What Lies Beneath: Foreign Exchange Rate Exposure, Hedging and Cash Flows

Bartram, Söhnke M.

Lancaster University

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Söhnke M. Bartram*

Abstract

This paper presents results from an in-depth analysis of the foreign exchange rate exposure of a large nonfinancial firm based on proprietary internal data including cash flows, derivatives and foreign currency debt, as well as external capital market data. While the operations of the multinational firm have significant exposure to foreign exchange rate risk due to foreign currency-based activities and international competition, corporate hedging mitigates this gross exposure. The analysis illustrates that the insignificance of foreign exchange rate exposures of comprehensive performance measures such as total cash flow can be explained by hedging at the firm level. Thus, the residual net exposure is economically and statistically small, even if the operating cash flows of the firm are significantly exposed to exchange rate risk. The results of the paper suggest that managers of nonfinancial firms with operations exposed to foreign exchange rate risk take savvy actions to reduce exposure to a level too low to allow its detection empirically.

Keywords: Foreign exchange rates, exposure, risk management, cash flow, derivatives, corporate finance

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* Lancaster University, Management School, Department of Accounting and Finance, Lancaster LA1 4YX, United Kingdom, phone: +44 (15 24) 592 083, fax: +1 (425) 952 10 70, Email: <s.m.bartram@lancaster.ac.uk>, Internet: <http://www.lancs.ac.uk/staff/bartras1/>.

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This paper presents results from an in-depth analysis of the foreign exchange rate exposure of a large nonfinancial firm based on proprietary internal data including cash flows, derivatives and foreign currency debt, as well as external capital market data. While the operations of the multinational firm have significant exposure to foreign exchange rate risk due to foreign currency-based activities and international competition, corporate hedging mitigates this gross exposure. The analysis illustrates that the insignificance of foreign exchange rate exposures of comprehensive performance measures such as total cash flow can be explained by hedging at the firm level. Thus, the residual net exposure is economically and statistically small, even if the operating cash flows of the firm are significantly exposed to exchange rate risk. The results of the paper suggest that managers of nonfinancial firms with operations exposed to foreign exchange rate risk take savvy actions to reduce exposure to a level too low to allow its detection empirically.

1 Introduction and Motivation

Since many currencies became freely floating after the breakdown of the Bretton Woods system in the mid 1970s, changes in exchange rates have been a major risk to nonfinancial corporations around the world. Particularly for firms with foreign currency-based activities, such as imports and exports, corporate cash flows and thus firm value are a function of exchange rates, rendering the management of foreign exchange rate risk an important corporate objective and activity. To illustrate, higher cash flow volatility due to exchange rate risk may lead to reductions in firm value if firms face constraints on their internal financing and, as a consequence, incur either higher costs of raising external funds or opportunity costs of forgone profitable investment projects (Froot et al., 1993). While the effect of exchange rate risk on the stock price of nonfinancial firms has been shown to depend on a variety of firm characteristics, most empirical studies report only a small number of firms with significant foreign exchange rate exposure. Consequently, researchers have come to conclude that, somewhat surprisingly, the effect of exchange rate changes on firm value is economically and statistically small (Griffin and Stulz, 2001).

To this end, this paper contributes to the literature by presenting an in-depth analysis of the foreign exchange rate exposure of the cash flows of a large nonfinancial corporation and its ability to hedge this exposure using proprietary corporate data including cash flows, derivatives and foreign currency debt. As Bodnar and Wong (2003) point out, the unavailability of suitable cash flow data makes the analysis of cash flow exposures generally impossible, and, as a consequence, studies of foreign exchange rate exposures typically use stock returns to proxy for changes in cash flows. Nevertheless, it is important to note that the early, mostly theoretical work on foreign exchange rate exposure is based on corporate cash flows (e.g. Flood and Lessard, 1986; Adler and Dumas, 1984; Hodder, 1982; Shapiro, 1975). These seminal papers relate firm value as the present value of all future cash flows as well as cash-flow volatility to the extent of foreign business (such as exports and imports) or competition of the firm. Similarly, most of the theoretical motivations for corporate risk management of foreign exchange rate risk are

based on cash flow volatility as well (Smith and Stulz, 1985; Froot et al., 1993). Given that it is difficult to tailor operational hedging to the particular needs of a firm, operating cash flow exposure is something many firms must live with, and they can try to hedge this exposure in financial markets. The paper analyzes a case where the success of such efforts can be evaluated based on data that are rarely available.

While the previous literature has documented the corporate use of different hedging tools in general, little detail is available for large samples of firms. Consequently, this paper documents and examines the nature and effects of corporate risk management practices in a way that cannot be employed for a large sample, showing in detail how nonfinancial firms conduct financial risk management and what the effects are on the sensitivity of cash flows and firm value with regards to exchange rate risk. In particular, the foreign-currency based activities of the firm are analyzed in order to identify the currencies that are the most important sources of exchange rate risk of the firm, yielding large gross exposures. For these currencies, foreign exchange rate exposures are estimated for different cash flows such as cash flows from operations, cash flows from investment activities, cash flows from financing activities and total (net) cash flows. In this context, the effect of operational hedging (foreign assets and operations) and financial hedging (foreign currency debt and derivatives) is considered. The results document that corporate cash flows are affected by foreign exchange rate risk, but that they are coordinated in a way that total (net) cash flows exhibit only small foreign exchange rate exposures and low cash flow volatility. Finally, stock price exposures are estimated for the same firm. Similar to total cash flows, the exposures of stock returns to the foreign exchange rates most important for the firm as well as to a foreign exchange rate index are economically and statistically small.

The paper thus illustrates how corporations use hedging tools to reduce the exposure of their operations to such an extent that the remaining net exposures are hard to identify in empirical analyses. The results are consistent with cash flow variability being a major concern of companies when considering foreign exchange exposure, as documented in Bodnar et al. (1995). If hedging at the firm level increases

value, firms with operations that are heavily affected by exchange rate changes (i.e. firms with large gross exposures) will engage in risk management activities to an extent that the residual exposure is small. Consequently, both firms with and without operations exposed to exchange rate risk are likely to show insignificant residual exposures.[1]

The remainder of the paper is organized as follows. Section 2 discusses related research, while Section 3 describes the methodology used to estimate cash flow and stock price exposures. The company examined in the clinical study is characterized in Section 4, and Section 5 describes the data set. Section 6 presents and discusses the results, and Section 7 concludes.

2 Extant Evidence of Foreign Exchange Rate Exposure

The early research on foreign exchange rate exposure goes back to seminal work by Adler and Dumas (1984), who define exchange rate exposure as the effect of unexpected changes in foreign exchange rates on cash flows and, by extension, firm value. Jorion (1990) first tested this phenomenon for a sample of 287 U.S. multinational firms in a regression of stock returns on changes in a foreign exchange rate index and, as a control variable, the market index. The results show that only few firms, namely 15 (representing 5.2% of the sample), have a statistically significant foreign exchange rate exposure at the 5% significance level. These findings have been perceived as surprising and, thus, have motivated a large body of empirical work investigating the effect of exchange rate changes on stock returns using a variety of alternative approaches with regards to methodology and data (see Bartram and Bodnar (2004) for a review). In contrast, due to data unavailability, there exists only very sparse evidence regarding the effect of exchange rate risk on corporate cash flows. To illustrate, the foreign exchange rate exposure of Vul-

[1] While the evidence in this clinical paper is based on one single firm, the results and conclusions are in line with recent theoretical insights and empirical evidence for a global sample of manufacturing corporations documenting that firms are able to manage exchange rate risk via three complementary channels. First, firms pass part of exchange rate changes through to customers. Second, most global manufactures utilize operational hedges (e.g., matching foreign sales with foreign production). Third, corporations employ financial risk management strategies such as issuing foreign currency denominated debt and entering into foreign exchange rate derivatives transactions (Bartram, Brown and Minton, 2005).

can Materials Company is analyzed in a regression of changes of the company's quarterly operating cash flows on changes in the USD/GBP exchange rate (Garner and Shapiro, 1986). The results show economically and statistically small foreign exchange rate exposures. Oxelheim and Wihlborg (1995) use quarterly changes of total cash flow, commercial cash flow and sales revenue in their exposure analysis of Volvo Cars. They find that the financial position of the firm lowers the DEM/SEK exchange rate exposure only to a modest degree. However, for a sample of 40 U.S. manufacturing firms, total cash flows show lower foreign exchange rate exposures than commercial cash flows using percentage changes of annual total and commercial cash flows (Oxelheim and Wihlborg, 1987), suggesting hedging effects of financial cash flows. This is consistent with the result of the clinical study of a U.S. multinational by Brown (2001) that the foreign exchange hedging policies of corporations aim to stabilize corporate cash flow, motivating the study of various cash flow exposures at the company-level pursued in this paper.

3 Estimating Foreign Exchange Rate Exposure

The availability of proprietary internal cash flow data of a nonfinancial firm allows conducting an exposure analysis in the spirit of the original work on foreign exchange rate exposure, which characterizes exposure as the elasticity of corporate cash flows with regards to unexpected exchange rate changes (Adler and Dumas, 1984). Consequently, the following regression can be estimated, as suggested in the literature:

$$CF_t = \alpha + \sum_{i=1}^{N} \delta_i R_{FX,t}^{(i)} + \phi_1 R_{ST,t} + \phi_2 R_{DS,t} + \varepsilon_t \qquad (1)$$

where CF_t denotes a cash flow variable, and $R_{FX,t}^{(i)}$ is the relative change in foreign exchange rate i. The model employs alternatively a foreign exchange rate index or a set of the bilateral exchange rates most relevant for the firm based on its operating characteristics (see Section 4). A short-term interest rate variable ($R_{ST,t}$) and a term-spread variable ($R_{DS,t}$) are employed as control variables. They are defined as follows: $R_{ST,t}$ is the change in the short-term interest rate divided by one plus the long-term rate, and $R_{DS,t}$ is

the change in the term spread divided by one plus the long-term rate, where the term spread is defined as the difference between the long-term rate and the short-term rate.[2] The regression coefficients of the exchange rate variables capture the sensitivity of the respective cash flow to an exchange rate change and, thus, represent a measure of foreign exchange rate exposure.[3] Stulz and Williamson (1997) use a similar framework to regress the change in cash flow of a manufacturing firm on changes in the prices of aluminum and copper. Similarly, Bartov and Bodnar (1994), Oxelheim and Wihlborg (1995) and Garner and Shapiro (1984) employ changes in corporate cash flow variables as regressands for contemporaneous (and lagged) exchange rate changes.

The advantages of this cash flow regression consist of the fact that the estimated effects of exchange rate risk on corporate cash flows are independent of the perception of market participants and their understanding of the relevance of exchange rate risk for the company. Another benefit of a cash flow approach is that various alternative cash flow variables can be employed. In particular, it can be of interest to analyze different cash flows, such as cash flows from operating activities, cash flows from financing activities and cash flows from investment activities, as well as total cash flow. This allows studying the components and sources of exposure as well as hedging effects of different cash flows. In particular, cash inflows in foreign currency such as from export sales will generally lead to positive exposures, while cash outflows in foreign currency such as from raw material purchases typically have a negative exposure.

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[2] Defining the interest rate variables this way has the advantage that the sum of them is the change in long-term rate divided by one plus the long-term rate, i.e. a measure that could be used to empirically estimate duration with one interest rate variable. Papers that investigate the interest rate exposure of firms use similar variables such as the percentage change in the short-term rate, the change in long-term yield, the holding period return on a default-free bond, or term-structure variables.

[3] A priori, it may not be clear what functional form the relationship between the measures of firm performance (i.e. stock returns or changes in cash flows) and exchange rate innovations should have. One may rightfully hypothesize that the relationship is non-linear or asymmetric, because of real or financial options at the firm level, pricing-to-market, market inefficiencies, or simply because corporate cash flows are a non-linear function of the exchange rate (e.g. due to price and quantity risk). While several studies investigate nonlinear and asymmetric features of exchange rate exposures (Bartram, 2004; Koutmos and Martin, 2003; Miller and Reuer, 1998), the evidence does not fully resolve the exposure puzzle either, as nonlinear exposures appear more significant, but still only for a limited number of firms.

Thus, depending on the currency mix, cash flow variables combining cash inflows and outflows will exhibit positive or negative exposures. Currency matching of inflows and outflows may cancel out exposures and effectively lead to small or zero remaining exposure. Hedging effects of this nature could be the result of natural hedges, such as sales and raw material purchases being determined by the same currencies, or they may occur by construction, such as when a company issues foreign currency debt or employs derivatives to purposely offset existing operating exposures. In principle, the operating cash flow will reflect the gross exposure of a firm's operations in general and its foreign sales in particular, net of operational hedging (foreign currency costs), pass-through and currency diversification. Changes in asset values are captured by cash flows from investing activities, and cash flows from financial instruments are part of the company's cash flow from financing activities. Therefore, if a company uses its financial policy for hedging purposes, the sign of the financing exposure should be opposite that of the operating exposure. Effective corporate hedging would be consistent with total cash flows being (largely) unaffected by foreign currency movements. Nevertheless, it is difficult to predict the relative size of exposures of different cash flows, given the effect of leverage on exposure, the possibility of firms taking bets with derivatives (on direction or volatility), possibly even under the guise of hedging, difficulties of measuring the hedging effects of foreign currency debt for cash flows, etc.

In addition to estimating cash flow exposures, the availability of stock price data allows employing the regression framework commonly used in the academic literature, where stock returns are regressed on exchange rate changes and control variables. In particular, the following regression model is used following Jorion (1990):

$$R_t = \alpha + \beta R_{m,t} + \sum_{i=1}^{N} \delta_i R_{FX,t}^{(i)} + \phi_1 R_{ST,t} + \phi_2 R_{DS,t} + \varepsilon_t \qquad (2)$$

where R_t denotes the excess stock return on the company, $R_{m,t}$ is the excess return on a market index and all other variables are defined as above. Given the ready availability of stock return data (and general

unavailability of suitable corporate cash flow data), virtually all academic studies employ this model to estimate exposure. Note that stock returns represent changes in firm value. At the same time, the value of the firm is nothing other than the present value of all current and future (net) cash flows. Therefore, there is natural link between regression models (1) and (2).[4] Since cash flow volatility may be costly in the presence of capital market imperfections such as bankruptcy costs, convex tax schedules (Smith and Stulz, 1985), or underinvestment problems (Bessembinder, 1991; Froot, Scharfstein, and Stein, 1993), there are economic rationales for firms to be concerned with cash flows as well as value (Starks and Wei, 2006). Therefore, both approaches are important and relevant in their own right.

Note also that the stock return is a comprehensive measure of corporate performance that is aggregated across time and space and incorporates all effects of currency matching and diversification, operational and financial hedging, pass-through, etc. As such, stock return exposures (and similarly total (net) cash flow exposures) allow only capturing net or post-hedging exposures.[5] As a consequence, these residual exposures may be too small to be detected empirically if managers act rationally and take effective exposure-reducing measures in case the operations of their firm are sensitive to exchange rate risk, i.e. if the firm has gross foreign exchange rate exposure.

4 VEBA Corporation

The clinical study in this paper is based on the German multinational company VEBA AG ("Vereinigte Elektrizitäts- und Bergwerks-Aktiengesellschaft"), a conglomerate with a high degree of industrial diversification.[6] Its main industry sectors are chemicals and allied products, freight transportation, petroleum products and refining, and utilities. Further business areas include real estate management, tele-

[4] Given common practice to use the return on the market index as a control variable in the stock return regression, the coefficients of the exchange rate variables reflect exchange rate exposures over and above what is captured by the market index.

[5] Exposure of total cash flow and stock returns may differ due to differences in time horizon, flexibility of operations in the longer, but not in the short term, non-random walks, mean reversion in exchange rates, etc.

[6] VEBA merged with VIAG in 2000 to form E.ON.

communications, silicon wafers and electronics. With total sales of around € 42.8 billion and over 131,000 employees, VEBA AG is the fifth-largest publicly traded German company as of December 1998 and as such a member of the DAX. Table 1 shows the geographic scope of VEBA's operations. The company generates sales all over Europe, the Americas, Asia, and South Africa. The table shows the local currencies of the countries where VEBA has operations, and the currencies of the resulting exposures, taking into account linkages between currencies (such as currency pegs). Of the set of relevant currencies, eight are pegged to the U.S. Dollar or the SDR. Another eight currencies maintain some form of currency peg to the Deutsche Mark or are part of the European Monetary System (EMS).

Two factors are generally important for a company to have an economically important foreign exchange rate exposure: The relevant exchange rate has to be volatile, and/or the cash flows affected have to be large. Therefore, Table 1 also presents the standard deviations of the changes in the exchange rates of the local currency relative to the German Mark. It documents that exchange rate risk differs significantly across the various foreign countries. Given that the sample period includes the Asian crisis, the Russian crisis and the (beginning of the) Brazilian crisis, it is not surprising that many Asian currencies, the Russian Ruble as well as Latin American currencies show the highest standard deviations. At the same time, even major international currencies like the U.S. Dollar (2.4), the British Pound (2.3) and the Japanese Yen (3.8) show quite high volatility, potentially giving rise to important exposures to the respective exchange rates. In contrast, EMS currencies show little variation and are therefore less likely to cause large foreign exchange exposures.

In order to gauge the absolute and relative importance of the cash flows in foreign currency as a source of exchange rate exposure, Table 2 reports VEBA's sales and total assets by geographic segment. While the company naturally has large domestic sales and assets, it also has important foreign business, particularly in other European countries (14% of sales and 7% of total assets in 1997), North America (11% of sales and 10% of assets) and other foreign countries (4% of sales and 2% of assets). Over the

1995-1999 period, the proportion of foreign sales as well as foreign assets increased significantly (from 18% to 39% and from 11% to 27%, respectively). Given the skewed distribution of foreign activity, the degree of geographic diversification appears smaller than one might have believed from Table 1.[7]

Considering VEBA's extensive petrochemical operations, the U.S. Dollar is likely to be one of the most important sources of its foreign exchange rate exposure. Moreover, the company's operations and recent investments in Scandinavia, notably in oil-related projects in Norway and in the electricity market in Sweden, suggest important exposures to the Swedish Krona and the Norwegian Krone. Furthermore, the British Pound is likely another source of significant exposure due to the company's telecommunications and utility business. Finally, East Asia, notably Japan, is important for VEBA in terms of its operations, customers and sourcing, which suggests the Japanese Yen as an important source of exposure.

Expectations on the direction of the exposure of VEBA are derived from the nature and the development of its business within the different currency areas. First, exposure to the U.S. Dollar is expected to be negative. This is mainly due to two factors. First, most of the inputs of VEBA's large petrochemical business such as crude oil and oil derivatives are denominated in U.S. Dollars, while the markets for its outputs, such as chemicals and petrol, are mainly outside the United States. Second, its operations in the United States experienced operating difficulties and several restructurings, which negatively affected VEBA's operating cash flow and stock market value. This is in contrast to its exposure to Britain, Sweden and Norway, where VEBA successfully sells electricity produced by its German power plants. Thus, as an exporter to these markets, VEBA's operating cash flow is likely positively exposed to these three currencies. Finally, while VEBA has some chemical operations in Japan, it also uses this market to source some of its electronics inputs, so that the sign of the exposure to the Japanese Yen is

[7] Back-of-the envelope calculations indicate that about 60% of the variance of the currency portfolio can be reduced due to diversification, suggesting that significant exchange rate risk remains after taking this effect into account.

difficult to predict.

For the analysis of exchange rate exposures, it is also important to consider all corporate activities that likely reduce the gross exposure originating from foreign business activities. To this end, operational and financial hedging activities at the corporate level are relevant. With regards to operational hedges, Table 2 reveals that VEBA has high concentrations of foreign assets in countries/regions where it also has high foreign sales. Foreign assets may proxy for foreign production and thus indicate that the company has not only revenue, but also cost in foreign currency, which establish natural hedges. These effects reduce the sensitivity of the firm's operating cash flow to exchange rate risk (relative to the firm not having such operational hedges).

Firms typically employ operational hedges to reduce the long-term exposures of future cash flows, while the flexibility of financial instruments such as derivatives is used to complement and fine-tune operational hedging measures. VEBA is no exception, as it employs foreign currency derivatives as well as foreign currency debt. The corporation pursues systematic and group-wide foreign exchange risk management with the objective of limiting its exposure to exchange rate fluctuations, which it also states in its annual report. To illustrate, Table 3 shows VEBA's positions in cash and derivatives instruments for foreign currency that are expiring in the years 1997 and 1998 by type of instrument and currency of denomination. Consistent with the above risk management objective, the largest foreign currency transactions are in the currencies to which the company is most exposed, i.e. the U.S. Dollar, Japanese Yen, British Pound, and the Swedish Krona. The Swiss Franc is another important currency of denomination, which is consistent with important operations in Switzerland. While transactions in currency options are limited to these currencies, VEBA actually engages in instruments with linear payoff profiles (i.e. cash, forward and swaps) for a quite extensive range of currencies, mostly in currencies of countries where it indeed has foreign operations, including the Argentine Peso, Australian Dollar, Canadian Dollar, Chinese Renminbi-Yuan, Czech Koruna, Danish Krone, Greek Drachma, Hong Kong Dollar, Hungarian

Forint, Kuwait Dinar, Malaysia Ringgit, New Zealand Dollar, Norwegian Krone, Polish Zloty, Singapore Dollar, South African Rand, Thai Baht, and the Venezuelan Bolívar.[8] In addition to currency derivatives, VEBA also employs foreign currency debt, mostly in U.S. Dollars, British Pound, Japanese Yen, Swiss Franc, Norwegian Krone, and Swedish Krona, which provides another source of financial hedging.

5 Data Sources

The analysis of cash flow exposures in this paper is based on a proprietary data set of monthly cash flows as well as information on derivatives' transactions and foreign currency debt from the Treasury Department of VEBA for the period January 1996 to December 1999. Most importantly, detailed cash flow data are available for the cash flow from operating activities, the cash flow from investing activities, the cash flow from financing activities and total cash flow. Following common practice, cash inflows and outflows are classified according to the activity to which they relate (see e.g. Sutton, 2000). In particular, the Operating Cash Flow (OCF) captures cash flows related to a firm's operating activities, such as revenue from the sale of goods and other receipts, as well as related costs such as salaries, supplies, utilities and other operational expenses.

The cash flow from investing activities reports the total change in a company's cash position resulting from any gains (or losses) from investments in financial markets and operating subsidiaries, and changes resulting from amounts spent on investments in capital assets such as plant and equipment. Therefore, the Investment Cash Flow (ICF) reflects investment activities such as the purchase or divestment of fixed (tangible and intangible) assets, the acquisition/sale of consolidated subsidiaries, interests in unconsolidated subsidiaries or participations, etc. Finally, the Financing Cash Flow (FCF) pertains to

[8] As of December 31, 1998, the face value of foreign exchange hedging transactions was DEM 4,537 million, and the market value of transactions for which no hedge accounting was applicable totaled DEM -3.7 million for foreign exchange hedging. The notional amount of exchange rate derivatives scaled by foreign sales is about 16%, which is of a similar order of magnitude as the 22% in Allayannis and Weston (2001). Results in Guay and Kothari (2003) suggest that this hedge ratio may overstate the amount of exchange rate risk that firms hedge with exchange rate derivatives.

the firm's financing activities and thus captures for instance cash flows originating from the increase/decrease of capital, short-term and long-term loans and deposits, acceptance credit, interest and dividend payments and includes the effects of financial hedging (i.e. derivatives and foreign currency debt).[9] By definition, the Total Cash Flow (TCF) is the combination of the cash flows from operating, investing and financing activities. Changes in these measures are scaled by total sales to create the dependent variables for the cash flow regressions.[10]

Further information about VEBA and its competitive environment is obtained from the Treasury Department and internal reports, annual reports, analysts' reports, publications in industry magazines and practitioner articles. Additional accounting data is from Thomson Analytics OneBanker. All capital market data are obtained from Datastream in monthly frequency. These are total return indices for VEBA stock as well as for the value-weighted stock market index of Germany. Excess returns are calculated as the log-difference in the total return indices minus the risk-free rate. The short-term rate is the three-month Euro-Mark interest rate, and the long-term rate is the ten-year government benchmark bond yield.

The exchange rate variables are calculated as log-differences in the exchange rates (in Deutsche Mark relative to foreign currency), in particular of the U.S. Dollar (USD), the British Pound (GBP), the Japanese Yen (JPY), the Swedish Krona (SEK), the Norwegian Krone (NOK) and the trade-weighted exchange rate index of the German Mark from the Bank of England. All data used in the study are de-

[9] One might also consider alternative definitions of these cash flows, for instance combining ICF with changes in long-term debt and equity. Note that hedging effects of foreign currency debt may also take the form of capital gains and losses on long-term debt, which are more difficult to measure.

[10] Given that cash flows can be positive or negative, it is not possible to use percentage changes or log-differences as endogenous variables, but changes in cash flows are typically scaled by some other variable, such as sales. Alternative scaling procedures, such as normalizing with the contemporary stock price, total assets, or net assets yield similar results.

nominated in Deutsche Mark.[11] Panel A of Table 4 shows summary statistics of the main variables. The cash flow variables, particularly cash flows from investing activities and cash flows from financing activities are more volatile than stock returns, while the operating cash flow variable has a smaller standard deviation. As a consequence of the significant investing activities of the firm, the mean values of the cash flow variables are negative, resulting on average in investing cash outflows and slight decreases in the operating cash flow and total cash flow during the sample period.[12]

The return on VEBA stock has been positive on average during the sample period, yielding 0.65% per month. At the same time, the German market index has performed even better (1.72% per month). The larger degree of diversification of the German market index is reflected in its lower standard deviation compared to VEBA (5.62% vs. 6.99%). The summary statistics on the exchange rate variables document that the German Mark has been depreciating against the selected currencies as well as the trade-weighted currency basket over the sample period. The short-term interest rate variable has mean and median values of close to zero, indicating that short-term rates changed little on average. The negative value of the term-structure variable shows that spreads between long-term rates and short-term rates decreased during the sample period.

Given that the Euro was introduced in 1999, which had important effects on market betas and exchange rate exposures (see Bartram and Karolyi, 2006), all regressors also enter the regression equations interacted with a dummy variable for the Euro effect. In order to accommodate the fact that the introduction of the Euro may have been anticipated to some extent, we follow other papers, such as Bris et al.,

[11] Note that the data are nominal, i.e. not adjusted for inflation. Studies that examine the effect of inflation on exchange rate exposure typically find that this effect is negligible (e.g. Bodnar and Wong, 2003; Choi and Prasad, 1995; Booth and Rothenberg, 1990).

[12] Figure 1 indicates that for the total cash flow this result is driven by the last large negative observation, which is also reflected in the positive median value. Clearly, investment cash flows are large and lumpy, and can heavily reduce the total cash flow in any particular period.

(2003) and use January 1, 1998 as the effective date of the Euro introduction.[13] Moreover, cash flow regressions use monthly dummy variables to control for potential seasonality effects in the data, even though the high degree of industrial diversification should attenuate potential seasonal effects.[14]

6 Results and Discussion

The time-series pattern of the different corporate cash flows is shown in Figure 1, and Table 4 (Panel B) characterizes the relationship between these cash flows by their correlation coefficients. Several interesting observations can be made: First, it is apparent that the cash flows from financing and investing activities are fairly volatile. This is likely due to large investments and restructurings that VEBA was undertaking between 1996 and 1999. Second, it is apparent that financing and investing cash flows are largely offsetting, suggesting that the need and availability of funds are highly synchronized. Indeed, the correlation between the changes in these cash flows is –0.89.

In contrast to the investing and financing cash flows, the cash flow from operating activities is very stable, reflecting the high degree of diversification of VEBA's operations as well as the effect of natural hedges and possibly pass-through. The significant correlation coefficient of –0.34 between operating and financing cash flows indicates that financial transactions complement these operational hedging effects. As a result, total cash flow as the sum of all three cash flows is quite stable as well. The correlation between total cash flow and the stock price of VEBA is low and insignificant, and the correlation between operating cash flow and stock price is larger and significant, but negative.[15]

Table 5 shows the results of the regression analysis with different cash flow variables.[16] For

[13] To illustrate, Danthine et al. (2001) document that there was already a consensus about Euro membership among financial and economic forecasters in January 1998.

[14] The results remain largely unchanged when using quarterly dummy variables.

[15] Correlations between all exogenous variables are reasonably low. Across different specifications, condition indices and variance inflation factors have values in the range of 6.61-8.35 and 1.20-6.40, respectively.

[16] Tests of the regression residuals fail to reject normality (Henze-Zirkler T) and homoskedasticity (White and Breusch-Pagan tests), and Q-tests do not indicate ARCH disturbances at conventional significance levels.

specification (1) that uses the trade-weighted exchange rate index, none of the cash flows exhibits a statistically significant foreign exchange rate exposure. In contrast, the use of sets of individual currencies that are identified in Section 4 as most important for VEBA's operations yields several significant exposures. Given the relatively high correlation between the Swedish Krona and the Norwegian Krone, these currencies are used as alternative measures to capture exposure of the Scandinavian operations in specifications (2) and (3). Specification (4) focuses on the most important exchange rates. The results of these specifications with bilateral exchange rates show that operating cash flows are exposed to several currencies. At the same time, the adjusted R-squared increases relative to specification (1) as well. These observations highlight the importance of carefully identifying the relevant currencies for the analysis of foreign exchange rate exposures.

The results of the specifications with individual currencies reveal significant exposures of the operating cash flow of VEBA to the British Pound, the Japanese Yen and the U.S. Dollar. Moreover, the signs of the coefficients are generally as predicted. In particular, the exposure coefficients for the British Pound, the Norwegian Krone, and the Swedish Krona are positive, which identifies these as export markets, e.g. for VEBA's electricity. The negative sign on the Japanese Yen and the U.S. Dollar suggests these as currencies of denomination of input markets and/or competitive effects. In fact, VEBA sources electronics in Japan, while its extensive petrochemical operations and loss-making U.S. operations imply adverse effects of the strengthening U.S. Dollar. The fact that operating cash flows exhibit significant foreign exchange rate exposures indicates that operational hedging and pass-through are not sufficient to eliminate foreign exchange rate exposure. This appears reasonable given that foreign business operations are costly to establish (and to unwind), that they are likely motivated by considerations other than just foreign exchange risk management, and that the nature of product market competition limits the ability to pass exchange rate effects on to customers.

In contrast to exposures of the operating cash flow, cash flows from financing and investing ac-

tivities do not exhibit significant foreign exchange rate exposures. Importantly, there are no significant foreign exchange rate exposures at the level of total cash flow. The exposure coefficient of the cash flow from financing activities typically has the opposite sign than that of the operating cash flow (as well as always that of the investing cash flow). Thus, VEBA is actively using its financial policy to offset the impact of foreign exchange rate risk on its medium and long-term cash flow commitments resulting from operations and investments. The resulting exposure coefficients associated with total cash flow show the residual, economically smaller and statistically insignificant foreign exchange exposure. This is an important result, as it documents the hedging effect of financial cash flows for operating and investing cash flows, reducing the exposures to a level too small to be detected empirically. As an aside, the interest rate variables are mostly insignificantly related to the cash flow variables, except for total cash flow. Finally, the incremental change in the exchange rate betas induced by the introduction of the Euro generally has the opposite sign to the exposure before the Euro.

Table 6 presents the results of the same specifications that estimate the foreign exchange rate exposure of VEBA's stock returns. The main result across all different specifications is that there is no significant relationship between the stock returns of VEBA and any exchange rate, which is also consistent with the idea that hedging at the firm level effectively eliminates exposures.[17] The signs of the estimated foreign exchange rate exposures are very consistent with the cash flow exposures estimated in Table 5, and they are generally in line with the priors based on the characteristics of VEBA' operations, i.e. stock returns are positively exposed to the British Pound, the Norwegian Krone, and the Swedish Krona, but negatively exposed to the U.S. Dollar. The market betas are estimated quite consistently across specification around 0.8 and are always highly significant. Moreover, the effect of the introduction of the Euro

[17] Results using a world market index are qualitatively similar. Note that specifications without market index (or other control variables) will overestimate foreign exchange rate exposures, as the exchange rate coefficients will capture correlated economic effects affecting stock markets that may have nothing to do with exchange rate risk.

is a reduction in the market and most of the foreign exchange rate betas, as documented in Bartram and Karolyi (2006).

In order to verify the robustness of the results, different sets of macroeconomic variables are included in the regressions as control variables. In particular, we use alternatively (1) short-term interest rate variables and term-structure variables for Germany, Britain, the United States and Japan, (2) short-term interest rate variables for Germany, Britain, the United States and Japan as well as interactions of these variables with a Euro dummy, (3) the short-term interest rate variable and the term-structure variable for Germany (both with Euro effects), the log-difference in the oil price and the yield of a global long-term government bond index (maturities of 10 years and more). The main result of significant foreign exchange rate exposures of the operating cash flow and insignificant foreign exchange rate exposures of the total cash flow and the stock return is unchanged.

7 Summary and Conclusion

To date, a sizable literature has empirically investigated the effect of foreign exchange rate risk on the stock returns of nonfinancial corporations, yielding a relatively small number of firms, i.e. 15-20%, that exhibit significant foreign exchange rate exposures in almost any sample. The clinical analysis of the foreign exchange rate exposure of a large multinational firm in this paper, based on a proprietary set of detailed internal data, including cash flows, derivatives and foreign currency debt, as well as capital market data, illustrates the importance of considering the effect of corporate hedging for this type of investigation. In particular, the operating cash flows of the firm are significantly exposed to the exchange rates that are of key relevance for its business activities. At the same time, the multinational firm uses hedging to reduce its exposure, resulting in insignificant exposure of total cash flow. The paper thus provides an illustration that managers of corporations exposed to foreign exchange rate risk are successful at reducing the exposure of their operations to such an extent that the remaining net exposures are hard to identify empirically.

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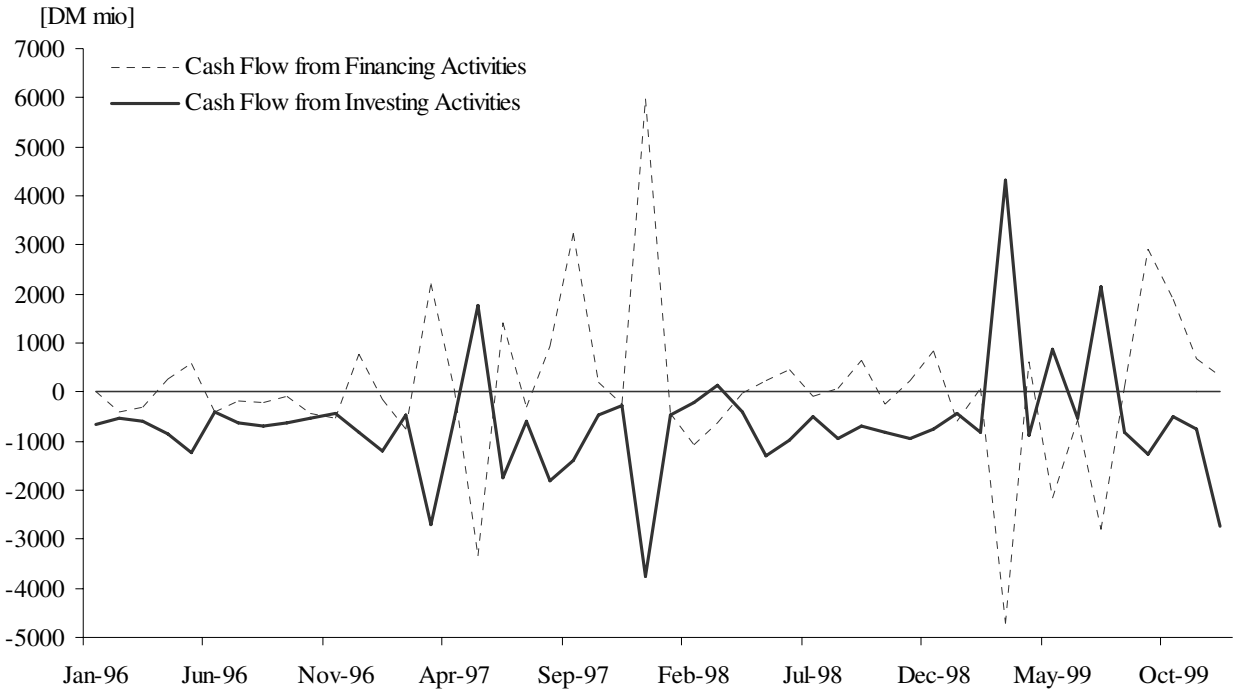
Figure 1: Time Series of Corporate Cash Flows

The figure shows the monthly time series of different cash flow levels of VEBA in millions of Deutsche Mark between January 1996 and December 1999. Panel A presents the cash flows from financing and investing activities, while Panel B shows the cash flows from operating activities and total cash flow, respectively.

Panel A: Investing and Financing Cash Flows



Panel B: Cash Flow from Operations and Total Cash Flow

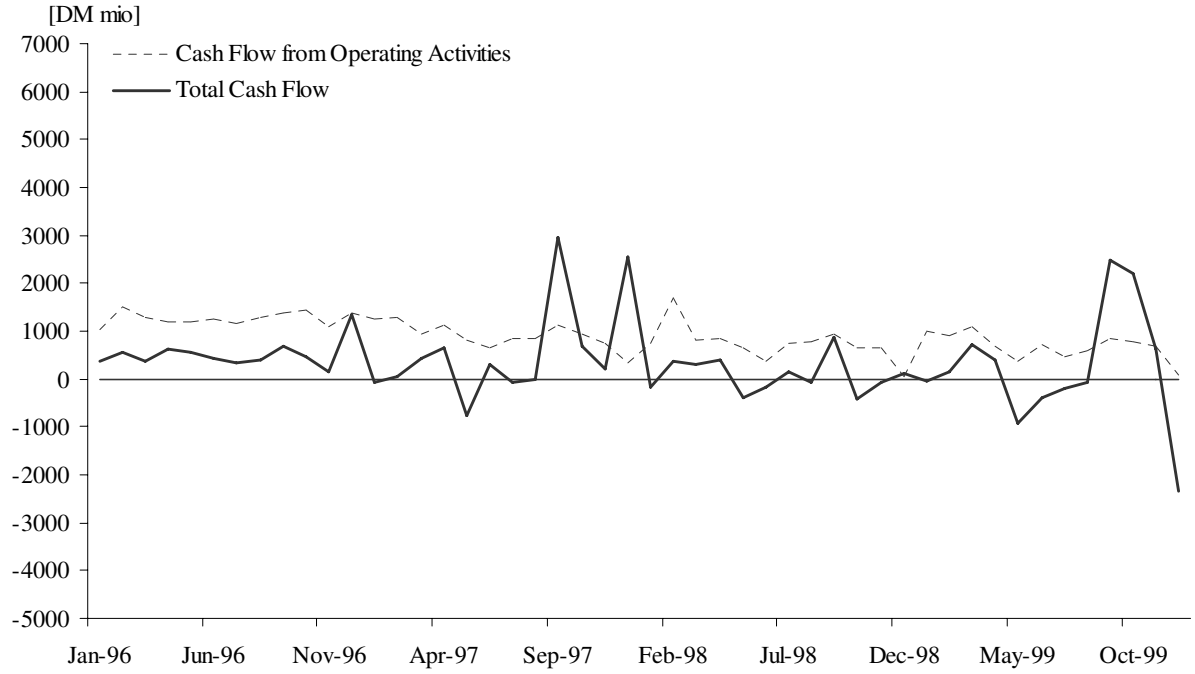


Table 1: Sources of Operating Exposure

The table reports information on the sources of operating exposure from the largest foreign markets for VEBA over the period 1996 to 1999. The first and second columns report the countries, the corresponding local currencies and their official symbol, respectively. The third column displays the actual currency of the exposure considering linkages (such as currency pegs) to other currencies. Latvia and Libya, for instance, maintain a peg to the Special Drawing Rights, SDR. The fourth column shows the standard deviation of monthly change of the exchange rates relative to the German Mark (times 100) over this period. Data of some currencies were not available for the entire time period. As a result, the series of the Balarus Ruble starts in October 1998, and the Azerbaijani Manat and the Kazakhstan Tenge both start in December 1998. All foreign exchange rates are expressed in Deutsche Mark per unit of foreign currency.

Country	Local Currency (Symbol)	Exposure	Standard Deviation
Argentina	Argentine Peso (ARS)	USD	2.43
Austria	Austrian Schilling (ATS)	ATS	0.02
Azerbaijan	Azerbaijani Manat (AZM)	AZM	9.66
Belarus	Balarus Ruble (BYB)	RUR	17.43
Belgium	Belgian Franc (BEF)	BEF	0.08
Brazil	Brazil Real (BRL)	BRL	8.50
Canada	Canadian Dollar (CAD)	CAD	2.93
China	Chinese Renminbi Yuan (CNY)	USD	2.43
Colombia	Colombian Peso (CLP)	CLP	4.00
Czech Republic	Czech Koruna (CZK)	CZK	2.38
Denmark	Danish Krone (DKK)	DKK	0.19
Egypt	Egyptian Pound (EGP)	USD	2.46
Estonia	Estonian Kroon (EEK)	DEM	0.28
Finland	Finnish Markka (FIM)	FIM	0.62
France	French Franc (FRF)	FRF	0.33
Great Britain	British Pound (GBP)	GBP	2.26
Hungary	Hungarian Forint (HUF)	HUF	1.21
Indonesia	Indonesian Rupiah (IDR)	IDR	15.33
Italy	Italian Lira (ITL)	ITL	0.96
Japan	Japanese Yen (JPY)	JPY	3.78
Kazakhstan	Kazakhstan Tenge (KZT)	KZT	13.40
Latvia	Latvian Lats (LVL)	SDR	1.58
Lithuania	Lithuanian Litas (LTL)	USD	2.37
Libya	Libyan Dinar (LYD)	SDR	3.51
Malaysia	Malaysia Ringgits (MYR)	MYR	7.80
Netherlands	Dutch Guilder (NLG)	NLG	0.05
New Zealand	New Zealand Dollar (NZD)	NZD	3.06
Norway	Norwegian Krone (NOK)	NOK	1.86
Poland	Polish Zloty (PLN)	PLN	2.33
Russia	Russian Ruble (RUR)	RUR	10.92
South Korea	South Korean Won (KRW)	KRW	7.98
Spain	Spanish Peseta (ESP)	ESP	0.42
Sweden	Swedish Krona (SEK)	SEK	1.75
Switzerland	Swiss Franc (CHF)	CHF	1.10
Syria	Syrian Pound (SYP)	USD	3.72
Taiwan	Taiwanese Dollar (TWD)	TWD	3.04
Trinidad	Trinidad Dollar (TTD)	USD	2.96
U.S.A.	U.S. Dollar (USD)	USD	2.43
Venezuela	Venezuelan Bolívar (VEB)	VEB	4.63

Table 2: Geographic Segments of Sales and Assets

The table presents a geographic breakdown of the sales and assets of VEBA, in millions of Deutsche Mark and as percentages of the total, for the period 1995 to 1999. Due to lack of data availability, the geographic segment data for 1999 shows fixed assets rather than total assets.

		1995		1996		1997		1998		1999	
	Geographic Segment	DEM	%	DEM	%	DEM	%	DEM	%	DEM	%
Total Sales	Germany	59,628	82.4	60,648	81.3	59,079	71.4	55,442	66.3	63,480	61.3
	Euro Area									9,870	9.5
	Other European Countries	6,439	8.9	6,690	9.0	11,454	13.8	15,022	17.9	5,072	4.9
	North America	5,208	7.2	6,090	8.2	8,715	10.6	9,370	11.2	15,889	15.4
	Other Countries	1,097	1.5	1,113	1.5	3,471	4.2	3,850	4.6	9,174	8.9
	Total	72,372	100.0	74,541	100.0	82,719	100.0	83,684	100.0	103,485	100.0
Total Assets	Germany	60,671	89.5	61,910	86.1	65,500	81.3	64,470	78.8	26,257	73.0
	Euro Area									1,369	3.8
	Other European Countries	2,885	4.3	4,677	6.5	5,667	7.0	7,830	9.6	2,413	6.7
	North America	3,097	4.6	4,186	5.8	7,824	9.7	6,690	8.2	3,839	10.7
	Other Countries	1,098	1.6	1,144	1.6	1,604	2.0	2,790	3.4	2,073	5.8
	Total	67,751	100.0	71,917	100.0	80,595	100.0	81,780	100.0	35,952	100.0

Table 3: Derivatives Positions

The table shows the derivatives positions of VEBA by maturity, instrument and currency for maturities between January 1997 and December 1998 for transactions with settlement date within that calendar year. The table reports the number of contracts during that year (Contracts), the notional amounts (Notional Amount) as well as the absolute notional amounts (Absolute Notional Amount) in Deutsche Mark.

		01/01/1997 - 31/12/1997			01/01/1998 - 31/12/1998		
Type of Instrument	Currency	Contracts	Notional Amount	Absolute Notional Amount	Contracts	Notional Amount	Absolute Notional Amount
Options	U.S. Dollar	6	10,102,794	12,985,628	86	-52,719,717	256,408,827
	Japanese Yen	27	2,371,729	3,124,872	10	11,624,375	19,026,875
	British Pound	2	-1,157,210	1,157,210	45	29,506,043	92,718,030
	Swiss Franc				1	3,144,466	3,144,842
	Swedish Krona				2	-89,098	542,084
Cash, Forwards, Swaps	U.S. Dollar	133	90,547,292	1,448,632,809	169	59,698,046	3,681,917,134
	Hong-Kong Dollar	20	60,625,078	64,674,481	18	1,585,085	7,562,302
	Japanese Yen	41	16,701,101	142,421,112	48	49,814,722	192,981,434
	Swiss Franc	30	-9,423,107	278,170,607	23	-21,541,958	348,463,789
	British Pound	35	-8,430,423	293,825,382	54	24,511,295	681,685,117
	Australian Dollar	11	6,724,891	14,755,732	11	-487,830	5,962,424
	Danish Krone	9	3,442,340	30,138,052	8	-3,665,359	19,477,800
	Singapore Dollar	7	3,127,087	6,249,461	5	109,359	5,738,182
	Polish Zloty	3	-2,357,186	13,798,389	2	-862,923	4,256,057
	Argentine Peso	6	-1,848,623	1,897,327	9	-1,655,550	1,845,561
	Swedish Krona	13	1,625,942	132,454,117	32	47,278,606	208,145,048
	Czech Koruna	9	-630,441	11,717,628	7	3,087,536	17,573,321
	Hungarian Forint	4	317,257	7,636,395	4	222,964	10,831,678
	Greek Drachma	1	171,707	171,707	4	74,445	324,445
	Canadian Dollar	5	139,764	845,341	7	-26,815	3,215,926
	Kuwait Dinar	4	-115,222	743,979	2	-186,719	403,333
	Norwegian Krone	3	70,804	629,915	10	-1,291,179	17,073,490
	South African Rand	1	-61,390	61,390	5	-975,988	2,726,888
	New Zealand Dollar	2	45,187	45,187		0	0
	Thai Baht	4	26,075	636,624	4	-334,694	814,021
	Malaysia Ringgits	1	9,361	9,361	2	18,527	23,909
	Venezuelan Bolívar	0	0	0	2	-27,469	1,805,572
	Chinese Renminbi Yuan	0	0	0	2	-31	4,829

Table 4: Summary Statistics of Variables

The table reports summary statistics of the dependent and independent variables. The cash flow variables are calculated as the monthly level changes scaled by contemporaneous sales. Stock market variables and exchange rate variables are log differences. R_{VEBA} and R_M denote the log difference in the total return indices of VEBA and the German stock market, respectively, in excess of the risk-free rate. FX Index represents the Bank of England trade-weighted foreign exchange index of the Deutsche Mark. The interest rate variables R_{ST} and R_{DS} are defined as the change in the short-term interest rate divided by one plus the long-term rate, and the change in the term-spread divided by one plus the long-term rate respectively. The German ten-year government bond benchmark yield serves as the long-term interest rate and the German three-month Euro-Mark interest rate as the short-term interest rate. All foreign exchange rates are expressed in Deutsche Mark per unit of foreign currency. Panel A shows descriptive statistics of different variables, while Panel B shows correlations between the cash flow variables and stock returns. [a], [b], and [c] indicate significance at the 1%, 5%, and 10% level, respectively. All variables are stationary according to the Phillips-Perron Unit Root Test.

Panel A: Descriptive Statistics

Variable		Mean	Std.	Minimum	Median	Maximum
Cash flow variables	Operating	-0.0031	0.0570	-0.1104	-0.0114	0.1691
	Investing	-0.0057	0.2201	-0.6461	0.0092	0.6161
	Financing	-0.0003	0.2980	-0.9163	0.0142	0.7756
	Total Cash Flow	-0.0081	0.1457	-0.3886	0.0077	0.3783
Stock market variables	R_{VEBA}	0.0065	0.0699	-0.1695	0.0152	0.1531
	R_M	0.0172	0.0562	-0.1787	0.0284	0.1320
Foreign exchange and interest rates	FX Index	0.0023	0.0069	-0.0129	0.0029	0.0192
	U.S. Dollar	0.0058	0.0243	-0.0536	0.0046	0.0608
	British Pound	0.0071	0.0226	-0.0389	0.0095	0.0483
	Japanese Yen	0.0067	0.0378	-0.0543	0.0041	0.1463
	Swedish Krona	0.0014	0.0175	-0.0288	-0.0008	0.0712
	Norwegian Krone	0.0013	0.0186	-0.0486	0.0020	0.0452
	R_{ST}	0.0001	0.0125	-0.0357	0.0000	0.0340
	R_{DS}	-0.0010	0.0186	-0.0340	-0.0025	0.0374

Panel B: Correlations of Cash Flow Variables and Stock Returns

	Total Cash Flow	Operating Cash Flow	Investing Cash Flow	Financing Cash Flow
Operating Cash Flow	0.097			
Investing Cash Flow	-0.233	0.347[b]		
Financing Cash Flow	0.626[a]	-0.344[b]	-0.891[a]	
R_{VEBA}	-0.045	-0.304[b]	-0.039	0.051

Table 5: Cash Flow Regressions

The table reports the results of the following regression, estimated between January 1996 and December 1999:

$$CF_t = \alpha + \sum_{i=1}^{N} \delta_i R_{FX,t}^{(i)} + \phi_1 R_{ST,t} + \phi_2 R_{DS,t} + \varepsilon_t$$

where CF_t denotes the change in cash flow *i* scaled by the level of total sales. OCF, ICF, FCF and TCF refer to Operating Cash Flow, Investment Cash Flow, Financing Cash Flow and Total Cash Flow, respectively. $R_{FX,t}^{(i)}$, $R_{ST,t}$, and $R_{DS,t}$ denote the percentage change of foreign currency *i*, the change in the short-term interest rate divided by one plus the long-term rate, and the change in the term-spread divided by one plus the long-term rate, respectively. All variables are also interacted with a dummy variable D_{EUR} with a value of 1 after January 1, 1998 and 0 otherwise. Dummy variables are further used to control for potential seasonality effects. USD, GBP, JPY, SEK, NOK, and FX Index represent percentage changes of the U.S. Dollar, the British Pound, the Japanese Yen, the Swedish Krona, the Norwegian Krone, and the Bank of England trade-weighted foreign exchange index of the Deutsche Mark. The German ten-year government bond benchmark yield serves as the long-term interest rate and the German three-month Euro-Mark interest rate as the short-term interest rate. All regressions include monthly dummy variables. For each variable, the table shows the estimated coefficient and *p*-value (in parentheses). *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Adj. R-Square is the adjusted R-Squared of the regression.

								Foreign Exchange Rates											
	Dependent Variable	Intercept	Intercept_Euro	R_{ST}	R_{ST}_Euro	R_{DS}	R_{DS}_Euro	FX Index	Index_ Euro	USD	USD_ Euro	GBP	GBP_ Euro	JPY	JPY_ Euro	NOK	NOK_ Euro	SEK	SEK_ Euro	Adj. R-Square
(1)	Operating CF	0.074**	-0.006	-0.298	-0.094	0.720	-1.746*	-0.984	2.399											0.411
		(0.022)	(0.679)	(0.834)	(0.950)	(0.309)	(0.069)	(0.536)	(0.332)											
	Investment CF	0.108	0.030	0.888	-0.453	0.432	-1.390	4.028	-1.775											-0.227
		(0.530)	(0.707)	(0.911)	(0.957)	(0.912)	(0.789)	(0.650)	(0.897)											
	Financing CF	-0.305	-0.078	-7.461	9.084	-2.536	3.044	-10.125	7.032											0.014
		(0.151)	(0.416)	(0.441)	(0.380)	(0.594)	(0.630)	(0.350)	(0.672)											
	Total CF	-0.140	-0.053	-7.135*	8.967**	-1.336	0.235	-6.736	6.282											0.342
		(0.102)	(0.174)	(0.072)	(0.036)	(0.483)	(0.926)	(0.124)	(0.347)											
(2)	Operating CF	0.069**	0.003	-0.716	0.662	0.431	-1.948**			-0.685	1.449	0.968	-1.785*	-0.710*	0.985*	0.098	0.930			0.540
		(0.039)	(0.829)	(0.604)	(0.657)	(0.564)	(0.036)			(0.269)	(0.152)	(0.103)	(0.074)	(0.078)	(0.074)	(0.887)	(0.250)			
	Investment CF	0.286	0.001	-1.608	0.991	1.952	0.349			0.781	-6.649	0.231	5.353	0.807	-0.903	-5.949	5.088			-0.280
		(0.174)	(0.994)	(0.856)	(0.918)	(0.684)	(0.951)			(0.843)	(0.303)	(0.950)	(0.392)	(0.748)	(0.793)	(0.187)	(0.327)			
	Financing CF	-0.536**	-0.040	-5.673	8.584	-5.244	1.450			-1.304	6.249	-1.336	-3.871	-2.073	2.540	8.112	-6.662			-0.045
		(0.043)	(0.699)	(0.602)	(0.466)	(0.376)	(0.835)			(0.787)	(0.426)	(0.768)	(0.611)	(0.501)	(0.546)	(0.143)	(0.295)			
	Total CF	-0.201*	-0.035	-8.177*	10.473**	-2.780	0.131			-1.067	0.546	-0.208	-0.294	-1.865	2.453	2.194	-0.278			0.255
		(0.064)	(0.415)	(0.078)	(0.039)	(0.258)	(0.964)			(0.593)	(0.865)	(0.912)	(0.925)	(0.150)	(0.166)	(0.331)	(0.915)			

(continued)

Table 5 Cash Flow Regression (continued)

										Foreign Exchange Rates										
	Dependent Variable	Intercept	Intercept_Euro	R_{ST}	R_{ST}_Euro	R_{DS}	R_{DS}_Euro	FX Index	Index_ Euro	USD	USD_ Euro	GBP	GBP_ Euro	JPY	JPY_ Euro	NOK	NOK_ Euro	SEK	SEK_ Euro	Adj. R-Square
(3)	Operating CF	0.052	0.003	-0.558	0.463	0.319	-1.991**			-0.665	1.500*	0.679	-1.681*	-0.759**	0.982*			0.897	0.413	0.614
		(0.120)	(0.786)	(0.658)	(0.743)	(0.657)	(0.027)			(0.268)	(0.098)	(0.208)	(0.062)	(0.045)	(0.054)			(0.260)	(0.670)	
	Investment CF	0.247	0.014	-1.566	3.145	-0.263	0.804			-2.263	-3.596	1.329	3.922	0.896	-0.175			2.179	-2.851	-0.377
		(0.301)	(0.874)	(0.864)	(0.760)	(0.960)	(0.897)			(0.602)	(0.575)	(0.731)	(0.535)	(0.734)	(0.961)			(0.704)	(0.687)	
	Financing CF	-0.525*	-0.056	-5.623	4.851	-1.942	0.299			3.441	1.327	-3.103	-1.705	-2.165	1.490			-3.588	5.863	-0.130
		(0.080)	(0.596)	(0.618)	(0.701)	(0.762)	(0.969)			(0.518)	(0.866)	(0.515)	(0.825)	(0.504)	(0.733)			(0.610)	(0.501)	
	Total CF	-0.25**	-0.037	-7.85*	8.501*	-1.611	-0.746			0.757	-1.174	-1.088	0.399	-1.836	2.004			-0.972	3.984	0.281
		(0.034)	(0.365)	(0.082)	(0.093)	(0.519)	(0.801)			(0.713)	(0.700)	(0.555)	(0.894)	(0.152)	(0.244)			(0.722)	(0.243)	
(4)	Operating CF	0.085**	0.003	0.153	-0.079	0.935	-1.956**			-0.958*	2.348**	1.155*	-2.237**							0.501
		(0.010)	(0.838)	(0.907)	(0.957)	(0.196)	(0.037)			(0.094)	(0.011)	(0.052)	(0.024)							
	Investment CF	0.210	0.022	-3.496	3.679	0.371	0.743			-0.811	-5.436	1.120	4.695							-0.195
		(0.266)	(0.776)	(0.657)	(0.672)	(0.930)	(0.890)			(0.808)	(0.301)	(0.744)	(0.407)							
	Financing CF	-0.424*	-0.068	-2.017	3.774	-2.510	0.854			0.615	5.069	-2.454	-3.198							-0.011
		(0.077)	(0.489)	(0.837)	(0.727)	(0.636)	(0.898)			(0.882)	(0.437)	(0.567)	(0.649)							
	Total CF	-0.147	-0.042	-5.619	7.802*	-1.192	-0.074			-1.065	1.706	-0.189	-0.863							0.255
		(0.138)	(0.312)	(0.179)	(0.094)	(0.593)	(0.979)			(0.542)	(0.532)	(0.916)	(0.769)							

Table 6: Stock Price Regressions

The table reports the results of the following regression, estimated between January 1996 and December 1999:

$$R_t = \alpha + \beta R_{m,t} + \sum_{i=1}^{N} \delta_i R_{FX,t}^{(i)} + \phi_1 R_{ST,t} + \phi_2 R_{DS,t} + \varepsilon_t$$

where R_t and $R_{m,t}$ denote the return on VEBA stock and the return on a local stock market index (R_M), respectively, in excess of the risk-free rate. $R_{FX,t}^{(i)}$ is the return on foreign exchange variable *i*. $R_{ST,t}$ and $R_{DS,t}$ are defined as the change in the short-term interest rate divided by one plus the long-term rate and the change in the term spread divided by one plus the long-term rate, respectively. All variables are also interacted with a dummy variable D_{EUR} with a value of 1 after January 1, 1998 and 0 otherwise. USD, GBP, JPY, SEK, NOK, and FX Index represent percentage changes of the U.S. Dollar, the British Pound, the Japanese Yen, the Swedish Krona, the Norwegian Krone, and the Bank of England trade-weighted foreign exchange index of the Deutsche Mark. The German ten-year government bond benchmark yield serves as the long-term interest rate and the German three-month Euro-Mark interest rate as the short-term interest rate. For each variable, the table shows the estimated coefficient and *p*-value (in parentheses). Panel A shows regressions with market index, while Panel B shows regression without market index. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Adj. R-Square is the adjusted R-Squared of the regression.

									Foreign Exchange Rates												
	Intercept	Intercept_Euro	R_M	R_{M_Euro}	R_{ST}	R_{ST}_Euro	R_{DS}	R_{DS}_Euro	FX Index	Index_ Euro	USD	USD_ Euro	GBP	GBP_ Euro	JPY	JPY_ Euro	NOK	NOK_ Euro	SEK	SEK_ Euro	Adj. R-Square
Panel A: Regressions with Market Index																					
(1)	0.011	-0.036*	0.788**	-0.312	-0.415	-0.536	0.037	0.629	0.618	1.381											0.354
	(0.419)	(0.054)	(0.011)	(0.380)	(0.792)	(0.766)	(0.962)	(0.553)	(0.752)	(0.624)											
(2)	0.011	-0.038*	0.763**	-0.246	-0.566	-0.490	0.045	0.617			-0.530	-0.164	0.435	0.408	0.410	-0.085	0.591	-0.172			0.288
	(0.450)	(0.064)	(0.037)	(0.563)	(0.749)	(0.806)	(0.959)	(0.599)			(0.491)	(0.888)	(0.572)	(0.721)	(0.424)	(0.888)	(0.507)	(0.882)			
(3)	0.012	-0.039*	0.812**	-0.268	-0.424	-0.580	-0.009	0.658			-0.444	-0.151	0.232	0.574	0.287	0.014			0.470	-0.267	0.277
	(0.412)	(0.055)	(0.023)	(0.521)	(0.810)	(0.772)	(0.992)	(0.580)			(0.555)	(0.895)	(0.750)	(0.612)	(0.570)	(0.981)			(0.634)	(0.828)	
(4)	0.011	-0.035*	0.830**	-0.292	-0.755	-0.181	-0.015	0.930			-0.263	-0.262	0.287	0.593							0.325
	(0.431)	(0.069)	(0.016)	(0.459)	(0.644)	(0.922)	(0.986)	(0.403)			(0.703)	(0.807)	(0.683)	(0.585)							
Panel B: Regressions without Market Index																					
(1)	0.019	-0.038*			-1.633	0.626	-0.300	1.209	2.587	0.366											0.169
	(0.207)	(0.068)			(0.343)	(0.752)	(0.730)	(0.311)	(0.213)	(0.904)											
(2)	0.015	-0.033			-1.628	0.445	0.015	0.892			-0.153	-0.082	0.953	-0.388	0.490	-0.208	1.132	-0.134			0.125
	(0.365)	(0.130)			(0.390)	(0.836)	(0.987)	(0.492)			(0.853)	(0.948)	(0.244)	(0.753)	(0.388)	(0.754)	(0.234)	(0.912)			
(3)	0.017	-0.036			-1.485	0.391	-0.068	0.956			0.118	-0.090	0.627	-0.220	0.269	-0.053			0.713	0.011	0.076
	(0.294)	(0.111)			(0.444)	(0.859)	(0.945)	(0.476)			(0.883)	(0.941)	(0.437)	(0.860)	(0.637)	(0.937)			(0.521)	(0.994)	
(4)	0.017	-0.033			-1.846	0.882	-0.046	1.175			0.356	-0.119	0.709	-0.179							0.127
	(0.298)	(0.120)			(0.305)	(0.668)	(0.962)	(0.352)			(0.628)	(0.916)	(0.362)	(0.882)							