerging markets (EM) currency index. Using a time series cross sectional analysis, we find statistically and economically significant unconditional exposure of the average firm in eleven U.S. industries to the two currency indices. Our results underscore the importance of methodology for the study of exposure. We then model the dynamics of currency exposure as a function of firm characteristics and macro variables. Exposure to the two real currency indices is significantly time-varying, its dynamics are mainly driven by the macro variables, and it increases during economic contractions.

JEL Classification: F31, E32

Keywords: Foreign exchange exposure, hedging, macroeconomic conditions, leverage, liquidity

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I. Introduction

There is ample anecdotal evidence that exchange rates fluctuation affect firms' performance. Yet, existing empirical studies find weak evidence of FX exposure for firms and industries, both within the U.S. and abroad.

The lack of a significant relationship between exchange rates and stock returns is puzzling in view of the economic theory and the observed strong impact of currency exposure on firms' cash flows as reported in the business press.[1] The literature provides two plausible explanations for this puzzle. The first explanation suggests that the insignificant exposure uncovered is due to firms hedging their exposure, whether through operational or financial hedges. The second explanation emphasizes the role of the methodology used to study exposure. We contribute to this debate. Our study supports the second explanation and shows that estimating exposure using a panel regression, specifically a linear mixed model, uncovers significant exposure to two currency indices that measure the competitiveness of the U.S. dollar against its major developed markets currencies and the major emerging markets currencies. The merit of our approach is that it exploits the information in the cross-section of firms' exposure to yield more precise estimates.

It is plausible that exchange rate changes affect firms' performance through various channels. Globalization affects the patterns of world trade, production and finance and transforms the interactions of economic variables, including possibly the way changes in the exchange rate affect the economy. Thus, providing an accurate measure of FX exposure and understanding what drives the time variation of exposure are important tasks. While investigating time variation of exposure has some merit on its own right, uncovering the economic determinants of such a variation over time is an even more interesting, but little explored, avenue. We therefore focus our attention on both, the unconditional and conditional exposure of U.S. firms, regardless of the direct involvement in international operations.

We examine whether firm-specific and macroeconomic variables are related to time variation in FX exposure. This question is of interest to corporate managers, portfolio managers, and policy makers. For corporate managers, it is relevant to know what part of FX exposure is directly related to firm specific circumstances. This would allow them to better manage their operations and possibly design more effective hedging strate-

[1] See, e.g., Jorion (1990), Bodnar and Gentry (1993), Amihud (1994), and Griffin and Stulz (2001).

gies. For portfolio managers, if much of the changes in FX exposure is not driven by common variables, then currency risk can be diversified away through optimal portfolio allocation. Otherwise systematic currency risk triggers a currency risk premium if currency risk is priced. Finally, the relation between FX exposure and the macroeconomic variables may provide useful information for policy makers who have some control on key economic variables given that the federal government regulates U.S. international trade and investment policy abroad. Though much work has been done to uncover the FX exposure of US and non-US firms as well as on the relationship between exchange rate changes and macroeconomic conditions, to our knowledge, none examines the link of the *dynamics* in FX exposure to macroeconomic conditions. This is an important contribution of this study.[2]

We cluster firms into eleven industries and model the time variation in FX exposure using firm-specific and macroeconomic variables. The firm-specific variables namely, financial leverage and liquidity have been found to explain the cross-sectional variation in firms' FX exposure. The financial macroeconomic variables are the default premium and the term premium. These variables are widely used in the literature because they perform well in predicting future macroeconomic conditions. We also run robustness tests using different firm variables and macro variables.

We measure FX exposure of firms to two trade-weighted real currency indices: the major index (MJ) and the other important trading partners (EM) index. We use panel regressions and a parametric specification to model the time variation in exposure. Motivated by the theoretical arguments and existing evidence, we set FX exposure as a function of firm-specific, as well as macroeconomic variables. We use panel analysis because it takes advantage of expanded observations to yield greater testing power and higher precision in estimation. Each panel contains the firms within the same industry. We explicitly allow heterogeneous exposure for firms within the same industry. Heterogeneity can take the form of a firm specific average expected return (i.e. each firm has different intercept) or as a different sensitivity of returns to changes in the foreign exchange rate (i.e. each firm has a different exposure coefficient). We estimate the panels using random effects on the slope.

[2]There are two papers that investigate the relationship between currency risk and macroeconomic variables for country equity index returns. Ferson and Harvey (1997) indicate that exchange rate betas are jointly related to both country-specific and global risk factors such as inflation and credit ratings for some countries. Patro et al. (2002) measure FX exposure of 16 OECD country equity index returns and show that country-specific macroeconomic variables can help explain foreign exchange rate exposures.

Our results can be summarized as follows. In a static framework, FX exposure is statistically and economically important when regressions are performed using a panel based approach. To shed light on the relevance of the methodology used to uncover FX exposure, we run firm-by-firm regressions as in Jorion (1990). We obtain the well known puzzling finding of a weak relationship between firms stock returns and exchange rate changes similar to the extant literature. However, Fama MacBeth statistics shows that the cross-sectional average exposure is statistically significant. This in turn suggests that a methodology that focuses on the individual firm's exposure, without taking into account the evidence of all firms jointly, may lack power and corroborates the use of panel regression.

Hence, our paper contributes to the ongoing debate whether the methodological shortcomings or the firms use of hedges that are responsible for the weak exposure and offers support to the former argument though it does not rule out the latter. Specifically, we provide indirect evidence on the incompleteness of the hedging argument as a reason for the insignificant exposure.

If the weak results in the literature are rather driven by firms' use of hedges, then we may expect to find significant exposure to the emerging market currency index and not to the major currencies, which are easier to hedge. We uncover significant exposure to both currency indices. Nonetheless, the magnitude of exposure to the emerging market currency index is higher than the exposure to the major currency index, which provides some support to the hedging argument.

In addition, we find that the exposure to the two currency indices is significantly time-varying for the average firm in each industry except for those in Chemicals and Telephone and TV industries. The time variation in the exposure to the two currency indices is mainly driven by the macro variables. Moreover, the exposure increases in periods of recession.

In view of the large currencies volatilities experienced by the emerging markets along with the difficulties to hedge against these currencies, it is interesting to find that exposure to the EM currency index affects US firms returns in an important way both in statistical and economic terms. Our results support the important role that emerging markets play in the US economy, particularly over the recent period.

The rest of the paper is organized as follows. Section II reviews the literature. Section III outlines the model and empirical methodology used in the study. Section IV describes the data. Section V reports the empirical results. Section VI concludes and suggests some guidelines for future research.

II. Literature Review

The literature on FX exposure is vast. A large part of it deals with the measurement of FX exposure. Early work mostly investigate FX exposure from an accounting perspective (see e.g. Rodriguez (1974), and Aliber and Stickney (1975)). This approach has however serious limitations as it abstracts from the impact that foreign exchange fluctuations have on the market value of the firm. The latter is termed economic exposure. It can be traced back to Lietaer (1971) and it is further developed in Dumas (1977) and Adler (1974). Adler defines FX economic exposure as "the amounts of foreign currencies which represent the sensitivity of the future, real domestic-currency (market) value of any physical or financial asset to random variations in the future domestic purchasing powers of these foreign currencies, at some specific future date." Hence FX exposure can be measured by the coefficient of a linear regression of a financial asset return on one or more foreign exchange rates. Following this approach, previous studies find no consensus on the extent to which U.S. companies are exposed to foreign exchange risk. They generally find a weak link between contemporaneous exchange-rate fluctuations and stock returns of US multinational firms. (See e.g. Jorion (1990), Bodnar and Gentry (1993), Doidge, Griffin, and Williamson (2006), and Griffin and Stulz (2001)). However, results in Amihud (1994), and Bartov and Bodnar (1994) suggest that lagged changes in the dollar can explain firms' current stock returns. In addition, there is some evidence for FX exposure of non-US firms. He and Ng (1998), using a sample of 171 Japanese multinationals from 1979-1993 finds that exposure depends on the level of the firm's international operations and the degree of hedging motive. Firms with low short-term liquidity or high financial leverage do hedge and are less exposed to changes in exchange rate. Dominguez and Tesar (2006) examine exposure of eight non-US industrialized and developing countries over 1980-1999 and find evidence for significant economic exposure in five out of eight countries. Exposure depends mainly on the firms' international activities, and to a lesser extent on the competitiveness of a particular industry.

Some studies argue that the weak results are due to the empirical inadequacies such as the sample selection procedure (see, e.g. Bartov and Bodnar, 1994; Dominguez and Tesar, 2001). Levi (1994) argues that the lack of evidence is due to the difficulty in obtaining stable measures of exchange rate exposures. Bartram and Bodnar (2007) and

Bartram, Brown and Minton (2007) suggest that the exposure puzzle is not due to methodological shortcomings but rather are the result of the endogeneity of operative and financial hedging at the firm level.

Previous work on firms' exposure to exchange rate risk primarily focused on multinationals (exceptions include Dominguez and Tesar (2001, 2006), and Starks and Wei (2006), Doukas et al. (1999)). However, exchange rate changes can affect firms' values through various channels and whether or not they are involved in international operations. In fact, changes in exchange rates can impact domestic firms with no foreign operations but face important foreign competition in their domestic markets, or are indirectly exposed, e.g., through their suppliers who import the products that serve as inputs to the domestic firms. Moreover, the firms with extensive international involvement are those that can pass-through currency changes, utilize operational hedges (e.g., matching foreign sales with foreign production), or contractual hedges (e.g. currency derivatives). Bartram et al. (2007) show that for a typical firm pass-through and operational hedging each reduce exposure by 10 percent to 15 percent and financial hedging reduces exposure by 45 percent to 50 percent. Bartram (2006) supports that operational and financial hedging by multinationals mitigate their large exposure significantly. Other studies, (see e.g. Allayannis and Ofek (2001), and Simkins and Laux (1997)), document significant negative relationships between FX exposures and the use of financial derivatives.

In addition, most past studies measure exposure in a static framework. However, there is evidence that FX exposure varies across sub-periods (see, e.g., Bodnar and Wong, (2003); Dominguez and Tesar, (2006)). A model that imposes constant exposure over time cannot capture significant exposure simply because periods of positive and negative exposure can offset each other.

Dominguez and Tesar (2006, pp. 206) state that: "time-variation in exposure reflects the adaptability of firms to exchange rate risk. Firms that find themselves highly exposed in one period will react by changing operational or financial policies to offset (or exploit) any adverse (positive) consequences of the exposure". In addition, exposure may vary over time because of the ability to hedge that also varies over time. Time variation in exposure has been studied using sub-periods dummies (see, e.g. Williamson (2001) and Parsley and Hopper (2006)). Williamson (2001) finds that exchange rate exposure changes over time and that time variation is related to changing industry structure and to large movements in real exchange rates. Parsley and Popper (2006) uncover time varying exposure of Asia-Pacific firms and find significant associations between exchange rate exposure and currency arrangements. Time variation in exposure has been also studied using rolling regressions (see, e.g., Starks and Wei (2006)), or econometric models that allow for regime switching (see, e.g., Priestley and Ødegaard, (2003)). A few other studies (e.g., Allayannis (1997), Allayannis and Ihrig (2001), Bodnar et al. (2003)) allow exposure to vary as a function of some variables, such as industry markups, foreign trade, industry competition. De Santis and Gerard (1998) Carrieri et. al. (2006) and Francis et al. (2008) examine the currency risk premium of industry portfolios using a conditional multi-factor asset pricing model and allowing for time-variation in exposure as a function of the time-varying second moments of portfolio returns and risk factors.

To summarize, the literature argues that the main reasons for the puzzling weak relationship between stock returns of firms and exchange rate changes are 1) firms pass-through part of the exposure to customers and use operating and financial hedges, 2) methodological shortcomings to the way exposure is measured, 3) not accounting for time variation in exposure. Our paper sheds further light on the relevance of the methodology used to uncover exposure and examines the dynamics of exposure.

III. Methodology

There is no clear consensus in the literature on how to measure exposure. Specifically, scholars and practitioners alike diverge on whether exposure should be measured 1) using bilateral rates or currency indices, 2) at the high or low frequency, and 3) as total or in excess of the market, i.e. excluding the market portfolio in the exposure regression or including it as in Jorion (1990). Bodnar and Wong (2003) and Dominguez and Tesar (2006) review the different methodologies and their implications on the measure of exposure. As for 1), Dahlquist and Robertson (2001) and Parsley and Popper (2006) among others argue that individual currency effects may be masked by a trade-weighted index, while Bartram (2006) shows that the use of bilateral rates does not improve the measurement of exposure. As for (2), some studies (see, e.g., Choi et al.,(1997)), detect exposure when using long-term horizon returns, while others, (see, e.g., Chamberlain et al., (1997); and Di Iorio and Faff, (2000)) show that daily return data may improve the detection of exposure. Regarding (3), several papers measure exposure conditional on the market to control for other macroeconomic influences on realized returns; other papers measure total exposure, i.e. without the market factor, arguing that controlling for the market exposure might lead to biases in the residual exposure estimates introduced by the choice of the market index (see, e.g., Bodnar and Wong, (1999), and Priestley and Ødegaard, (2003)).

In view of the importance of the emerging markets as trade partners to the U.S., we measure U.S. firms' exposure to two trade weighted currency indices, the major (MJ) index and the emerging markets (EM) index detailed in the data section. An alternative approach would be to use bilateral exchange rates. However, only a small number of bilateral rates can be used, which makes the analysis of exposure to emerging currencies intractable. As noted in the literature, currency indices tend to bias downward FX exposure. Therefore our results should be regarded as conservative since firms may have offsetting exposures to different currencies included in an index. We also measure exposure using quarterly returns horizon. Our choice of measuring exposure at the quarterly frequency is dictated by firm level data availability. In addition, we measure exposure in excess of that of the market similarly to Jorion (1990). We use the MSCI total return world market as a proxy for the market portfolio.

We first measure exposure in a *static* framework following two approaches: 1) We run firm by firm regressions similar to extant studies; 2) We use a panel. We then study the *dynamics* of foreign exchange exposure. Exposure to currency risk is allowed to vary with firm variables as well as macroeconomics variables.

We rely on the insight gained from the work on intertemporal models and specifically on the argument in Campbell (1993) that it is less likely to be misled by spurious patterns if one links time series and cross-sectional findings. Therefore, we model the exposure measures as a function of firm-specific variables that have been found useful to explain the cross-sectional variation in firms' FX exposure, namely leverage, and liquidity. As robustness, we also consider other firm variables such as, sales growth, profit margin, R&D, market to book, and the degree of operating leverage.

We also examine whether the dynamics of exposure are related to macroeconomic conditions. Though many variables may help predict future economic conditions, only a few variables can be included in order to ensure some precision in the estimation procedure. Several authors (see e.g. Ferson and Harvey (1993), Avramov (2002), Avramov and Chordia (2006), Stock and Watson (1989) and Bernanke (1990)) suggest that among a number of potential candidates the default spread and the term premium perform well in predicting future macroeconomic conditions.

To examine the dynamics of FX exposure, we use a large panel of U.S. firms. The benefit from using panel data is the large degree of freedom, and the consequent improved efficiency of the estimates. For the sake of illustration, assuming for the moment that all the firms in the same industry are homogenous, and excluding the market factor, we consider the following model,

$$r_{i,t} = \gamma^{MJ}_{i,t-1} MJ_t + \gamma^{EM}_{i,t-1} EM_t + \alpha + \varepsilon_{i,t}, \quad i = 1...M \tag{1}$$

$$\textit{where}$$

$$\gamma^{MJ}_{i,t-1} \equiv \sum_{j=0}^{K} \gamma^{MJ}_{j} IV_{j,t-1}, \quad j = 1,...K$$

$$\gamma^{EM}_{i,t-1} \equiv \sum_{j=0}^{K} \gamma^{EM}_{j} IV_{j,t-1}, \quad j = 1,...K$$

and where $i = 1...M$ indexes firms in the same industry, panel i consists of T_i observations, $IV_{j,t-1}$, $j = 1,...K$, are the vectors of instrumental variables, (including both firm and macro variables and a constant), MJ_t and EM_t are the continuously compounded real returns of the two currency indices at time t. The former is the price in US dollars of one unit of the Major Currencies Dollar Index (MJ), and the latter is the price in US dollars of Other Important Trading Partners (EM) detailed in the data section, α is the intercept, $\gamma^{MJ}_{i,t-1}$ and $\gamma^{EM}_{i,t-1}$ are the time-varying exposure coefficients. We parametrize $\gamma^{MJ}_{i,t-1}$ and $\gamma^{EM}_{i,t-1}$ as functions of the instrumental variables described in the data section.

Equation (1) is a linear model of the form

$$r_i = X_i \beta + \varepsilon_i, \tag{2}$$

where X_i is a $T_i \times (2 \text{ x } (K+1)+1)$ matrix of the independent variables (the exchange rates) and their interaction with lagged instrumental variables. Formally the matrix of independent variables X_i is defined as

$$\begin{bmatrix} MJ & IV_{1,i,-1} \cdot MJ & ... & IV_{K,i,-1} \cdot MJ & EM & IV_{1,i,-1} \cdot EM & ... & IV_{K,i,-1} \cdot EM & \iota \end{bmatrix}$$

where MJ and EM are the $T_i \times 1$ foreign exchange indices returns vectors, $IV_{j,i,-1}$ are the vectors instrumental variables and the subscript minus one denotes the lagged vectors, the operator $\cdot$ is the element by element product; and ι is a $T_i \times 1$ vector of ones. The parameter vector, β, is defined as

$$\beta \equiv \begin{bmatrix} \gamma_0^{MJ} & \gamma_1^{MJ} & \ldots & \gamma_K^{MJ} & \gamma_0^{EM} & \gamma_1^{EM} & \ldots & \gamma_K^{EM} & \alpha_0 \end{bmatrix}'$$

In estimating a panel model, one has to consider the possibility that, even within the same industry, firms may be heterogeneous. Heterogeneity takes the form of a firm-specific average expected return (i.e. each firm has different intercept) or as a different sensitivity of returns to changes in the foreign exchange rate (i.e. each firm has a different exposure coefficient). Ignoring such heterogeneity could indeed lead to biased estimates.

To explicitly allow for firm heterogeneity, we estimate a linear mixed model. Mixed linear models are a generalization of linear regression allowing for the inclusion of random deviations other than those associated with the overall error term. The generalization of (2) to a model allowing for heterogeneity for panel i can be represented as

$$r_i = X_i\beta + Z_i b_i + \varepsilon_i, \tag{3}$$

where b_i is a firm specific deviation from the common mean β, and Z_i is a subset of X_i for which we allow firm-specific coefficients. Since we are interested in the characteristics of the industry, we treat these parameters as random variables having zero mean and constant variance.[3] For the whole data set, we have

$$r = X\beta + Zb + \varepsilon, \tag{4}$$

where r is the $N \times 1$ vector of all the returns, X and Z are the fixed effect and random effect covariates, respectively. The fixed portion of (4) $X\beta$ is analogous to the usual OLS regression. For the random portion of (4) $Zb + \varepsilon$, we assume variance of the form

$$Var \begin{bmatrix} b \\ \varepsilon \end{bmatrix} = \begin{bmatrix} \sigma_b^2 I & 0 \\ 0 & \sigma_\varepsilon^2 I \end{bmatrix},$$

i.e. we assume that b and ε are orthogonal, and that b_i are independent across firms. Assuming that $\varepsilon \backsim N\left(0, \sigma_\varepsilon^2 I\right)$, and considering the combined error $Zb+\varepsilon$, the distribution function of r is

$$r \backsim N\left(X\beta, \Sigma\right),$$

[3] If the individual firm rather than the industry is the object of interest it is in principle possible to treat b_i as a fixed constant. Due to the structure of our data set, this approach is however unfeasible.

where $\Sigma = \sigma_b^2 Z'Z + \sigma_\varepsilon^2 I$. The random effects are not directly estimated but are summarized in the tables.

We implement the model as follows,

$$r_{i,t} = \sum_{j=0}^{K} \left(\gamma_j^{MJ} + \gamma_{j,i}^{MJ}\right) IV_{j,t-1} MJ_t + \sum_{j=0}^{K} \left(\gamma_j^{EM} + \gamma_{j,i}^{EM}\right) IV_{j,t-1} EM_t \\ + \sum_{j=0}^{k} \left(\gamma_j^{m} + \gamma_{j,i}^{m}\right) IV_{j,t-1} R_t^m + \alpha + \varepsilon_{i,t} \tag{5}$$

where K is the total number of instrumental variables including firm variables and macro variables described in the data section, k is the number of macro variable instruments, R_t^m is the continuously compounded market return, γ_j^{MJ}, and γ_j^{EM}, and γ_j^m are the average coefficients, $\gamma_{j,i}^{MJ}$, and $\gamma_{j,i}^{EM}$, $\gamma_{j,i}^m$ are firm specific deviations from the common coefficients.[4] This representation generalizes (1) to allow for random deviation in the slope coefficient estimates and thus for firms in the same industry to have different exposure to currency risk. In addition, Equation (5) controls for the market exposure.

The model is then estimated by maximizing the likelihood function,

$$L(\beta, \sigma_b^2, \sigma_\varepsilon^2) = -\frac{1}{2}\left[n \log(2\pi) + \log|\Sigma| + (r - X\beta)'\Sigma^{-1}(r - X\beta)\right]. \tag{6}$$

IV. The data

In this section we describe the data used in the empirical analysis. In sections IV.A and VI.B, we describe the instrumental variables, respectively, the firm specific variables and the macro variables. In section VI.C, we describe the exchange rate indexes.

A. Firms returns and characteristics

We examine FX exposure of U.S. firms from 1973:2 to 2005:4. The data on firms returns and characteristics are from COMPUSTAT. We only include firms with at least twenty observations. We exclude foreign owned companies and financial companies. The resulting sample comprises 4,265 firms, for a total of 194,000 data points. We cluster firms according to the eleven Fama and French industry classification.

[4] We do not include a random effect for the constant α, as its extremely low variance results in a de-facto collinear covariate and makes estimation of other parameters unstable.

As firm variables, we use leverage, and liquidity. The leverage variable $Lev_{i,t}$ is defined as the ratio of debt over equity at time t for firm i. The debt is computed as the sum of total liabilities (data54) and preferred stock (data55). The value of equity is computed as the product of common shares outstanding (data61) and price at the end of the quarter (data14). As a measure of liquidity we use the quick ratio, $Liq_{i,t}$, which is computed as current assets (data40) minus inventories (data38) divided by current liabilities (data49).

For robustness tests, we also include proxies for growth opportunities, profit margin, and the degree of operating leverage. As proxies of growth opportunities, we use sales growth measured in real terms (data2), R&D (data4), or Book-to-market ratio. Profit margin is the ratio of net income (data69) to sales. The degree of operating leverage is computed as the ratio of change in operating income (data21) to change in sales. All variables are winsorized at the one per cent level. We use quarterly data as firms report financial results quarterly.

In Table I we report summary information of the US firms of our sample, specifically the number of firms in each industry and the median firm market value. Table I also reports the descriptive statistics of the firm variables, including their returns, leverage, and liquidity. The number of firms varies from 85 for Chemicals to 954 for Business Equipment industry. Business Equipment has the smallest firms with a median firm market value of $67 million. Utilities has the largest firms with a size of $1,513 million. Leverage and liquidity vary substantially across firms and industries. Utilities has the most highly leveraged firms, with a median debt-equity ratio of 1.89, while Health industry has the least leveraged firms, with a median debt-equity ratio of 0.14. Utilities industry has also the firms the least liquid with a median quick ratio of 0.66. The most highly liquid firms of our sample are in Health industry with a median quick ratio of 2.62. The mean returns range from -1.7% per quarter for the Business Equipment industry to 2.3% for Utility.

[Insert table I here]

B. The macro variables

We model time variation of FX exposure as a function of macro variables in addition to the firm specific variables. We include macro variables following the extensive evidence on time series predictability of equity returns (see, e.g., Keim and Stambaugh (1986), Fama and French (1989), Chen (1991), Ferson and Harvey (1991), Avramov and Chordia (2005)). We use the total return market factor, the default premium (DP) defined as the yield difference between the U.S. Moody's Aaa and Baa Corporate Bonds, and the term spread (TP) defined as the difference between the U.S. 10 year Treasury with constant maturity and the U.S. 3-month T-Bill. DP and TP are from the Federal Reserve Board.

As robustness, we also use the first three principal components from a principal component analysis of widely used macro variables. The macro variables are from Datastream, unless mentioned otherwise. The data series used to compute these macro financial instruments are the Gross Domestic Product (GDP), the Industrial Production (IP), the Money supply ($M2$), Unexpected inflation (UI), the total return market factor, the default premium, the term premium, the Export as proportion of GDP (Ex/GDP), the Import as a proportion of GDP (Im/GDP). US export and import data are from the Bureau of Economic Analysis. We take the first differences of continuously compound rates of change of the GDP, IP, and $M2$ series. UI is computed as the residuals of an $ARMA(1,1)$ regression of the first differences of continuously compounded rates of change of the Consumers Price Index (CPI). The cumulative proportion of variance of all macro variables explained by the first three components is 0.3, 0.45, and 0.58 respectively. We will refer to all these variables as "macro variables" for brevity.

All the instruments, both macro variables and firm characteristics are lagged. Panel A of Table II presents the descriptive statistics of the macroeconomic variables. The correlation between DP and TP is 0.11. Also, the correlation among all macro variables does not exceed 0.4 in absolute terms.

[Insert table II here]

C. The exchange rate indexes

It is well known that inflation differentials between the U.S. and foreign countries, especially emerging countries, are highly variable. We therefore use two real exchange rate indexes expressed in real terms; the major currency index (MJ) and the emerging market currency index (EM). The rates are expressed in U.S. dollars per unit of foreign currencies i.e. higher index values represent an appreciation of the foreign currency. The two currency indexes are obtained from the Federal Reserve Board. The Fed uses moving average trade weights based on annual trade flows of U.S. trading partners.[5]

The two currency indices are subindexes of the broad dollar index that includes twenty-six currencies. The MJ currency index includes the widely traded currencies in foreign exchange markets and comprised sixteen currencies until the introduction of the euro in January 1999. After that, the index reflects the value of the dollar against seven major currencies, namely the euro, Canadian dollar, Japanese yen, British pound, Swiss franc, Australian dollar, and Swedish krona. The EM currency index, termed other important trading partners (OITP) by the Fed, shows the dollar value against the remaining nineteen currencies in the broad index. These currencies are not heavily traded outside their home markets and are mainly emerging market currencies.

The trade with the developing countries represents about 48% of U.S. total trade in 2006.[6] We therefore use the EM currency index in addition to the MJ. Rather than relying on a single broad index, we measure separately exposure to the MJ and EM because of the different type of trade patterns between the US the developed countries vs. the emerging markets. In addition, while it is easier to hedge exposure to the major currencies, hedging emerging market currencies can be more involved. Hence if hedging were the reason for the insignificant exposure as argued e.g. by Allayannis and Weston (2001) or Bartram et al. (2007), we should uncover exposure to the EM currency index and only weak exposure to the MJ currency index. However, if the previous weak results are rather driven by the methodology used, then we may expect to find significant exposure with both currency indices.[7]

Panel B of Table II presents the descriptive statistics of the changes in exchange rates, in nominal and real terms, for the two currency indices. The mean real depreciation of the dollar against the currencies in the MJ index is about 0.06% per quarter. The mean real appreciation of the dollar against the currencies in the EM index is about 0.1% per quarter. The correlation between the two currency indices is low. It is equal to 0.18 and 0.23, respectively in nominal and real terms.

[5] For details on the construction of the weights, please refer to the Winter 2005 Federal Reserve Bulletin. http://www.federalreserve.gov/pubs/bulletin/2005/winter05_index.pdf

[6] See Federal Reserve, Bulletin (2007).

[7] A similar argument with respect to the pricing of exchange risk is made in Francis et al. (2008).

V. Empirical findings

In this section, we first discuss the results of the estimation of FX exposure in an unconditional setting and then allowing for time variation in the exposure.

A. Unconditional exposure to foreign exchange risk

We first estimate FX exposure in a static framework. We run firm-by-firm regressions similar to Jorion (1990). In table III we report the percentage of firms with significant exposure to the two currency indices. The percentage of firms that show significant unconditional exposure coefficients to one of the two currency indices are generally single digit in most industries. The only two exceptions are Utility and Durables. Fourteen percent of the firms in the Durables industry show a significant exposure coefficient for the MJ currency index. Twenty nine per cent of the firms in the Utilities show a significant exposure coefficient for the EM currency index. Hence, the extent of exposure from the firm-by-firm regressions is about the same as what is reported in the extant literature.

Panel A of Table IV reports the average of exposure coefficients of firm-by-firm regressions by industry, the standard error of the estimated parameters and their ratio, i.e. the Fama MacBeth t-stats. Panel A shows that the average of the exposure coefficients are significantly different from zero in most cases. The standard error of the firm-by-firm exposure coefficients also suggests that exposure is heterogeneous across firms within the same industry. Although the Fama MacBeth t-stats should be taken with cautions, they suggest that by focusing on individual firms one is limited by the low power of the individual regression and ends up ignoring the joint statistical evidence available by considering all the firms at the same time.[8] In other words, by using individual regression to detect exposure one "can not see the forest for the tree."

The significance level suggested by the t-stats in Panel A and the heterogeneity of the individual firm's exposure provide substantive motivation to the use of the linear mixed panel methodology with a random effect on the slope. This methodology addresses the joint significance of the firms exposure using the power from the cross section while allowing for different exposure across firms in the same industry. This methodology does not provide the percentage of firms with significant exposure. It however provides the

[8] Shanken, (1992), and Jagannathan and Wang, (1998) argue that the standard errors based on the Fama-MacBeth procedure overstate the precision of the estimated parameters.

standard deviation around the exposure of the average firm. Panel B of Table IV shows the results of the unconditional exposure regressions estimated using the linear mixed model in the Methodology section. We report the coefficient estimates, their t-stats, and the standard deviation of the zero-mean random effect.

Panel B shows that in all industries, except non-Durables, the average US firm is significantly exposed to at least one of the two currency indices. As expected, the average of the firms' exposure coefficients from the mixed panel regression in Panel B have the same sign and comparable magnitudes to exposure coefficients shown in Panel A. Also, significance levels are broadly consistent. It is noteworthy that since the percentage of firms with significant exposure coefficient in the firm by firm regressions is low, the significance of our results can not be attributed to the quarterly frequency.

Our results highlight the importance of the methodology used to uncover exposure. There are two main advantages in using the linear mixed panel approach. Firstly, because it is a panel regression it allows us to use a larger number of data points and to exploit cross-section variations of the data to increase estimation efficiency. Secondly, it allows for heterogeneous FX exposure across firms in the same industry. For the rest of the paper we only use the mixed linear panel approach.

Table IV also indicates that, with the exception of Utilities, the average U.S. firm shows a negative exposure to the MJ currency index and a positive exposure to the EM index. That is, a real depreciation of the dollar against the major currency index would negatively impact the returns on the average U.S. firm. This result is consistent with the US being a net importer from its major developed countries partners therefore benefitting from a real appreciation of the dollar. However, a real depreciation of the dollar against the EM index would positively affect the returns on the average U.S. firm. This is consistent with the US being a net exporter to its main emerging countries trading partners over most of the sample period covered in this study.[9] Lacking an economic model that links exposure and its dynamics to the firm's returns, we cannot identify the channels through which exchange rate changes affect firms returns. We especially cannot identify whether exchange rate changes affect the demand or the supply side of the economy and refer the reader to Kandil and Mirzaie (2002) for a theoretical

[9] Some supportive data regarding US balance of goods and services can be obtained from the Bureau of Economic Analysis (BEA) statistics of U.S. International Transactions Accounts Data. Given that the historical data on the balance of trade between the US and many emerging countries only starts in 1999, we cannot provide detailed statistics of the balance of trade between the US and its major emerging countries trade partners over the entire period covered in our study i.e. 1973-2005.

explanation and empirical investigation of the different channel through which exchange rate shocks could affect the industry real output and price.

Our results for the Utilities industry differ from the evidence in the literature of small exchange exposure for firms in this group (see, e.g. Hutson and Stevenson (2009)). It is also at odds with the theoretical argument that enjoying high markups and producing non-tradeable output may imply low exposure for Utilities firms. However, many U.S. utilities moved from purely domestic to multinational firms since 1992, with the passage of The Energy Policy Act (EPAct). U.S. Utilities acquired foreign utilities, many of which are located in emerging market countries. In 2004, according to the US Treasury, Utilities FDI's amount in millions of dollars to 27,615 in Brazil, 3,283 in India, $10,330 in Venezuela, and $10,341 in Indonesia. The negative exposure of the average U.S. Utilities firm to EM currency index that we uncover could be explained by financial and currency crisis witnessed in emerging countries in the late 1990's. In addition, the uncertain regulatory framework for Utilities industry in many emerging markets may affect U.S. MNC Utilities exchange exposure through limitations in setting prices (see e.g. Pinto (2003).)

Table IV also shows that the exposure to the EM index, in absolute terms, is in many cases economically larger than the exposure to the MJ index. Recall that the EM index comprises the currencies of important partners of U.S. economy that are not heavily traded outside their home market. We conjecture that the high volatility of the emerging market currencies along with the difficulties to hedge against these currencies may explain our result. Financial hedging against EM currencies may be not effective due to inexistent or illiquid currency derivative contracts. Also financial and currency turmoil may affect the trading of derivative contracts against some EM currencies. For example, futures on the pesos were interrupted for 10 years during which time the Mexican central bank stopped allowing pesos to be delivered against financial contracts. Pesos futures contracts began trading again at the Chicago Mercantile Exchange (CME) in April 1995. Nonetheless, some emerging markets have well functioning currency derivatives markets, such as Bolsa de Mercadorias & Futuros (BM&F) of Brazil. Pantzalis, Simkins, and Laux (2001) find that operational hedging leads to lower foreign exchange risk exposures for MNC's. However, even though operational hedging can substitute for financial hedging, only multinational firms can implement it.

[Insert table IV about here]

In view of the large currencies volatilities experienced by the emerging markets, it is interesting to find that exposure to the EM currency index affects significantly the US firms returns. This result underscores the important role that emerging markets play in the US economy. The importance of emerging markets is also evident from Carrieri et. al. (2006) and Francis et al. (2008). They show that EM currency risk factor contributes significantly to explaining the expected returns for some developed markets including the US.

B. Time-variation in foreign exchange exposure

We now allow for exposure to vary over time. We use a parametric specification to model the time variation in exposure. The advantage of such an approach is that it explicitly links time variation in exposure to macroeconomic state variables and firm characteristics. A similar approach is widely used in specification of the dynamics of market betas. We use it to explore two related questions. 1) How much of the changes in the FX exposure of US firms is driven by fundamental economic variables that are common across industries? 2) How much of the dynamics of FX exposure are firm-specific? These questions are of interest to corporate managers, investors, and policy makers. For corporate managers, it is relevant to know what part of FX exposure can be affected by their discretionary managerial decisions. This would allow them to better design their operations and hedging strategies. For investors, if much of the changes in FX exposure is firm-specific, then currency risk could be diversified away through optimal portfolios allocation. Otherwise systematic currency risk triggers a premium if currency risk is a priced factor. As for policy makers, understanding the relationship between exchange rates and economic performance of firms is extremely relevant in order to appropriately assess the likely impact of monetary policy actions.

Table V reports the results from the estimation of Equation (5). Table VI reports the Wald test of the null hypothesis that i) exposure to each currency index (MJ or EM) is not significant, ii) exposure is not time-varying, iii) the joint coefficients in the firm-specific variables are all equal to zero, iv) the joint coefficients in the macro variables are all equal to zero.

Table VI shows that the exposure to the MJ currency index is significant for the average firm in each industry except for those in Chemicals and Telephone and TV industries. In all cases where MJ currency index exposure is significant it is also statistically time-varying except for firms in Durable industry. Moreover, exposure to the EM currency index is significant for the average firm of each industry and is statistically time-varying for the average firm in each industry except for those in Chemicals and Telephone and TV industries. Interestingly, time variation for the exposure to the two currency indices is mainly driven by the macro variables. For the exposure to the MJ currency index, there are no instances where the Wald test rejects the null hypothesis of joint zero coefficients on the firm specific variables, while the null of zero coefficients on macro variables is rejected in all cases. For the exposure to the EM currency index, the Wald tests suggest the firm variables significantly contribute to the time variation of exposure only for the average firm in two industries, namely Durables and Business Equipment. Macro variables significantly drive the exposure time variation in all cases. Table VI also indicates that the market beta is statistically significant and time varying in all cases, except for firms in Telephone and TV and Utilities industries, where the market beta is significant but not significantly time-varying.

Table V shows the estimated coefficients on the different instruments, their t-stats, and the standard deviation of the random component. Results from this table can be summarized as follows. First, for the exposure to the MJ currency index, the coefficients on the term premium are significantly positive for the average firm in half of the industries, while significantly negative for the average firm in Utilities. A large term premium indicates a downturn of the economy. The positive coefficient on the term spread implies, all else equal, that the exposure to the MJ index increases in periods of recession. Nonetheless, the overall exposure depends on the sign and magnitude of the constant (i.e. the unconditional exposure).

For the exposure to the EM currency index, the coefficients on the term premium are only significant for the average firm in three industries, while the default premium coefficients are negative in all cases and are significant for the average firm in seven out of eleven industries. The sign of the coefficient on the default premium is positive. This implies that the US firms' exposure increases when the default spread is relatively large. Given that a large default spread might indicate a recession period, exposure to the EM currency index increases in periods of recession.

The coefficients on liquidity and leverage are only significant for the average firms in two industries. It is worth noticing that the factors that may explain the cross-sectional difference in exchange exposure among firms may not necessarily explain the time series of a firm's specific exposure if they do not change much over time. Our results are also consistent with Francis et al. (2008). The paper examines the role of currency risk premium for US industries returns and find that the cross-industry variation in the currency premium is explained by industry characteristics while its time variation is explained by macro variables. The next sub-section discusses the economic magnitude of exposure and provides some illustrative examples.

[Insert tables V and VI about here]

C. Economic interpretation of the results

In this sub-section we discuss the magnitude of exposure and present some examples to illustrate the economic significance of the results. Panel B of Table (IV) shows that the unconditional exposure to the EM currency index is economically larger than that to the major index. In addition, the magnitude of exposures to the two currency indices varies across industries. The exposure coefficients to the MJ currency index range in absolute terms from 0.01 to 0.4, while those to the EM currency index range from 0.04 to 0.98. Recall that these are measures of residual exposure and hence the economic importance can be fully appreciated only in combination with the exposure of the market.

The magnitude of the total exposure is defined as the sum of exposure to the MJ and EM indices. In the manufacturing industry for instance, the exposure coefficients on the MJ and EM currency indices are respectively -0.26 and 0.25. Assuming a one percent real depreciation of the dollar against major and emerging market trading partners, the total average impact on the returns would be negligible as the exposures would offset each other. However this implicitly assumes that the two currency indices are perfectly correlated while they are not as evidenced by the low correlation of 0.23 in Panel B of Table II. Other industries as well do not show offsetting exposures to the two currency indices even if we assume the same percentage real depreciation of the dollar against the two currency indices. For instance, in the Energy industry, the exposure coefficients on the MJ and EM currency indices are respectively -0.30 and 0.66. Assuming a one percentage real depreciation of the dollar against major and emerging market trading partners, the total impact on the firm stock excess return is an increase by 0.33%, on average.

To illustrate the economic importance of the time variation in exposure, we take the case of Manufacturing industry. Table V shows that the unconditional excess exposure to the major currency index is -0.27, and that the coefficients for the default premium and the term premiums are highly significant and equal to 0.61 and 0.17 respectively. These coefficients imply that, ceteris paribus, a decrease of one standard deviation in the default premium is associated with a change in the exposure from -0.27 to -0.54, which in turn implies that a one percent real depreciation of the US dollar vis-a-vis the MJ index is associated with about 0.5 percent decline in excess returns, on average. An increase of one standard deviation in the default premium is instead associated with a change in exposure from -0.27 to -0.002, which in turn implies that a one percent depreciation of the US dollar is associated with a decline in the excess returns of 20 basis points. Similar considerations hold for the term premium and for the other industries where either of the macro variables is significant. Overall, the results imply that, depending on the macroeconomic conditions, the economic importance of exposure ranges from substantial to small.

To further gauge the economic importance of FX exposure to the two currency indices, we plot the total exposure as driven only by the macro variables.[10] Figure 1 presents the quarterly total exposure for the eleven industries between 1973 and 2005. Figure 2 and 3 show the contribution of the MJ and the EM to total exposure. Figure 1 indicates that aggregate exposure varies substantially across industries and over time. Aggregate exposure not only varies over time but also changes sign. These findings are similar to Allayannis (1997), Griffin and Stulz (2001), Allayannis and Ihrig (2001), and Priestly and Ødegaard (2007). In addition, the plots suggest that the size of exposure and its variation around the mean are economically important. The aggregate exposure increases during economic contractions, which are represented by the shaded areas in the figures, and peaks near business cycle troughs.[11] Figures 2 and 3 also illustrate that the exposure to the MJ index increases during economic contractions and that the exposure to the EM index tends to increase in absolute terms during economic recessions and around the 1997-1998 Asian financial crisis.

D. Robustness

To ensure the validity of our results, we carry out several robustness tests with different firm variables and macro variables. We re-estimate the model with additional macro variables. Specifically, we use the principal components of other important macro vari-

[10] We exclude firm variables as they are generally not significant drivers of exposure dynamics.

[11] The period of contraction is measured from peak to trough as determined by the National Bureau of Economic Research, NBER

ables widely used in the literature (e.g. Doukas et al., 1999, Kandil and Mirzaie, 2002). The macro variables include GDP, industrial production, money supply, trade, inflation variables, and the market return. The results are summarized in Tables VII and VIII. Table VII shows that the unconditional exposures are of the same economic magnitude to the ones displayed in Table V.

Table VIII shows that the three principal components of the macro variables explain the dynamics of the exposure to the MJ currency index for the average firm in all industries except for Telephone and TV. These three components also explain the dynamics of the exposure to the EM currency index for the average firm in all industries except for Energy and Telephone and TV. In addition, the results with regards to the firm variables are unchanged. Hence our results are robust to the specification of the macro variables.

The fact that firm specific variables do not significantly explain the time variation of exposure clearly does not contradict the empirical evidence of their explanatory power in the cross section found in the extant literature. To test whether the lack of explanatory power of the firm variables in the dynamics of exposure is driven by our limited choice of firm variables, we re-estimate the model using alternative firm variables that have been related to cross-section changes in firms' exposure. We include different proxies for growth opportunities, namely, sales growth, R&D, and market to book ratio. We also include profit margin and the degree of operating leverage. All these variables are investigated in turn. It is noteworthy that profitability, leverage, and liquidity are related to financial distress and hence bankruptcy risk. Highly levered firms will experience financial distress after only small declines in operating performance (see e.g. Jensen (1989)). In addition, Bodnar and Marston (2002) emphasize the importance of industry competition and profit margin to exchange rate exposure. We generally do not find that the additional firm specific variables explain the time variability of exposure. Results are not reported, but are available upon request.

Overall the robustness test results confirm that macro variables explain the time variation in exposure while firm variables are not important determinants of the FX exposure dynamics.

[Insert tables VII and VIII about here]

VI. Conclusion

We study the exposure of U.S. firms to two trade-weighted currency indices, the major and the emerging market currency indices. The major currency index includes the currencies of the major partners of U.S. firms. The emerging market currency index represents the other important trading partners and mainly the emerging markets. We measure FX exposure both in a static framework as well as in a conditional framework.

Using firm-by-firm regressions we replicate the well known and puzzling result in the literature that only a relatively small number of firms show significant exposure coefficients. We however argue that this result is due to shortcomings in the methodology. The Fama MacBeth tests of the estimated exposure coefficients shows that the average of the exposure coefficients are significantly different from zero in most industries. Furthermore, inferences based on a mixed panel approach to measure exposure reach the same formal conclusion. Hence, our results highlight the importance of the methodology used to uncover exposure and indicate that one should not ignore the joint evidence provided by the cross section of firms in the same industry. Moreover, we find strong evidence that the exposure to the two currency indices, and particularly to the emerging market index, is statistically and economically significant. Our results also underscore the important role that emerging markets play in the U.S. economy.

We also examine the dynamics of FX exposure. We use a parametric specification to model the time variation in exposure. The advantage of such an approach is that it explicitly links time variation in exposure to firm characteristics and macroeconomic state variables. We use financial leverage and liquidity as they have been found to explain the cross-sectional variation in FX exposure and the default premium and the term premium for their ability to capture the macroeconomic conditions. We also run extensive robustness tests using a wide array of both firm and macro variables.

Our results can be summarized as follows. The exposure is significantly time-varying for the average firm in most industries and the economic importance of exposure varies over time. We also find that the dynamics of exposure to the two currency indices are mainly driven by macro variables and that total exposure increases during economic contractions.

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Table I

Industry	Returns					Leverage					Liquidity				
	firms	**m.cap.**	**mean**	**med.**	**sd**	**obs**	**firms**	**mean**	**med.**	**sd**	**obs**	**firms**	**mean**	**med.**	**sd**
All ex Financials	4,265	103	-0.006	0.000	0.352	194,000	4265	1.07	0.47	1.67	193,874	4232	2.46	1.37	3.59
Non Durables	218	105	0.000	0.001	0.298	10,871	218	1.20	0.57	1.80	10,871	218	1.91	1.28	2.52
Durables	124	102	-0.008	0.000	0.327	6,099	124	1.36	0.64	1.97	6,099	124	1.89	1.32	2.05
Manufacturing	496	93	-0.004	0.000	0.318	24,421	496	1.19	0.59	1.75	24,402	496	1.92	1.32	2.37
Energy	197	72	-0.001	0.000	0.371	8,830	197	1.15	0.53	1.84	8,827	197	2.44	1.18	4.21
Chemicals	85	133	-0.001	0.004	0.328	4,404	85	0.89	0.45	1.54	4,404	85	2.47	1.36	3.81
Business Equip.	954	67	-0.017	-0.001	0.402	45,672	954	0.64	0.27	1.24	45,670	954	2.82	1.94	3.07
Telephone and TV	101	279	-0.005	0.006	0.388	4,060	101	1.19	0.62	1.78	4,060	101	1.90	1.18	2.51
Utilities	208	1513	0.023	0.031	0.141	14,457	208	2.16	1.89	1.26	14,437	208	0.73	0.66	0.37
Shops	525	134	-0.006	0.000	0.328	24,522	525	1.40	0.71	1.97	24,484	524	1.22	0.85	1.62
Health	518	79	-0.006	0.000	0.385	24,547	518	0.48	0.14	1.13	24,547	518	5.03	2.62	5.97
Other	640	70	-0.011	0.000	0.375	26,117	640	1.22	0.54	1.94	26,073	640	2.47	1.40	3.88

This table presents the number of firms, the median market cap, and the mean and standard deviation of the US firms' returns. Firms are clustered according to the eleven Fama and French industry classification. The sample period is from 1973:2 to 2005:4. The sample comprises 4,265 firms, for a total of 194,000 data points. The data on firms returns, leverage, and liquidity are from COMPUSTAT. The debt is computed as the sum of total liabilities (data54) and preferred stock (data55). The value of equity is computed as the product of common shares outstanding (data61) and price at the end of the quarter (data14). The leverage variable $Lev_{i,t}$ is defined as the ratio of debt over equity at time t for firm i. The measure of liquidity is the quick ratio, $Liq_{i,t}$, which is computed as current assets (data40) minus inventories (data38) divided by current liabilities (data49).

Table II

Panel A
Macro — Correlation

	mean	sd	GDP	IP	M2	Ex/GDP	Im/GDP	UI	DP	TP
GDP	1.734	0.914								
IP	0.606	1.617	0.411							
M2	0.572	1.014	-0.161	0.048						
Ex/GDP	0.450	2.750	0.116	0.024	-0.438					
Im/GDP	0.762	3.327	0.134	0.324	-0.330	0.429				
UI	0.001	0.006	0.289	0.156	-0.434	0.278	0.361			
DP	1.089	0.442	0.109	-0.299	0.181	-0.262	-0.173	-0.292		
TP	1.661	1.364	-0.177	0.034	0.259	-0.287	-0.182	-0.276	0.105	
VWRETD	0.631	3.866	0.053	0.121	0.082	0.078	0.000	-0.121	-0.099	0.038

Panel B
FX — Correlation

	obs	mean	sd	MJ	EM	NMJ
MJ	131	0.017	1.657			
EM	131	-0.211	1.053	0.144		
NMJ	131	0.036	1.633	0.982	0.145	
NEM	131	-1.160	1.294	0.132	0.666	0.169

Panel A reports the descriptive statistics of the macro data series. The variables are the Gross Domestic Product (GDP, first differences of continuously compounded rates of change), Industrial Production (IP, first differences of continuously compounded rates of change), Money supply (M2, first differences of continuously compound rates of change), unexpected inflation (UI, computed as the residuals of an ARMA (1,1) regression of the first differences of continuously compounded rates of change of the Consumer's Price Index, CPI), the total return market factor. These variables are from Datastream. The Export as proportion of GDP (Ex/GDP), Import as a proportion of GDP (Im/GDP), are from the Bureau of Economic Analysis. The default premium (DP) defined as the yield difference between the U.S. Moody's Aaa and Baa Corporate Bonds, and the term spread (TP) defined as the difference between the U.S. 10 year Treasury with constant maturity and the U.S. 3-month T-Bill are from the Federal Reserve Board. Panel B reports the mean and standard deviation of the real major (MJ) and emerging market (EM) currency indices, and the nominal major (NMJ) and emerging (NEM) market currency indices returns and the correlations. Data are from Federal Reserve Board. The sample period is from 1973:2 to 2005:4

Table III

Percentage of firms with significant excess exposure

Industry	$t(\gamma^{MJ})^{**}$	$t(\gamma^{EM})^{**}$
Non Durables	6.0	10.2
Durables	13.9	4.9
Manufacturing	6.7	7.3
Energy	3.2	6.5
Chemicals	8.4	2.4
Business Equip.	6.7	6.0
Telephone and TV	7.0	5.0
Utilities	13.2	29.3
Shops	7.4	4.5
Health	4.3	3.7
Other	6.3	5.3

This table shows the percentage of firms that display a significant exposure (t-stats larger than two) with respect to the major and emerging markets currency indices.

Table IV

Panel A
Firm-by-firm.

Industry	γ^{MJ}	SE	t-stats	γ^{EM}	SE	tstats
Non Durables	-0.185	0.107	-1.7	0.002	0.183	0.0
Durables	-0.559	0.172	**-3.3**	-0.015	0.264	-0.1
Manufacturing	-0.293	0.068	**-4.3**	0.304	0.145	**2.1**
Energy	-0.285	0.135	**-2.1**	0.574	0.235	**2.4**
Chemicals	-0.114	0.193	-0.6	0.520	0.277	1.9
Business Equip.	-0.024	0.071	-0.3	0.243	0.122	**2.0**
Telephone and TV	0.092	0.208	0.4	0.737	0.378	**2.0**
Utilities	0.332	0.035	**9.6**	-0.804	0.068	**-11.8**
Shops	-0.140	0.070	**-2.0**	0.169	0.132	1.3
Health	-0.430	0.076	**-5.7**	0.472	0.129	**3.7**
Other	-0.064	0.086	-0.7	0.121	0.136	0.9

Panel B
Mixed linear panel

Industry	γ^{MJ}	sd_i	t-stats	γ^{EM}	sd_i	t-stats
NonDurables	-0.147	0.278	-1.8	0.037	1.019	0.3
Durables	-0.434	0.383	**-3.6**	0.184	0.003	1.0
Manufacturing	-0.257	0.371	**-4.4**	0.249	0.965	**2.5**
Energy	-0.303	0.013	**-2.8**	0.666	0.036	**3.8**
Chemicals	-0.014	0.651	-0.1	0.472	0.004	**2.2**
Busines Equip.	0.019	0.567	0.4	0.425	0.908	**4.8**
Telephone and TV	-0.018	0.013	-0.1	0.977	0.005	**3.7**
Utilities	0.272	0.001	**8.5**	-0.688	0.002	**-12.8**
Shops	-0.189	0.386	**-3.1**	0.230	0.150	**2.5**
Health	-0.282	0.002	**-4.1**	0.484	0.002	**4.5**
Other	-0.053	0.636	-0.8	0.206	0.043	**2.0**

This table shows estimates in real terms of FX exposure to the major and emerging market currency indices in a static framework at the quarterly frequency. The sample period is from 1973:2 to 2005:4. The sample comprises 4,265 firms, for a total of 194,000 data points. Firms are clustered according to the eleven Fama and French industry classification. The real exchange rate indices are the major trading partners currency index (MJ) and the emerging countries currency index (EM), from the Federal Reserve Board. The two currency indices are the trade-weighted values of US dollar against a number of currencies where the trade-weights are allowed to vary over time. Panel A reports the average exposure coefficient, the standard error of the coefficient average and their ratio (i.e. Fama MacBeth t-stats) of firm-by-firm exposure regressions. Panel B reports the exposure coefficients $\gamma's$, the t-stats, and the standard deviation of the slope's random effect sd_i of mixed linear panel regressions with a random effect on the slope. The slope coefficient's t-stats larger than two are in bold.

Exposure Coefficients Estimates for Major Currencies

Industry	γ_0^{MJ}	t-stats	sd_i	$\gamma_1^{MJ \cdot Lev}$	t-stats	sd_i	$\gamma_2^{MJ \cdot Liq}$	t-stats	sd_i
NonDurables	-0.181	**-2.197**	0.011	-0.095	-0.830	0.765	-0.041	-0.846	0.064
Durables	-0.433	**-3.282**	0.509	-0.120	-0.903	0.703	0.127	0.939	0.514
Manufacturing	-0.273	**-4.467**	0.340	0.004	0.051	0.878	0.013	0.322	0.155
Energy	-0.251	**-2.220**	0.010	-0.064	-0.394	1.230	0.054	0.914	0.215
Chemicals	0.055	0.322	0.736	-0.171	-0.866	0.676	-0.004	-0.081	0.004
Busines Equip.	0.038	0.642	0.638	-0.199	-1.937	1.313	0.017	0.747	0.003
Telephone and TV	-0.123	-0.716	0.120	0.352	1.027	2.067	0.063	0.502	0.323
Utilities	0.354	**10.461**	0.001	0.018	0.375	0.265	0.033	0.304	0.006
Shops	-0.228	**-3.584**	0.286	0.012	0.205	0.548	0.112	**2.025**	0.152
Health	-0.379	**-5.117**	0.019	0.370	1.655	2.325	0.011	0.618	0.009
Other	-0.116	-1.596	0.628	-0.080	-0.996	0.865	0.054	1.805	0.149

Industry	$\gamma_3^{MJ \cdot Mkt}$	t-stats	sd_i	$\gamma_4^{MJ \cdot DP}$	t-stats	sd_i	$\gamma_5^{MJ \cdot TP}$	t-stats	sd_i
NonDurables	-0.527	-0.397	0.044	-0.114	-0.372	0.038	0.323	**3.988**	0.258
Durables	0.054	0.028	0.028	0.603	1.338	0.004	0.176	1.514	0.003
Manufacturing	-1.126	-1.203	0.024	0.613	**2.799**	0.004	0.170	**3.040**	0.001
Energy	-2.689	-1.487	0.155	1.221	**2.984**	0.019	-0.087	-0.828	0.022
Chemicals	-4.339	-1.873	0.303	0.152	0.282	0.007	0.165	1.218	0.002
Busines Equip.	-4.978	**-5.783**	0.081	-0.204	-0.971	0.008	0.105	1.995	0.002
Telephone and TV	-1.143	-0.416	0.139	0.595	0.843	0.015	0.262	1.550	0.009
Utilities	2.486	**4.614**	0.108	0.362	**3.630**	0.005	-0.227	**-9.628**	0.002
Shops	0.025	0.025	0.026	-0.270	-1.126	0.005	0.301	**5.012**	0.002
Health	-0.360	-0.308	0.359	0.124	0.410	0.083	0.378	**5.126**	0.022
Other	1.144	1.048	0.035	0.387	1.465	0.006	0.237	**3.627**	0.002

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Exposure Coefficients Estimates for OTP Currencies and Fixed Effect

Industry	γ_0^{EM}	t-stats	sd_i	$\gamma_1^{EM \cdot Lev}$	t-stats	sd_i	$\gamma_2^{EM \cdot Liq}$	t-stats	sd_i
NonDurables	0.023	0.159	0.644	-0.230	-1.237	1.162	-0.055	-0.707	0.001
Durables	0.339	1.692	0.005	0.294	1.436	0.852	-0.390	**-3.331**	0.001
Manufacturing	0.333	**2.978**	1.021	0.180	1.253	1.482	0.004	0.044	0.577
Energy	0.591	**3.082**	0.043	-0.177	-1.011	0.689	-0.018	-0.182	0.311
Chemicals	0.529	**2.193**	0.010	-0.018	-0.048	1.349	-0.031	-0.146	0.729
Busines Equip.	0.375	**3.847**	0.751	-0.542	**-2.880**	2.349	-0.013	-0.254	0.436
Telephone and TV	1.024	**3.447**	0.029	0.055	0.140	1.874	0.063	0.567	0.001
Utilities	-0.808	**-13.588**	0.003	-0.113	-1.528	0.341	0.080	0.419	0.008
Shops	0.216	**2.093**	0.007	-0.087	-0.808	0.986	-0.093	-1.058	0.228
Health	0.323	**2.577**	0.037	-0.028	-0.102	2.114	0.004	0.174	0.015
Other	0.308	**2.701**	0.006	-0.139	-1.129	1.096	-0.048	-0.928	0.270

Industry	$\gamma_4^{EM \cdot Mkt}$	t-stats	sd_i	$\gamma_4^{EM \cdot DP}$	t-stats	sd_i	$\gamma_5^{EM \cdot TP}$	t-stats	sd_i	α	t-stats
NonDurables	-2.634	-1.456	0.505	-0.963	**-2.092**	0.013	-0.213	-1.241	0.643	-0.027	-8.801
Durables	-3.990	-1.530	0.027	-1.585	**-2.374**	0.005	0.165	0.681	0.018	-0.038	-8.296
Manufacturing	0.124	0.095	0.146	-0.950	**-2.853**	0.005	0.140	1.179	0.003	-0.033	-14.661
Energy	3.719	1.276	18.675	-0.464	-0.769	0.021	0.742	**3.242**	0.008	-0.020	-4.668
Chemicals	1.979	0.606	0.022	-1.065	-1.295	0.023	-0.062	-0.214	0.008	-0.026	-4.758
Busines Equip.	1.757	1.466	0.063	-1.022	**-3.084**	0.012	-0.030	-0.270	0.007	-0.049	-23.732
Telephone and TV	-5.042	-1.305	0.140	-1.285	-1.054	0.046	-0.226	-0.638	0.015	-0.052	-8.019
Utilities	-3.113	**-4.017**	0.056	-1.009	**-7.585**	0.271	0.550	**8.751**	0.003	-0.007	-5.117
Shops	-1.639	-1.201	0.046	-1.252	**-3.348**	0.027	-0.116	-0.858	1.034	-0.032	-13.847
Health	8.306	**5.063**	0.338	-0.866	-1.733	0.079	-0.272	-1.863	0.072	-0.039	-14.383
Other	-3.278	**-2.212**	0.079	-0.452	-1.069	0.008	-0.321	**-2.323**	0.003	-0.041	-16.120

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Coefficients Estimates for the Conditional Market Factor

Industry	γ_4^{Mkt}	t-stats	sd_i	$\gamma_4^{Mkt \cdot Mkt}$	t-stats	sd_i	$\gamma_5^{Mkt \cdot DP}$	t-stats	sd_i	$\gamma_5^{Mkt \cdot TP}$	t-stats	sd_i
NonDurables	0.493	**8.983**	0.529	2.201	**3.875**	4.306	0.222	**2.027**	0.005	0.031	0.902	0.003
Durables	0.590	**7.726**	0.510	2.356	**2.949**	3.805	0.422	**2.446**	0.464	0.020	0.381	0.001
Manufacturing	0.604	**15.563**	0.557	1.473	**3.936**	3.192	0.063	0.798	0.003	0.101	**3.970**	0.123
Energy	0.410	**6.099**	0.496	2.948	**4.447**	0.110	-0.314	**-2.207**	0.005	0.128	**2.525**	0.240
Chemicals	0.514	**5.361**	0.554	3.008	**3.357**	2.781	0.448	**2.285**	0.002	0.061	1.014	0.002
Busines Equip.	0.796	**20.392**	0.855	1.082	**3.008**	5.187	0.234	**3.005**	0.006	0.064	**2.752**	0.001
Telephone and TV	1.023	**9.416**	0.655	0.955	0.968	0.061	0.030	0.108	0.786	0.156	**2.073**	0.004
Utilities	0.434	**24.039**	0.089	-0.195	-0.764	1.898	0.004	0.128	0.001	0.018	**1.662**	0.001
Shops	0.530	**13.906**	0.505	0.859	**2.229**	3.136	0.175	**2.003**	0.020	0.089	**3.350**	0.001
Health	0.885	**18.181**	0.717	0.198	0.421	4.737	0.233	**2.029**	0.043	0.124	**3.794**	0.038
Other	0.725	**17.795**	0.574	1.649	**3.590**	5.525	0.267	**2.795**	0.005	0.125	**4.355**	0.004

This table shows results from the estimation of Equation (5) at the quarterly frequency, when both firm specific, and macro variables are used as instruments. The sample period is from 1973:2 to 2005:4. The table reports the exposure coefficients $\gamma's$, the t-stats, and the standard deviation of the slope's random effect sd_i. Firms are clustered according to the eleven Fama and French industry classification. The data on firms returns, leverage, and liquidity are from COMPUSTAT. The debt is computed as the sum of total liabilities (data54) and preferred stock (data55). The value of equity is computed as the product of common shares outstanding (data61) and price at the end of the quarter (data14). The leverage variable $Lev_{i,t}$ is then defined as the ratio of debt over equity at time t for firm i. The measure of liquidity is the quick ratio, $Liq_{i,t}$, which is computed as current assets (data40) minus inventories (data38) divided by current liabilities (data49). All firm variables are winsorized at the one per cent level. The real exchange rate indices are the major trading partners currency index (MJ) and the emerging countries currency index (EM) described in the data section. The two currency indices are the trade-weighted values of US dollar against a number of currencies where the trade-weights are allowed to vary over time. The data series used to compute the macro financial instruments are the lagged total market return factor, the default premium (DP), and the term spread (TP) described in the data section. The slope coefficient's t-stats larger than two are in bold.

Table VI

Wald tests for Major Currencies

Industry	$\gamma_i^{MJ} = 0\ \forall\ i$ χ^2	*pval*	$\gamma_i^{MJ} = 0\ \forall\ i > 0$ χ^2	*pval*	$\gamma_i^{MJ} = 0\ i = 1,2$ χ^2	*pval*	$\gamma_i^{MJ} = 0\ i = 3,4,5$ χ^2	*pval*
NonDurables	20.906	**0.002**	19.053	**0.002**	1.267	0.531	17.952	**0.000**
Durables	16.312	**0.012**	8.229	0.144	1.945	0.378	6.252	0.100
Manufacturing	42.899	**0.000**	29.638	**0.000**	0.104	0.949	29.315	**0.000**
Energy	18.810	**0.004**	12.833	**0.025**	1.066	0.587	11.464	**0.009**
Chemicals	7.399	0.286	7.111	0.213	0.750	0.687	6.516	0.089
Busines Equip.	47.694	**0.000**	47.329	**0.000**	4.873	0.087	43.037	**0.000**
Telephone and TV	6.708	0.349	6.628	0.250	1.206	0.547	5.004	0.171
Utilities	216.484	**0.000**	136.959	**0.000**	0.211	0.900	131.811	**0.000**
Shops	37.534	**0.000**	30.866	**0.000**	4.102	0.129	26.380	**0.000**
Health	50.902	**0.000**	37.306	**0.000**	2.919	0.232	34.438	**0.000**
Other	26.454	**0.000**	26.200	**0.000**	4.677	0.096	21.219	**0.000**

Wald tests Emerging Markets Currencies

Industry	$\gamma_i^{EM} = 0\ \forall\ i$ χ^2	*pval*	$\gamma_i^{EM} = 0\ \forall\ i > 0$ χ^2	*pval*	$\gamma_i^{EM} = 0\ i = 1,2$ χ^2	*pval*	$\gamma_i^{EM} = 0\ i = 3,4,5$ χ^2	*pval*
NonDurables	12.620	**0.049**	11.924	**0.036**	1.871	0.392	9.992	**0.019**
Durables	26.972	**0.000**	22.625	**0.000**	14.648	**0.001**	7.771	0.051
Manufacturing	22.946	**0.001**	9.428	0.093	1.588	0.452	8.162	**0.043**
Energy	26.189	**0.000**	12.260	**0.031**	1.030	0.597	11.350	**0.010**
Chemicals	11.798	0.067	3.071	0.689	0.023	0.989	2.935	0.402
Busines Equip.	60.657	**0.000**	24.916	**0.000**	8.344	**0.015**	15.945	**0.001**
Telephone and TV	20.941	**0.002**	3.450	0.631	0.328	0.849	3.233	0.357
Utilities	287.732	**0.000**	139.724	**0.000**	2.548	0.280	119.145	**0.000**
Shops	31.003	**0.000**	18.425	**0.002**	1.596	0.450	16.217	**0.001**
Health	74.520	**0.000**	45.912	**0.000**	0.046	0.977	45.729	**0.000**
Other	24.550	**0.000**	13.943	**0.016**	1.929	0.381	12.071	**0.007**

Wald tests Market

Industry	$\gamma_i^{Mkt} = 0\ \forall\ i$ χ^2	*pval*	$\gamma_i^{Mkt} = 0\ \forall\ i > 0$ χ^2	*pval*
NonDurables	113.107	**0.000**	22.645	**0.000**
Durables	87.500	**0.000**	16.981	**0.001**
Manufacturing	297.851	**0.000**	36.224	**0.000**
Energy	57.542	**0.000**	24.972	**0.000**
Chemicals	55.346	**0.000**	20.719	**0.000**
Busines Equip.	499.324	**0.000**	38.203	**0.000**
Telephone and TV	99.277	**0.000**	5.889	0.117
Utilities	635.455	**0.000**	3.692	0.297
Shops	254.181	**0.000**	30.644	**0.000**
Health	407.756	**0.000**	34.752	**0.000**
Other	421.353	**0.000**	56.300	**0.000**

This table report Wald tests from the estimation of Equation (5) at the quarterly frequency, when both firm specific, and macro variables are used as instruments. The Wald tests are that i) exposure to each currency index (MJ or EM) is not significant, ii) exposure is not time-varying, iii) the joint coefficients in the firm-specific variables are all equal to zero, iv) the joint coefficients of the macro variables are all equal to zero.

Exposure Coefficients Estimates for Major Currencies

Industry	γ_0^{MJ}	t-stats	sd_i	$\gamma_1^{MJ \cdot Lev}$	t-stats	sd_i	$\gamma_2^{MJ \cdot Liq}$	t-stats	sd_i
NonDurables	-0.185	**-2.289**	0.023	-0.069	-0.579	0.836	-0.029	-0.622	0.014
Durables	-0.486	**-3.786**	0.506	-0.054	-0.395	0.719	0.138	1.040	0.495
Manufacturing	-0.323	**-5.362**	0.379	0.058	0.714	0.885	0.024	0.578	0.169
Energy	-0.378	**-3.382**	0.010	-0.026	-0.160	1.257	0.051	0.908	0.191
Chemicals	-0.046	-0.271	0.776	-0.132	-0.761	0.510	0.007	0.119	0.095
Busines Equip.	-0.016	-0.281	0.684	-0.142	-1.380	1.299	0.013	0.565	0.006
Telephone and TV	-0.139	-0.830	0.179	0.418	1.213	2.080	0.067	0.539	0.319
Utilities	0.264	**7.598**	0.001	0.019	0.420	0.256	0.037	0.342	0.005
Shops	-0.230	**-3.668**	0.339	0.040	0.645	0.569	0.119	**2.160**	0.153
Health	-0.221	**-3.076**	0.005	0.315	1.381	2.401	0.013	0.742	0.003
Other	-0.133	-1.849	0.655	-0.046	-0.559	0.873	0.054	1.777	0.156

Industry	$\gamma_3^{MJ \cdot pc1}$	t-stats	sd_i	$\gamma_4^{MJ \cdot pc2}$	t-stats	sd_i	$\gamma_4^{MJ \cdot pc3}$	t-stats	sd_i
NonDurables	-0.065	-0.841	0.004	0.322	**2.480**	0.554	-0.042	-0.350	0.011
Durables	-0.300	**-2.645**	0.002	0.282	1.546	0.004	-0.550	**-3.092**	0.002
Manufacturing	-0.233	**-4.258**	0.132	0.265	**2.933**	0.512	-0.493	**-5.771**	0.216
Energy	0.074	0.687	0.466	-0.546	**-3.360**	0.039	-0.184	**-1.137**	0.017
Chemicals	-0.407	**-3.049**	0.005	0.202	0.826	1.062	-0.735	**-3.472**	0.283
Busines Equip.	-0.291	**-5.626**	0.005	-0.102	-1.245	0.013	-0.356	**-4.444**	0.008
Telephone and TV	-0.158	-0.918	0.003	0.324	0.972	1.901	-0.480	-1.801	0.005
Utilities	-0.079	**-3.275**	0.001	-0.283	**-7.085**	0.002	-0.022	-0.556	0.001
Shops	-0.222	**-3.722**	0.002	0.439	**4.614**	0.351	-0.069	-0.743	0.003
Health	-0.292	**-3.868**	0.004	-0.288	**-2.499**	0.417	-0.628	**-5.579**	0.139
Other	-0.288	**-4.431**	0.003	0.271	**2.677**	0.040	-0.277	**-2.678**	0.363

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Exposure Coefficients Estimates for OTP Currencies and Fixed Effect

Industry	γ_0^{EM}	t-stats	sd_i	$\gamma_1^{EM \cdot Lev}$	t-stats	sd_i	$\gamma_2^{EM \cdot Liq}$	t-stats	sd_i
NonDurables	-0.110	-0.688	0.712	-0.258	-1.371	1.185	-0.058	-0.744	0.001
Durables	0.271	1.218	0.009	0.216	1.049	0.860	-0.383	**-3.276**	0.001
Manufacturing	0.297	**2.498**	0.898	0.177	1.227	1.469	0.012	0.135	0.530
Energy	0.620	**2.965**	0.033	-0.232	-1.291	0.760	-0.014	-0.145	0.270
Chemicals	0.103	**0.383**	0.004	-0.071	-0.190	1.290	0.023	0.111	0.698
Busines Equip.	0.455	**4.125**	0.960	-0.559	**-2.932**	2.385	-0.023	-0.461	0.433
Telephone and TV	1.018	**3.082**	0.018	0.027	0.069	1.859	0.063	0.567	0.001
Utilities	-0.697	**-11.534**	0.002	-0.204	**-2.698**	0.376	0.137	0.718	0.010
Shops	0.162	1.408	0.008	-0.099	-0.915	1.012	-0.098	-1.141	0.204
Health	0.016	0.115	0.008	-0.029	-0.104	2.136	-0.002	-0.068	0.004
Other	0.224	1.769	0.009	-0.153	-1.235	1.111	-0.066	-1.242	0.292

Industry	$\gamma_4^{EM \cdot pc1}$	t-stats	sd_i	$\gamma_4^{EM \cdot pc2}$	t-stats	sd_i	$\gamma_4^{EM \cdot pc3}$	t-stats	sd_i	α	t-stats
NonDurables	-0.385	**-2.677**	0.012	-0.211	-1.486	0.209	0.279	1.272	0.010	-0.026	-8.159
Durables	-0.291	-1.331	0.005	-0.489	**-2.313**	0.149	0.717	**2.226**	0.004	-0.038	-8.204
Manufacturing	0.037	0.359	0.277	-0.264	**-2.263**	1.107	0.625	**3.998**	0.264	-0.032	-14.178
Energy	0.166	0.865	0.011	0.081	0.413	0.510	-0.381	-1.329	0.019	-0.019	-4.221
Chemicals	-0.507	-1.995	0.004	-0.064	-0.239	0.839	0.872	**2.041**	1.253	-0.028	-5.079
Busines Equip.	-0.280	**-2.682**	0.756	-0.443	**-4.540**	0.021	0.389	**2.579**	0.022	-0.049	-23.743
Telephone and TV	0.131	0.399	0.006	-0.259	-0.836	0.013	1.017	**2.001**	0.028	-0.050	-7.741
Utilities	-0.038	-0.842	0.002	0.140	**2.576**	0.003	0.089	1.233	0.002	-0.007	-5.498
Shops	-0.199	-1.771	0.018	-0.137	-1.215	0.629	0.392	**2.305**	0.010	-0.031	-13.086
Health	-0.051	-0.353	0.723	0.308	**2.343**	0.008	0.776	**3.412**	1.477	-0.038	-14.074
Other	-0.278	**-2.227**	0.006	-0.180	-1.510	0.007	-0.027	-0.141	0.029	-0.042	-16.189

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Coefficients Estimates for the conditional market factor

Industry	γ_4^{Mkt}	t-stats	sd_i	$\gamma_4^{Mkt \cdot Pc1}$	t-stats	sd_i	$\gamma_5^{Mkt \cdot Pc2}$	t-stats	sd_i	$\gamma_5^{Mkt \cdot Pc3}$	t-stats	sd_i
NonDurables	0.463	**8.428**	0.545	0.088	**2.924**	0.004	-0.005	-0.105	0.182	-0.024	-0.414	0.003
Durables	0.515	**6.759**	0.530	0.162	**3.279**	0.184	-0.064	-0.935	0.291	-0.101	-1.175	0.009
Manufacturing	0.523	**13.706**	0.556	0.026	1.101	0.190	-0.008	-0.231	0.389	-0.105	**-2.469**	0.116
Energy	0.318	**4.909**	0.453	0.002	0.059	0.002	-0.016	-0.297	0.021	-0.052	-0.659	0.004
Chemicals	0.467	**4.963**	0.551	0.176	**3.300**	0.001	0.067	0.977	0.001	-0.046	-0.461	0.001
Busines Equip.	0.751	**19.466**	0.855	0.002	0.075	0.211	-0.173	**-5.529**	0.399	-0.053	-1.341	0.007
Telephone and TV	0.963	**8.997**	0.658	0.019	0.252	0.293	0.021	0.215	0.390	-0.123	-0.891	0.403
Utilities	0.424	**23.263**	0.104	-0.002	-0.192	0.000	0.005	0.357	0.000	-0.050	**-2.720**	0.001
Shops	0.499	**13.214**	0.512	0.118	**4.803**	0.136	0.088	**2.499**	0.301	-0.075	-1.666	0.001
Health	0.822	**17.023**	0.733	0.061	**2.029**	0.128	-0.299	**-7.184**	0.314	0.162	**2.849**	0.290
Other	0.695	**17.159**	0.588	0.102	**3.567**	0.268	0.011	0.313	0.125	-0.107	**-2.066**	0.296

This table shows results from the estimation of Equation (5) at the quarterly frequency, when both firm specific, and the first three *principal components* of the macro variables are used as instruments. The sample period is from 1973:2 to 2005:4. The table reports the exposure coefficients $\gamma's$, the t-stats, and the standard deviation of the slope's random effect sd_i. Firms are clustered according to the eleven Fama and French industry classification. The data on firms returns, leverage and liquidity are from COMPUSTAT. The debt is computed as the sum of total liabilities (data54) and preferred stock (data55). The value of equity is computed as the product of common shares outstanding (data61) and price at the end of the quarter (data14). The leverage variable $Lev_{i,t}$ is then defined as the ratio of debt over equity at time t for firm i. The measure of liquidity is the quick ratio, $Liq_{i,t}$, which is computed as current assets (data40) minus inventories (data38) divided by current liabilities (data49). All firm variables are winsorized at the one per cent level. The real exchange rate indices are the major trading partners currency index (MJ) and the emerging countries currency index (EM), from the Federal Reserve Board. The two currency indices are the trade-weighted values of US dollar against a number of currencies where the trade-weights are allowed to vary over time. The data series used to compute the macro financial instruments are three lagged principal components from the following macro variables, the GDP, Industrial production, M2, unexpected inflation, total return market factor, export as proportion of GDP, import as a proportion of GDP, the default premium, the term premium described in the data section. The cumulative proportion of variance of all macro variables explained by the first three components is 0.3, 0.45, and 0.58 respectively. All instruments are lagged. The t-stats of the slope coefficients larger than two are in bold.

Table VIII

Wald tests for Major Currencies

	$\gamma_i^{MJ} = 0 \; \forall \; i$		$\gamma_i^{MJ} = 0 \; \forall \; i > 0$		$\gamma_i^{MJ} = 0 \; i = 1, 2$		$\gamma_i^{MJ} = 0 \; i = 3, 4, 5$	
Industry	χ^2	*pval*	χ^2	*pval*	χ^2	*pval*	χ^2	*pval*
NonDurables	12.742	**0.047**	8.522	0.130	0.653	0.721	7.665	0.053
Durables	32.357	**0.000**	20.211	**0.001**	1.367	0.505	18.392	**0.000**
Manufacturing	83.590	**0.000**	60.101	**0.000**	0.747	0.688	59.620	**0.000**
Energy	27.923	**0.000**	14.417	**0.013**	0.884	0.643	13.279	**0.004**
Chemicals	21.318	**0.002**	21.318	**0.001**	0.611	0.737	20.226	**0.000**
Busines Equip.	47.266	**0.000**	47.258	**0.000**	2.515	0.284	44.086	**0.000**
Telephone and TV	7.138	0.308	6.734	0.241	1.636	0.441	4.967	0.174
Utilities	109.901	**0.000**	68.615	**0.000**	0.264	**0.876**	67.831	**0.000**
Shops	55.229	**0.000**	45.463	**0.000**	4.819	**0.090**	40.727	**0.000**
Health	54.142	**0.000**	46.587	**0.000**	2.242	0.326	43.990	**0.000**
Other	42.210	**0.000**	40.140	**0.000**	3.712	0.156	35.872	**0.000**

Wald tests Emerging Markets Currencies

	$\gamma_i^{EM} = 0 \; \forall \; i$		$\gamma_i^{EM} = 0 \; \forall \; i > 0$		$\gamma_i^{EM} = 0 \; i = 1, 2$		$\gamma_i^{EM} = 0 \; i = 3, 4, 5$	
Industry	χ^2	*pval*	χ^2	*pval*	χ^2	*pval*	χ^2	*pval*
NonDurables	15.949	**0.014**	15.945	**0.007**	2.240	0.326	13.556	**0.004**
Durables	27.524	**0.000**	25.936	**0.000**	13.029	**0.001**	12.934	**0.005**
Manufacturing	28.013	**0.000**	20.942	**0.001**	1.507	0.471	19.352	**0.000**
Energy	15.214	**0.019**	5.433	0.365	1.667	0.435	3.864	0.277
Chemicals	15.394	**0.017**	12.586	**0.028**	0.054	0.974	12.415	**0.006**
Busines Equip.	61.364	**0.000**	40.863	**0.000**	8.599	**0.014**	34.043	**0.000**
Telephone and TV	20.035	**0.003**	4.347	0.501	0.321	0.852	4.145	0.246
Utilities	171.688	**0.000**	37.748	**0.000**	7.971	**0.019**	15.046	**0.002**
Shops	23.197	**0.001**	15.848	**0.007**	1.919	0.383	13.333	**0.004**
Health	39.221	**0.000**	26.729	**0.000**	0.014	0.993	26.622	**0.000**
Other	14.405	**0.025**	9.656	**0.086**	2.758	0.252	6.927	0.074

Wald tests Market

	$\gamma_i^{Mkt} = 0 \; \forall \; i$		$\gamma_i^{Mkt} = 0 \; \forall \; i > 0$	
Industry	χ^2	*pval*	χ^2	*pval*
NonDurables	90.567	**0.000**	10.681	**0.014**
Durables	74.123	**0.000**	17.144	**0.001**
Manufacturing	226.381	**0.000**	10.010	**0.018**
Energy	28.783	**0.000**	0.699	0.874
Chemicals	41.567	**0.000**	13.493	**0.004**
Busines Equip.	472.376	**0.000**	37.611	**0.000**
Telephone and TV	91.451	**0.000**	0.972	0.808
Utilities	572.655	**0.000**	7.564	0.056
Shops	235.522	**0.000**	36.267	**0.000**
Health	364.103	**0.000**	56.508	**0.000**
Other	360.152	**0.000**	21.969	**0.000**

This table report Wald tests from the estimation of Equation (5) at the quarterly frequency, when both firm specific, and macro variables are used as instruments. The Wald tests are that i) exposure to each currency index (MJ or EM) is not significant, ii) exposure is not time-varying, iii) the joint coefficients in the firm-specific variables are all equal to zero, iv) the joint coefficients of the principal component macro variables are all equal to zero.

Figure 1. Total macro driven FX exposure

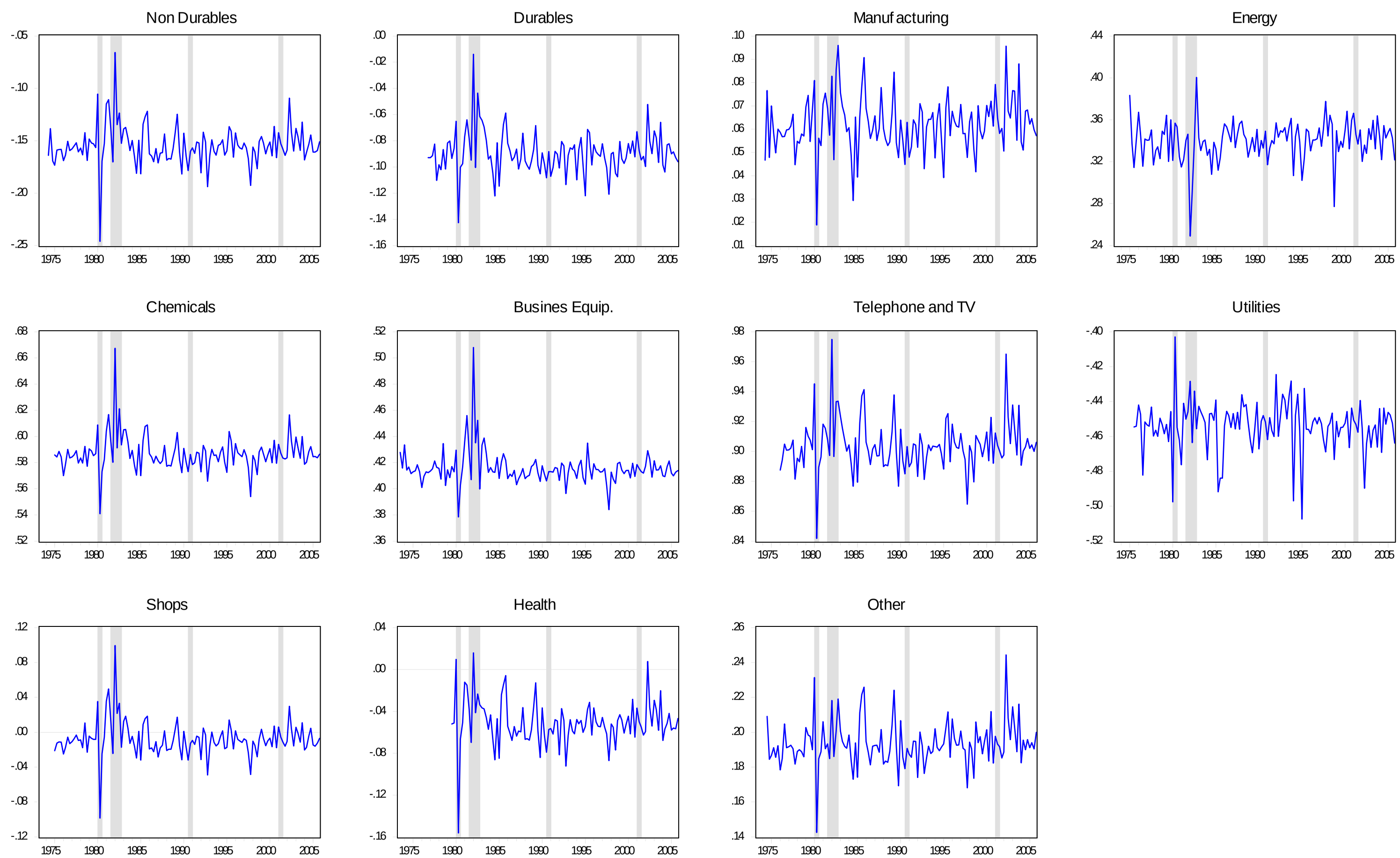

Figure 2. Macro driven FX exposure to major currencies

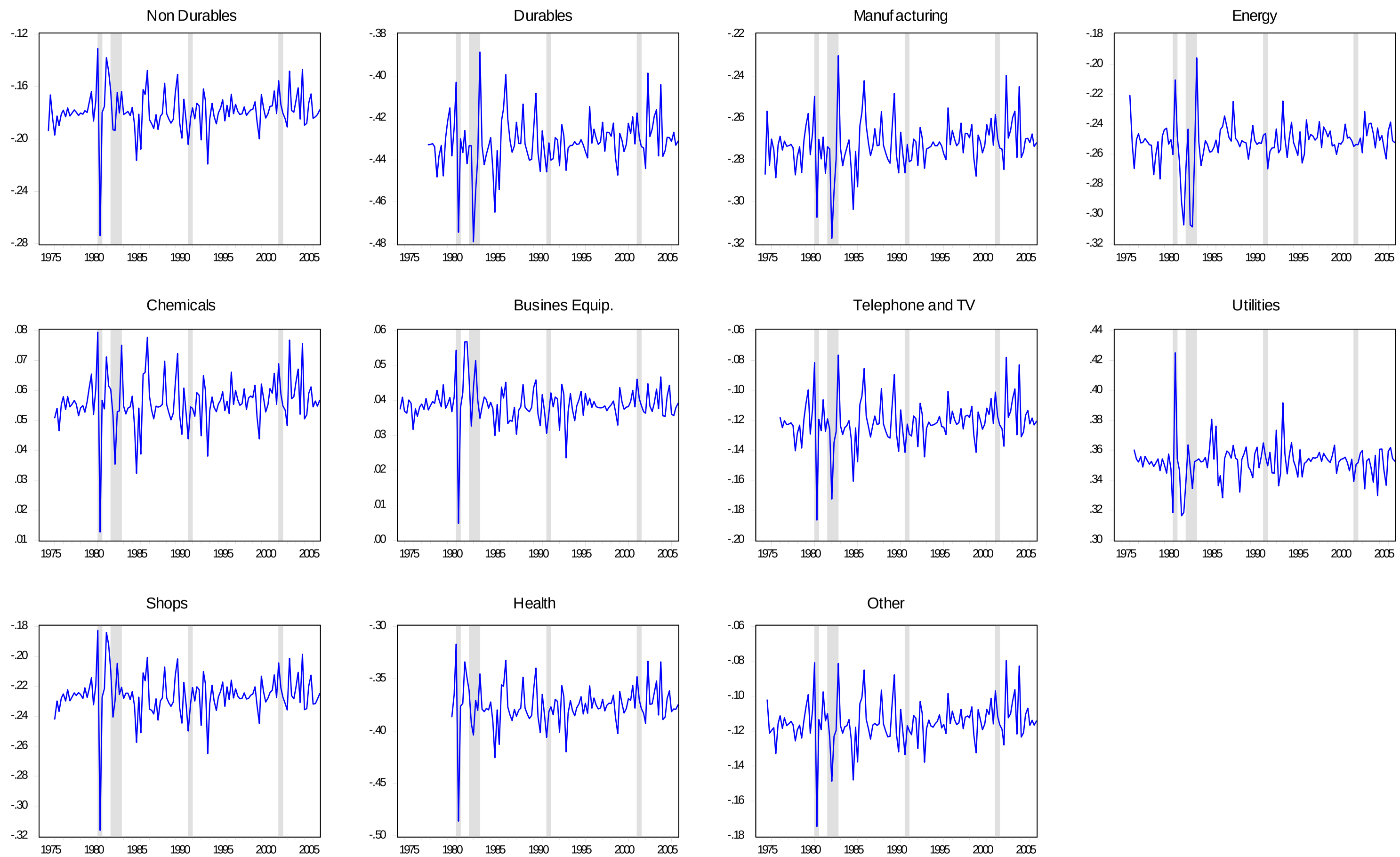

Figure 3. Macro driven FX exposure to EM currencies