RIDING ON THE WEAK SWEDISH KRONA: IS PRODUCTIVITY PAYING THE PRICE?

AN EMPIRICAL ANALYSIS OF THE WEAKENING SWEDISH KRONA'S IMPACT ON THE PRODUCTIVITY OF SWEDISH FIRMS

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Abstract:

In this paper, we aim to examine the impact of the depreciation of the Swedish krona on Swedish companies' productivity using a Generalized Method of Moments methodology, where we measure productivity as labor productivity and total factor productivity. To comprehensively understand the phenomenon, we initially analyze the firms' real exchange rate exposure to stock returns and firm-level profitability. We conduct the empirical analysis on a panel dataset of 360 companies listed on Nasdaq Stockholm in 2023. The dataset is divided into ten industries, where we split the industries into high- and low-exporting and expect the high-exporting industries to be more exposed to currency fluctuations. We find a time lag between the Swedish krona's depreciation and the impact on contemporary firm-level productivity. Additionally, we observe a relationship between a weaker domestic currency and higher profitability, albeit statistically insignificant. Furthermore, stock returns correlate negatively with exchange rate fluctuations, implying that a stronger SEK is related to a higher stock return.

Keywords: Swedish Krona, Exchange Rate, Currency Exposure, Profitability, Productivity

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1. Introduction

Between 2010 and 2023, the Swedish krona depreciated against the US dollar and the Euro by 32% and 17%, respectively (Riksbanken, 2024). Since Sweden is a small export-dependent country, the substantial depreciation of the Swedish krona has induced discussions and debates regarding its impact on domestic firms' profitability and productivity. Sweden has had a positive trade balance since the mid-1980s (Statistics Sweden, 2024c), and in 2022, exports of goods and services comprised 53% of Sweden's GDP (Öljemark, 2024). Additionally, Sellgren (2023a) reports that 46% of the exports in 2022 were conducted in EUR, followed by 41% in SEK and 8% in USD. Accordingly, the Swedish kronas' relationship with the EUR and USD affects the companies and the country's prosperity.

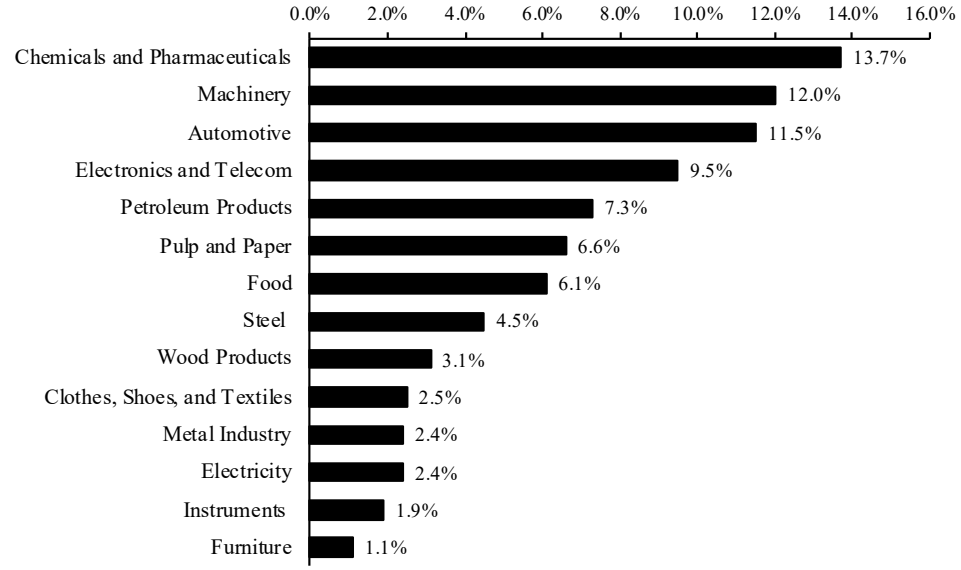
Furthermore, there are ongoing discussions regarding the impact of the weakening Swedish krona on firm-level performance. Johan Hjertsson, CEO of the investment company Latour, emphasizes the opportunity enclosed with a weak domestic currency for exporting companies in the short run. He suggests that a weak krona induces more competitive products and services internationally. However, he acknowledges the conceivable challenges of losing productivity in the long run due to the possibility of riding on a weak krona (Hultgren, 2023). Moreover, Swedish multinational enterprises' productivity has been decelerating since 2006, with the manufacturing sector experiencing an average annual productivity growth of 1%. This contrasts with global competitors' 1.5% productivity growth, indicating a potential competitive disadvantage for Swedish industries. Sven-Olov Daunfeldt, Chief Economist, Svenskt Näringsliv, emphasizes a critical concern that low productivity growth may compromise Sweden's resilience to looming economic challenges. (Svidén, 2022) Thus, a weaker Swedish krona may have been an essential aspect of Swedish firms' competitiveness, boosting the profitability among high-exporting enterprises. Nevertheless, there are concerns regarding how the weak krona affects long-term prosperity and firm-level productivity.

In this paper, we perform an empirical analysis to determine the implications of the weakening Swedish krona on the productivity of publicly listed Swedish firms. Yet, we initially measure the impact of exchange rate fluctuations on stock returns and firm-level profitability. We conduct these analyses as a first step to understand

whether stock prices and firm fundamentals are sensitive to exchange rate fluctuations. Subsequently, we examine how firm-level productivity is impacted by the fluctuation of the SEK against the USD and EUR. Lastly, we analyze whether highly stock return-exposed companies encounter negative productivity over the sample period.

The analysis is conducted on 360 companies, all listed on Nasdaq Stockholm in 2023. Exhibit 3 divides the industries provided by Nasdaq (Appendix 5) into high- and low-exporting industries, in line with Business Sweden's division in Exhibit 1 (Sellgren, 2023b). Moreover, we exclude financial companies due to their divergent accounting principles.

Exhibit 1. Share of Swedish Exports in 2022



Source: Global Export 2023, Business Sweden

Considerable previous literature prevails regarding how exchange rate fluctuations affect stock returns. Adler and Dumas (1984) and Jorion (1990) examine the correlation between currency fluctuations and stock returns, subsequently inspiring numerous papers. However, limited research has been conducted on how exchange rates impact firm fundamentals, like profitability and productivity. Nevertheless, Goddard et al. (2005) and McDonald (1999) analyze profitability determinants, whereas Bloom and Van Reenen (2007) and Syverson (2011) examine productivity drivers. Henceforth, we use inspiration from these papers' methodology and extend the analysis by including currency fluctuations as a potential profitability and productivity determinant.

Our initial results establish a positive correlation between stock returns and a stronger Swedish krona. Moreover, while not reaching statistical significance, a decrease in the domestic currency positively impacts the firm-level profitability. This effect is more prominent for firms heavily engaged in export activities. Further, our analysis presents a negligible impact on firm-level productivity from contemporary movements in the real exchange rate. However, we observe a statistically significant relationship between lagged real exchange rates and contemporary productivity deteriorations among high-exporting firms. Additionally, when combining the industries' exchange rate exposure and currency movements, we primarily obtain insignificant relationships with productivity.

Our study contributes with empirical analysis to the ongoing discussions regarding the impact of the SEK depreciation on Swedish firms. Hence, through quantitative analysis, we observe that more extended periods of a weakening SEK may deteriorate the productivity among Swedish companies. Therefore, the short-term gains of boosted profitability due to the weakening krona may deteriorate long-term productivity, implying that riding on the SEK depreciation should not be considered a long-term competitive advantage.

2. Previous Research

In this section, we present theories and existing literature regarding exchange rate exposure and papers that outline methodologies for determining profitability and productivity drivers. Henceforth, we use these findings to determine our hypothesis and methodology and subsequently compare them to our results.

2.1 Baseline Theory

2.1.1 Marshall-Lerner Condition and Operating Exposure Theory

The Marshall-Lerner condition addresses how exchange rate fluctuations affect a country's trade dynamics with foreign countries. The condition states that a domestic currency depreciation increases the country's trade balance, given that export and import volumes are sensitive to price changes (Black et al., 2012). The Marshall-Lerner condition serves as a framework for the analysis in this paper as it suggests that a depreciation of the SEK induces cheaper exports from Sweden for foreign countries and, conversely, more expensive imports for Sweden. Given that Sweden and its trade allies alter their trading volume due to price fluctuations, the domestic currency depreciation benefits Sweden's outlook regarding an increased trade balance. Moreover, Swedish firms may face fluctuations in their profitability due to the changes in the real exchange rates, an effect called operating exposure. Typically, domestic currency depreciation benefits exporting firms due to decreased costs and increased revenues but conversely hurts importing firms. (Bekaert and Hodrick, 2012)

2.1.2 Mitigating Exchange Rate Exposure Activities

When examining exchange rate exposure, hedging activities require consideration since multinational firms commonly hedge their exposure using financial and operational hedging instruments (Bekaert and Hodrick, 2012). In an empirical analysis of manufacturing firms from diverse countries, Bartram et al. (2009) reveal a more negligible exchange rate exposure for exporting firms than predicted according to estimated models. The study indicates that firms are aware of their gross exchange rate exposure and implement strategies such as customer pass-through, operational hedging, and financial risk management to mitigate these fluctuations, leading to a low net effect.

Consequently, such strategies can reduce the firm's exchange rate exposure by approximately 70%. (Bartram et al., 2009)

Additionally, Bodnar et al. (2002) explore how firms transfer exchange rate exposure to their customers to maintain lower levels of risk. Their findings suggest that companies with higher market share and lower substitutability of their offering can efficiently pass through the exchange rate shock to foreign prices and thus minimize their exposure. Based on these findings, an exporting firm could utilize a domestic currency depreciation to reduce prices and expand market share in the importing country or maintain the price level to boost profit margins.

2.1.3 The Exchange Rate Disconnect Puzzle

Previous research encounters diverse results when analyzing the impact of exchange rates on stock returns. Hence, a long-standing puzzle in international economics is connecting macroeconomic fundamentals to exchange rate fluctuations. Meese and Rogoff (1983) analyze this area, later described as the exchange rate disconnect puzzle. The authors find that the random walk and univariate time series models explain the relationship of exchange rates between countries with similar inflation rates and fundamental variables equally well. Accordingly, exchange rate fluctuations are likely to follow a random walk and thus be disconnected from various macroeconomic fundamentals. Additionally, the Chief of the Swedish Central Bank points out that exchange rates often reflect factors like hedging and speculation, which do not correspond directly to Sweden's economic fundamentals, consistent with the disconnect puzzle (Thedéen, 2023). This phenomenon indicates that fluctuations in the Swedish krona may be relatively independent of the country's economic conditions.

2.2 Exchange Rates' Impact on Stock Returns

Numerous previous studies analyze the impact of exchange rate exposure on stock returns and firm value. Adler and Dumas (1984) were among the first researchers to outline a methodology to empirically test the impact of exchange rate exposure on stock returns. The methodology comprises a linear regression with stock prices as the dependent variable and exchange rates as the independent variable. Henceforth, Jorion (1990) utilizes this methodology and extends it by incorporating the market return as a

complimentary independent variable in the linear regression to control for market movements.

Subsequently, several papers employ this methodology and analyze the effect exchange rate exposure has on firm value, showcasing diverse results. A paper by Williamson (2000) examines currency fluctuation's impact on firm valuations within the automotive sector, focusing on companies in the US and Japan. The automotive industry is distinguished by considerable exporting activities in a competitive environment, making it compelling to analyze in this context. The empirical analysis finds that an exporting company with costs denominated in the domestic currency faces significant exchange rate exposure. Specifically, the value of the US automotive firms decreases when the USD increases towards the Japanese Yen. Similarly, the Japanese automotive industry exhibits a decrease in firm value when the Yen increases to the USD. On the contrary, the US automotive enterprise's firm value benefits when the USD appreciates towards the Deutsche Mark. Additionally, the Japanese automotive industry showcases an insignificant correlation with the Deutsche Mark. (Williamson, 2000) Hence, these mixed results outline the complexity and potentially divergent impact of exchange rate exposure, which could depend on factors such as cost structures, foreign sales, competition, and an individual firm's hedging activities.

Moreover, He and Ng (1998) empirically analyze the Japanese stock returns of 171 multinational companies and find that high-exporting firms enjoy favorable stock market returns when the domestic currency depreciates. The paper thus indicates that exporting firms benefit when the domestic currency depreciates. On the contrary, Griffin and Stulz (2001) suggest that exchange rate fluctuations in the US have a negligible impact on stock returns. When analyzed over a longer horizon, the effect of exchange rate shocks on stock market valuation slightly increases. However, the impact remains small. Since the study is performed on stock returns, the findings do not neglect the potential impact of currency fluctuations on firm fundamentals (Griffin and Stulz, 2001). Nevertheless, the advantage of using stock market reactions compared to profitability metrics is the forward-looking feature of stock prices. In an efficient market, stock prices adjust quickly to fundamental news affecting the company, whereas financial statements depict historical performance (Berk and DeMarzo, 2017). Consistent with Griffin and Stulz (2001), the stock market may therefore consider the exchange rate shocks trivial to

the firm value, or alternatively, the market does not fully price the impact of exchange rate fluctuations.

Furthermore, Can and Soo (2011) extend the previous models for analyzing exchange rate exposure by including dynamic effects. The dynamic effects enclose lagged exchange rates as complementary independent variables in the regressions, arguing that there could be a lag before an exchange rate fluctuation impacts the stock returns. Their initial analysis uses the methodology outlined by Adler and Dumas (1984) and Jorion (1990) by including the contemporary exchange rate and the market return as independent variables. They observe significant results for four of the nine examined industries. Industrials and Health Care showcase a positive and significant coefficient, meaning that a depreciation of the USD correlates with higher stock returns. Conversely, Energy and Financials exhibit a negative and significant relationship. Technology, Materials, Consumer Staples, Utilities, and Consumer Discretionary henceforth showcase insignificant results. Further, when extending the analysis by including lagged exchange rates, they find significant results for most of their sample, albeit with mixed signs. (Can and Soo, 2011)

2.3 Exchange Rates' Impact on Profitability and Productivity

Limited empirical research studies currency fluctuations' effects on firm fundamentals. Hence, most previous analyses within the field focus on the exchange rate exposure to stock returns. Accordingly, our analysis builds on the findings from the existing research presented below, which determines factors affecting firm-level profitability and productivity.

2.3.1 Firm-level Profitability

Identifying sources and determinants of firm-level profitability has historically been a considerable research topic. Goddard et al. (2005) use a panel dataset from manufacturing and service companies to determine profitability drivers. The authors find that firm-level profitability correlates positively with a higher market share and liquidity ratio, while a negative correlation with size and the gearing ratio are identified. McDonald (1999) also employs a panel dataset, but for Australian manufacturing firms. He presents that lagged profitability and industry concentration are significant determinants of profitability.

Further, the study discusses the benefits of utilizing a panel dataset when analyzing profitability drivers. He argues that it diminishes the effect of simultaneity bias when including potential endogenous variables and allows for firm-specific, unobserved features that may affect the regression outcome. (McDonald's, 1999)

Moreover, Yeboah and Takacs (2019) are among the few researchers examining the impact of exchange rate fluctuations on profitability. They empirically analyze the effect of exchange rates on profitability among South African listed companies in the mining and manufacturing industries. They find that exchange rate fluctuations significantly negatively affect profitability within the manufacturing industry. Scilicet, a depreciation of the domestic currency RAND relative to the USD deteriorates the profitability of manufacturing companies (Yeboah and Takacs, 2019).

2.3.2 Firm-level Productivity

Equivalent to profitability, previous research has analyzed the determinants and sources of firm-level productivity. Syverson (2004) finds considerable differences in productivity levels among manufacturing firms within the same industry, showing a case where a plant at the 90th percentile produces almost twice as much output with the same estimated input as the 10th percentile plant. Subsequently, multiple theories try to explain the productivity differences raised by Syverson (2004). Bloom and Van Reenen (2007) show that internal factors such as higher-quality management practices correlate with higher labor and Total Factor Productivity ("TFP"). Further, Syverson (2011) suggests that investments in technology innovations affect firm-level productivity. He also emphasizes some firm-level factors that influence productivity, such as firm size, the organizational structure of the production units, and the industry they operate within.

Other external drivers have also been shown to affect productivity at a firm level. Hence, competition redistributes market share to more efficient producers, forcing less efficient firms to exit the market and thus paving the way for more productive firms. Competition may also induce firms to take productivity-enhancing actions they might not otherwise have taken (Syverson, 2011). In addition, competition within trade activities drives productivity differences among enterprises. Previous research finds that sectors facing new import competition experience faster productivity growth than sectors producing mainly non-tradable goods (Pavcnik, 2000). Further, firms experiencing an

increase in competition and subsequently innovating to remain competitive experience an increase in TFP (Bloom et al., 2011). Lastly, Fan et al. (2021) study the relationship between exports and productivity and find lower TFP growth in exporting enterprises than in non-exporting firms in China's agricultural industry.

3. Hypothesis Formulation

The paper's fundamental purpose is to quantitatively examine the impact of the depreciating SEK on Swedish companies' productivity (Hypothesis 3). To analyze the primary hypothesis, we divide the paper into distinct sub-sectional analyses and hypotheses to comprehensively understand the phenomenon. A narrative in news reporting is that exporting companies enjoy boosted profitability due to the weakening Swedish krona, which consequently conveys productivity deterioration (Hultgren, 2023; Svidén, 2022). Accordingly, our analyses examine exchange rate exposure on stock returns, profitability, and productivity. Lastly, we conduct a combined analysis of the effect of exposure and exchange rate on productivity metrics.

We outline the separate hypotheses for each analysis below. The first analysis is conducted on each industry separately, whereas the second and third are performed separately on the high- and low-exporting industries. Lastly, the fourth analysis is conducted on the dataset altogether.

3.1 Stock Return Exposure

Hypothesis 1: The depreciation of the Swedish krona correlates with higher stock returns for high-exporting industries

We formulate the first hypothesis based on the operating exposure theory alongside the efficient market hypothesis. The operating exposure theory proposes that exporting companies benefit from a domestic currency depreciation, and the efficient market hypothesis suggests that the stock market incorporates all fundamental news (Bekaert and Hodrick, 2012; Berk and DeMarzo, 2017). Accordingly, companies involved in exporting activities observe revenue boosts when the domestic currency depreciates, consequently boosting stock returns. The first sub-sectional analysis contributes to understanding the papers' fundamental purpose since it determines whether high-exporting industries are exposed to currency fluctuations, measured by stock returns.

Moreover, we employ the information regarding diverse product groups' exporting activities by Business Sweden in Exhibit 1 to divide the industries into high- and low-exporting industries in Exhibit 3 (Sellgren, 2023b). We assume that the high-

exporting industries, Basic Materials, Industrials, Energy, Health Care, Technology, and Telecommunications retain positive exposure, implying that a relatively weaker SEK correlates with a higher stock return. On the contrary, we assume that the low-exporting industries Consumer Goods, Consumer Services, Real Estate, and Utilities, face low exposure to exchange rate fluctuations.

3.2 Firm-level Profitability

Hypothesis 2: The depreciation of the Swedish krona relates positively to relatively higher profits and lower costs for high-exporting industries

We likewise utilize the operating exposure theory to outline the second hypothesis. Hence, a SEK depreciation leads to lower costs relative to the foreign denominated revenues. Consequently, currency fluctuations should have a tangible impact on profitability. Therefore, we expect the Operating Margin to correlate positively with currency fluctuations for high-exporting firms. On the contrary, the COGS Margin should negatively correlate with currency fluctuations as the costs decline relative to the revenues. See Equation 1 for the quotations of the exchange rates. Furthermore, we expect the relationships to be negligible for low-exporting firms, as the currency fluctuations impact their revenues and expenses equally. (Bekaert and Hodrick, 2012)

The second sub-sectional analysis is vital for determining the fundamental hypothesis. Hence, the news narrative outlines that exporting companies observe productivity deterioration due to profitability increases because of favorable currency fluctuation (Hultgren, 2023; Svidén, 2022). Henceforth, companies should experience higher profitability levels for the narrative to hold.

3.4 Firm-level Productivity

Hypothesis 3: When the Swedish krona depreciates, high-exporting industries experience a decline in productivity

The third hypothesis tests our fundamental research question, which we formulate in line with previous news reports and debates. Hence, we assume that high-exporting industries

enjoy a boost in profitability, leading to decreased productivity as firms continuously meet their performance targets (Hultgren, 2023; Svidén, 2022).

3.5 Combining Stock Return Exposure and Productivity

Hypothesis 4: Firms heavily exposed to foreign currency fluctuations experience decreased productivity

The last analysis examines the exposure coefficients and currency fluctuations' impact on the productivity metrics in a combined analysis. Hence, we aim to conclude the study and interpret our fundamental research question, which is whether currency-exposed companies experience a drop in productivity due to favorable currency fluctuations. Moreover, the fourth hypothesis proposes that companies largely exposed to exchange rate movements encounter negative productivity over the sample period.

Exhibit 2. Hypothesis Overview

Hypothesis:	High-Exporting Industries	Low-Exporting Industries	Full Sample
H1. Stock Return Exposure	Positive	Negligible	-
H2. Profitability	Positive/Negative	Negligible	-
H3. Productivity	Negative	Negligible	-
H4. Exposure-Productivity Combined	-	-	Negative

High-Exporting Industries: Basic Materials, Industrials, Energy, Health Care, Technology, and Telecommunications

Low-Exporting industries: Consumer Goods, Consumer Services, Real Estate, and Utilities

Notes: A positive relationship implies that the dependent variable increases when the SEK depreciates, while a negative relationship means that the dependent variable decreases when the SEK depreciates. A negligible relationship implies that the dependent variable is uncorrelated with exchange rate fluctuations.

4. Methodology

We employ a quantitative approach to examine our hypotheses and determine the effect of prolonged periods of a depreciated SEK on Swedish firms' stock returns, profitability, and productivity. Our objective is to determine whether such a relationship exists and, if so, to clarify the nature of these effects. We test our hypotheses against the EUR and USD since Sweden is exposed to these currencies in its exports of goods, and the currencies are among the most traded currencies in the world (Statistics Sweden, 2024b; Thaxton, 2023). Furthermore, we aim to investigate whether the impact varies between high- and low-exporting industries. Although we have encountered limited research in this field in a Swedish context, we base our study on the principles of the Marshall-Lerner condition, the operating exposure theory, and other international studies related to this topic.

This section first outlines the methodology for determining the correlation between currency fluctuations and stock returns. Subsequently, we present the method for analyzing the relationship between exchange rates and profitability and productivity. Lastly, we outline the approach for the combined analysis of stock return exposure and FX movements with firm-level productivity metrics.

4.1 Exchange Rates' Impact on Stock Returns

The initial step of the analysis involves quantifying the impact of currency fluctuations on companies listed on Nasdaq Stockholm stock returns' to determine the diverse industries' exposure to exchange rate fluctuations. We employ monthly stock returns segmented by industry and the simultaneous SEK fluctuation to EUR and USD. We determine the exchange rate where the foreign currency is the base currency, and SEK is the quote currency, that is, how much Swedish krona is needed to purchase one EUR or USD. Further, we employ the real exchange rates throughout the analyses, as it aims to estimate the country's purchasing power parity (Cassel, 1918). This section outlines how we calculate the real exchange rates ("RER") and excess exchange rates ("EER") and the regression methodology for determining the relationship between currency fluctuations and stock returns. Notably, the RER (1) and EER (3) calculations are repeated for the profitability and productivity analysis, albeit quarterly instead of monthly, to match the

financial data from quarterly reports. Additionally, we refer to three-month forward prices instead of one-month forward prices in the profitability and productivity analysis.

4.1.1 Calculating Real Exchange Rate

In line with the Purchasing Power Parity theory (Cassel, 1918), we use real exchange rates to compare currencies, which denote the nominal exchange rate times the ratio of the different price levels. Since we observe periods of inflation during the sample period, RER is more appropriate for determining the purchasing power between various currencies (Riksbanken, 2021). We use the Consumer Price Index ("CPI") indexed to 01-01-2010 for each currency to compute the RER.

We calculate the real exchange rates as follows:

$$Real\ Exchange\ Rate_t = \frac{Nominal\ exchange\ rate\left(\frac{FC}{SEK}\right)_t \times CPI_{Foreign\ country_t}}{CPI_{Domestic\ country_t}} \quad (1)$$

where FC is the foreign currency, EUR or USD.

Further, we calculate RER percentage changes month-over-month to match the exchange rate quotations with the stock returns:

$$Real\ Exchange\ Rate\ change_{\ t} = \frac{Real\ exhange\ rate_t}{Real\ exchange\ rate_{t-1}} \quad (2)$$

A positive RER change, namely, a value *t* greater than *t-1*, indicates that the foreign currency has appreciated and strengthened its position against the Swedish krona.

4.1.2 Calculating Excess Exchange Rate

Exchange rate exposure may be affected by the firm's ability to hedge against unfavorable currency movements. Therefore, we incorporate a metric to analyze how the excess exchange rate, denoting the difference between the spot and forward price, correlates with stock returns, profitability, and productivity. Nevertheless, Fama (1984) presents that the forward exchange rate is a weak predictor of future spot rates. He examines that the variation in forward rates is determined by risk premiums rather than the expected future spot prices. However, a detailed analysis of hedging activities is outside this analysis's

scope, and therefore, we employ forward rates as a proxy for the market's expectations of exchange rate fluctuations (Bekaert and Hodrick, 2012).

We calculate the excess exchange rate as follows:

$$Excess\ exchange\ rate_t = \frac{Spot\ price\left(\frac{FC}{SEK}\right)_t - Forward\ price\left(\frac{FC}{SEK}\right)_{t-1}}{Spot\ price\left(\frac{FC}{SEK}\right)_t} \quad (3)$$

where FC is the foreign currency, EUR or USD.

The excess exchange rate denotes the percentage difference between the contemporary spot price and the previous period's forward price relative to the spot price. A positive EER indicates that the spot rate exceeds the anticipated exchange rate. Namely, the Swedish krona is weaker than anticipated, and vice versa.

4.1.2 Exchange Rate Exposure on Stock Return

We use the model developed by Adler and Dumas (1984) and Jorion (1990) to determine which industries are most exposed to exchange rate fluctuations. Further, we extend the research by analyzing the excess exchange exposure to capture potential hedging activities and market expectations. Additionally, given the ambiguity in previous research regarding the correlation between stock returns and exchange rate movements, we consider the dynamic effects by including lagged RER variables in line with Can and Soo (2011). Including lagged variables allows for a potential delay before the currency fluctuations impact the stock returns. We thus include three lagged values of the exchange rates, namely, (t-1), (t-2), and (t-3).

Based on Nasdaq's breakdown, we apply the following Ordinary Least Square ("OLS") regressions to each of the ten industries (Exhibit 3). We employ the OLS regression methodology to replicate previous literature and utilize an asset pricing model to determine how stock returns correlate with exchange rates. Six regressions are executed in each industry: two with RER (4), two with EER (5), and two with the lagged RER (6), with EUR/SEK and USD/SEK exchange rates separately.

$$r_{it} = \alpha_i + \beta_{1_i} RER_t + \beta_{2_i} R_{M_t} + e_{it} \quad (4)$$

$$r_{it} = \alpha_i + \beta_{1_i} EER_t + \beta_{2_i} R_{M_t} + e_{it} \quad (5)$$

$$r_{it} = \alpha_i + \beta_{1_i} RER_t + \beta_{2_i} RER_{t-1} + \beta_{3_i} RER_{t-2} + \beta_{4_i} RER_{t-3} + \beta_{5_i} R_{M_t} + e_{it} \quad (6)$$

Where:

r_{it}: Individual monthly stock return

RER_t: Monthly real exchange rate change against EUR or USD

EER_t: Excess exchange rate against EUR or USD

RER_{t-1}: Lagged real exchange rate against EUR or USD

R_{M_t}: Monthly market return (SIXRX)

4.2 Exchange Rates' Impact on Profitability and Productivity

4.2.1 Estimating Profitability Metrics

We employ Operating Margin and COGS Margin as dependent variables to determine whether currency fluctuations depict profitability determinants. The Operating Margin captures how much a company earns before taxes and interest and thus also includes exchange rate gains and losses of an operating nature. This makes the EBIT Margin a relevant metric for capturing the effect of exchange rate fluctuations on firm-level profitability. Further, the COGS Margin captures the costs for each krona of sales, a metric for the production costs component of sales. Thus, lower costs relative to revenues innately boost profitability, and it is a complimentary metric to determine the direct impact on companies' relative costs from currency depreciation. (Berk and DeMarzo, 2017)

As the Hypothesis section outlines, we expect a weaker Swedish krona to reduce domestic costs and increase international sales, prompting higher profitability and lower costs for exporting firms.

$$Operating\ Margin_{it} = \frac{EBIT_{it}}{Sales_{it}} \quad (7)$$

$$COGS\ Margin_{it} = \frac{COGS_{it}}{Sales_{it}} \quad (8)$$

4.2.2 Estimating Productivity Metrics

Firm-level productivity is often determined as the relationship between the output and input ratio, with output usually quantified in sales or production volume and input

expressed as a combination of labor, capital, and materials employed in the production process. Productivity can be challenging to quantify, as mark-up effects and macroeconomic conditions may bias a firm's productivity. For instance, changes in a firm's market position or competitive landscape may affect the prices that firms charge for their goods and services. At the same time, macroeconomic factors such as a fluctuating exchange rate can impact the cost of inputs as well as the value of output. The latter is particularly relevant for firms involved in international trade (Katayama et al., 2009).

Firstly, we employ Labor Productivity ("LP") in this paper as it is a standard metric of firm-level productivity and is relatively easy to measure since the number of employees is the only input variable. However, since it is a single-factor measurement, it does not account for additional factors that could affect firm-level productivity, such as intermediate goods, capital, or technology used in production (Syverson, 2011). Hence, this underlines the need to include a multi-factor productivity metric.

Therefore, we complete the firm-level productivity analysis using Total Factor Productivity to capture additional factors that plausibly influence the output. However, there are inherent concerns regarding estimating TFP. Hence, TFP, at its core, is a residual since it depicts the variation in the observable output that the observable inputs cannot explain (Syverson, 2011). The concerns thus relate to endogeneity issues, selection bias, omitted price bias, and multi-product firms. Firstly, the endogeneity issues are associated with the simultaneity of observed inputs and outputs, leading to an ambiguous causal relationship. Even though higher input levels are assumed to cause a higher output, these decisions are not independently determined. A firm expecting higher output levels due to, for instance, an external chock of increased demand may increase its input levels. Secondly, the selection bias relates to the utilized unbalanced panel to determine TFP. Hence, all firms included in the study were listed on Nasdaq Stockholm 2023, even if they had not been on the stock exchange during the whole sample period. Thus, a selection bias occurs due to firms exiting the market, potentially causing boosted TFP figures since higher productivity firms are more likely to survive. In addition, firms with higher input levels are likely to survive independently of their productivity, potentially inflating the estimated productivity. Further, the TFP is calculated by omitting the individual firm's price levels and instead using the CPI to deflate the output and inputs.

Biases thus occur since one can assume variation in price levels between firms and industries, which could either under- or overestimate the firm's productivity. Lastly, there are issues related to multi-product firms or conglomerates since they exploit diverse inputs in their production and face varied demands for their output. (Van Beveren, 2012)

Given the risk of biases and measurement errors associated with estimating TFP, we use one single-factor metric, LP, and one multi-factor model, TFP, in our productivity analysis.

Labor Productivity

Labor productivity is defined as:

$$Labor\ Productivity_{it} = \frac{Real\ Sales_{it}}{No.of\ full\ time\ employees_{it}} \tag{9}$$

The sales output is defined as real sales, deflating total sales to remove the effect of price increases due to inflation and receive more comparable sales values over time. We adjust sales figures using CPI for Sweden according to below:

$$Real\ Sales_{it} = \frac{Total\ Sales_{it}}{CPI_{Sweden_t}} \tag{10}$$

Total Factor Productivity

We determine Total Factor Productivity through a Cobb-Douglas model, where the output is assumed to be a function of the observable inputs and the internal productivity (Van Beveren, 2012; Syverson, 2011):

$$Y_{it} = A_{it}K_{it}^{\beta_k}L_{it}^{\beta_l}M_{it}^{\beta_m} \tag{11}$$

Where Y_{it} is the observable output for firm *i* in quarter *t*. Likewise K_{it}, L_{it} and M_{it} are the observed capital, labor, and materials inputs. See Exhibit 6 for how we define the observable output and inputs. To obtain a linear production function, the natural logarithm is taken on all the observable inputs in equation (11):

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it} \tag{12}$$

The lower-case letters represent the natural logarithms of the observable input and outputs. To solve for the unobserved A_{it}, the following equation is utilized:

$$ln\,(A_{it}) = \beta_0 + \varepsilon_{it} \tag{13}$$

Hence, β_0 is the mean efficiency level of all firms over all periods and ε_{it} is the specific deviation from the mean of the particular firm *i* in a specific quarter *t*. $ln\,(A_{it})$ can thus be decomposed into the two following components: one observable or predictable (β_0), and one unobservable (v_{it}) as follows:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + v_{it} + u_{it}^q \tag{14}$$

Where $w_{it} = \beta_0 + v_{it}$ is the firm-level productivity and u_{it}^q represents an independent and identically distributed component, denoting deviations due to external circumstances or other measurement errors. To obtain the firm-level estimated productivity, we calculate the above regression (14) and determine it as follows:

$$\hat{w}_{it} = \hat{\beta}_0 + \hat{v}_{it} = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} \tag{15}$$

Lastly, to obtain the productivity level (TFP) for each firm at each observed period, we calculate the exponential of the $\hat{w}_{it}$:

$$\hat{\Omega}_{it} = e^{\hat{w}_{it}} \tag{16}$$

4.2.3 Handling Extreme Values

We apply a 1% winsorization to the profitability and productivity metrics to minimize sensitivity to extreme values. Winsorizing is a methodology where the extreme values, here the lowest 1% and the highest 1%, in the dataset, are replaced with the nearest less extreme values at the 1st and 99th percentile, respectively (Tukey and McLaughlin, 1963). An alternative approach involves removing extreme values rather than adjusting them. However, given the presence of missing data for other variables in our dataset, we opt for winsorizing the extreme values. Adjusting the outliers allows us to maintain the dataset's size rather than remove observations.

4.2.4 Generalized Methods of Moments

In line with Goddard et al. (2005) and McDonald (1999), we use a panel dataset to analyze profitability and productivity. A panel dataset includes cross-sectional and time-series data where the cross-sectional observations represent individual firms' financial

performance at each point in time. Hence, the same firms are observed over the sample period (Wooldridge, 2018). Moreover, a dynamic panel data model allows us to control for patterns among firms and over time. When examining how exchange rate movement affects firm-level profitability and productivity, we expect past firm-specific patterns, namely lagged observations, to influence current observations. Therefore, a dynamic panel data model is practical in these regressions, allowing previous outcomes of the dependent variable to correlate with the current level. (Ao, 2007)

Moreover, utilizing firm-level quarterly data and exchange rates to assess the effect of currency fluctuations on profitability and productivity, we employ a Generalized Method of Moments ("GMM") approach derived by Arellano and Bond (1991). This dynamic method is appropriate for dealing with endogeneity that may arise when including lagged dependent variables in a regression analysis since they likely correlate with the unobserved firm-specific effects. Hence, the Arellano and Bond (1991) method employs first-differencing to remove these firm-specific fixed effects. First-differencing thus refers to removing the unobserved firm-specific effects that are constant over time. Including lagged dependent variables as instruments in the GMM approach eliminates the noise from the unobserved factors and enables the determination of the true relationship.

We conduct the Arellano and Bond (1991) one-step estimator regression with a robust variance-covariance estimator in Stata (StataCorp, 2023b) using the *xtabond* command (StataCorp, 2023a). *Xtabond* performs the Arellano Bond (1991) GMM estimator and addresses the unobserved firm-specific effects using lagged dependent variables to provide the estimation. We use one lag of the dependent variable as the covariate, which is the default in the Arellano and Bond (1991) methodology.

GMM formula – One-step Arellano-Bond estimator

$$\hat{\delta}_1 = Q_1^{-1}(\sum_{i=1}^{N} X_{it}^{*\prime} Z_{it}) A_1 (\sum_{i=1}^{N} Z_i^{\prime} y_{it}^{*}) \tag{17}$$

where

$$Q_1 = (\sum_{i=1}^{N} X_{it}^{*\prime} Z_{it}) A_1 (\sum_{i=1}^{N} Z_{it}^{\prime} X_{it}^{*\prime}) \tag{18}$$

and

$$A_1 = (\sum_{i=1}^{N} Z_{it}' H_{it} Z_{it})^{-1} \quad (19)$$

In the dynamic panel data, y_{it} represents the dependent variable for each firm i in period t. The vector δ_1 denotes the estimated coefficients, including those for the specified independent variables.

The pivotal matrix Q_1 is a function based on instruments Z_{it} and the set of predetermined variables X_{it}^*, which encloses lagged values of the dependent variable. The weighting matrix A_1 is critical in the GMM estimator, assigning weights to various moment conditions. Within this framework, H_i is integral to the formation of A_1. (Ao, 2007)

The one-step and alternative two-step estimators yield similar coefficient estimates, where the asymptotic standard errors are often lower for the two-step estimates. However, previous papers have shown that the asymptotic standard errors may be downward biased in the two-step estimator, which is why most prior studies employ the one-step estimator. Nonetheless, heteroskedasticity may deteriorate the accuracy of the standard errors in the one-step estimator. Therefore, we utilize a robust variance-covariance estimator to address potential heteroskedasticity. (Arellano and Bond, 1991; Ao, 2007)

4.2.5 Implementation of GMM Regression

Firstly, we conduct regression analyses for each industry group to examine profitability. These analyses employ the profitability metrics Operating Margin and COGS Margin as dependent variables. Specifically, we execute the regressions separately with the two exchange rates (EUR/SEK and USD/SEK) and the RER and EER for each industry group. Additionally, we perform a final regression with lagged RER values for the preceding three quarters to capture the effects of exchange rate movements over the previous year. Hence, we aim to determine whether lagged variables better explain the potential effect exchange movement has on firm-level profitability and productivity. If so, we assume that there is a delay before the fluctuations materialize and affect firm fundamentals. We also include four control variables, discussed below. Further, we conduct the same regression analyses with the productivity metrics TFP and LP as dependent variables.

Hence, we conduct the following GMM regressions:

$$y_{it} = \sum_{j=1}^{p} \alpha_j \, y_{it-j} + RER_t\beta_1 + log\,(Mcap)_{it-1}\beta_2 + CurrentRatio_{it-1}\beta_3 + LeverageRatio_{it-1}\beta_4 + \gamma_i + \varepsilon_{it} \quad (20)$$

$$y_{it} = \sum_{j=1}^{p} \alpha_j \, y_{it-j} + RER_t\beta_1 + RER_{t-1}\beta_2 + RER_{t-2}\beta_3 + RER_{t-3}\beta_4 + log\,(Mcap)_{it-1}\beta_5 + CurrentRatio_{it-1}\beta_6 + LeverageRatio_{it-1}\beta_7 + \gamma_i + \varepsilon_{it} \quad (21)$$

where:

y_{it}: is the dependent variable for firm *i* and time *t.* In the profitability regression, *y* is defined as Operating Margin or COGS Margin, and in the productivity regression, *y* is defined as TFP or LP

α_j: is the coefficient for the lagged *j* values of the dependent variable (y_{it})

γ_i: unobserved firm-specific effects that are constant over time for each firm *i*

ε_{it}: is the idiosyncratic error term for firm *i* at time *t*

4.2.6 Control Variables

Various factors simultaneously affect individual firms' profitability and productivity, and using control variables aims to explicitly capture some of these effects and isolate the causal impact of the exchange rate on the respective dependent variables. Additionally, including relevant variables helps avoid omitted variable bias since excluding important variables may impair the predicted relationships between the dependent and included independent variables. However, including all variables that could potentially impact the specified profitability or productivity is unattainable. Further, over-specifying or including inadequate control variables will cause less efficient estimators. Hence, we employ theoretical predictions and previous research to determine which control variables to include in our analysis. The control variables thus consist of the lagged dependent variable, the natural logarithm of the Market Capitalization (MCAP), the Current Ratio, and the Leverage Ratio. See the rationale behind these control variables below. Hence, we lag all control variables to avoid the potential simultaneity bias where exchange rate shocks affect the contemporary dependent and control variables (Wooldridge, 2018).

Lagged (t-1) dependent variable

In line with McDonald (1999), we include a lagged dependent variable as a control variable, as profitability and productivity are assumed to be correlated over time. Hence, this allows us to account for historical aspects that affect the current differences in the dependent variable, which would otherwise be unobserved and challenging to control for (Wooldridge, 2018).

Lagged (t-1) Natural logarithm of the Market Capitalization

The natural logarithm of the firm's Market Capitalization (MCAP) is also included as a control variable, as we expect a correlation between size and the dependent variable. Given the potential economies of scale and scope, the correlation can be positive. Alternatively, the correlation can be negative, given the diseconomies of scale in growth stages. (Goddard et al., 2005)

Lagged (t-1) Current Ratio

Moreover, we include the liquidity ratio Current Ratio as a control variable and define it as Current Assets / Current Liabilities. It depicts whether firms have sufficient working capital to meet their short-term needs (Berk and DeMarzo, 2017). Accordingly, the Current Ratio shows how fast firms can react to sudden changes in their operations and environment. Hence, it is a potential determinant of whether the firm can maintain its profitability and productivity levels (Goddard et al., 2005).

Lagged (t-1) Leverage Ratio

Lastly, the Leverage Ratio is included and defined as Total Debt / Total Equity. A higher ratio indicates that the company relies more on external funding for its operations and is conceivably more risk-averse. Additionally, higher leverage ratios cause higher interest expenses. Accordingly, high-profitability firms inherently possess a higher debt capacity, and productivity is required to manage the higher interest costs. Hence, we assume that the Leverage Ratio positively correlates with profitable and productive firms. (Berk and DeMarzo, 2017)

4.3 Combining Analysis on Stock Return Exposure and Productivity

To examine whether there is a correlation between highly foreign exchange rate-exposed industries and lower productivity, we conduct a regression using the exposure coefficient from regression (4). The coefficient for the interaction term below reflects the additional effect on the productivity of a one-unit change in the exchange rate variable depending on how sensitive the industry is to currency fluctuations.

$$y_{ist} = \alpha + \theta\left(\hat{\beta}_{st} \times RER_t\right) + RER_t + \gamma_i + \epsilon_{it} \tag{22}$$

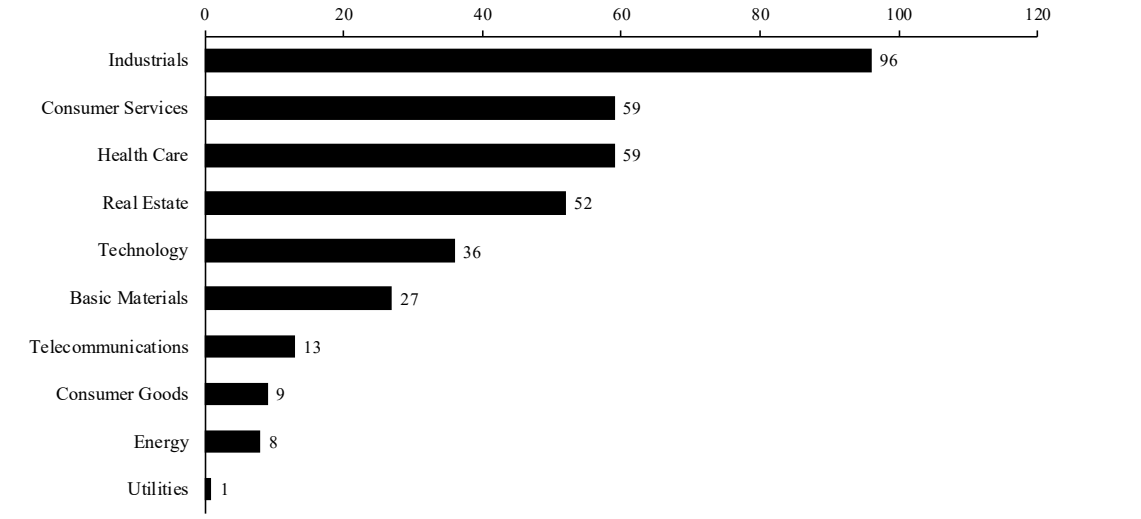
where y_{ist}: represents the dependent variable, Labor Productivity or TFP, for individual firm i in sector s at time t while θ is the coefficient for the interaction between the estimated coefficient $\hat{\beta}_{st}$ from equation (4). RER_t, is the quarterly RER change against EUR and USD. γ_i represents the fixed effects for each firm i accounting for unobserved heterogeneity that is constant over time, and lastly, ϵ_{it} represents the error term.

5. Data

This section outlines the data employed in our empirical analysis. The methodology used throughout the paper is fourfold since we examine stock return exposure, profitability, productivity, and the combined effect of productivity and stock return exposure. The combined productivity and stock return exposure regression (22) includes no additional data except the exposure coefficients received from the stock return exposure regression (4). Hence, we do not specifically outline the data required for this regression.

Moreover, the first stock return exposure regressions are conducted on a monthly frequency, whereas the profitability and productivity analyses are performed on a quarterly frequency. Consequently, the datasets used in these diverse analyses slightly differ. Accordingly, we divide this section into two parts: the first outlines the data needed for the stock return exposure regressions, and the second outlines the data required for the profitability and productivity analyses. Nevertheless, for the entire analysis, the sample consists of the 360 companies listed on Nasdaq Stockholm in 2023 (Nasdaq Stockholm, 2024). We replicate the industry split introduced by Nasdaq and supported by Sellgren (2023b) (Appendix 5 and Exhibit 1), which culminates in ten diverse industries when excluding the financial companies. Exhibit 3 below showcases the number of companies within each industry in 2023.

Exhibit 3. Industry Split 2023



5.1 Stock Return Exposure

The initial part of our analysis aims to replicate the models developed by (Adler and Dumas, 1984) and (Jorion, 1990), examining how exchange rate fluctuations affect stock returns. Accordingly, monthly stock returns, including dividends, from the 360 companies listed on Nasdaq Stockholm are downloaded from FactSet. Following the analysis by (Jorion, 1990), the stock market rate of return is included in the regressions. Hence, the SIX Return Index ("SIXRX"), exhibiting the average return on the Stockholm Stock Exchange, including dividends, is downloaded from Fondbolagen (Fondbolagen, 2024), and employed as a proxy for the market return.

Moreover, the SEK nominal exchange rates against EUR and USD are downloaded from the Swedish Central Bank (Riksbanken, 2024). To convert the nominal exchange rates to real exchange rates according to Equation 1 and 2, the Consumer Price Indexes are required and downloaded for Sweden from Statistics Sweden (Statistics Sweden, 2024a) and the US and the Eurozone from the Federal Reserve Bank of St. Louis (FRED, 2024). Lastly, the one-month forward exchange rates are downloaded from FactSet to determine the EER. See Appendix 2 for Descriptive Statistics.

Exhibit 4. Definition of Variables Exchange Rate Exposure

Variable	Type	Definition	Sources
Stock Returns	Dependent	Monthly stock market returns including dividends	FactSet
Real Exchange Rate Change	Independent	Real exchange rate_t / Real exchange rate_{t-1} - 1	FRED & Riksbanken
Excess Exchange Rate	Independent	$\left(S(\frac{FC}{SEK})_t - F(\frac{FC}{SEK})_{t-1}\right) / S(\frac{FC}{SEK})_t$	FactSet & Riksbanken
Lagged RER	Independent	Three lagged values of the RER, i.e., (t-1), (1-2), and (t-3)	FRED & Riksbanken
SIXRX	Control	Average return on the Stockholm Stock Exchange including dividends	Fondbolagen

Notes: Definitions are further clarified in the methodology section. FC is the Foreign Currency

5.2 Profitability and Productivity Data

We analyze profitability and productivity quarterly to match the reporting frequency of financial information by the firms in our sample. Similarly, we download exchange rates and CPIs quarterly to conform with the accounting figures. Likewise, three-month forward rates are retrieved from FactSet to calculate the excess exchange return on a quarterly frequency. Further, the profitability metrics employed are Operating Margin

and COGS Margin, and the productivity metrics are Labor Productivity and Total Factor Productivity. The control variables are the lagged dependent variable, the logarithm of the market capitalization, the current ratio, and the leverage ratio. See Appendix 3 for Descriptive Statistics.

Exhibit 5. Definition of Variables Profitability and Productivity

Variable	Type	Definition	Sources
Operating Margin	Dependent	$(\text{EBIT})_{it}$ / Sales_{it}	FactSet
COGS Margin	Dependent	$(\text{COGS})_{it}$ / Sales_{it}	FactSet
Labor Productivity	Dependent	Real Sales_{it} / $\text{No. of full time employees}_{it-1}$	FactSet
Total Factor Productivity	Dependent	$\widehat{\Omega}_{it} = e^{\widehat{w}_{it}}$	FactSet
Real Exchange Rate	Independent	$\left(S(\frac{FC}{SEK})_t \times CPI(FC)_t\right)$ / $CPI(SEK)_t$	FRED & Riksbanken
Excess Exchange Rate	Independent	$\left(S(\frac{FC}{SEK})_t - F(\frac{FC}{SEK})_{t-1}\right)$ / $S(\frac{FC}{SEK})_t$	FactSet & Riksbanken
Lagged RER	Independent	Three lagged values of the RER, i.e., (t-1), (1-2), and (t-3)	FRED & Riksbanken
Log(MCAP)_{t-1}	Control	Logarithm of the firms′ market capitalization	FactSet
$\text{Current Ratio}_{t-1}$	Control	$\text{Total Current Assets}_{it}$ / $\text{Total Current Liabilities}_{it}$	FactSet
$\text{Leverage Ratio}_{t-1}$	Control	Total Debt_{it} / Total Equity_{it}	FactSet
$\text{Dependent Variable}_{t-1}$	Control	Lagged Dependent variable	FactSet

Notes: Definitions are further clarified in the methodology section. FC is the Foreign Currency

5.2.1 Total Factor Productivity Data

As outlined in the methodology section, Total Factor Productivity is, at its core, a residual. Hence, we utilize observable inputs to receive TFP as an outcome of the production function. Syverson (2011) outlines that the observable inputs are output, capital, labor, and materials. Further, we deflate the output, capital, and material variables with CPI to adjust for inflation in line with the methodology presented by Syverson (2011). The exhibit below outlines our definition of the variables and the data we used for the observable inputs. See Appendix 4 for Descriptive Statistics.

Exhibit 6. Definition of Variables Total Factor Productivity

Variable	Variable Name	Definition	Sources
y_{it}	Log(Real Sales)	Logarithm of the Deflated Sales	FactSet & SCB
k_{it}	Log(Real Assets)	Logarithm of the Deflated Total Assets	FactSet & SCB
l_{it}	Log(Labor)	Logarithm of the Number of employees	FactSet
m_{it}	Log(Real Materials)	Logarithm of the Deflated Costs of Goods Sold ("COGS")	FactSet & SCB

Notes: Definitions are further clarified in the methodology section

6. Limitations

Due to the scope of this paper, the empirical analysis possesses limitations and potential shortcomings that could bias or impair the results. Hence, this section outlines the limitations enclosed with the research.

6.1 Industry Split and Exclusion of Import Analysis

When constructing the hypothesis and dividing the industries into high- and low-exporting groups, we mainly employ Sellgren's (2023b) information on how diverse product groups in Sweden export (Exhibit 1). However, as these product groups do not perfectly align with the industry split presented by Nasdaq (Appendix 5), there are weaknesses entailed with our hypothesis formulation in Exhibit 2. Hence, firms within the same industry may be heterogeneous regarding their exporting activities (Syverson, 2004). For example, Sellgren (2023b) presents that Chemicals and Pharmaceuticals is the product group with the highest export in 2022. Hence, chemicals and pharmaceutical companies are included in the Health Care industry. However, this industry also includes care services companies, which more resemble consumer services companies. This heterogeneity may impair the analysis since we employ the Nasdaq industries rather than determining export activities on a firm-level.

Although the export volume is critical for determining exchange rate exposure, there are other aspects besides this. For the operating exposure theory to hold, the costs should be denominated in the domestic currency and the revenues in the appreciated foreign currencies. Hence, if a high-exporting company imports most of its intermediate goods or has production facilities abroad, it will not benefit from the relatively lower domestic costs (Bekaert and Hodrick, 2012). Accordingly, one should assess the foreign revenue and domestic cost ratio on a firm-level to improve the analysis. However, a manual approach is required to collect the data for each firm and quarter due to difficulties finding this firm-specific data on available databases.

6.2 Hedging Activities

As presented in the Literature Review, multinational firms commonly hedge their exposure. However, controlling for all conceivable hedging activities is out of the scope of this study. Nevertheless, a financial hedging approach that we aim to control is the usage of forward contracts (Bekaert and Hodrick, 2012). When we conduct the excess exposure regressions (Equation 3), we assume that firms expect the previous periods' forward rate to be the current spot rate. Thus, firms can hedge against the exposure outlined by the forward contracts.

The outlined approach to assessing excess exposure encloses limitations. First, it presumes that all firms in the sample employ forward rates for their hedging activities. However, Bodnar et al. (1998) observe that 83% of the larger firms use derivatives to hedge, whereas only 12% of the smaller firms do. This divergence could partially be explained by the costs associated with hedging, which may not be justifiable for relatively small firms. Accordingly, there is heterogeneity amongst the hedging practices for the firms in the sample as we divide the firms per industry rather than size. Moreover, it is not certain that all firms consistently use the previous period's forward rate for their hedging activities since it is considered a weak predictor of future spot prices (Fama, 1984). Accordingly, a detailed analysis of each firm's hedging practices is necessary to comprehensively determine each firm's excess exchange rate exposure. However, such an analysis requires more detailed firm-level data and is beyond the scope of this paper.

6.3 Constraints of the Sample Period

The sample period for this analysis spans from 2010 to 2023, and we deliberately exclude the 2008 financial crisis and include the most recent years. These recent years are crucial for the analysis due to the prevailing weakening of the Swedish krona. However, the chosen sample period could bias the studies' results due to other macroeconomic events and instability, such as COVID-19. Hence, the pandemic has impacted domestic trading practices with foreign countries, where exporting companies have been reported to be more affected than non-exporting companies (Persson, 2020). Second, the Swedish krona has depreciated since the pandemic, and inflation has been high (Riksbanken, 2021).

Additionally, there is often a flight of liquid and stable currencies, like the USD and EUR, during uncertain macroeconomic times (Bekaert and Hodrick, 2012; Ranaldo and Söderlind, 2010). Since the SEK is a comparatively small currency, it may face reduction during economic instability.

6.4 Data Constraints

This section raises the more minor issues regarding the data, whereas we examine the broader limitation topics above.

Total Factor Productivity

To replicate the methodology for determining the firm-level Total Factor Productivity (Equation 11-16), deflated intermediate materials should be employed as real materials in the Cobb-Douglas model (Van Beveren, 2012; Syverson, 2011). Intermediate materials are the direct tangible inputs required to produce a product. Due to data limitations, we have employed real costs of goods sold as a proxy for intermediate materials. The costs of goods sold include the intermediate materials as well as direct labor costs (Berk and DeMarzo, 2017). Hence, as labor is another observable input in the TFP analysis, obtaining a clean material input is more appropriate.

Moreover, in line with Syverson (2011), we deflate the sales, assets, and materials with price indices. Nevertheless, to improve the analysis, it is practical to deflate the figures with the respective exchange rates to clean the productivity effect that may derive from the depreciation of the Swedish krona. Deflating for exchange rates requires calculating a separate TFP number for the USD and EUR, respectively. Alternatively, a weighted exchange rate can be determined. However, we use the methodology employed by Syverson (2011) and, in the next step, examine the impact of the diverse exchange rates on the productivity metric.

Employees Data

When downloading the employee data from FactSet, we aim to obtain the number of employees at the end of each quarter. Nevertheless, due to significant missing data, we also downloaded each company's average yearly number of employees. Consequently,

for the Labor Productivity and Total Factor Productivity analysis, we used the end-of-quarter figures when available and, otherwise, the average annual figures.

Survivorship Bias and Skewed Industries

Our sample consists of companies listed on Nasdaq Stockholm in 2023. However, not all companies listed in 2023 have been in the sample for the entire period, which may be leading to survivorship bias. Since the firms delisted from Nasdaq Stockholm between 2010 and 2023 are excluded from the sample, we only include the survivors in our analysis, which may bias the results. See 4.2.2 for a thorough discussion regarding how this affects TFP.

Further, in the stock return exposure analysis, we compare the results for the industries against each other, although the different industries include a diverse number of companies. Hence, Utilities include one company, whereas the Industrial industry comprises 96 companies. Likewise, for the profitability and productivity analysis, we compare high- and low-exporting industries, where the first group consists of 239 companies and the latter 121 companies. Thus, a larger sample size may improve the reliability of the regression results, and a skewed sample size could impair the analysis (Wooldridge, 2018).

7. Result

In the following sections, we present the results from our analysis, primarily focusing on the effect of the exchange rate coefficients on the respective dependent variables.

7.1 Stock Return Exposure

The results in Exhibit 7, Panel A show primarily significant negative coefficients for the RER among all industries, contradicting our first hypothesis. The significant negative coefficients span between -118.4% and -23.2% for the various industries. Hence, a one percentage point strengthening of the Swedish krona correlates with an increase in stock returns between 1.18 and 0.23 percentage points, contradictory to our hypothesis. Notably, the Utility industry contains one firm, which may explain the abnormally high correlation of 118.4%. Basic Materials and Energy showcase positive coefficients between 7% and 22.8%. Nevertheless, only the EUR/SEK coefficient for Basic Materials is statistically significant. Moreover, the RER coefficients magnitudes show no considerable difference between the high- and low-exporting industries. The coefficients for the EER in Exhibit 7, Panel B show similar results as those in Panel A. Furthermore, the SIX Return Index shows an overall high correlation of around 100% with the stock returns at the 0.1% significance level.

To explore the influence of past currency fluctuations on present stock returns, we observe the contemporary and lagged RER coefficients (Exhibit 8). In this analysis, the contemporary exchange rate coefficients show more significant results than the lagged RER coefficients. Neglecting statistical significance, we observe that the contemporary RER coefficients show more negative outcomes than RER_{t-3}.

Exhibit 7. Stock Return Exposure

Real Exchange Rate (RER) Exposure

Panel A — **Dependent Variable: Stock Returns**

High-Exporting Industries:		EUR/SEK				USD/SEK			
	N	RER	SIXRX	Constant	R2	RER	SIXRX	Constant	R2
Basic Materials	*4,049*	22.79%*	97.70%****	6.12%	0.15	6.95%	96.88%****	6.05%	0.15
		(0.12)	(0.04)	(0.17)		(0.07)	(0.04)	(0.16)	
Industrials	*12,359*	-35.22%****	102.72%****	14.55%*	0.22	-23.18%****	103.34%****	18.00%**	0.22
		(0.06)	(0.02)	(0.09)		(0.04)	(0.02)	(0.09)	
Energy	*898*	-4.24%	97.69%****	59.29%	0.10	20.20%	99.06%****	52.53%	0.10
		(0.34)	(0.10)	(0.48)		(0.20)	(0.10)	(0.48)	
Health Care	*7,453*	-35.28%**	90.08%****	53.45%***	0.06	-9.46%	91.47%****	51.66%**	0.059
		(0.15)	(0.04)	(0.20)		(0.09)	(0.04)	(0.21)	
Technology	*4,712*	-45.33%****	101.34%****	50.46%***	0.12	-29.91%****	102.07%****	55.16%***	0.12
		(0.14)	(0.04)	(0.20)		(0.08)	(0.04)	(0.19)	
Telecommunications	*1,843*	-40.45%	81.27%****	-5%	0.11	-8.49%	83.03%****	-6.66%	0.10
		(0.25)	(0.06)	(0.27)		(0.12)	(0.06)	(0.27)	
Low-Exporting Industries:									
Consumer Goods	*1,278*	-17.09%	65.35%****	6.70%	0.11	-24.62%**	64.98%****	12.65%	0.12
		(0.18)	(0.05)	(0.25)		(0.11)	(0.05)	(0.25)	
Consumer Services	*7,538*	-38.09%**	106.24%****	-27.87%	0.10	-27.33%***	106.84%****	-23.97%	0.10
		(0.13)	(0.04)	(0.18)		(0.08)	(0.04)	(0.18)	
Real Estate	*5,333*	-43.24%****	112.82%****	-12.69%	0.20	-26.62%****	113.68%****	-9.84%	0.20
		(0.11)	(0.03)	(0.16)		(0.07)	(0.04)	(0.15)	
Utilities	*165*	-118.43%*	82.64%****	-28.14%	0.16	-52.50%	86.12%****	-27.07%	0.15
		(0.58)	(0.22)	(0.83)		(0.34)	(0.22)	(0.83)	

Excess Exchange Rate* (EER) Exposure

Panel B — **Dependent Variable: Stock Returns**

High-Exporting Industries:		EUR/SEK				USD/SEK			
	N	EER*	SIXRX	Constant	R2	EER*	SIXRX	Constant	R2
Basic Materials	*4,049*	2.04%	96.59%****	9.08%	0.15	2.3%**	96.71%****	11.79%	0.15
		(0.02)	(0.04)	(0.17)		(0.01)	(0.04)	(0.00)	
Industrials	*12,359*	-2.00%**	104.46%****	12.26%	0.22	-0.09%	104.55%****	10.87%	0.22
		(0.01)	(0.02)	(0.09)		(0.01)	(0.02)	(0.09)	
Energy	*898*	-5.78%	97.57%****	65.74%	0.10	-2.44%	97.63%****	62.46%	0.10
		(0.06)	(0.10)	(0.48)		(0.03)	(0.10)	(0.48)	
Health Care	*7,453*	-5.23%**	91.72%****	56.11%***	0.06	-2.58%*	91.71%****	54.50%***	0.06
		(0.03)	(0.04)	(0.16)		(0.01)	(0.04)	(0.00)	
Technology	*4,712*	-4.82%**	103.45%****	47.78%**	0.12	-1.63%	103.55%****	45.99%**	0.12
		(0.02)	(0.04)	(0.16)		(0.01)	(0.04)	(0.00)	
Telecommunications	*1,843*	-9.47%**	83.01%****	-8.10%	0.11	-4.46%**	83.09%****	-11.64%	0.11
		(0.03)	(0.07)	(0.16)		(0.02)	(0.07)	(0.00)	
Low-Exporting Industries:									
Consumer Goods	*1,278*	-9.69%***	65.78%****	9.74%	0.12	-4.43%**	65.82%****	6.14%	0.12
		(0.03)	(0.05)	(0.25)		(0.02)	(0.05)	(0.25)	
Consumer Services	*7,538*	-4.82%**	108.00%****	-27.81%*	0.10	-1.91%**	108.04%****	-29.65%*	0.10
		(0.02)	(0.04)	(0.16)		(0.01)	(0.04)	(0.00)	
Real Estate	*5,333*	-6.79%****	114.70%****	-4.85%	0.20	-4.00%****	114.57%****	-4.91%	0.20
		(0.02)	(0.03)	(0.16)		(0.01)	(0.04)	(0.00)	
Utilities	*165*	15.87%*	89.82%****	-30.66%	0.16	8.22%	89.52%****	-26.94%	0.16
		(0.09)	(0.21)	(0.16)		(0.05)	(0.21)	(0.00)	

Notes: Estimation method: Ordinary Least Square Regressions. Robust SE.
Excess Exchange Rate = (Spot t - Forward t-1) / Spot t. Standard Errors are in paranthesis.
Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

Exhibit 8. Lagged Stock Return Exposure

		Dependent Variable: Stock Returns						
		EUR/SEK						
	N	RER	RER_{t-1}	RER_{t-2}	RER_{t-3}	SIXRX	Constant	R2
High-Exporting Industries:								
Basic Materials	*4,046*	25.57%**	-6.84%	8.96%	8.09%	98.15%****	5.23%	0.15
		(0.12)	(0.12)	(0.13)	(0.14)	(0.04)	(0.17)	
Industrials	*12,356*	-33.86%****	-5.18%	1.87%	2.13%	102.82%****	14.40%*	0.22
		(0.06)	(0.06)	(0.07)	(0.06)	(0.02)	(0.08)	
Energy	*895*	-2.06%	14.00%	58.74%*	5.11%	99.43%****	52.74%	0.10
		(0.35)	(0.33)	(0.35)	(0.34)	(0.12)	(0.49)	
Health Care	*7,450*	-36.63%**	3.28%	-32.01%**	55.37%****	89.95%****	50.59%**	0.06
		(0.15)	(0.16)	(0.15)	(0.15)	(0.04)	(0.21)	
Technology	*4,712*	-40.87%***	-26.31%*	-7.57%	7.16%	101.21%****	51.93%***	0.12
		(0.14)	(0.15)	(0.15)	(0.16)	(0.04)	(0.19)	
Telecommunications	*1,840*	-36.78%	-21.11%	-7.00%	2.88%	81.15%****	-4.24%	0.11
		(0.26)	(0.18)	(0.21)	(0.19)	(0.07)	(0.27)	
Low-Exporting Industries:								
Consumer Goods	*1,275*	-3.98%	-24.14%	23.77%	14.26%	64.75%****	-0.30%	0.12
		(0.19)	(0.18)	(0.18)	(0.18)	(0.06)	(0.24)	
Consumer Services	*7,438*	-39.77%***	5.32%	-8.52%	6.50%	106.07%****	-27.89%	0.10
		(0.12)	(0.13)	(0.11)	(0.15)	(0.04)	(0.18)	
Real Estate	*5,330*	-33.91%***	-52.58%****	-11.44%	45.14%****	113.12%****	-12.61%	0.21
		(0.12)	(0.13)	(0.11)	(0.13)	(0.04)	(0.15)	
Utilities	*165*	-94.48%	-29.63%	97.02%*	17.09%	85.85%****	-39.85%	0.18
		(0.64)	(0.59)	(0.58)	(0.59)	(0.22)	(0.84)	

		Dependent Variable: Stock Returns						
		USD/SEK						
	N	RER	RER_{t-1}	RER_{t-2}	RER_{t-3}	SIXRX	Constant	R2
High-Exporting Industries:								
Basic Materials	*4,046*	8.44%	-8.66%	-18.50%***	3.34%	95.71%****	13.32%	0.15
		(0.09)	(0.08)	(0.08)	(0.07)	(0.04)	(0.17)	
Industrials	*12,356*	-23.97%****	2.54%	-7.09%*	4.52%	103.01%****	18.52%**	0.22
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.09)	
Energy	*895*	22.96%	1.45%	41.17%*	45.62%**	101.97%****	24.39%	0.11
		(0.24)	(0.23)	(0.23)	(0.23)	(0.12)	(0.48)	
Health Care	*7,450*	-4.24%	-18.97%*	13.98%	4.78%	91.79%****	49.87%**	0.06
		(0.09)	(0.10)	(0.10)	(0.09)	(0.04)	(0.21)	
Technology	*4,712*	-27.93%***	-9.07%	-8.77%	8.02%	101.44%****	57.94%***	0.13
		(0.09)	(0.10)	(0.09)	(0.09)	(0.04)	(0.20)	
Telecommunications	*1,840*	-5.06%	-14.41%	2.16%	-3.80%	82.89%****	-3.37%	0.10
		(0.14)	(0.13)	(0.12)	(0.12)	(0.07)	(0.28)	
Low-Exporting Industries:								
Consumer Goods	*1,275*	-22.70%**	-2.23%	7.92%	-8.40%	63.54%****	63.55%	0.12
		(0.10)	(0.11)	(0.11)	(0.11)	(0.06)	(0.05)	
Consumer Services	*7,438*	-27.68%****	0.33%	-4.65%	-3.53%	106.55%****	-21.24%	0.10
		(0.08)	(0.07)	(0.09)	(0.09)	(0.04)	(0.19)	
Real Estate	*5,330*	-22.27%***	-18.01%***	-11.18%	29.98%****	112.68%****	-11.09%	0.21
		(0.07)	(0.07)	(0.07)	(0.07)	(0.04)	(0.16)	
Utilities	*165*	-67.93%*	65.12%	12.37%	25.42%	87.75%****	-54.46%	0.18
		(0.40)	(0.44)	(0.38)	(0.42)	(0.22)	(0.80)	

Notes: Estimation method: Ordinary Least Square Regressions. Robust SE.

Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

7.2 Profitability

7.2.1 Operating Margin

Exhibit 9 presents the results of the impact of the real and excess exchange rates on the Operating Margin. The coefficients for the RER show higher positive magnitudes for the high-exporting industries compared to the low-exporting industries. Hence, for every 1 SEK increase to EUR and USD, the Operating Margin increases by 34.6% and 20%, respectively, for the high-exporting industries. For the low-exporting industries, a 1 SEK increase in the RER is correlated with a -1.9% (EUR/SEK) and -0.6% (USD/SEK) decrease in the Operating Margin. As shown in Exhibit 9, Panel B, the results are similar for the EER. The results thus align with the second hypothesis; however, most coefficients are not statistically significant.

Observing the lagged RER coefficient in Exhibit 11, we likewise see that the absolute magnitude of the RER coefficients is larger for the high-exporting compared to the low-exporting firms. However, the statistical significance and signs of the RER coefficients vary.

7.2.2 COGS Margin

In line with the second hypothesis, we expect the FX coefficients to be significantly negative for high-exporting industries. Additionally, we expect low-exporting industries to be relatively unaffected by the exchange rate and, accordingly, to show close to zero FX coefficients. We observe negative FX coefficients for both groups and currencies for RER (Exhibit 10, Panel A) and EER (Exhibit 10, Panel B). In line with the hypothesis, the RER coefficients for the high-exporting industries show slightly larger magnitudes in absolute value, between -3.6% and -5.5% compared to -0.4% and -0.6% for low-exporting industries.

When examining lagged RER coefficients (Exhibit 11), we observe diverse results. However, as for the Operating Margin, the RER coefficients for the high-exporting industries show larger absolute magnitudes than for the low-exporting industries.

Exhibit 9. Operating Margin

	Dependent Variable: Operating Margin							
	Panel A: Real Exchange Rate (RER) Exposure				Panel B: Excess Exchange Rate* (EER) Exposure			
	High Exporting		Low Exporting		High Exporting		Low Exporting	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
FX	**34.57%**	**20.04%**	**-1.85%****	**-0.55%**	**42.95%**	**19.29%**	**-1.43%****	**-0.55%**
	(0.41)	(0.22)	(0.01)	(0.00)	(0.35)	(0.21)	(0.01)	(0.00)
Market Cap_{t-1}	-24.69%	-24.89%	3.65%*	3.52%*	-26.38%	-22.65%	3.56%	3.46%*
	(0.45)	(0.46)	(0.02)	(0.02)	(0.46)	(0.45)	(0.02)	(0.02)
Current $Ratio_{t-1}$	-12.58%	-12.54%	0.04%	0.13%	-12.36%	-12.58%	0.09%	0.15%
	(0.09)	(0.09)	(0.01)	(0.01)	(0.09)	(0.09)	(0.01)	(0.01)
Leverage $Ratio_{t-1}$	0.04%	0.04%	0.03%	0.03%	0.04%	0.04%	0.03%	0.02%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-207.88%	-36.08%	-9.53%	-22.37%	151.06%	119.65%	-27.40%	-26.64%
	(4.57)	(3.36)	(0.22)	(0.19)	(3.70)	(3.64)	(0.17)	(0.17)
Operating $Margin_{t-1}$	46.37%****	46.35%****	23.27%**	23.32%**	46.31%****	46.37%****	23.28%	23.33%**
	(0.13)	(0.13)	(0.12)	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)
Wald Chi2	*18.09*	*17.65*	*46.62*	*34.25*	*18.98*	*17.52*	*49.28*	*36.98*
Prob > Chi2	*0.003*	*0.003*	*0*	*0*	*0.002*	*0.004*	*0*	*0*
N	*8,430*	*8,430*	*2,717*	*2,717*	*8,430*	*8,430*	*2,717*	*2,717*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. FX Coefficient represent RER in Panel A and EER in Panel B. *Excess Exchange Rate= Spot t - Forward t-1.
Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

Exhibit 10. COGS Margin

	Dependent Variable: COGS Margin							
	Panel A: Real Exchange Rate (RER) Exposure				Panel B: Excess Exchange Rate* (EER) Exposure			
	High Exporting		Low Exporting		High Exporting		Low Exporting	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
FX	**-5.49%**	**-3.59%**	**-0.55%**	**-0.35%**	**-6.61%**	**-4.16%**	**-0.60%**	**-0.24%**
	(0.19)	(0.09)	(0.01)	(0.01)	(0.17)	(0.09)	(0.01)	(0.01)
Market Cap_{t-1}	15.63%	15.95%	-0.93%	-0.94%	16.10%	15.47%	-0.94%	-0.98%
	(0.21)	(0.21)	(0.02)	(0.02)	(0.20)	(0.20)	(0.02)	(0.02)
Current $Ratio_{t-1}$	-1.01%	-1.09%	1.15%	1.14%	-1.09%	-1.09%	1.15%	1.15%
	(0.08)	(0.08)	(0.01)	(0.01)	(0.08)	(0.08)	(0.01)	(0.01)
Leverage $Ratio_{t-1}$	0.01%***	0.01%***	-0.15%	-0.16%	0.01%***	0.01%***	-0.15%	-0.16%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	13.63%	-12.32%	67.47%***	65.11%***	-45.00%	-39.31%	61.99%***	62.31%***
	(1.68)	(1.46)	(0.22)	(0.22)	(1.77)	(1.71)	(0.21)	(0.21)
COGS $Margin_{t-1}$	39.35%***	39.34%***	23.69%*	23.68%*	39.34%***	39.34%***	23.69%*	23.72%*
	(0.15)	(0.15)	(0.13)	(0.13)	(0.15)	(0.15)	(0.13)	(0.13)
Wald Chi2	*11.21*	*12.43*	*9.2*	*9.76*	*11.32*	*12.29*	*9.22*	*9.6*
Prob > Chi2	*0.047*	*0.029*	*0.101*	*0.083*	*0.045*	*0.031*	*0.101*	*0.088*
N	*8,325*	*8,325*	*2,746*	*2,746*	*8,397*	*8,397*	*2,746*	*2,746*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. FX Coefficient represent RER in Panel A and EER in Panel B. *Excess Exchange Rate= Spot t - Forward t-1.
Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

Exhibit 11. Operating and COGS Margin with Lagged RER

	Dependent Variable: Operating Margin				Dependent Variable: COGS Margin			
	High Exporting		Low Exporting		High Exporting		Low Exporting	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
Real Exchange Rate$_t$	**13.30%**	**42.27%**	**-1.43%**	**-0.39%**	**2.44%**	**-9.42%**	**0.96%**	**-0.62%**
	(0.36)	(0.34)	(0.02)	(0.01)	(0.19)	(0.13)	(0.02)	(0.01)
Real Exchange Rate$_{t-1}$	**-77.18%***	**-100.93%***	**0.21%**	**-1.58%**	**15.22%**	**21.47%**	**-2.26%**	**0.89%**
	(0.45)	(0.54)	(0.04)	(0.02)	(0.18)	(0.17)	(0.03)	(0.01)
Real Exchange Rate$_{t-2}$	**47.57%**	**71.39%**	**-1.92%**	**2.45%**	**-25.69%**	**-13.81%**	**1.14%**	**-0.78%**
	(0.35)	(0.46)	(0.03)	(0.02)	(0.17)	(0.13)	(0.02)	(0.01)
Real Exchange Rate$_{t-3}$	**72.74%***	**26.72%**	**1.36%**	**-1.00%**	**0.80%**	**-5.20%**	**-0.76%**	**0.01%**
	(0.39)	(0.30)	(0.03)	(0.02)	(0.19)	(0.11)	(0.02)	(0.01)
Market Cap$_{t-1}$	-27.81%	-33.11%	3.59%*	3.49%*	13.75%	17.58%	-0.98%	-0.94%
	(0.46)	(0.48)	(0.02)	(0.02)	(0.21)	(0.23)	(0.02)	(0.02)
Current Ratio$_{t-1}$	-14.24%	-13.90%	0.03%	0.09%	0.32%	-0.02%	1.24%	1.25%
	(0.09)	(0.09)	(0.01)	(0.01)	(0.08)	(0.08)	(0.01)	(0.01)
Leverage Ratio$_{t-1}$	0.04%	0.03%	0.03%	0.03%	0.013%***	0.01%***	-0.15%	-0.16%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-390.18%	-130.00%	-9.64%	-22.33%	39.54%	-2.59%	70.81%***	65.80%***
	(4.78)	(3.41)	(0.20)	(0.18)	(1.86)	(1.45)	(0.24)	(0.21)
Operating Margin$_{t-1}$	47.21%****	47.12%****	23.73%**	23.82%**	41.93%****	41.93%****	24.42%*	24.33%*
	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)
Wald Chi2	*36.88*	*50.45*	*97.03*	*90.81*	*36.34*	*33.96*	*17.95*	*12.47*
Prob > Chi2	*0*	*0*	*0*	*0*	*0*	*0.000*	*0*	*0*
N	*8,199*	*8,199*	*2,648*	*2,648*	*8,099*	*8,099*	*2,677*	*2,677*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

7.3 Productivity

7.3.1 Labor Productivity

Reviewing the Labor Productivity regression in (Exhibit 12, Panels A, and B), the FX coefficients are statistically insignificant for both currencies among the two industry groups. Additionally, the high-exporting industries show positive RER coefficients, while the low-exporting group shows negative coefficients. Hence, we do not receive results that align with our third hypothesis.

In addition, the lagged RER regressions on Labor Productivity in Exhibit 14 show varying signs, although the second lag is consistently positive and primarily significant. Conversely, the third lag showcases consistently negative coefficients in line with our hypothesis, where the high-exporting group presents statistically significant results.

7.3.2 Total Factor Productivity

Exhibit 13 shows the TFP regression results, where panels A and B show no statistically significant FX coefficients. However, the FX coefficients consistently show negative results, aligning with our hypothesis. Nevertheless, the coefficient magnitudes are

relatively small, between -1.2% and -2.3%, with no substantial difference between the low- and high-exporting industries.

Reviewing the lagged regressions in Exhibit 14, the third-lagged RER coefficients among both industry groups consistently show negative results. Additionally, we see more statistical significance and larger magnitudes among the high-exporting industries, which aligns with the hypothesis. Moreover, similar to the results in LP (Exhibit 14), the second-lagged RER coefficients show significant positive results. Moreover, the contemporary RER coefficients show mostly positive coefficients, while the first lag shows mostly negative coefficients; however, most of these coefficients are statistically insignificant.

Exhibit 12. Labor Productivity

	Dependent Variable: Labor Productivity							
	Panel A: Real Exchange Rate (RER) Exposure				**Panel B: Excess Exchange Rate* (EER) Exposure**			
	High Exporting		**Low Exporting**		**High Exporting**		**Low Exporting**	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
FX	**1.81%**	**0.31%**	**-3.60%**	**-0.59%**	**0.34%**	**1.01%**	**-3.82%**	**-0.26%**
	(0.04)	(0.02)	(0.03)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)
Market Cap_{t-1}	8.79%	9.26%	4.41%	4.23%	9.25%	9.02%	4.34%	4.18%
	(0.07)	(0.07)	(0.04)	(0.04)	(0.07)	(0.07)	(0.04)	(0.04)
Current $Ratio_{t-1}$	-1.60%**	-1.61%**	-4.05%	-3.79%	-1.62%**	-1.59%**	-4.06%	-3.73%
	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)	(0.03)
Leverage $Ratio_{t-1}$	-0.01%***	-0.01%***	-0.03%	-0.04%	-0.01%***	-0.01%***	-0.03%	-0.04%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-44.59%	-32.89%	99.59%**	69.36%*	-29.99%	-28.40%	64.12%*	64.44%*
	(0.62)	(0.52)	(0.48)	(0.37)	(0.49)	(0.49)	(0.36)	(0.36)
LP_{t-1}	45.80%****	45.79%****	-1.33%	-1.15%	45.79%****	45.77%****	-1.36%	-1.14%
	(0.13)	(0.13)	(0.05)	(0.05)	(0.13)	(0.13)	(0.05)	(0.05)
Wald Chi2	*163.59*	*162.22*	*4.38*	*4.09*	*165.1*	*161.53*	*4.89*	*4.35*
Prob > Chi2	*0*	*0*	*0.496*	*0.537*	*0*	*0*	*0.430*	*0.501*
N	*8,140*	*8,140*	*2,541*	*2,541*	*8,140*	*8,140*	*2,541*	*2,541*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. FX Coefficient represent RER in Panel A and EER in Panel B. *Excess Exchange Rate= Spot t - Forward t-1.
Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

Exhibit 13. Total Factor Productivity

	Dependent Variable: Total Factor Productivity							
	Panel A: Real Exchange Rate (RER) Exposure				Panel B: Excess Exchange Rate* (EER) Exposure			
	High Exporting		Low Exporting		High Exporting		Low Exporting	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
FX	**-1.69%**	**-1.16%**	**-2.35%**	**-1.31%**	**-1.11%**	**-0.15%**	**-1.55%**	**-1.12%**
	(0.05)	(0.03)	(0.03)	(0.01)	(0.04)	(0.02)	(0.03)	(0.02)
Market Cap_{t-1}	9.90%	10.15%	-3.15%	-3.07%	9.65%	9.23%	-3.25%	-3.25%
	(0.08)	(0.08)	(0.03)	(0.03)	(0.08)	(0.08)	(0.03)	(0.03)
Current $Ratio_{t-1}$	-1.20%	-1.22%	-5.91%**	-5.90%**	-1.17%	-1.14%	-5.84%**	-5.82%**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leverage $Ratio_{t-1}$	-0.05%****	-0.05%****	0.21%**	0.21%**	-0.05%****	-0.05%****	0.21%**	0.21%**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	101.75%	92.96%	147.34%****	134.36%****	86.78%	90.12%	124.09%****	124.08%****
	(0.84)	(0.76)	(0.34)	(0.25)	(0.79)	(0.77)	(0.21)	(0.21)
TFP_{t-1}	33.39%****	33.38%****	45.99%****	46.14%****	33.41%****	33.43%****	46.18%****	46.26%****
	(0.10)	(0.10)	(0.09)	(0.09)	(0.10)	(0.10)	(0.09)	(0.09)
Wald Chi2	*192.4*	*193.73*	*47.56*	*47,74*	*193.28*	*202.64*	*46.8*	*46.78*
Prob > Chi2	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
N	*6,288*	*6,288*	*2,257*	*2,257*	*6,288*	*6,288*	*2,257*	*2,257*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. FX Coefficient represent RER in Panel A and EER in Panel B. *Excess Exchange Rate= Spot t - Forward t-1.
Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

Exhibit 14. Labor Productivity and Total Factor Productivity with Lagged RER

	Dependent Variable: Total Factor Productivity				Dependent Variable: Labor Productivity			
	High Exporting		Low Exporting		High Exporting		Low Exporting	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
Real Exchange $Rate_t$	**3.16%**	**-0.03%**	**1.39%**	**2.00%**	**2.00%**	**0.41%**	**-1.03%**	**2.79%**
	(0.06)	(0.03)	(0.04)	(0.03)	(0.06)	(0.04)	(0.04)	(0.04)
Real Exchange $Rate_{t-1}$	**-10.27%**	**-2.18%**	**-8.08%**	**-8.81%*****	**-1.11%**	**1.16%**	**-6.77%**	**-6.41%**
	(0.08)	(0.04)	(0.05)	(0.03)	(0.08)	(0.06)	(0.05)	(0.04)
Real Exchange $Rate_{t-2}$	**13.31%****	**8.10%***	**10.95%***	**8.53%****	**11.53%***	**3.28%**	**19.03%****	**9.84%***
	(0.07)	(0.04)	(0.06)	(0.04)	(0.07)	(0.06)	(0.09)	(0.05)
Real Exchange $Rate_{t-3}$	**-9.46%***	**-8.58%****	**-6.94%**	**-2.76%**	**-14.54%****	**-7.82%****	**-16.39%**	**-7.90%***
	(0.06)	(0.04)	(0.05)	(0.04)	(0.06)	(0.03)	(0.10)	(0.04)
Market Cap_{t-1}	10.99%	11.95%	-3.04%	-3.10%	10.33%	11.75%	4.79%	4.56%
	(0.08)	(0.08)	(0.03)	(0.03)	(0.07)	(0.07)	(0.04)	(0.04)
Current $Ratio_{t-1}$	0.43%	0.51%	-6.14%**	-6.08%**	-1.83%**	-1.86%**	-4.34%	-3.91%
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)
Leverage $Ratio_{t-1}$	-0.05%****	-0.05%****	0.21%***	0.20%**	-0.01%**	-0.011%**	-0.02%	-0.03%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	97.10%	79.84%	150.01%****	132.79%****	-17.69%	-24.42%	112.12%*	75.92%*
	(0.87)	(0.80)	(0.37)	(0.26)	(0.69)	(0.55)	(0.58)	(0.42)
Total Factor $Productivity_{t-1}$	36.24%****	36.00%****	46.10%****	46.16%****	45.75%****	45.54%****	-1.24%	-1.18%
	(0.10)	(0.10)	(0.09)	(0.09)	(0.14)	(0.13)	(0.05)	(0.05)
Wald Chi2	*702.91*	*617.62*	*67.09*	*104.93*	*210.02*	*175.28*	*28.66*	*32.21*
Prob > Chi2	*0*	0	*0*	*0*	*0*	*0*	*0*	*0*
N	*5,856*	*5,856*	*2,130*	*2,130*	*7,979*	*7,979*	*2,476*	*2,476*

Notes: Estimation method: Generalized Method of Moments, Arellano-Bond. Robust SE.
See Indudstry split in Hypothesis section, Exhibit 2. Standard Errors are in paranthesis. Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

7.4 Stock Return Exposure and Productivity Combined

To confirm our fourth hypothesis, firms with high exposure to foreign currencies should experience a negative effect on firm-level productivity. The interaction term in Exhibit 15 represents the stock return exposure coefficients from Exhibit 7, Panel A, combined with the EUR/SEK and USD/SEK exchange rates, respectively.

Contradictory to our hypothesis, the interaction term coefficients show positive coefficients for both currencies against the productivity metrics. Hence, a one-

unit increase in the interaction term correlates with an increase in LP by 10% (EUR/SEK) and 4.2% (USD/SEK) and an increase in TFP by 2.5% (EUR/SEK) and 2.7% (USD/SEK). However, only the interaction term for EUR/SEK against LP shows a statistically significant coefficient.

Examining the RER coefficients, which represent the real exchange rates for EUR/SEK and USD/SEK, respectively, the coefficients' magnitudes are larger than the interaction term coefficients, except for EUR/SEK against LP. These results indicate that the FX coefficients obtain a higher positive correlation with LP and TFP than the interaction term.

Exhibit 15. Stock Return Exposure and Productivitty combined

	Dependent Variable: Labor Productivity		**Dependent Variable: Total Factor Productivity**	
	EUR/SEK	USD/SEK	EUR/SEK	USD/SEK
Interaction term*	**9.97%***	**4.21%**	**2.47%**	**2.71%**
	(0.05)	(0.07)	(0.03)	(0.06)
RER	9.84%****	4.51%**	9.14%***	5.21%****
	(0.02)	(0.02)	(0.01)	(0.01)
R2	*0.81*	*0.81*	*0.79*	*0.79*
N	*14,259*	*14,259*	*11,836*	*11,836*

Notes: Estimation method: Firm fixed effects model. Robust SE.
Interaction term denotes the interaction between the respective RER and the exposure coefficient from Exhibit 7.
RER denotes the Real Exchange Rate. Standard Errors are in paranthesis.
Significant levels are presented by 10% (*), 5% (**), 1% (***), and 0.1% (****)

8. Analysis

Below, we analyze the results for the regression outcomes presented in section 7, contributing to the discussion of how exchange rate movements affect firm fundamentals. Our initial results showcase a positive correlation between stock returns and a stronger Swedish krona. Further, profitability metrics are mainly positively affected, yet statistically insignificantly, by movements in RER, while such a relationship is more elusive when measuring productivity. However, our result indicates that a long-term weakening of the domestic currency can reduce firm-level productivity.

8.1 Stock Return Exposure

As the Result section outlines, the RER coefficients showcase mostly negative outcomes against stock returns. These results suggest a correlation between a strong SEK and positive stock returns, contradicting our hypothesis, the operating exposure theory (Bekaert and Hodrick, 2012), and He and Ng's (1998) findings regarding the advantageous situation for exporting firms when the domestic currency depreciates. A potential explanation for these results is that the USD and EUR obtain safe-haven currency characteristics due to the high liquidity and perceived stability of the US and many Eurozone economies. Hence, safe haven-denominated assets tend to increase in value during macroeconomic instability. This could be the situation in our study since the sample period includes economic downturns, such as the COVID-19 pandemic. Hence, the demand for investment in Swedish companies may face a reduction during events that cause instability. (Sellgren, 2023b; Bekaert and Hodrick, 2012; Ranaldo and Söderlind, 2010).

Moreover, we do not find a considerable difference between the exposure among the high- and low-exporting industries. Thus, we cannot conclude that the high-exporting industries' stock returns are more exposed to currency fluctuations than the low-exporting industries. Williamson (2000) analyzes the export-dependent automotive industry and finds divergent exposure coefficients against diverse currencies. In line with his findings, our results indicate that factors beyond the exporting volume impact firms' stock return exposure. Hence, Bartram et al. (2009) and Bodnar et al. (2002) suggest that exporting firms' exchange rate exposure decreases due to customer pass-through,

operational hedging, and financial risk management. Accordingly, the inherent stock return exposure among multinational firms stemming from a high share of international sales may be reduced through various hedging activities, which may disrupt our results.

We analyze the excess exposure coefficients (Exhibit 7, Panel B) to control for some of the firms' hedging activities. Although this methodology retains shortcomings discussed in the Limitations section, it is a proxy for what the market expects about future exchange rates. Hence, the stock market would potentially react more substantially to EER since it is unpredicted (Berk and DeMarzo, 2017). However, we find coefficients similar to the RER coefficients (Exhibit 7, Panel A), albeit with smaller magnitudes. Hence, the EER coefficients suggest that stock returns positively correlate with a stronger-than-expected Swedish to a lesser extent than the RER.

Furthermore, as outlined in the Literature Review, Griffin and Stulz (2001) suggest that the impact of currency fluctuations on stock returns is negligible. Hence, we obtain relatively low R-squared numbers for the contemporary regressions (Exhibit 7). However, this could be due to omitted variables since numerous factors explain the stock returns beyond the market and exchange rates. Moreover, potential endogeneity creates ambiguity in determining a causal relationship between exchange rate and stock returns (Wooldridge, 2018). Therefore, we are cautious about determining a causal relationship between the exchange rates and stock returns. Nevertheless, we employ the methodology outlined in previous literature to examine the exchange rate exposure on stock returns. However, we discuss a correlation rather than a causal relationship between the exchange rate and the stock returns.

As presented in Exhibit 8, the lagged RER coefficients showcase significance for some lagged periods and exchange rates. Further, most statistically significant coefficients are negative, in line with the findings by Can and Soo (2011). Hence, this outcome also contradicts our hypothesis, and as for the previous results, we do not see a substantial difference between the high and low-exporting industries. Notably, we observe more statistically significant coefficients on the current exchange rate than for lagged periods. This observation is in line with the efficient market hypothesis, implying that stock prices adjust quickly to news regarding currency fluctuations and therefore are forward-looking (Berk and DeMarzo, 2017).

Disregarding the statistical significance, we observe that the contemporary RER coefficient showcases more negative results than the third-lagged RER coefficients in Exhibit 8. Hence, a stronger contemporary SEK correlates with higher stock returns, whereas a weaker domestic currency in the previous quarter correlates with higher current stock returns. In line with our second hypothesis and the operating exposure theory (Bekaert and Hodrick, 2012), domestic currency depreciation affects firm-level fundamentals positively. Our result proposes that a subsequent quarterly report reveals the boosted performance from currency depreciation, which increases the then simultaneous stock price. Accordingly, stock markets do not correctly price the impact of currency fluctuations. Nevertheless, we are cautious regarding establishing this conclusion due to the low statistical significance of the positive third lags.

8.2 Profitability

Overall, the results from the FX coefficients in Exhibits 9 and 10 suggest that firms generally benefit from a weak domestic currency, which aligns with the operating exposure theory (Bekaert and Hodrick, 2012). Additionally, the results contradict the findings by Yeboah and Takacs (2019), who present a negative effect on the profitability of manufacturing firms in domestic currency depreciation. However, since their study is conducted on South African listed companies, the different geographical settings restrain a direct comparison.

Moreover, we see that the FX coefficients magnitudes are larger for the RER and EER in absolute terms for the high-exporting industries compared to the low-exporting industries, which aligns with our second hypothesis. From Exhibits 9 and 10 and the Descriptive Statistics in Appendix 3, we compute that a 5% increase in RER from the mean, or comparatively a weakening of the Swedish krona, relates to an increase in the Operating Margin among the high-exporting group by 17% to the EUR exposure and a 9% increase to USD. The COGS margin experiences a decrease of -3% (EUR/SEK) and -2% (USD/SEK) among the high-exporting industries, to the same percentage currency fluctuation. Moreover, the examined 5% increase in the exchange rates translates into a relatively small impact among the low-exporting industries, between -0.9% and 0%, in Operating Margin and COGS Margin. Hence, the relatively small impact on low-exporting industry metrics aligns with our hypothesis. Additionally, the Operating Margin

metric is perceived as more sensitive to exchange rate fluctuations than the observed cost metric. As discussed in the Limitations section, we do not assess a firm-level analysis of the share of exporting intermediate goods or prevalent foreign production facilities. Hence, a firm may possess costs of goods sold denominated in the foreign appreciated currency and thereby see a relatively smaller impact on the costs-to-sales ratio. The positive impact on the Operating Margin is thus likely attributable to the remaining lower costs not directly linked to the production of the goods sold. A Swedish company may retain its fixed costs, central functions, and R&D expenses in SEK, which show up in EBIT but not in the COGS.

Although our results align with the second hypothesis, most FX coefficients are statistically insignificant, discouraging a definitive conclusion that domestic currency depreciation consistently correlates with enhanced profitability metrics. The exchange rate disconnect puzzle theory, proposed by Meese and Rogoff (1983), suggests that exchange rate movements likely resemble random walks and are thus disconnected from macroeconomic fundamentals. Additionally, Thedéen (2023) suggests that exchange rates reflect hedging and speculation, which do not constitute Sweden's economic fundamentals. If exchange rates are disconnected from external factors that impact companies' performance, it may be challenging to establish a robust relationship between exchange rate fluctuations and firm-level profitability.

Since the lagged RER coefficients in Exhibit 11 showcase a blend of positive and negative coefficients, we cannot determine that the previous quarters' real exchange rate consistently impacts the contemporary Operating and COGS Margin. Nevertheless, we see that the magnitude of the RER coefficients are more prominent for the high-exporting industries, suggesting that these industries are more exposed to currency fluctuations than the low-exporting industries. Additionally, as for Exhibits 9 and 10, we see few significant results, which mitigates our findings.

8.3 Productivity

As presented in the Results section (Exhibit 12 and 13), the contemporary RER and EER show no statistically significant coefficients for LP and TFP. Disregarding the statistical significance, we observe relatively small magnitudes of the FX coefficients. Hence, all coefficients are lower than 4% in absolute values, suggesting that the impact of the

exchange rate on firm-level productivity is low among the two industry groups. Thus, a 5% weakening of the mean SEK relates to a change between -2% and 1% in the respective productivity metrics. Due to the statistically insignificant and relatively low economic significance, we cannot conclude that the weaker Swedish krona consistently negatively impacts firm-level productivity. Since we cannot conclude a robust difference between high- and low-exporting industries, these findings contradict our hypothesis and those of Fan et al. (2021), who observe a lower TFP growth among high-exporting Chinese enterprises.

Previous studies on firm-level productivity suggest that investments in technology, increased competition, organizational structure, and high-quality management correlate with higher productivity levels (Bloom and Van Reenen, 2007; Syverson, 2011; Pavcnik, 2000; Bloom et al., 2011). These findings suggest that the factors influencing productivity take time to implement. Henceforth, we aim to examine whether lagging the FX variables impacts firm-level productivity differently. Thus, the third-lagged RER coefficients consistently showcase negative results. Additionally, these coefficients are consistently statistically significant for the high-exporting industries. Hence, a 1 SEK weakening of the exchange rate three quarters earlier significantly influences the profitability among these industries between -7.8% and -14.5%. These results align with our third hypothesis and suggest that there is a time lag before the exchange rate affects the productivity metrics.

8.4 Stock Return Exposure and Productivity Combined

We obtain a positive correlation between the interaction term and the productivity metrics for both currencies (Exhibit 15), contradicting the fourth hypothesis. It also provides a slightly different view than Exhibit 13, where a depreciation in the real exchange rate is related to a decline in TFP. However, the relatively small and statistically insignificant coefficients observed in Exhibit 13 suggest that firms do not consistently obtain a drop in productivity from a SEK depreciation. Moreover, this last analysis is conducted on our entire sample, and it is thus conceivable that exchange rate fluctuations in a distinctive way influence all companies when taken together. Consequently, we cannot assert that higher exposure is associated with reduced productivity when the domestic currency depreciates.

As noted in the stock return exposure analysis in section 8.1 an, we do not find considerable differences between exposure levels among the high- and low-exporting industries, which may affect the outcome of this combined analysis. Hence, high-exporting firms that innately should be relatively more exposed to exchange rate fluctuations may face reduced exposure up to 70% due to efficient risk management and hedging strategies, as explored by Bartram et al. (2009) and Bodnar et al. (2002).

8.5 Concluding Remarks

The Marshall-Lerner condition and operating exposure theory outline the baseline theory for our paper. In summary, these theories suggest that exporting firms benefit from a domestic currency depreciation if export volumes are sensitive to price fluctuations (Black et al., 2012; Bekaert and Hodrick, 2012). When examining stock returns, we find the opposite effect, where a strengthened Swedish krona correlates with higher returns. However, we observe that the profitability metrics align with our baseline theories and that high-exporting firms show higher positive results when SEK depreciates. Nevertheless, Thedéen (2023) highlights the impact of hedging strategies and speculations on exchange rates. Meese and Rogoff (1983) suggest that exchange rates likely resemble random walks, which may complicate the statistical relationships in this study. Hence, this may underline the difficulty in establishing statistically significant relationships between currency fluctuations and firm performance.

As an extension of the Marshall-Lerner condition and operating exposure theory, we aim to determine whether this impacts firm-level productivity to contribute with empirical analysis to the current news reporting (Hultgren, 2023; Svidén, 2022). We do not see a simultaneous correlation between currency depreciation and lower productivity. However, we observe that a weaker domestic currency in the preceding three quarters relates to lower contemporary firm-level productivity, primarily for high-exporting companies. Hence, exploiting the SEK depreciation as a competitive advantage could be risky in the long run. Notably, since 2006, manufacturing firms in Sweden have experienced a lower productivity growth than global manufacturers (Svidén, 2022). This observation indicates that during periods of a weakening SEK, overall productivity among Swedish firms has experienced a slower growth rate than international competitors. However, this is examined over a longer time horizon.

9. Conclusion

Throughout our analysis, we find a positive correlation between a strong SEK and positive stock returns. Moreover, our study reveals that the weakening Swedish krona positively relates to higher profitability of high-exporting firms, albeit with mainly statistically insignificant coefficients. Moreover, we observe a time lag before the currency depreciation correlates with contemporary productivity deteriorations among domestic companies. Hence, we acknowledge that more extended periods of a weakening domestic currency can deteriorate the productivity of Swedish companies, which has been a pivotal debate in recent years (Hultgren, 2023; Svidén, 2022).

We employ export volumes among diverse product groups to determine the high- and low-exporting industries analyzed throughout our paper. However, a more detailed firm-level assessment of the share of foreign sales would thus be interesting due to the heterogeneity of foreign activities within industries. Additionally, an analysis of imported intermediate goods would contribute to determining the net effect of foreign activities. An interesting future research is thus to utilize company-specific data on export and import volumes to obtain a more thorough and firm-specific analysis.

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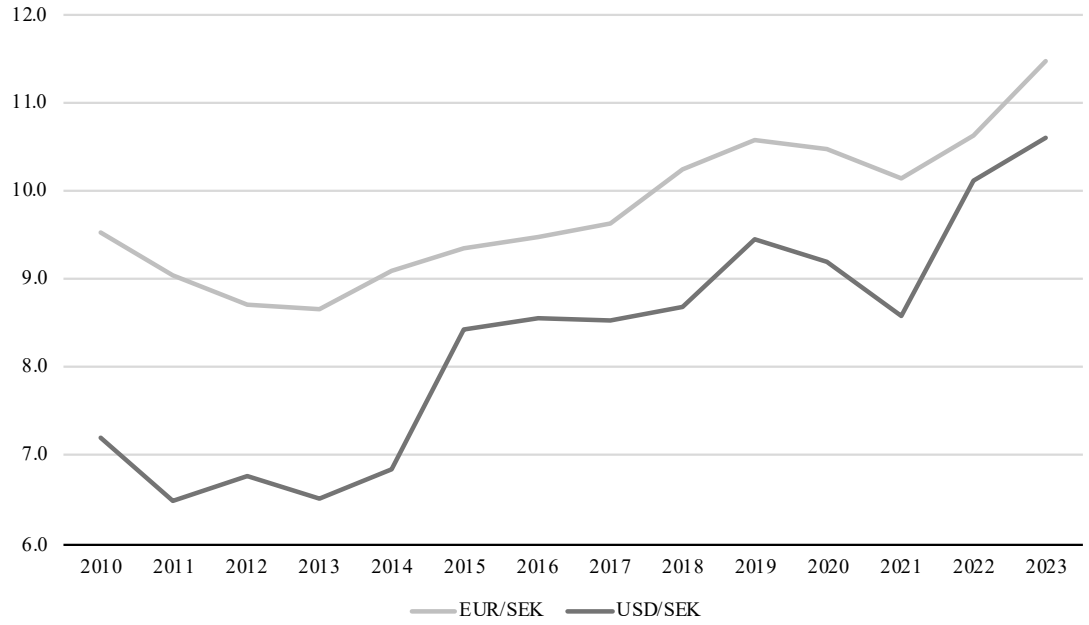
Appendix

Appendix 1. SEK development against EUR and USD



Notes: Nominal exchange rates

Appendix 2. Descriptive Statistics Stock Return Exposure

	Count	Mean	SD	Min	Max
Dependent Variables					
Basic Materials	4,049	1.1%	11.5%	-41.7%	267.2%
Consumer Goods	1,278	0.7%	9.2%	-53.5%	83.8%
Consumer Services	7,538	0.8%	16.2%	-82.2%	557.0%
Industrials	12,359	1.2%	10.4%	-61.7%	198.7%
Energy	898	1.5%	14.7%	-65.2%	122.2%
Health Care	7,453	1.4%	17.8%	-90.8%	292.2%
Real Estate	5,333	1.0%	12.4%	-77.3%	174.0%
Technology	4,712	1.5%	13.9%	-52.5%	141.9%
Telecommunications	1,843	0.8%	12.1%	-78.1%	126.6%
Utilities	165	0.5%	10.8%	-27.0%	40.0%
Control Variables					
SIXRX	168	1.04%	4.55%	-13.29%	12.16%
Exchange Rates					
Real Exchange Rates Change					
EUR/SEK	168	0.03%	1.40%	-3.74%	3.44%
USD/SEK	168	0.26%	2.26%	-5.78%	7.33%
Excess Exchange Rate Change					
EUR/SEK	168	0.00%	1.26%	-3.79%	2.62%
USD/SEK	168	0.23%	2.19%	-5.63%	6.50%

Appendix 3. Descriptive Statistics Profitability and Productivity

	Count	Mean	SD	Min	Max
Dependent Variables					
Operating Margin					
Basic Materials	1,263	-11.8%	1.8	-1639.5%	53.0%
Consumer Goods	424	6.3%	0.0	-16.8%	15.1%
Consumer Services	2,633	1.6%	0.4	-290.4%	62.4%
Industrials	4,156	6.4%	0.1	-97.3%	28.8%
Energy	242	8.3%	0.7	-334.8%	88.6%
Health Care	2,042	-2582.1%	117.6	-90400.0%	65.2%
Real Estate	1,885	46.2%	0.3	-125.7%	83.4%
Technology	1,589	-3.2%	0.5	-319.2%	41.4%
Telecommunications	609	9.3%	0.1	-47.8%	27.7%
Utilities	55	10.4%	0.3	-70.8%	75.8%
High Exporting	9,901	-200.1%	12.67	-11100.0%	48.7%
Low Exporting	4,997	18.8%	0.43	-244.8%	81.8%
COGS Margin					
Basic Materials	1,261	91.2%	1.2	33.9%	1175.6%
Consumer Goods	424	72.9%	0.1	52.0%	95.1%
Consumer Services	2,606	72.8%	0.3	11.3%	231.7%
Industrials	4,150	75.2%	0.2	26.3%	105.8%
Energy	237	56.5%	0.3	11.5%	161.0%
Health Care	1,912	1832.3%	92.7	0.0%	75539.6%
Real Estate	1,903	41.3%	0.4	10.7%	342.6%
Technology	1,588	72.2%	0.3	4.3%	243.3%
Telecommunications	609	55.8%	0.3	18.6%	142.7%
Utilities	55	54.2%	0.2	22.6%	100.0%
High Exporting	9,757	151.4%	5.48	3.5%	4825.0%
Low Exporting	4,988	60.1%	0.35	11.3%	233.2%
Labor Productivity					
Basic Materials	1,150	0.9	0.5	0.0	2.5
Consumer Goods	401	1.0	0.5	0.4	2.2
Consumer Services	2,456	0.8	0.7	0.1	3.8
Industrials	3,842	0.7	1.2	0.1	9.7
Energy	206	6.2	5.3	0.0	20.4
Health Care	2,306	0.5	0.5	0.0	2.8
Real Estate	1,754	3.4	2.5	0.2	10.4
Technology	1,532	0.6	0.5	0.1	2.8
Telecommunications	557	1.0	0.6	0.3	3.7
Utilities	55	2.6	3.0	0.6	20.2
High Exporting	9,593	0.8	1.24	0.0	9.6
Low Exporting	4,666	1.8	2.04	0.1	9.8
Total Factor Productivity					
Basic Materials	1,034	0.8	0.1	0.6	1.1
Consumer Goods	355	3.9	0.8	3.0	6.2
Consumer Services	2,214	1.8	0.6	0.3	4.1
Industrials	3,246	1.5	0.4	1.0	3.4
Energy	112	4.5	3.1	1.3	14.3
Health Care	1,593	1.2	1.1	0.0	5.9
Real Estate	1,641	1.8	0.7	0.5	3.9
Technology	1,102	1.0	0.9	0.2	7.3
Telecommunications	484	1.3	0.5	0.4	2.6
Utilities	55	0.1	0.0	0.1	0.3
High Exporting	7,571	2.5	1.65	0.0	12.3
Low Exporting	4,265	2.1	1.00	0.4	5.5

Appendix 3 (cont.). Descriptive Statistics Profitability and Productivity

Control Variables					
Log(MCAP)					
High Exporting	9,751	8.2	2.17	2.0	14.7
Low Exporting	4,354	8.5	1.82	2.2	13.3
Current Ratio					
High Exporting	10,309	4.0	55.62	0.0	4582.7
Low Exporting	3,295	1.8	1.88	0.1	42.3
Leverage Ratio					
High Exporting	10,241	0.9	42.52	-47.5	4301.3
Low Exporting	5,027	1.1	5.49	-225.1	125.6
Exchange Rates					
Real Exchange Rates					
EUR/SEK	55	10.0	0.77	8.6	11.6
USD/SEK	55	8.6	1.51	6.3	11.4
Excess Exchange Rates					
EUR/SEK	55	0.0	0.80	-1.4	2.0
USD/SEK	55	0.0	1.30	-2.0	2.6

Notes: Descriptive statistics for the individual industries dependent variables are presented to depict the exceptionally high Operating and COGS-Margins' means in the high-exporting industry, which is attributed to the Health Care industry, where some companies have low sales.

Appendix 4. Descriptive Statistics Total Factor Productivity

	Count	Mean	SD	Min	Max
Dependent Variables					
Log(Real Sales)					
High Exporting	7,571	6.48	2.62	-5.40	11.59
Low Exporting	4,265	6.36	1.84	-5.42	11.30
Independent Variables					
Log(Real Assets)					
High Exporting	7,571	8.39	2.35	1.35	15.04
Low Exporting	4,265	8.41	2.13	2.14	13.11
Log(Number of Employees)					
High Exporting	7,571	7.16	2.36	0.00	12.79
Low Exporting	4,265	6.23	2.18	0.47	14.29
Log(Real Materials)					
High Exporting	7,571	6.12	2.49	-6.23	11.25
Low Exporting	4,265	5.66	2.09	-0.40	11.09

Appendix 5. Companies

Name	Symbol	Currency	ISIN	Sector
AAK	AAK	SEK	SE0011337708	Consumer Goods
ABB Ltd	ABB	SEK	CH0012221716	Industrials
Abliva	ABLI	SEK	SE0002575340	Health Care
AcadeMedia	ACAD	SEK	SE0007897079	Consumer Services
Acrinova	ACRI A	SEK	SE0015660014	Real Estate
Actic Group	ATIC	SEK	SE0009269467	Consumer Services
Active Biotech	ACTI	SEK	SE0001137985	Health Care
AddLife	ALIF B	SEK	SE0014401378	Health Care
Addnode Group	ANOD B	SEK	SE0017885767	Technology
Addtech	ADDT B	SEK	SE0014781795	Industrials
Africa Oil	AOI	SEK	CA00829Q1019	Energy
AFRY	AFRY	SEK	SE0005999836	Industrials
Alfa Laval	ALFA	SEK	SE0000695876	Industrials
Alimak Group	ALIG	SEK	SE0007158910	Industrials
Alleima	ALLEI	SEK	SE0017615644	Basic Materials
Alligator Bioscience	ATORX	SEK	SE0000767188	Health Care
Alligo	ALLIGO B	SEK	SE0009922305	Industrials
Ambea	AMBEA	SEK	SE0009663826	Health Care
Annehem Fastigheter	ANNE B	SEK	SE0015221684	Real Estate
Anoto Group	ANOT	SEK	SE0010415281	Technology
AQ Group	AQ	SEK	SE0000772956	Industrials
Arctic Paper	ARP	SEK	PLARTPR00012	Basic Materials
Arise	ARISE	SEK	SE0002095604	Utilities
Arjo	ARJO B	SEK	SE0010468116	Health Care
Arla Plast	ARPL	SEK	SE0015810817	Industrials
Ascelia Pharma	ACE	SEK	SE0010573113	Health Care
ASSA ABLOY	ASSA B	SEK	SE0007100581	Industrials
AstraZeneca	AZN	SEK	GB0009895292	Health Care
Atlas Copco	ATCO A	SEK	SE0017486889	Industrials
Atrium Ljungberg	ATRLJ B	SEK	SE0000191827	Real Estate
Attendo	ATT	SEK	SE0007666110	Health Care
Autoliv SDB	ALIV SDB	SEK	SE0000382335	Consumer Services
Axfood	AXFO	SEK	SE0006993770	Consumer Goods
B3 Consulting Group	B3	SEK	SE0008347660	Technology
Bactiguard Holding	BACTI B	SEK	SE0005878741	Health Care
Balco Group	BALCO	SEK	SE0010323998	Industrials
BE Group	BEGR	SEK	SE0008321921	Basic Materials
Beijer Alma	BEIA B	SEK	SE0011090547	Basic Materials
Beijer Ref	BEIJ B	SEK	SE0015949748	Industrials
Bergman & Beving	BERG B	SEK	SE0000101362	Industrials
Besqab	BESQ	SEK	SE0005991411	Consumer Services
Betsson	BETS B	SEK	SE0020845014	Consumer Services
Better Collective	BETCO	SEK	DK0060952240	Technology
BHG Group	BHG	SEK	SE0010948588	Consumer Services
BICO Group	BICO	SEK	SE0013647385	Health Care
Bilia	BILI A	SEK	SE0009921588	Consumer Services
Billerud	BILL	SEK	SE0000862997	Basic Materials
BioArctic	BIOA B	SEK	SE0010323311	Health Care
BioGaia	BIOG B	SEK	SE0017769995	Health Care
BioInvent International	BINV	SEK	SE0015244520	Health Care
Biotage	BIOT	SEK	SE0000454746	Health Care
Björn Borg	BORG	SEK	SE0020050805	Consumer Services
Boliden	BOL	SEK	SE0020050417	Basic Materials
Bonava	BONAV A	SEK	SE0008091573	Consumer Services
BONESUPPORT HOLDING	BONEX	SEK	SE0009858152	Health Care
Bong	BONG	SEK	SE0000396061	Industrials
Boozt	BOOZT	SEK	SE0009888738	Consumer Services
Boule Diagnostics	BOUL	SEK	SE0011231158	Health Care

Appendix 5 (cont.). Companies

Bravida Holding	BRAV	SEK	SE0007491303	Industrials
Brinova Fastigheter	BRIN B	SEK	SE0008347652	Real Estate
BTS Group	BTS B	SEK	SE0000805426	Industrials
Bufab	BUFAB	SEK	SE0005677135	Industrials
Bulten	BULTEN	SEK	SE0003849223	Consumer Services
Byggfakta Group Nordic HoldCo	BFG	SEK	SE0016798581	Technology
Byggmax Group	BMAX	SEK	SE0003303627	Consumer Services
C-RAD	CRAD B	SEK	SE0002016352	Health Care
Calliditas Therapeutics	CALTX	SEK	SE0010441584	Health Care
Camurus	CAMX	SEK	SE0007692850	Health Care
Cantargia	CANTA	SEK	SE0006371126	Health Care
Castellum	CAST	SEK	SE0000379190	Real Estate
Catena	CATE	SEK	SE0001664707	Real Estate
Catena Media	CTM	SEK	MT0001000109	Consumer Services
Cavotec	CCC	SEK	CH0136071542	Industrials
CellaVision	CEVI	SEK	SE0000683484	Health Care
Christian Berner Tech Trade	CBTT B	SEK	SE0006143129	Industrials
Cibus Nordic Real Estate	CIBUS	SEK	SE0010832204	Real Estate
Cint Group	CINT	SEK	SE0015483276	Technology
Clas Ohlson	CLAS B	SEK	SE0000584948	Consumer Services
Cloetta	CLA B	SEK	SE0002626861	Consumer Goods
Concejo	CNCJO B	SEK	SE0000236382	Industrials
Concentric	COIC	SEK	SE0003950864	Industrials
Concordia Maritime	CCOR B	SEK	SE0000102824	Industrials
Coor Service Management Hold.	COOR	SEK	SE0007158829	Industrials
Copperstone Resources	COPP	SEK	SE0021148160	Basic Materials
Corem Property Group	CORE A	SEK	SE0010714279	Real Estate
Corem Property Group Pref	CORE PREF	SEK	SE0010714311	Real Estate
CTEK	CTEK	SEK	SE0016798763	Energy
CTT Systems	CTT	SEK	SE0000418923	Industrials
Dedicare	DEDI	SEK	SE0003909282	Health Care
Diös Fastigheter	DIOS	SEK	SE0001634262	Real Estate
Dometic Group	DOM	SEK	SE0007691613	Consumer Services
DORO	DORO	SEK	SE0000215493	Telecommunications
Duni	DUNI	SEK	SE0000616716	Consumer Goods
Duroc	DURC B	SEK	SE0000331266	Basic Materials
Dustin Group	DUST	SEK	SE0006625471	Consumer Services
Eastnine	EAST	SEK	SE0002158568	Real Estate
Egetis Therapeutics	EGTX	SEK	SE0003815604	Health Care
Elanders	ELAN B	SEK	SE0000119299	Industrials
Electrolux	ELUX A	SEK	SE0016589170	Consumer Services
Electrolux Professional	EPRO B	SEK	SE0013747870	Industrials
Elekta	EKTA B	SEK	SE0000163628	Health Care
Elon	ELON	SEK	SE0001572520	Consumer Services
Eltel	ELTEL	SEK	SE0006509949	Industrials
Embracer Group	EMBRAC B	SEK	SE0016828511	Consumer Services
Enea	ENEA	SEK	SE0009697220	Technology
Engcon	ENGCON B	SEK	SE0017769847	Industrials
Eniro Group	ENRO	SEK	SE0011256312	Consumer Services
Eolus Vind	EOLU B	SEK	SE0007075056	Energy
Ependion	EPEN	SEK	SE0000671711	Industrials
Epiroc	EPI A	SEK	SE0015658109	Industrials
Episurf	EPIS B	SEK	SE0003491562	Health Care
Ericsson	ERIC A	SEK	SE0000108649	Telecommunications
Essity	ESSITY A	SEK	SE0009922156	Consumer Goods
Evolution	EVO	SEK	SE0012673267	Consumer Services
Ework Group	EWRK	SEK	SE0002402701	Industrials
Fabege	FABG	SEK	SE0011166974	Real Estate
Fagerhult Group	FAG	SEK	SE0010048884	Industrials

Appendix 5 (cont.). Companies

Fasadgruppen Group	FG	SEK	SE0015195771	Industrials
Fast. Balder	BALD B	SEK	SE0017832488	Real Estate
Fastator	FASTAT	SEK	SE0015407382	Real Estate
Fastighetsbolag. Emilshus Pref	EMIL PREF	SEK	SE0016785794	Real Estate
Fastighetsbolaget Emilshus	EMIL B	SEK	SE0016785786	Real Estate
Fastpartner	FPAR A	SEK	SE0013512506	Real Estate
Fenix Outdoor International	FOI B	SEK	CH0242214887	Consumer Services
Ferronordic	FNM	SEK	SE0005468717	Industrials
Fingerprint Cards	FING B	SEK	SE0008374250	Technology
FM Mattsson Mora Group	FMM B	SEK	SE0018040883	Industrials
Formpipe Software	FPIP	SEK	SE0001338039	Technology
Fortnox	FNOX	SEK	SE0017161243	Technology
G5 Entertainment	G5EN	SEK	SE0001824004	Consumer Services
Gaming Innovation Group	GIGSEK	SEK	US36467X2062	Consumer Services
Garo	GARO	SEK	SE0015812417	Technology
Genova Property Group	GPG	SEK	SE0007184189	Real Estate
Getinge	GETI B	SEK	SE0000202624	Health Care
Gränges	GRNG	SEK	SE0006288015	Consumer Services
Green Landscaping Group	GREEN	SEK	SE0010985028	Industrials
HAKI Safety	HAKI A	SEK	SE0000122657	Industrials
Hansa Biopharma	HNSA	SEK	SE0002148817	Health Care
HANZA	HANZA	SEK	SE0005878543	Industrials
HEBA	HEBA B	SEK	SE0017911480	Real Estate
Hemnet Group	HEM	SEK	SE0015671995	Real Estate
Hennes & Mauritz	HM B	SEK	SE0000106270	Consumer Services
Hexagon	HEXA B	SEK	SE0015961909	Technology
Hexatronic Group	HTRO	SEK	SE0018040677	Telecommunications
HEXPOL	HPOL B	SEK	SE0007074281	Basic Materials
HMS Networks	HMS	SEK	SE0009997018	Telecommunications
Holmen	HOLM A	SEK	SE0011090000	Basic Materials
Hufvudstaden	HUFV A	SEK	SE0000170375	Real Estate
Humana	HUM	SEK	SE0008040653	Health Care
Husqvarna	HUSQ A	SEK	SE0001662222	Consumer Services
I.A.R Systems Group	IAR B	SEK	SE0005851706	Technology
Image Systems	IS	SEK	SE0006421871	Industrials
Immunovia	IMMNOV	SEK	SE0006091997	Health Care
Indutrade	INDT	SEK	SE0001515552	Industrials
Infant Bacterial Therapeutics	IBT B	SEK	SE0008015259	Health Care
Infrea	INFREA	SEK	SE0010600106	Industrials
Instalco	INSTAL	SEK	SE0017483506	Industrials
International Petroleum Corp.	IPCO	SEK	CA46016U1084	Energy
INVISIO	IVSO	SEK	SE0001200015	Industrials
Inwido	INWI	SEK	SE0006220018	Industrials
IRLAB Therapeutics	IRLAB A	SEK	SE0012675361	Health Care
Isofol Medical	ISOFOL	SEK	SE0009581051	Health Care
ITAB Shop Concept	ITAB	SEK	SE0015962097	Industrials
JM	JM	SEK	SE0000806994	Real Estate
John Mattson Fastighetsföret.	JOMA	SEK	SE0012481364	Real Estate
K-Fast Holding	KFAST B	SEK	SE0016101679	Real Estate
K2A Knaust & Andersson	K2A B	SEK	SE0010520254	Real Estate
KABE Group	KABE B	SEK	SE0000107724	Consumer Services
Karnov Group	KAR	SEK	SE0012323715	Consumer Services
Karolinska Development	KDEV	SEK	SE0002190926	Health Care
Kindred Group	KIND SDB	SEK	SE0007871645	Consumer Services
KlaraBo Sverige	KLARA B	SEK	SE0010832287	Real Estate
Knowit	KNOW	SEK	SE0000421273	Technology
Lagercrantz Group	LAGR B	SEK	SE0014990966	Technology
Lammhults Design Group	LAMM B	SEK	SE0000386138	Consumer Services
Lifco	LIFCO B	SEK	SE0015949201	Industrials

Appendix 5 (cont.). Companies

Lime Technologies	LIME	SEK	SE0011870195	Technology
Lindab International	LIAB	SEK	SE0001852419	Industrials
Logistea	LOGI A	SEK	SE0017131329	Real Estate
Loomis	LOOMIS	SEK	SE0014504817	Industrials
Lucara Diamond Corp	LUC	SEK	CA54928Q1081	Basic Materials
Lundin Gold	LUG	SEK	CA5503711080	Basic Materials
Lundin Mining Corporation	LUMI	SEK	CA5503721063	Basic Materials
Maha Energy	MAHA A	SEK	SE0008374383	Energy
Malmbergs Elektriska	MEAB B	SEK	SE0000507659	Industrials
MedCap	MCAP	SEK	SE0009160872	Health Care
Medicover	MCOV B	SEK	SE0009778848	Health Care
Medivir	MVIR	SEK	SE0020181014	Health Care
MEKO	MEKO	SEK	SE0002110064	Consumer Services
Mendus	IMMU	SEK	SE0005003654	Health Care
Micro Systemation	MSAB B	SEK	SE0000526626	Technology
Midsona	MSON A	SEK	SE0000565210	Consumer Goods
Mildef Group	MILDEF	SEK	SE0016074249	Industrials
Millicom Int. Cellular SDB	TIGO SDB	SEK	SE0001174970	Telecommunications
Mips	MIPS	SEK	SE0009216278	Consumer Services
Moberg Pharma	MOB	SEK	SE0020353928	Health Care
Modern Times Group	MTG B	SEK	SE0018012494	Consumer Services
Moment Group	MOMENT	SEK	SE0020388932	Consumer Services
Momentum Group	MMGR B	SEK	SE0017562523	Industrials
Munters Group	MTRS	SEK	SE0009806607	Industrials
Mycronic	MYCR	SEK	SE0000375115	Technology
mySafety Group	SAFETY B	SEK	SE0010769182	Technology
Nanologica	NICA	SEK	SE0005454873	Health Care
NCAB Group	NCAB	SEK	SE0017160773	Technology
NCC	NCC A	SEK	SE0000118952	Industrials
Nederman Holding	NMAN	SEK	SE0011204510	Industrials
Nelly Group	NELLY	SEK	SE0015245535	Consumer Services
Net Insight	NETI B	SEK	SE0000366098	Telecommunications
Netel Holding	NETEL	SEK	SE0016798417	Industrials
New Wave	NEWA B	SEK	SE0020356970	Consumer Services
NGS Group	NGS	SEK	SE0009947708	Industrials
NIBE Industrier	NIBE B	SEK	SE0015988019	Industrials
Nilörngruppen	NIL B	SEK	SE0007100342	Consumer Services
Nivika Fastigheter	NIVI B	SEK	SE0017083272	Real Estate
Nobia	NOBI	SEK	SE0000949331	Consumer Services
Nolato	NOLA B	SEK	SE0015962477	Industrials
Nordic Paper Holding	NPAPER	SEK	SE0014808838	Basic Materials
Nordic Waterproofing Holding	NWG	SEK	SE0014731089	Industrials
Nordisk Bergteknik	NORB B	SEK	SE0015812128	Basic Materials
Norva24 Group	NORVA	SEK	SE0017084759	Industrials
NOTE	NOTE	SEK	SE0001161654	Industrials
NOVOTEK B	NTEK B	SEK	SE0000567752	Technology
NP3 Fastigheter	NP3	SEK	SE0006342333	Real Estate
Nyfosa	NYF	SEK	SE0011426428	Real Estate
OEM International	OEM B	SEK	SE0017766843	Industrials
Oncopeptides	ONCO	SEK	SE0009414576	Health Care
Orexo	ORX	SEK	SE0000736415	Health Care
Orrön Energy	ORRON	SEK	SE0000825820	Energy
Ortivus	ORTI A	SEK	SE0000188930	Health Care
Oscar Properties Holding	OP	SEK	SE0016278303	Real Estate
Ovzon	OVZON	SEK	SE0010948711	Telecommunications
OX2	OX2	SEK	SE0016075337	Energy
Pandox	PNDX B	SEK	SE0007100359	Real Estate
Peab	PEAB B	SEK	SE0000106205	Industrials
Pierce Group	PIERCE	SEK	SE0015658364	Consumer Services

Appendix 5 (cont.). Companies

PION Group	PION B	SEK	SE0000567539	Industrials
Platzer Fastigheter Holding	PLAZ B	SEK	SE0004977692	Real Estate
PowerCell Sweden	PCELL	SEK	SE0006425815	Industrials
Precise Biometrics	PREC	SEK	SE0018013849	Technology
Prevas	PREV B	SEK	SE0000356008	Technology
Pricer	PRIC B	SEK	SE0000233934	Technology
Proact IT Group	PACT	SEK	SE0015961222	Technology
Probi	PROB	SEK	SE0001280355	Health Care
Profilgruppen	PROF B	SEK	SE0000393860	Basic Materials
Profoto Holding	PRFO	SEK	SE0015962147	Industrials
Projektengagemang Sweden	PENG B	SEK	SE0011337666	Industrials
Q-Linea	QLINEA	SEK	SE0011527845	Health Care
Railcare Group	RAIL	SEK	SE0010441139	Industrials
RaySearch Laboratories	RAY B	SEK	SE0000135485	Health Care
Rejlers	REJL B	SEK	SE0000123671	Industrials
Rizzo Group	RIZZO B	SEK	SE0016276109	Consumer Services
Rottneros	RROS	SEK	SE0000112252	Basic Materials
Rusta	RUSTA	SEK	SE0020848356	Consumer Services
RVRC Holding	RVRC	SEK	SE0015962485	Consumer Services
SAAB	SAAB B	SEK	SE0000112385	Industrials
Sagax	SAGA A	SEK	SE0004635878	Real Estate
Samhällsbyggnadsbo. i Norden	SBB B	SEK	SE0009554454	Real Estate
Sandvik	SAND	SEK	SE0000667891	Industrials
Saniona	SANION	SEK	SE0005794617	Health Care
SAS	SAS	SEK	SE0003366871	Consumer Services
SCA	SCA A	SEK	SE0000171886	Basic Materials
Scandi Standard	SCST	SEK	SE0005999760	Consumer Goods
Scandic Hotels Group	SHOT	SEK	SE0007640156	Consumer Services
Sdiptech	SDIP B	SEK	SE0003756758	Industrials
SECTRA	SECT B	SEK	SE0020539310	Health Care
Securitas	SECU B	SEK	SE0000163594	Industrials
Sedana Medical	SEDANA	SEK	SE0015988373	Health Care
Sensys Gatso Group	SGG	SEK	SE0020356244	Technology
Senzime	SEZI	SEK	SE0002478776	Health Care
Sinch	SINCH	SEK	SE0016101844	Technology
SinterCast	SINT	SEK	SE0000950982	Industrials
Sivers Semiconductors	SIVE	SEK	SE0003917798	Technology
Skanska	SKA B	SEK	SE0000113250	Industrials
SKF	SKF A	SEK	SE0000108201	Basic Materials
SkiStar	SKIS B	SEK	SE0012141687	Consumer Services
Sleep Cycle	SLEEP	SEK	SE0015961404	Technology
Softronic	SOF B	SEK	SE0000323305	Technology
SSAB	SSAB A	SEK	SE0000171100	Basic Materials
Starbreeze	STAR A	SEK	SE0007158928	Consumer Services
Stendörren Fastigheter	STEF B	SEK	SE0006543344	Real Estate
Stillfront Group	SF	SEK	SE0015346135	Consumer Services
Stora Enso	STE A	SEK	FI0009007603	Basic Materials
Strax	STRAX	SEK	SE0012040459	Consumer Services
Studsvik	SVIK	SEK	SE0000653230	Industrials
Svedbergs Group	SVED B	SEK	SE0000407991	Industrials
SWECO	SWEC A	SEK	SE0014960365	Industrials
Swedish Logistic Property	SLP B	SEK	SE0017565476	Real Estate
Swedish Orphan Biovitrum	SOBI	SEK	SE0000872095	Health Care
SynAct Pharma	SYNACT	SEK	SE0008241491	Health Care
Synsam	SYNSAM	SEK	SE0016829709	Consumer Services
Systemair	SYSR	SEK	SE0016609499	Industrials
Tele2	TEL2 A	SEK	SE0005190220	Telecommunications
Telia Company	TELIA	SEK	SE0000667925	Telecommunications
Tethys Oil	TETY	SEK	SE0020180917	Energy

Appendix 5 (cont.). Companies

Thule Group	THULE	SEK	SE0006422390	Consumer Services
TietoEVRY Oyj	TIETOS	SEK	FI0009000277	Technology
Tobii	TOBII	SEK	SE0002591420	Technology
Tobii Dynavox	TDVOX	SEK	SE0017105620	Technology
TradeDoubler	TRAD	SEK	SE0001552357	Technology
Transtema Group	TRANS	SEK	SE0006758587	Industrials
TRATON	8TRA	SEK	DE000TRAT0N7	Industrials
Trelleborg	TREL B	SEK	SE0000114837	Industrials
Trianon	TRIAN B	SEK	SE0018013658	Real Estate
Troax Group	TROAX	SEK	SE0012729366	Basic Materials
Truecaller	TRUE B	SEK	SE0016787071	Technology
VBG GROUP	VBG B	SEK	SE0000115107	Consumer Services
Vestum	VESTUM	SEK	SE0017134125	Consumer Services
Viaplay Group	VPLAY A	SEK	SE0012324226	Telecommunications
Vicore Pharma Holding	VICO	SEK	SE0007577895	Health Care
Vitec Software Group	VIT B	SEK	SE0007871363	Technology
Vitrolife	VITR	SEK	SE0011205202	Health Care
Vivesto	VIVE	SEK	SE0000722365	Health Care
Volati	VOLO	SEK	SE0009143662	Industrials
Volati Pref	VOLO PREF	SEK	SE0009143670	Industrials
Volvo	VOLV A	SEK	SE0000115420	Industrials
Volvo Car	VOLCAR B	SEK	SE0016844831	Consumer Services
Wall to Wall Group	WTW A	SEK	SE0016075246	Industrials
Wallenstam	WALL B	SEK	SE0017780133	Real Estate
Wästbygg Gruppen	WBGR B	SEK	SE0014453874	Industrials
Wihlborgs Fastigheter	WIHL	SEK	SE0018012635	Real Estate
Wise Group	WISE	SEK	SE0007277876	Industrials
XANO Industri	XANO B	SEK	SE0018014151	Industrials
Xbrane Biopharma	XBRANE	SEK	SE0007789409	Health Care
Xspray Pharma	XSPRAY	SEK	SE0009973563	Health Care
Xvivo Perfusion	XVIVO	SEK	SE0004840718	Health Care