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The effects and implications of zero and negative interest rate policy on corporate valuation multiples

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Abstract

Zero and negative central bank policy rates have become more predominant primarily due to a fall in the natural interest rate and financial crises (bursting of the dot.com bubble in 2000, the Global Financial Crisis (GFC) of 2008, and the European Sovereign Debt Crises since the onset of the GFC) accelerating the natural interest rate's decline. Since the mid-1980's, the natural interest rate has gradually fallen and in turn has lowered 10-year sovereign government bond yields globally, which are commonly used as the risk-free rate in computing the cost of capital (and its components cost of equity and cost of debt, which both depend significantly on the risk-free rate) for a firm. The focus of this paper is on the impact of zero and negative interest rate policy through the discount rate channel on corporate valuation multiples, which are EV/EBITDA, EV/EBIT, P/E TTM, and P/E forward-looking. The sample countries are chosen on the basis that their central banks' policy rates have reached zero or below within the sample date range from 1996 to 2019. After, the valuation multiples of the three largest firms by market capitalization of each sample country over the sample date range are collected. Structural breakpoints in the time series of each countries' respective 1-month (or 3-month if 1-month not available) interbank rate are identified to determine points in time where one would expect the corporate valuation multiples to increase or decrease (depending on the sign of the change in the mean interbank rate after the structural breakpoints identified). The results show that median corporate valuation multiples significantly rose after the GFC of 2008 as a consequence of central banks' policy rates being cut to and remaining at zero or below for an extended period of time.

Section 1. Introduction

Unaccounted for in many foundational economic theories and models such as the IS-LM model, the capital asset pricing model, the Solow-Swan model etc., zero and negative interest rates pose a significant obstacle to and cast doubt on many of the underpinnings to countless aspects of economics. For example, conventional monetary policy is classed as the use of three monetary policy tools to achieve a central bank’s mandate such as stable, low, and positive inflation, full employment, economic growth, etc.: open market operations (OMO), defined as the purchasing or selling of government debt securities by the central bank (CB) to provide or withdraw reserves to and from depository institutions in order to achieve a target interbank lending rate, standing facilities or loans from the CB to depository institutions, and changing the minimum reserve requirement of depository institutions. Notably, OMO is the main method for CBs to realize a target interbank lending rate. Due to the Global Financial Crisis (GFC) of 2008, quantitative easing (QE) (large asset purchase programs to unclog liquidity-stripped credit markets by lowering interest rates, e.g., purchase of 10-year Treasury Bonds and mortgage-backed securities, to stimulate investment spending) has led to the ballooning of the supply of reserves in developed economies’ financial systems. This glut of reserves in excess of required reserves, driven by QE, has rendered CBs’ main monetary policy tool OMO useless, as increases in the supply of reserves (through OMO) do not change the interbank lending rate (Wolla, 2019). As such, CB policymakers have had to resort to unconventional monetary policy tools (those tools used when the CB policy rate has reached the zero-lower bound) such as forward guidance, long-term QE, and yield curve control (Rudebusch, 2018). Consequently, developed economies’ CBs in light of the exponential increase in reserves in their systems of depository institutions are faced with a heavy headwind. This headwind is trying to achieve an accommodative monetary policy stance at the zero-lower bound (i.e. lower the real interest rate as this is the main determinant of investment spending and borrowing) in order to spark economic growth.

The risk-free rate, defined as the rate of return (more commonly referred to as yield-to-maturity (YTM)) of default-free government debt securities, is extensively used in many facets of economics and finance. Risk-free rates are predominantly used in valuing financial instruments (forwards, futures, options, etc.) and in determining the hurdle and discount rates used to assess and value projects, assets, and firms. Most notably, risk-free rates play a pivotal role in discerning and affecting the fundamental value of a firm's project and a firm as a whole. Due to the substantial role risk-free rates, which are dependent on the CB's policy rate, play in the determination of hurdle rates and discount rates that affect the valuation of a project, asset, and firm, one must call into question whether the suppression of policy rates, and in turn the (long-term) risk-free rates used in calculating hurdle and discount rates, increases the valuation of companies, all else equal. It is common practice in determining the fundamental value of a firm or project to discount the firm's or project's expected cashflows considering aspects endogenous to the cashflows. The most common method for estimating the fundamental value of a firm or project is the discounted-cash-flow (DCF) method. In addition to the DCF method, comparable peer companies' multiples of earnings and profitability metrics such as price-to-earnings-per-share (P/E) and enterprise-value-to-earnings-before-interest-depreciation-amortization (EBITDA) are used to benchmark and provide a range for the fundamental valuation. Due to the dependency of the fundamental value of firms on a CB's policy rate and the long-term risk-free rate, it is of importance to explore how the gradual decline and the potential suppression of the natural interest rate (and thus, policy, nominal, and real interest rates) impacts the valuation of companies, specifically the multiples used to value a company.

This paper is structured as follows: First, a review of literature on the natural interest rate, its drivers, and the causes of its decline, literature on real and nominal interest rates, literature on discount rates and its determinants, and literature on valuation using the discounted cash flow and multiples methods. Furthermore, hypotheses on the implications of zero and negative interest rate policy on the corporate valuation multiples are formulated. Second, the data, the data collection methods, and data sources are explained. Third, the methods of discerning structural breakpoints in interbank rate time series and analyzing multiples data are elaborated upon. Fourth, the results of the analysis are described, and its implications are explored and detailed. Fifth, a conclusion on the implications and consequences of zero and negative interest rates on corporate valuation multiples is drawn and a call for more research on zero and negative interest rates and their effects discount rates and household wealth is made.

Section 2. Theoretical Framework

2.1. Natural, real, and nominal interest rates

2.1.1. The natural interest rate, its drivers for its decline, and the expected prevalence of low natural interest rates

Definition

An unobservable and difficult to estimate or predict parameter, the natural or neutral interest rate (NIR) is the real interest rate which neither stimulates or restrains actual real economic output (value of economic output adjusted for inflation) above or below potential output (real economic output at the natural rate of unemployment or full employment) and does not push or pull inflation above or below an inflation target rate (Lane, 2019; Wicksell, 1936; Williams, 2003). The NIR equates actual real gross domestic product (GDP) to potential GDP, which achieves the nonaccelerating inflation rate of unemployment (NAIRU) (Mishkin, 2019). The NAIRU is the unemployment rate that does not cause inflation to change, i.e. inflation rate is constant. As such, the NIR does not produce any type of additional inflationary pressures (deflationary or inflationary) at full employment. The NIR can be concluded to be a function of the potential output growth rate (which is determined by the growth rate of the amount of labor, capital accumulation (which is a function of an economy's savings rate), total factor productivity (marginal productivity of labor and capital with respect to output), and technological progress) and the selected target inflation rate (Holston, Laubach, & Williams, 2016; IMF, 2015; Laubach & Williams, 2015).

The drivers for the decline of the natural interest rate

Much of literature mentions three primary factors for the gradual decline of the NIR (and hence, interbank rates and 10-year sovereign government bond yields, see Figure 1) since the mid-1980's: demographic trends, decline in potential growth rates, flight to safe assets and risk aversion (Brand, Bielecki, Brzoza-Brzezina, & Kolasa, 2018).

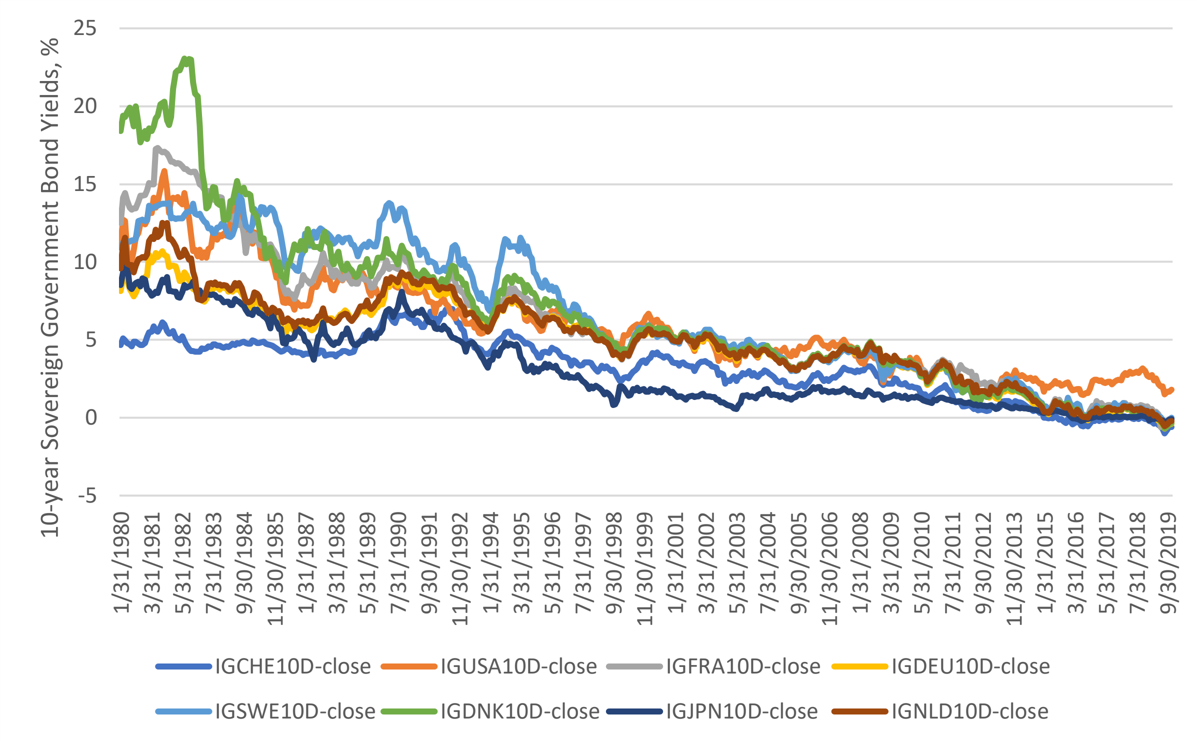

Figure 1. *Monthly 10-year Sovereign government bond yields of Switzerland, the U.S.A., the Netherlands, Germany, France, Sweden, Denmark, and Japan, 1980-2019*

Demographic trends

Demographic trends are perceived as the main driver of the gradual decline in the NIR in developed economies (the United States (U.S.), the Euro Area, and Japan etc.). Primarily, both decreases in the fertility rate and a longer life expectancy (which both decrease the growth of labor as an input in the production function of an economy, and hence decreases potential output growth and the NIR) as well as increased income inequality have led to the declination of the NIR (Brand et al., 2018). These demographic trends have had their influence on the NIR through three particular channels:

The decreases in fertility rates have translated into slower population growth and increases in the old-age dependency ratios across the U.S. and the Euro Area (Brand et al., 2018). In turn, declining fertility rates have decreased the amount of labor and thus reduced the demand for capital (Brand et al., 2018). Labor is one of two production factors in an economy, and as labor decreases, ceteris paribus, capital per worker increases, thus reducing the marginal productivity of capital (which is the increase in output per one unit increase in capital), and the NIR (Solow, 1956). Consequently, declining fertility rates are analogous to a permanent deterioration in potential output growth (Brand et al., 2018).

Increases in life expectancy have led to a depressive impact on NIRs in the form of increased savings (Brand et al., 2018). As life expectancy increases, the preference to save more in expectation of a longer life and, hence a longer retirement life, grows (Brand et al., 2018). Consequently, the increase in life expectancy, which translates into increased savings, increases the supply of capital and thus decreases the marginal productivity of capital, due to diminishing marginal returns to capital (Brand et al., 2018; Solow, 1956). The decrease in the marginal productivity of capital leads to a decline in potential output growth and the NIR.

An increase in the proportion of dissavers as a direct result of an increase in life expectancy, which lowers capital supply and increases the marginal productivity of capital, has an uplifting effect on the NIR (Brand et al., 2018). However, the consensus is that an ageing population, driven by suppressed fertility rates and a longer life expectancy, have led to the NIR to gradually decline since these demographic trends ensued.

Another important demographic trend which has contributed to the decline of the NIR has been the growing disparity in income distribution. As shown by Rannenberg (2019), increases in income inequality have been driven by increases in wage inequality. Subsequently, an increase in income inequality could decrease the NIR as rich households have a higher tendency to save a portion of the permanent increase in income, which increases the amount of capital available and decreases the marginal productivity of capital (Brand et al., 2018; Lane, 2019). As before, decreases in the marginal productivity of capital, all else equal, leads to a decrease in the growth of potential output, which decreases the NIR.

Decline in potential growth rates

Decreases in potential output growth are also to blame for the depression of the NIR. What has driven the decline in potential output growth has been a decline in both total factor productivity and labor productivity growth (Lane, 2019). Another reason for why potential output growth has declined is because of employment growth being concentrated in the services sector in developed economies (Lane, 2019). Productivity growth in the services sector has stagnated relative to other sectors like manufacturing and informationtechnology, and alongside the increase in proportion of the services sector employment with respect to total employment, this leads to a depressive influence on potential output growth (Lane, 2019).

Flight to safety and risk aversion

Since the 1990's, risk aversion and the preference and demand for safe and liquid assets has dramatically increased, causing the NIR to decline (Del Negro, Giannone, Giannoni, & Tambalotti, 2017). Due to an increasing life expectancy and suppressed fertility rate, an ageing population has led to a heightened preference for lower-risk assets as the senior saver nears a relatively longer retirement (Lane, 2019; Papetti, 2019). Additionally, the introduction of stricter financial regulations, specifically the Basel II and more recently the Basel III Accord, has amplified the demand and preference for high quality liquid assets (Lane, 2019). Financial intermediaries' increased demand for high quality liquid assets has been primarily driven by new regulatory requirements such as the Liquidity Coverage Ratio and increased capital requirements.

The expected prevalence of very low NIRs

Declines in labor growth, total factor productivity, potential output growth, and heightened risk aversion and demand for safe assets have led to the gradual decline in the NIR across developed economies (Holston et al., 2016; IMF, 2015). The GFC of 2008 accelerated the decline in the NIR due to the sharp decline in potential output growth it had brought alongside the effect of the continuing demographic trend of an ageing population on labor growth (IMF, 2015). Further declines in potential output growth, incited by a decline in the growth of the working-age population and total factor productivity growth, are expected to depress developed economies' NIRs long-term, and in turn confine CBs' policy rates to the zero-lower bound (Laubach & Williams, 2015). The issue of CB policy rates and real interest rates at the zero-lower bound is exacerbated by the fact that monetary policy is awfully limited in its ability to influence potential output growth, which is the main determinant for the immense decline in the NIR since the 1980's. As such, one can expect developed economies' CBs' policy rates and real interest rates to be confined at the zero-lower bound for the medium- to long-term unless fiscal policy and structural reforms are put in place which increase potential output and potential output growth.

2.1.2. The real interest rate

Fisher effect

The Fisher effect stipulates that the (ex-ante) real interest rate is equal to the difference between the nominal interest rate and the expected inflation rate (Fisher, 1930; Mundell, 1963). As such, for savings to equal investment at a certain real interest rate, one must increase the nominal interest rate by the expected inflation rate (Fisher 1930; Mundell, 1963). Much of literature on the behavior and components of interest rates are concentrated on interest rates in the U.S. due to the continuity of its data. Mishkin (1981) finds that the ex-post (or realized) real interest rate is significantly negatively correlated with the ex-post inflation rate and that increased money growth rates, which are associated with an increase in the inflation rate, are associated with a decrease in real interest rates (consistent with Fisher, 1930; Mundell, 1963). Crowder and Hoffman (1996) also find significant evidence for the validity of the tax-adjusted Fisher equation, where a one percent increase in the inflation rate leads to a 1.34 percent increase in the nominal interest rate, which after accounting for taxes is approximately a one-to-one increase.

2.1.3. The nominal interest rate

Risk structure of interest rates

Merton

As proposed by Merton (1974), the Black-Scholes Formula can be used to price corporate debt, specifically discount bonds which do not pay out a coupon, to determine the risk structure of interest rates. The risk structure of interest rates is defined as the evolution of the price of or yield on fixed income instruments (bonds) with the same term to maturity as the probability of default increases. Accordingly, the risk structure of interest rates is equivalent to the risk premium (defined as the difference between the YTM on risky debt given the firm does not default and the YTM on risk-free debt with an equivalent maturity to that of the risky debt), which is a function of the variance of the firm's operations and the ratio of the present value of the promised repayment (discounted at the risk-free rate) of the debt to the current value of the firm (Merton, 1974). Thus, as the variance of the firm's operations (volatility of firm's cash flows) or the ratio of debt-to-firm value increases, the risk premium and hence the default risk increases and vice versa.

Mishkin

The risk structure of interest rates (with respect to corporate bonds) is a function of default risk, liquidity, and tax considerations (Mishkin, 2019).

As the default risk on a corporate bond increases for a certain firm, the expected return on the corporate bond decreases relative to the expected return of risk-free bonds and the corporate bond's relative riskiness (in line with theory of portfolio choice, uncertainty of expected return is proxied by variance of returns) increases (Mishkin, 2019). Consequently, the demand for the corporate bond falls as it is less desirable relative to risk-free bonds, causing the equilibrium price of the corporate bond to fall and its equilibrium YTM to rise (Mishkin, 2019). Simultaneously, the default-free bond increases in desirability and demand (due to an increase in expected return relative to the default-prone corporate bond and fall in relative riskiness), which increases the equilibrium price of the default-free bond, thus leading to a fall in the equilibrium YTM of the default-free bond (Mishkin, 2019). In sum, the risk premium widens as default risk for a company increases. Hence, a corporate bond with a higher probability of default relative to another corporate bond with the same term to maturity will have a higher YTM.

Mishkin (2019) stipulates that the more liquid (which is how quickly and cheaply an asset can be converted into cash) a bond is, ceteris paribus, the more desirable and in demand it is, which increases its price and lowers its YTM. The more traded a bond is, the more liquid it is, as it is easier to sell quickly and cheaply. As such, if the liquidity for a corporate bond falls, the YTM of the corporate bond increases relative to the more widely traded risk-free bond (Mishkin, 2019).

The risk structure of interest rates is influenced by the income tax considerations, specifically whether the coupon payments are subject to taxation or not. The YTM on a bond whose coupon payments are not taxed is lower relative to a bond that is subject to taxation (Mishkin, 2019).

Term structure of interest rates – Mishkin

Modifications of the Expectations Theory Liquidity Premium Theory and Preferred Habitat Theory

The term structure of interest rates is the plot of the yields on bonds with differing terms to maturity that have identical default risk, liquidity, and tax considerations. Fisher's Expectations Theory and the revised version of the Expectations Theory by Hicks and Lutz fail to explain all three empirical facts on the yield curve, which are: 1) Yields on bonds of different maturities move together over time, 2) when short-term interest rates are low, yield curves are more likely to have an upward slope; when short-term interest rates are high, yields curves are more likely to slope downward and be inverted, 3) yield curves almost always slope upward (Mishkin, 2019). Both the liquidity premium theory (LPT) and the preferred habitat theory (PHT) explain all three empirical facts.

The LPT is based on a key assumption that bonds with differing maturities are substitutes, implying that a bond's expected return (its yield) does affect the expected return on a bond with a different maturity (Mishkin, 2019). Additionally, the LPT does allow for investors to prefer one bond over another. Specifically, investors prefer short-term bonds due to lower interest-rate risk (duration risk) and as such must be offered a positive liquidity premium to be willing to hold longer-term bonds (Mishkin, 2019). In sum, the LPT shows that the interest rate on a long-term bond will equal an average of short-term interest rates expected to occur over the term to maturity of the long-term bond plus a liquidity premium that is influenced by the supply and demand conditions for that bond (Mishkin, 2019).

In the PHT, it is assumed that investors can prefer to invest in bonds with a certain maturity to another. Investors are only induced to buy a bond that is not of their preferred maturity by earning a higher expected return on that bond relative to the bond with the preferred maturity (Mishkin, 2019). As investors are risk-averse they prefer to hold short-term bonds rather than long-term bonds due to duration risk. Thus, investors must earn a higher expected return to induce them to hold long-term bonds over short-term bonds, leading to a rising liquidity premium that tends to rise with maturity (same conclusion reached in the LPT) (Mishkin, 2019).

2.2. Company valuation and the discount rate used in determining project or company value

2.2.1. Rational Expectations, Efficient Market Hypothesis, & Modigliani-Miller (MM) Theorems

Rational expectations are optimal forecasts which incorporate all available information, including historical experiences or trends (Muth, 1961). Pertaining to capital markets, rational expectations is an important requisite for efficient capital markets. Efficient markets are those that have prices that fully incorporate all available information (Fama, 1970). This is important as capital markets rely on prices to optimally allocate resources, i.e. provide resources to those opportunities that are most profitable. As such, efficient markets are an important assumption in valuing projects, firms and other of the like. Evidence for the efficiency of capital markets is supplied by event studies such as those related to corporate finance (e.g. investment decisions, capital structure changes, dividend changes, and so on) (Fama, 1991).

MM's first proposition stipulates that the value of a company is, in perfect capital markets, independent of its capital structure (Modigliani & Miller, 1958). Consequently, the cost of capital is defined as the cost of a company's funds or from the perspective of an investor is the required rate of return on a portfolio of a firm's issued securities, which is the market-value weighted averages of the cost of equity and cost of debt (which is equal to the required return on unlevered equity when there are no taxes) (Berk & DeMarzo, 2017). However, in the presence of taxes, where interest payments on a firm's outstanding debt are tax-deductible, the value of the firm can rise from an increase in leverage by decreasing the after-tax weighted-average-cost-of-capital (WACC) up to a certain point (Berk & DeMarzo, 2017; Jagannathan, Liberti, Liu, & Meier, 2017; Modigliani & Miller, 1958). The WACC is shown by the following formula, where E is the market value of equity, D is the market value of debt, r_E is the required return on equity (cost equity), r_D is the required return on debt (cost of debt), and $\mathcal{T}_C$ is the marginal corporate tax rate:

$$WACC = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \mathcal{T}_C)$$

The second proposition shows that the required return on equity is equal to the unlevered firm cost of capital (or pre-tax WACC) plus the difference between the unlevered firm cost of capital (or pre-tax WACC) and the cost of debt times the leverage ratio (debt-to-equity ratio), which is based on market values. Hence, as leverage increases in a company, the required return on levered equity increases. The required rate of return on equity is equal to the pre-tax (unlevered) WACC (represented by r_U) plus the difference between the pre-tax WACC and the cost of debt times the leverage ratio:

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

2.2.2. Discounted-cash-flow model and the weighted-average-cost-of-capital

Ascertaining the fundamental value of a firm is mainly performed using the DCF model (which is akin to the net present value method in valuing projects) and using the WACC as the discount rate for the expected cash flows (Brotherson, Eades, Harris, & Higgins, 2013).

The components of the WACC include the market values of debt and equity, the cost of equity, the cost of debt, and the marginal corporate tax rate and is calculated as discussed in Section 2.2.1. The risk-free rate is an important component in the derivation of both the cost of equity and the cost of debt.

In calculating the cost of equity, the Sharpe-Litner capital asset pricing model (CAPM) is largely utilized by practitioners (Brotherson et al., 2013; Graham & Harvey, 2001). Components of the CAPM include the risk-free rate, a firm's beta, and the difference between the expected market return and the risk-free rate, also known as the equity risk premium (ERP). In the CAPM a firm's beta and the ERP should be forward-looking. The majority of practitioners and companies use long-term bond yields, primarily the 10-year government bond yield, as the risk-free rate as it more accurately represents the default-free returns available on similar long-term investments typically made by companies (Brotherson et al., 2013). Companies choose the risk-free rate, i.e. the long-term bond yield, by matching the tenure of the investment to the term to maturity of the bond. As unveiled by Brotherson et al. (2013), financial advisors draw on published sources for an estimation of beta, which is the sensitivity of a stock's return to the market's return, specifically fundamental betas such as Barra's beta. The derivation of ERP is focused on the calculation of the expected market return, which is unobservable. Consequently, for both financial advisors and companies more than half use historical returns, usually the arithmetic average of historical market returns, as a proxy for future returns. However, some practitioners and companies use forward-looking estimates of the ERP such as the dividend discount model and variations of it (Brotherson et al., 2013). For example, the Gordon growth model (GGM) can be used to estimate the expected market return, given that the market's long-term dividend growth rate is constant (Jagannathan et al., 2017). The expected market return based on the GGM is calculated as follows: it is the sum of the ratio of the dividend in the current period, which is multiplied by the expected long-term growth rate of the dividend, to the current price of the stock market index and the long-term expected growth rate of the market index's dividend. Accordingly, the difference between the GGM calculated expected market return and the risk-free rate (which is matched to the investment horizon) is taken to arrive at the forward-looking ERP. The GGM assumes that given constant dividends, one can ascertain a stock's price by taking the dividend in the current period, which is then multiplied by the expected long-term growth rate of the dividends, over the difference between the cost of equity (required return on equity) and the long-term growth rate of the dividends.

To calculate the cost of debt, first the pre-(corporate-)tax cost of debt must be ascertained. The pre-corporate-tax cost of debt for a firm is equal to the YTM on the firm's issued corporate bond and is adjusted for the expected loss, which accounts for the probability of default based on the bond's credit rating and current economic conditions (Jagannathan et al., 2017). Applying the marginal corporate tax rate to the pre-corporate-tax cost of debt yields the after-tax cost of debt. As the YTM on a corporate bond is based on the prevailing YTM on a risk-free bond (see Section 2.1.3.), the risk-free rate is a prominent component in the calculation of the cost of debt.

In summary, the WACC, which is used as the discount rate in the DCF method for valuing companies, is significantly influenced by the risk-free rate. As shown in Brotherson et al. (2013) a majority of practitioners and companies use the YTM of government bonds as the risk-free rate. When the risk-free rate (YTM of risk-free bonds) declines, ceteris paribus, the WACC falls, which increases the present value of cash flows of a firm (in a DCF model) and consequently increases the present value of the firm.

Due to the prevailing low interest rate environment since the GFC of 2008, discount rates, if unadjusted, are markedly lower. Accordingly, some practitioners normalize and adjust the discount rate, whether it be through adjustments of the required return on equity, required return on debt, the discount rate as a whole, or even the risk-free rate, to account for the fact that risk-free rates are very low. The need to adjust the discount rate used to value companies and projects due to the prevailing environment of low interest rates is evident as shown in Brotherson et al. (2013), which shows that some practitioners adjust the discount rate as without the adjustment the discount rate is strikingly too low.

2.2.3. Multiples, their use and accuracy in valuation

Determining the fundamental value of companies through the DCF method is often complimented with a valuation by multiples (Lie & Lie, 2002). Multiples are employed to gauge the range of value of a firm relative to comparable peer firms. The basic definition of a multiple is that it is the ratio of price or a value metric, usually stock price or enterprise value, to a historical (or forward-looking) accounting measure such as EBITDA or earnings-per-share (EPS). Lie and Lie (2002) find that the stock-price-to-forecasted-EPS (P/E 1-year forward-looking) is superior in accuracy to stock-price-to-historical-EPS (trailing-twelve-months (TTM) P/E) and that enterprise-value-to-EBITDA (EV/EBITDA) is more accurate than enterprise-value-to-earnings-before-interest-taxes (EV/EBIT) in valuing firms. The finding that using forecasted EPS improves the valuation accuracy of P/E is consistent with Kim and Ritter (1999), who reach the same conclusion with respect to valuing IPOs.

2.3. Main Hypotheses

A lowering of the CB's main policy rate (which lowers the interbank rates and 10-year sovereign government bond yields) leads to an expansion of the EV/EBITDA, EV/EBIT, P/E TTM, and the P/E forward-looking multiples, all else equal.

The one-month or three-month interbank rate and the 10-year sovereign government bond yield is negatively related to the valuation multiples. Increases in the one-month or three-month interbank rate and in the 10-year sovereign government bond yield will lead to a decrease in the valuation multiples, all else equal.

Sustained zero or negative interest rate policy is positively related to the valuation multiples. If zero or negative interest rate policy has been introduced and sustained for an extended length of time, one can expect the valuation multiples (EV/EBITDA, EV/EBIT, P/E TTM, and the P/E forward looking) in the periods that follow the introduction of zero or negative interest policy to be significantly higher than the periods prior, all else equal.

Section 3. Data

3.1. Countries, Companies, and Multiples

For this empirical analysis on the implications of zero and negative interest rate policy on valuation multiples, countries that have introduced zero or negative interest rate policy and have well-developed and efficient capital markets are chosen. The countries chosen are Switzerland, the U.S., the Netherlands, Germany, France, Sweden, Denmark, and Japan. From each country the three largest firms by market capitalization over the duration of the sample date range, with an emphasis on their market capitalizations from the past decade (post-2008), are chosen. The country specific median valuation multiples based on the valuation multiples of the country's three largest firms by market capitalizations (companies are listed in the notes of the tables of the median multiples) over the sample date range is found in Appendix A. The sample date range is from 01/01/1996 to 31/12/2019. The multiples chosen that represent firm value (see Section 2.2.2. and 2.2.3.) are EV/EBITDA, EV/EBIT, P/E TTM, and the P/E forward looking. In deriving the median multiples for a given country, those firms with no available value for a certain multiple take on the value zero. For example, if Novartis AG has no available value for EV/EBITDA for the year 1999 it is given a value of zero, rather than being left blank. This forces the median multiple to equate to the lower multiple between the two firms that do have a value for that year. Median valuation multiples are used as the mean valuation multiple can be skewed towards extreme values. Hence, the median valuation multiple is a more representative measure of the expected valuation multiple of the average firm in a major stock index (Damodaran, 2012). Historical annual data on the EV/EBITDA, EV/EBIT, and P/E TTM multiples are obtained from ThomsonOne, a database that contains data on annual reports from corporations worldwide, on IPOs, and on merger and acquisitions. Data collected for the P/E forward-looking multiple includes the 1-year forecasted full-year EPS estimates from the Institutional Brokers Estimate System (I/B/E/S) (from Wharton Research Data Services (WRDS)), which is a database that contains historical data on analyst's estimates of firm performance, and the historical daily share price data from Yahoo Finance, which comprises data on financial and company related items such as financial reports, historical prices, news etc. The P/E forward-looking multiple is derived by taking the ratio of the closing share price on the day the certain estimate of a company's full-year EPS for the next fiscal year is recorded by I/B/E/S to the corresponding estimate of the full-year EPS for the next fiscal year by the analyst. Subsequently, the P/E forward-looking multiple for a given firm in a given year is the median P/E forward-looking multiple in that given year. As some analysts' estimates of a company's EPS in the following fiscal year were only recorded by I/B/E/S during or after the following fiscal year (e.g. full-year EPS estimate for 2019 made in 2018 by a certain analyst was only recorded by I/B/E/S in 2019) it is assumed that these analysts had disclosed these estimates to their (institutional) clients well before the date of record of the estimate by I/B/E/S. For Atlas Copco AB, there was no up-to-date collection of estimates for full-year EPS in the following fiscal year.

3.2. Interbank Rates and Sovereign Government Bond Yields

The interbank rate selected to analyze structural break points is the one-month interbank (1MIB) rate (daily frequency), which is the interest rate charged on loans with a term to maturity of one month between banks in a certain country. The 1MIB rate is retrieved from the Global Financial Data (GFD) database. GFD holds comprehensive historical and current information on more than 150 countries' financial and economic related items such as government bond yields of differing maturities, interbank rates of differing maturities, stock market index prices, stock market index dividend yield etc. 10-year sovereign government bonds yields (GBY) (daily frequency) are also collected from GFD. The length of the 1MIB rate and 10-year sovereign GBY time series matches the sample date range. In the regression analysis, the 1MIB rate is expressed as IB(3 letter country code)1D_CLOSE and the 10-year sovereign GBY is expressed as IG(3 letter country code)10D_CLOSE. For the U.S., instead of the 1MIB rate, the market federal funds rate (expressed as FFYD_CLOSE in the regression analysis) retrieved from GFD, is used. The market federal funds rate serves as a more accurate indicator of the rates charged between depository institutions to lend to each other on a short-term basis. As an updated time series of the Danish 1MIB rate is not available on GFD the time series of the monthly 3-month interbank (3MIB) rate is used, which was taken from the ECB Statistical Data Warehouse. The Danish 3MIB is expressed as IBDNK3M_CLOSE in the regression results. The

ECB Statistical Data Warehouse holds data on financial and CB related items such as time series on a CB's policy rate, depository institution data etc.

3.3. Control Variables

Annual Core Consumer Prices Inflation Rate

The annual core consumer prices inflation rate, collected from GFD, is the monthly time series (from 01/01/1996 to 31/12/2019) of the annual percentage change from one month to last year's corresponding month e.g. percentage change in the core consumer prices from October 2019 to October 2018. Core consumer prices are defined as the prices of goods and services but excludes cost of expenditure related to energy and food. Annual core consumer prices inflation rate (referred to in the regression results as CPX_3 letter country code_MAPC) is used as a control variable as it is a more accurate measure of the inflation rate in developed economies and is closely related to the 1MIB or 3MIB rates (due to developed economies' CBs following a policy strategy of inflation rate targeting) and the 10-year sovereign GBYs (see section 2.1.2. and 2.1.3.).

Real GDP Growth

To account for the productivity of economies and its impact on a CB's policy rate and a firm's valuation multiples, the annual real GDP percentage growth with a quarterly frequency is taken from GFD. As real economic output growth increases, earnings (EBITDA, EBIT, and net income) of firms rise (as, for example, consumers are able to purchase more goods due to increased real wage growth which stems from the rise in real economic output growth) and as such one can expect valuation multiples to expand. Due to the interactions between a firm's multiple value, the discount rate (which is a function of the CB policy rate, interbank rate, and 10-year GBY), and the productivity of the aggregate economy in real terms (and its effect on the natural rate of interest and implicitly the inflation rate), the annual real GDP growth is taken into account. Annual real GDP growth is expressed as GDPC(3 Letter country code)APC.

Stock Market Value, Monthly Return, and Aggregate Dividend Yield and P/E Ratio

The historical monthly major stock market index value (for some countries was collected from Yahoo Finance and was also used to calculate the corresponding monthly return), the monthly return (in percent), and the stock market index's aggregate dividend yield and P/E ratio were collected from GFD. The historical monthly major stock market index value and its monthly return are included as control variables as it controls for the relationship between the expansion of a firm's valuation multiples and the expansion of the major stock market index's capitalization. This relationship is exemplified by the beta of the firm's stock price with respect to the stock market index's capitalization and return. Additionally, the major stock market index's dividend yield is included to signify the relationship between valuation multiples and the dividend yield. As discussed in Section 2.2.2., the GGM shows that as the dividend yield increases, one can expect the valuation multiples to increase. Dividends are a portion of the net income a firm earns in a given year which is redistributed to a firm's equity holders; thus one can expect all valuation multiples to increase following increases in dividends as this is usually a signal for sustainable long-term growth in the profitability of a firm (Lang & Litzenberger, 1989). The major stock market index's P/E ratio is included to control for the sensitivity of the median valuation multiples to changes in the stock market's P/E ratio. The variables are expressed in the regression analysis as follows: Market index short name_VALUE, Market index short name_MONTHLY_RETURN, SY(3 letter country code)YM (dividend yield), and SY(3 letter country code)PM (P/E ratio). For Japan the stock market index P/E ratio is SYJPNPTM and for the Netherlands the stock market index's dividend yield is SYNLDAYM.

Section 4. Methodology

4.1. Least Squares Analysis and Structural Breakpoint Analysis

To analyze and determine the effects of zero and negative interest rate policy on corporate valuation multiples least squares analysis with date dummy variables, which are determined by structural breakpoints analysis of the interbank rate time series, is used. Least squares analysis is employed as it determines the most accurate expected measure of the median valuation multiple (the dependent variable), given the effects of other variables related to the valuation multiple, by minimizing the sum of squares of the error term of the regression. Accordingly, least squares regression analysis with date dummy variables determined by structural breakpoints analysis allows for the study of the evolution of the expected median valuation multiples following abrupt changes in the mean value of the

1MIB rate time series. Least squares regression analysis with date dummy variables determined by structural breakpoint analysis is performed as follows: first, the structural breakpoints in the interbank rate time series must be discerned, second, the date dummy variables according to the structural breakpoints are produced, and then finally, the regression with the dummy date variables is constructed.

4.2. Analysis of Interbank Rates and 10-year Sovereign Government Bond Yields

Multiple Structural Breakpoint Test

In analyzing the impact of significant changes in policy rates (proxied by the 1MIB rate) on valuation multiples, one must first identify structural breakpoints (SBP) in the interbank rate time series, which are abrupt changes in the mean in the interbank rate time series. Specifically, the methods from Bai and Perron (2003) are utilized to derive and analyze SBPs (equivalent to finding the corresponding date in a time series where the mean value sharply and abruptly changes) in the 1MIB rate or 3MIB rate time series for each country. Deriving when the SBPs occur a Break Least Squares (LS) regression was performed in EViews 11, regressing the 1MIB rate upon a constant, allowing the error term distribution to vary between breakpoints, and employing heteroskedasticity and autocorrelation consistent (HAC) estimators. As performed in Bai and Perron (2003), the HAC estimator, which is an estimate of a covariance matrix that is robust to heteroskedasticity and autocorrelation in the error term, is constructed by taking the Newey-West covariance matrix with a fixed whitening specification of one lag, a Quadratic-Spectral kernel and the Andrews automatic bandwidth selection. The constant in the break LS results indicate the mean interbank rate that prevailed during the period after the initial SBP till the next SBP.

The amount of SBPs for a given interbank rate time series is selected by first regressing the Break LS with a break specification following the Bai-Perron test of L+1 vs L sequentially determined breaks with a trimming percentage of 15%, a maximum number of 5 SBPs, and a significance level of 5%. However, as mentioned in Bai and Perron (2003), the sequentially determined breaks method can at times reject the null hypothesis of no breaks vs one break and not reject the null hypothesis of no breaks vs multiple breaks. As such, if the Break LS using the sequentially determined breaks indicates no SBPs, the advice outlined in Bai and Perron (2003) is taken. The Break LS is thus altered to a break specification method of the Bai-Perron tests of 1 vs M globally determined breaks, which is selected by taking the number of breaks which maximizes the unweighted maximum F-statistics of the globally determined Break LS given a maximum number of SBPs, M, to test whether the interbank rate time series has multiple SBPs. Then the Break LS with a break specification method of the Bai-Perron tests of 1 vs M globally determined breaks, which is selected using the sequential evaluation technique (L+1 vs L breaks), is performed. The last two aforementioned Break LSs are derived with the same HAC estimator, allowing the error term's distribution to vary between breaks, a trimming percentage of 15%, and a maximum number of 5 SBPs. If there are suspected to be more breaks than specified by the Bai-Perron 1 vs M globally determined sequential evaluation method, the Break LS is then performed by utilizing the global information criteria, specifically the LWZ criterion (an altered Schwarz criterion) with the same trimming percentage, maximum SBP numbers, and significance level.

Once the SBPs are derived, date dummy variables which take on value one for any date after a certain SBP and until the next SBP in the interbank rate time series, and 0 for any other date are formed. For example, if two SBPs are identified in the sample date range of the interbank rate time series such as 01/12/2008 and 15/01/2015, the first date dummy variable takes on value 1 if the date is after 01/11/2008 and before 15/01/2015, and 0 for any other date outside this range, the second dummy variable takes on value 1 if the date is after 15/01/2015 (until the end of the sample date range) and 0 if outside this date range. SBPs observed outside the sample date range of 01/01/1996 to 31/12/2019 are not considered. In the multiple structural breakpoint test results (Break LS regression results) and the LS with date dummy variable regression results the break dates are formatted in the American date format of Month/Day/Year.

4.2. Regression analysis using the (Ordinary) Least Squares (LS) Method

General regression formula

The basic regression is as follows: the respective country's median large cap multiple is regressed upon the corresponding interbank rate and 10-year sovereign GBY, date dummy variables, and control variables. For example, the U.S. multiple regression with five SBPs in the market federal funds rate time series can be formulated as follows:

$$Median\ Multiple_{USA} = \beta_0 + \beta_1 FFYD\_CLOSE + \beta_2 IGUSA10D\_CLOSE + \beta_3 SP\_500\_VALUE + \beta_4 SP\_500\_MONTHLY\_RETURN + \beta_5 SYUSAPM + \beta_6 SYUSAYM + \beta_7 CPXUSAMAPC + \beta_8 GDPCUSAAPC + +\beta_9 DUMDATE\_SBP1 + \beta_{10} DUMDATE\_SBP2 + \beta_{11} DUMDATE\_SBP3 + \beta_{12} DUMDATE\_SBP4 + \varepsilon_{USA}$$

Section 5. Results

Regression Results

Table 1. Switzerland Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
03/26/2002	-1.4746	***	-2.9445	***	-7.1564	***	-5.9095	***
	(0.4210)		(0.5903)		(1.3405)		(1.1561)	
12/11/2008	-1.0797	**	-2.3683	***	-5.2401	***	-6.1603	***
	(0.4734)		(0.9139)		(1.2578)		(1.3716)	
Constant (01/15/2015)	19.7001	***	27.6421	***	42.3095	***	41.2373	***
	(2.6839)		(2.8357)		(8.4366)		(5.0567)	
1-Month Swiss Interbank Rate	-0.1778		-0.4327		2.3435		-0.1181	
	(0.3633)		(0.4524)		(2.2580)		(0.7835)	
10-year Swiss Bond Yield	-1.2647	***	-1.6030	***	-3.9379	*	0.4263	
	(0.4229)		(0.4749)		(2.2848)		(0.7827)	
SMI Market Cap	-0.0001		0.0001		-0.0001		-0.0008	***
	(0.0002)		(0.0002)		(0.0004)		(0.0003)	
SMI Monthly Return	-0.0373		2.2869		8.8031		-6.3077	*
	(1.6041)		(2.4420)		(7.2555)		(3.4351)	
SMI P/E Ratio	0.1005	***	-0.1151	**	-0.0887		0.1530	***
	(0.0211)		(0.0521)		(0.0638)		(0.0501)	
SMI Dividend Yield	-2.2947	***	-2.5535	***	-4.3619	***	-6.4725	***
	(0.5826)		(0.5536)		(1.3182)		(1.1893)	
Annual Core CP Inflation Rate	0.1873		0.0813		-0.5528		-1.4649	***
	(0.3908)		(0.4277)		(0.8327)		(0.5068)	
Annual % Change in Real GDP	-0.9438		16.7968		-23.5285		16.3281	
	(17.0762)		(27.6736)		(63.5942)		(36.1474)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01

Table 2. USA Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
04/08/2001	10.2920	***	13.8317	***	34.4572	***	18.8835	***
	(1.6672)		(1.9655)		(4.6956)		(2.0672)	
02/03/2005	3.8621	**	2.7394		20.4860	***	6.8632	**
	(1.5785)		(2.0025)		(3.5741)		(2.9814)	
12/01/2008	5.1100	**	4.9461	**	12.7000	*	3.7101	
	(2.4775)		(2.4363)		(7.1322)		(2.4339)	
10/02/2012	1.8698		1.9803		6.0531	*	-2.1318	**
	(1.8381)		(1.6953)		(3.6704)		(1.0461)	
Constant (09/04/2016)	-20.0786	***	-23.7610	***	17.9033		-30.3294	***
	(7.0051)		(7.0621)		(24.3677)		(11.6495)	
Federal Funds Rate Market Rate	1.9207	**	1.9140	**	2.4378		0.8718	
	(0.7758)		(0.8236)		(1.4873)		(1.2307)	
10-year Treasury Bond Yield	1.2489		1.3299		-3.3566	*	3.5406	***
	(0.9347)		(1.0171)		(1.9185)		(0.8772)	
S&P 500 Market Cap	0.0048	***	0.0063	***	0.0090	**	0.0061	***
	(0.0013)		(0.0014)		(0.0039)		(0.0008)	
S&P 500 Monthly Return	19.7682	***	16.4843	***	-19.2214	***	11.0027	
	(3.7791)		(4.9431)		(6.9941)		(8.6807)	
S&P 500 P/E Ratio	-0.1024	***	-0.0980	**	0.1690	***	-0.0265	
	(0.0337)		(0.0471)		(0.0532)		(0.0648)	
S&P 500 Dividend Yield	9.7266	***	9.3610	***	-9.4027	***	11.0721	***
	(1.9676)		(2.6119)		(3.1963)		(2.6353)	
Annual Core CP Inflation Rate	-1.1041		0.9576		0.3814		1.1669	
	(1.1020)		(2.2171)		(3.8800)		(2.6354)	
Annual % Change in Real GDP	0.0767		-0.0657		0.0895		1.5513	
	(0.5857)		(0.6994)		(1.4696)		(1.5423)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 3. Netherlands Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
12/09/1997	6.2240	***	7.7981	***	16.3894	**	4.7550	***
	(0.0666)		(0.7854)		(6.4429)		(0.9912)	
11/05/2001	0.4993		2.0261		6.5837		10.3232	***
	(0.7778)		(2.0125)		(4.0902)		(1.7657)	
09/23/2005	-0.5288		-1.0832		3.1607		6.1880	***
	(0.9727)		(2.1327)		(3.0752)		(1.1765)	
08/17/2009	-2.5794	***	-4.8442	***	0.6616		0.0496	
	(0.5648)		(1.3932)		(4.3923)		(1.6250)	
Constant (06/17/2014)	10.3039	***	19.2108	***	37.8627	***	3.5123	
	(0.3637)		(2.9609)		(14.0456)		(7.0139)	
1-Month EURIBOR Rate	-0.7312	***	0.5203		4.5268	*	-0.9701	
	(0.2040)		(0.9536)		(2.5936)		(1.6876)	
10-year Dutch Bond Yield	-0.5330	*	-2.4829	**	-6.0068	**	-1.8873	
	(0.2889)		(1.0855)		(2.3574)		(1.6007)	
AEX Market Cap	0.0109	***	0.0062		-0.0536	***	0.0362	***
	(0.0030)		(0.0125)		(0.0179)		(0.0137)	
AEX Monthly Return	0.5495	***	-3.3273	***	12.7418	*	-19.1470	***
	(0.0331)		(0.3062)		(6.8115)		(1.6647)	
AEX P/E Ratio	-0.1354		-0.0568		1.0346	***	-0.0084	
	(0.0933)		(0.2582)		(0.3421)		(0.1699)	
AEX Dividend Yield	0.3858	***	-0.2384		-1.9161	**	-0.7536	
	(0.0769)		(0.2797)		(0.8747)		(0.6885)	
Annual Core CP Inflation Rate	0.1964	***	0.5689		-1.9470		2.4363	***
	(0.0743)		(0.3670)		(1.3412)		(0.8925)	
Annual % Change in Real GDP	-0.6035	***	-0.9925	***	1.1530		-0.5742	***
	(0.0918)		(0.2058)		(1.1983)		(0.1758)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 4. Germany Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
12/09/1997	-0.7099	***	6.2643	*	14.7645	***	2.3304	
	(0.1175)		(3.7788)		(0.7155)		(1.4429)	
11/05/2001	2.7618	***	12.1029	***	4.9935	***	0.1026	
	(0.2808)		(0.8681)		(0.2846)		(0.1641)	
09/23/2005	2.4955	***	1.0147		3.2674	***	-4.0661	**
	(0.2123)		(4.1752)		(0.4203)		(1.9762)	
08/17/2009	1.3539	***	-3.4516	***	1.1526	***	-0.7622	***
	(0.3847)		(0.9193)		(0.1752)		(0.2406)	
Constant (06/17/2014)	2.6135	*	23.4661		14.2682	***	9.8305	
	(1.4607)		(17.7919)		(3.0435)		(6.9639)	
1-Month EURIBOR Rate	0.0072		-0.2305		-0.3372		1.8251	**
	(0.2677)		(1.5629)		(0.2366)		(0.8673)	
10-year German Bond Yield	-0.1356	**	2.3962		-0.4789		1.0444	*
	(0.0585)		(1.8941)		(0.3652)		(0.5742)	
DAX Market Cap	0.0005	***	0.0017		0.0004		0.0006	
	(0.0001)		(0.0014)		(0.0003)		(0.0005)	
DAX Monthly Return	-1.5562	***	-4.1866		0.4473	*	1.0020	
	(0.2431)		(2.8742)		(0.1664)		(0.9076)	
DAX Dividend Yield	-0.1100	***	-0.9102	***	-0.2431	***	-0.3593	***
	(0.0266)		(0.2533)		(0.0298)		(0.1343)	
DAX Dividend Yield	0.4418	***	-2.3041		-1.6152	***	-0.0186	
	(0.1355)		(2.6710)		(0.3210)		(1.6583)	
Annual Core CP Inflation Rate	-0.3935	*	-6.1143	***	-0.1426		-1.4092	
	(0.2128)		(1.7379)		(0.4409)		(0.7768)	
Annual % Change in Real GDP	-0.3479	***	-0.8033	*	-0.3756	***	-0.3610	***
	(0.0626)		(0.4492)		(0.0239)		(0.1034)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 5. France Median Valuation Multiples Regression Results

Variable	EV/EBITDA Coefficient		EV/EBIT Coefficient		P/E TTM Coefficient		P/E Forward-looking Coefficient	
12/09/1997	4.3392	***	9.3452	***	31.1023	***	17.4185	***
	(0.5965)		(0.2813)		(0.8131)		(4.0558)	
11/05/2001	0.1578		-0.7965		11.1863	***	10.0499	***
	(0.6605)		(0.5213)		(1.9055)		(2.6976)	
09/23/2005	0.7320		-2.0155	***	4.3317		-2.6269	
	(1.3119)		(0.4798)		(3.2712)		(2.9908)	
08/17/2009	-3.3992	***	-3.3595	***	-1.6729	*	-0.2794	
	(0.9592)		(1.0882)		(1.0133)		(2.7981)	
Constant (06/17/2014)	12.4607	***	23.9965	***	32.2698	***	-39.2578	**
	(4.1239)		(1.7123)		(9.4388)		(17.9119)	
1-Month EURIBOR Rate	-2.1942	**	-0.4433		-0.7895		-4.8756	*
	(0.9756)		(0.7156)		(1.0925)		(2.5130)	
10-year French Bond Yield	1.3480	*	-0.9358		-0.4539		4.4344	
	(0.6955)		(0.7124)		(0.7342)		(2.9566)	
CAC 40 Market Cap	-0.0004		0.0000		-0.0018		0.0093	***
	(0.0005)		(0.0002)		(0.0013)		(0.0022)	
CAC 40 Monthly Return	5.1506	**	-0.8921		9.3945		-22.2028	***
	(2.6073)		(1.9264)		(7.3801)		(5.4013)	
CAC 40 P/E Ratio	0.0698	**	0.0073		0.3306	***	-0.0221	
	(0.0336)		(0.0071)		(0.0468)		(0.0723)	
CAC 40 Dividend Yield	-0.3305		-1.6711	***	-0.7052		3.1093	
	(0.5223)		(0.2035)		(1.3164)		(1.9870)	
Annual Core CP Inflation Rate	0.0851		3.4132	***	-4.4375	**	2.8443	**
	(0.4878)		(0.2606)		(1.8497)		(1.2554)	
Annual % Change in Real GDP	0.6887	**	-0.4485	***	0.2910		-0.3375	
	(0.3277)		(0.0544)		(0.4883)		(1.4032)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 6. Swedish Median Valuation Multiples Regression Results

Variable	EV/EBITDA Coefficient	EV/EBIT Coefficient	P/E TTM Coefficient	P/E Forward-looking Coefficient
04/27/1998	-0.5956	0.7655	7.3943 ***	11.1297 ***
	(0.4568)	(0.7859)	(0.3307)	(1.0416)
05/28/2003	-1.1847 **	-1.4693 *	9.9796 ***	9.5380 ***
	(0.5857)	(0.8652)	(0.2733)	(1.5430)
01/04/2009	-3.3619 ***	-5.8686 ***	2.0219 ***	-1.9658
	(1.0587)	(1.7809)	(0.1225)	(1.2016)
Constant (07/03/2014)	9.4731 ***	18.1666 ***	11.2560 ***	9.5303 *
	(2.5759)	(3.9167)	(1.7616)	(5.2613)
1-Month Swedish Interbank Rate	-0.3980	-0.6669	-1.1802 ***	-3.0349 ***
	(0.3113)	(0.5019)	(0.0352)	(1.0960)
10-year Swedish Bond Yield	-0.1191	-0.5632	-0.9422 ***	0.3978
	(0.3338)	(0.5589)	(0.1869)	(0.9576)
OMX Stockholm 30 Market Cap	0.0045 ***	0.0036 **	0.0124 ***	0.0021
	(0.0010)	(0.0015)	(0.0010)	(0.0039)
OMX Stockholm 30 Monthly Return	-1.7755	-0.2487	-21.3533 ***	0.6126
	(1.2931)	(2.0461)	(1.8910)	(2.7826)
OMX Stockholm 30 P/E Ratio	0.0517	0.1210 *	0.3711 ***	0.2399
	(0.0556)	(0.0682)	(0.0224)	(0.1574)
OMX Stockholm 30 Dividend Yield	-0.5524	-1.4401 ***	-2.9644 ***	-0.5732
	(0.3944)	(0.5269)	(0.0591)	(0.4613)
Annual Core CP Inflation Rate	0.7439 **	1.5420 ***	3.2771 ***	2.0545 *
	(0.2962)	(0.4816)	(0.3345)	(1.0711)
Annual Change in Real GDP	-0.3971 **	-0.6773 **	-1.6543 ***	-0.5397 *
	(0.1942)	(0.3255)	(0.1442)	(0.3001)

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 7. Danish Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
October 2001	-1.4774	***	-3.2865	***	0.7456		14.8052	***
	(0.1362)		(0.5905)		(0.5435)		(3.1525)	
July 2005	0.9732	***	-0.0396		0.2372		8.6356	**
	(0.0841)		(0.7446)		(0.3046)		(3.4080)	
April 2009	-1.3226	***	-2.3532	***	-3.5702	***	7.5222	*
	(0.1255)		(0.6784)		(1.1312)		(4.0164)	
January 2013	1.5863	***	-0.9595		-1.7865	***	4.3659	*
	(0.0625)		(0.8728)		(0.6421)		(2.2334)	
Constant (October 2016)	12.0016	***	15.1360	***	25.1639	***	4.4081	
	(0.0857)		(4.4943)		(1.3484)		(14.7737)	
3-Month Danish Interbank Rate	-0.0790	***	0.0515		1.9559	***	1.6605	
	(0.0118)		(0.4365)		(0.3145)		(1.1299)	
10-year Danish Bond Yield	-0.4660	***	-0.8098		-3.4675	***	-1.3070	
	(0.0731)		(0.6243)		(0.3140)		(1.3575)	
OMX Copenhagen 20 Market Cap	0.0048	***	0.0034	**	0.0061	***	0.0265	**
	(0.0003)		(0.0017)		(0.0019)		(0.0105)	
OMX Copenhagen 20 Monthly Return	3.6743	*	5.7566		-0.2575		-4.4596	*
	(1.9895)		(4.1403)		(4.4387)		(2.6988)	
OMX Copenhagen 20 P/E Ratio	0.0678	***	0.1777	**	0.3069	***	0.0857	
	(0.0091)		(0.0723)		(0.0747)		(0.1568)	
OMX Copenhagen 20 Dividend Yield	-0.3814		0.3892		-3.1014	***	-2.9049	
	(0.2469)		(0.6072)		(0.7951)		(2.2675)	
Annual Core CP Inflation Rate	-0.0218		-0.5735		0.9416		-0.1096	
	(0.3660)		(0.8655)		(0.8623)		(0.9035)	
Annual % Change in Real GDP	0.2902	***	0.2809		0.0324		-0.2155	
	(0.0529)		(0.2908)		(0.1065)		(0.2998)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

Table 8. Japanese Median Valuation Multiples Regression Results

	EV/EBITDA		EV/EBIT		P/E TTM		P/E Forward-looking	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
03/09/1998	2.7369		5.2685	**	7.5244		3.7835	**
	(2.2084)		(2.5857)		(6.3960)		(1.5475)	
06/21/2006	1.8377		1.9833		6.4562	**	8.6968	***
	(1.1457)		(1.5635)		(2.6173)		(1.5396)	
Constant (08/22/2011)	10.2867		7.8472		25.7550	*	39.7698	***
	(7.7265)		(6.6192)		(13.6773)		(9.3506)	
1-Month Japanese Interbank Rate	3.8040		5.7689	**	14.2496	*	-3.1213	
	(2.7043)		(2.8547)		(7.6750)		(6.2218)	
10-year Japanese Bond Yield	-4.5630	***	-6.0365	***	-16.5219	***	-12.0869	***
	(0.5680)		(1.3324)		(4.6956)		(2.7836)	
Nikkei 225 Market Cap	0.0000		0.0003		-0.0008	**	-0.0010	***
	(0.0002)		(0.0002)		(0.0003)		(0.0002)	
Nikkei 225 Monthly Return	-18.0537		-21.0650	*	-28.4729	*	-24.2591	*
	(12.1038)		(11.4122)		(16.4462)		(13.7734)	
Nikkei 225 P/E Ratio	0.2170	***	0.2844	***	0.8709	***	0.2551	**
	(0.0462)		(0.0476)		(0.1410)		(0.1169)	
Nikkei 225 Dividend Yield	-1.4390		-1.0760		-1.8940		-3.4535	
	(1.7195)		(1.6224)		(3.4689)		(3.0903)	
Annual Core CP Inflation Rate	-2.3988		-1.4659		-1.8602		-4.4449	**
	(1.5137)		(1.6288)		(2.2109)		(2.0835)	
Annual % Change in Real GDP	-0.3115		0.0795		0.6942		1.8101	*
	(0.2458)		(0.5161)		(0.7693)		(0.9312)	

Note. Standard errors are in parentheses; *p<0.10, **p < 0.05, ***p < 0.01.

EV/EBITDA and EV/EBIT

Across all countries except for the U.S., Germany, and Japan, the EV/EBITDA and EV/EBIT multiples after the most recent SBP in their corresponding 1MIB (or 3MIB) rate time series are significantly higher than in the periods before (for Denmark this only holds for EV/EBIT) (see Table 1, 3, 4, 5, 6, and 7). As a majority of the firms included in the sample had IPO'd in the period shortly prior or after the first SBP in their respective countries' 1MIB or 3MIB rates time series, the value of the EV/EBITDA and EV/EBIT in that period can be ignored (as firms that IPO tend to have higher multiples due to lower earnings and the multiples account for anticipated high-growth of earnings) for the sake of comparing the elevation of the valuation multiples due to a low interest rate environment. Table 1 best exemplifies the impact of zero and negative interest rate policy on corporate valuation multiples. The Swiss median multiples regression results in Table 1 show that the constants for EV/EBITDA and EV/EBIT are significant at the 1% level and larger than the expected median EV/EBITDA and EV/EBIT multiples to occur in the periods prior to the most recent SBP (before 15/01/2015). The constants in the Swiss EV/EBITDA and EV/EBIT regressions are the expected median multiples in the period after the most recent SBP in the Swiss 1MIB rate's time series, namely after the 15/01/2015 (see Appendix B.1). This SBP is important as on this date the Swiss National Bank (SNB) cut its main policy rate to -0.75% and ceased the minimum exchange rate of the Swiss Franc vis-à-vis the Euro, thus cementing the SNB's policy rate into negative territory (SNB, 2015). In general, one can attribute (a significant portion of) the rise in the median EV/EBITDA and EV/EBIT multiples of the aforementioned countries' (Switzerland, the Netherlands, France, Sweden, and Denmark) large caps to a lowering and suppression of the CB's main policy rate at or below the zero-lower bound (concerning the latest SBP in the interbank rate time series, one can attribute the cause of the SBP to the cutting and suppression of interest rates to or below zero: for the Netherlands, Germany, and France this corresponds with the ECB introducing negative interest rates on the deposit facility rate on 05/06/2014, and an announcement on 17/06/2014 (which is the date of the most recent SBP in the 1-month EURIBOR interbank rate time series) of the continuation of the US dollar liquidity provisions beyond the end of July 2014, showing signs of sustained stress in financial markets and the continuation of zero and negative interest rate policy (European Central Bank, 2014a; European Central Bank, 2014b); for Sweden, on 03/07/2014 the Sveriges Riksbank cut their main policy rate by 0.50% down to 0.25%, more than anticipated, in a bid to fight deflationary pressures and reinvigorate inflation towards the target inflation rate (Sverige Riksbank, 2014); for Denmark, the introduction of negative interest rates on certificates of deposits (main policy rate) was on 06/07/2012 to sustain the gap between the ECB policy rate and the Danmarks Nationalbank's policy rate, however the SBP is identified on the month of October 2016 (Danmarks Nationalbank, 2012)), which lowers the 10-year sovereign GBY (LPT, see section 2.1.3.) and accordingly a firm's discount rate (assuming the equity risk premium stays constant), and ultimately increases firm value (due to present value of a firm's expected cash flows and of their outstanding debt increasing), all else equal. The negative relationship between multiple value and the interbank rate and the 10-year sovereign bond yield is represented by a negative coefficient. For Switzerland, the Netherlands, and Japan either the interbank rate or the 10-year sovereign GBY holds a negative coefficient for both EV/EBITDA and EV/EBIT, which is significant at the 10% level at least (see Table 1, 3, and 8). With respect to the rest of the sample countries, the relationship between the valuation multiple and the interbank rate and 10-year sovereign GBY varies and is at times insignificant (see Table 2, 4, 5, 6, and 7). A negative coefficient for the interbank rate or 10-year sovereign bond yield implies that an increase of 1% in either of the respective rates leads to a certain on average decline in the median multiple (EV/EBITDA, EV/EBIT, P/E TTM, P/E Forward-looking). As such, the lowering of a CB's policy rate, which lowers the interbank rate and the 10-year sovereign GBY, leads to an increase in the median large cap EV/EBITDA and EV/EBIT multiples for Switzerland, the Netherlands, Germany (holds only for EV/EBITDA), France (holds only for EV/EBITDA), Denmark (holds only for EV/EBITDA), and Japan, all else equal. For the U.S., Germany, and Japan, the median EV/EBITDA and EV/EBIT multiples after the most recent SBP in the 1MIB rate time series are lower than the median multiples before the most recent SBP, which is in contrast to the findings of the rest of the sample countries.

P/E TTM and P/E Forward-looking

Concerning the P/E TTM and the P/E forward-looking multiples there are differences across countries and unexpected findings. For U.S. and French large caps, the constant for the median P/E forward-looking regression results (the expected median P/E forward-looking multiple after the most recent SBP in their respective interbank rates' time series) is negative. This is in contrast to the anticipation that firstly, the P/E forward-looking multiple would be positive, and secondly, relatively lower interest rates (which results in a lower risk-free rate) would lead to a higher P/E forward-looking multiple, all else equal. In contrast, for the rest of the sample countries (Switzerland, Netherlands, Germany, Sweden, Denmark, and Japan) the results are expected, where the constant of the median P/E forward-looking multiple regression is positive. However, the constants of the median P/E forward-looking multiple regressions are positive and significant at the 1% level for only Switzerland and Japan. Concerning the P/E TTM multiple, the constant in the P/E TTM regression results is significantly (at the 10% level at least) smaller than the expected median P/E TTM in the periods prior to the most recent structural break for the U.S., Netherlands, Germany, France, Sweden, and Japan. This could be due to the fact that the large cap firms in the mentioned countries experienced larger growth in stock price relative to growth in EPS in the periods preceding the most recent SBP in their respective interbank rate time series. The relationship between the interbank rates and 10-year sovereign GBYs to the P/E multiples (TTM and forward-looking) also differs across countries. In Switzerland, the coefficients of the 1MIB rate and the 10-year GBY for the P/E forward-looking multiple regression are not significant at the 10%-level. Additionally, the coefficient of the 1MIB rate is also insignificant for the Swiss median P/E TTM multiple, however the 10-year GBY is significant at the 10%-level with a coefficient of -3.9379, implying that an increase of 1% (an increase of 100 basis points) in the 10-year GBY on average decreases the median P/E TTM multiple by 3.9379. Additionally, for the median P/E TTM for the U.S., the Netherlands, Sweden, Denmark, and Japan, the respective 10-year sovereign GBY coefficient is significantly negative at the 10% level at least, implying that an increase of 1% in the 10-year sovereign GBY leads to a certain on average decline in the median P/E TTM. This is consistent with earlier evidence of the negative relationship between the interbank rates and 10-year sovereign GBYs and the median EV/EBITDA and EV/EBIT multiples. Regarding the P/E forward-looking multiple, the impact of the interbank rates and the 10-year sovereign GBYs is not only different across countries, but also ambiguous. A CB's policy rate, which is used to achieve a CB's mandate (the Federal Reserve, unlike most developed economies' CBs, has a dual mandate of a target inflation rate and full employment) such as reaching a target inflation rate and full employment (at full employment an economy operates at its potential output level given no transitory shocks), indicate the nature of the gap between actual real economic output and potential output and the gap between the actual (realized) inflation rate and the target inflation rate. An accommodative monetary policy stance, defined as cutting short-term real interest rates below the NIR, would imply that actual real economic output is below potential output. As all the sample countries' CBs target an inflation rate, the CB would also employ an accommodative monetary policy stance when the inflation rate is below the target inflation rate to revive the inflation rate back to its target rate (cutting the short-term real interest rate below the NIR when an economy is operating at full employment leads to real economic output to increase above its potential output, leading to the tightening of labor markets, i.e. an unemployment rate below the structural unemployment rate, and ultimately leading to an increasing inflation rate). CBs' policy rates at or below zero and staying there have three implications on the state of an economy. CB policy rates remaining at or below zero could suggest that: real economic output is not at potential output, or the current inflation rate is below the target inflation rate, or both. Because of the interaction between real economic output and the inflation rate, where, for example, if real economic output is persistently above the potential output level this would lead to an increase of the inflation rate above the target inflation rate (via tight labor markets, which increases labor costs and prices, which increases the inflation rate and increases the expected inflation rate), the long-term nature of zero and negative policy rates suggests the following: actual real economic output is below potential output and the inflation rate is below the CB's target inflation rate, or that potential output growth has fallen, which lowers the NIR. Due to the demographic trends and declines in total factor productivity discussed in Section 2.1.1., the fall in potential output growth is most likely responsible for the suppression of policy rates at and below zero. If the decline in potential output growth explains the decline of interest rates since the 1980's and the prevalence of zero and negative interest rates, then one could expect the growth rate of firms' dividends to fall (assuming that real economic output growth acts as a proxy of a firm's growth potential), resulting in a lower stock price, all else equal. Secondly, due to the prevalence of zero and negative interest rates, which has driven 10-year GBYs down, one could also expect the required return on equity used to discount the dividends in determining stock price in the GGM to fall, which increases the stock price today, all else equal. Looking at the coefficients of the interbank rates and the 10-yr GBYs in the median P/E forward-looking multiple regression results, one can see that for Switzerland, the Netherlands, France, and Denmark that neither are significant at the 5% level. For the U.S. and Germany, the coefficient for at least one of the rates (interbank rate or 10-year sovereign GBY) in the median P/E forward-looking multiple regression is significantly positive at the 5% level at least. This is consistent with the notion that increases in either the interbank rate or the 10-year sovereign GBY lead to an expansion of the P/E forward-looking multiple, as rises in the rates imply a rising NIR as a result of increases in potential economic output growth. A rise in the potential economic output growth rate implies that aggregate earnings of firms will increase, thus driving aggregate stock prices and the P/E forward-looking multiple up (in accordance with the GGM). However, the coefficients are significantly negative (at the 1% level) for the Swedish 1MIB rate and the Japanese 10-year GBY in the median P/E forward-looking regression for Sweden and Japan. This is consistent with the notion that increases in policy rates lead to an increase in the discount rate used to discount firms' earnings, which lowers the share prices of firms today (in accordance with GGM) and the P/E forward-looking multiple.

Dividend Yield and Valuation Multiples

Upon inspection of the coefficient of the dividend yield of the major stock market index, one would expect the valuation multiples (EV/EBITDA, EV/EBIT, P/E TTM, and P/E forward-looking) to increase as the major stock market index's dividend yield increases (a negative coefficient), all else equal. This is important as growth in profitability, shown by increases in EBITDA and EPS, suggest two effects on the valuation multiples. First, increases in profitability would lead to increases in a company's dividends (assuming firms primarily use dividends to redistribute their earnings back to equity holders), given that they can sustain this increase in dividends in the future, i.e. increases in profitability are not of a temporary nature. This increase in dividends, catalyzed by increases in profitability, would lead to a decline in valuation multiples (contractionary effect), all else equal. Secondly, valuation multiples could be expected to increase following increases in dividends. Sustained increases in profitability and therefore dividends would lead to an increase in a firm's current stock price and enterprise value (expansionary effect), given the GGM holds (see Section 2.2.2). The major stock market index's dividend yield coefficient for Switzerland is negative and significant at the 1% level for all valuation multiples, implying that the contractionary effect on the valuation multiples to be more dominant than the expansionary effect. For the rest of the countries, the results of the effect of increases in profitability and thus dividend yield differs across the valuation multiples. Common among the U.S., the Netherlands, Germany, Sweden, and Denmark are that increases in the respective major stock market index's dividend yield on average decreases the median P/E TTM, which is significant (at least) at the 5% level and consistent with the contractionary effect of increases in dividend yield on valuation multiples.

Valuation Multiples following the GFC of 2008

More importantly, the nature of the valuation multiples in the period subsequent to the GFC of 2008 is of interest. Across the sample countries, interbank rates and 10-year sovereign GBYs are significantly lower in the period following the GFC of 2008 than in the period prior, as shown by SBPs identified near the time of the GFC of 2008 and in the years following the GFC of 2008 (see Appendix B). Moreover, interbank rates and 10-year sovereign GBYs have stayed at the zero or negative level for an extended period of time following the GFC of 2008. Accordingly, one would expect the median valuation multiples in all countries to expand (increase) given the global decline in interest rates (namely, the discount rate channel, where a lower risk-free rate prompted by a decline in the NIR decreases the discount rates used to value firms), ceteris paribus. In Switzerland, all median valuation multiples (EV/EBITDA, EV/EBIT, P/E TTM, and P/E forward-looking) are significantly higher in the periods after 2008 (valuation multiples are higher after the SBP found in 12/11/2008 relative to the valuation multiples before this SBP). This is consistent with the expectation that valuation multiples would be significantly higher in a prolonged environment of zero and negative interest rates (the long-term nature of zero and negative policy rates lowers the risk-free rate (10-year sovereign GBYs) used to derive the required return on equity in determining stock price in the GGM and the discount rate (WACC) used to discount cash flows and ascertain firm value with the DCF method, all else equal). In the U.S. and Germany, the valuation multiples are significantly higher in the period prior to 2008. For the Netherlands, France, Sweden, and Denmark, the EV/EBITDA and EV/EBIT multiples are higher in the periods following 2008 (the year that marks the beginning of the zero and negative interest rate environment) if one assumes that EV/EBITDA and EV/EBIT are only higher after the first SBP as the sample firms were young and naturally had lower values of EBITDA and EBIT, but their EVs are high as they accounts for high expected growth in earnings (Damodaran, 2015). Following this assumption, the median P/E TTM for the Netherlands and Denmark is higher in the period following the GFC of 2008 than in the period prior, owing to the prolonged period of zero and negative interest rates (policy rates, interbank rates, and 10-year sovereign GBYs).

Section 6. Conclusion

Globally, interest rates, specifically the NIR, CBs' policy rates, interbank rates, and (10-year) sovereign GBYs have fallen drastically since the mid-1980's. This depression of interest rates is owed to the demographic shifts that have developed since the 1980's, particularly lower fertility rates and increased life expectancy, and a decline in the potential output growth of developed and developing economies (which was caused by a fall in labor growth and productivity of capital and labor). Additionally, financial crises such as the bursting of the dot.com bubble of 2000, the GFC of 2008, and the European sovereign debt crisis accelerated the decline of interest rates globally as well as gave birth to perpetual zero and negative interest rate policy. Countries that have cut policy rates to zero or below and kept their policy rates at zero or negative are considered for the sample, which is used to study the effect of lasting zero and negative interest rate policy on corporate valuation multiples. The sample countries, and their three largest firms by market capitalization, analyzed are Switzerland, the U.S., the Netherlands, Germany, France, Sweden, Denmark, and Japan. The risk-free rate, commonly defined as the 10-year sovereign GBY, is an important factor in the evaluation of projects and the valuation of firms. In valuing a company, one often employs the method of multiples alongside a DCF valuation, using multiples like the EV/EBITDA, EV/EBIT, P/E TTM, and P/E forward-looking of comparable firms to benchmark and define a valuation range for a company being valued. As such, the effect of prolonged zero and negative interest rate policy since the GFC of 2008 on the valuation multiples of companies is of interest. SBPs (points in the interbank rate time series where the mean interbank rate abruptly changes) in the time series of each countries' 1MIB rate are identified to indicate where one can expect the valuation multiples following the SBPs to significantly differ from the period prior to the SBPs identified. For all countries (except Japan), SBPs at the time of the GFC of 2008 and six to seven years after show that the mean interbank rates are significantly lower than the mean interbank rates observed prior to the GFC of 2008. In studying the evolution of the valuation multiples with respect to these SBPs in the interbank rates' time series, it is clear that valuation multiples for most countries increased following the GFC of 2008. This expansion of the valuation multiples following the GFC can be attributed to the sample countries' CBs initiating and suppressing interest rates at zero or below (the discount rate channel). With regards to further research, the effect of interest rates being bound at zero or even at negative levels on the discount rate used to value firms must be examined. Additionally, the decline of the NIR and its consequences on institutions and household wealth must also be investigated, as equity markets become the main store of wealth for households as bond yields and savings (e.g. checking deposit rates) rates are at zero and even negative (Giugliano, 2019).

Appendix

A. Median Company Multiples by Country

A.1

Switzerland

Table 9 Median Swiss large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	P/E Forward-looking
31.12.96	12.46	15.12	23.04	30.80
31.12.97	17.12	12.67	21.50	37.24
31.12.98	16.99	20.93	30.34	36.41
31.12.99	14.36	16.75	23.89	31.58
31.12.00	11.55	15.51	25.35	30.03
31.12.01	12.16	16.23	21.98	24.35
31.12.02	10.92	11.89	15.02	26.89
31.12.03	12.92	15.39	20.72	23.25
31.12.04	12.04	15.83	1.75	22.17
31.12.05	14.03	17.45	28.11	20.62
31.12.06	11.68	13.90	18.26	20.46
31.12.07	11.58	14.55	18.43	18.44
31.12.08	9.63	12.01	13.47	15.90
31.12.09	11.95	14.64	17.19	13.91
31.12.10	10.10	12.27	13.51	12.08
31.12.11	10.37	14.82	15.96	11.83
31.12.12	10.49	13.86	16.55	12.88
31.12.13	12.26	17.04	20.50	15.64
31.12.14	15.26	19.14	23.90	17.41
31.12.15	15.94	20.05	25.73	18.98
31.12.16	14.02	18.45	26.47	16.76
31.12.17	14.27	21.90	25.80	16.02
31.12.18	11.80	14.67	19.86	13.87
31.12.19	15.97	20.47	24.34	16.96

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Nestlé, Roche Holdings AG, and Novartis AG; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.2

USA

Table 10 Median U.S. large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	P/E Forward-looking
31.12.96	16.82	19.21	0.00	30.29
31.12.97	24.56	27.13	0.00	40.01
31.12.98	8.05	10.34	18.45	20.28
31.12.99	9.49	10.60	17.99	16.02
31.12.00	4.17	4.49	11.81	30.27
31.12.01	21.57	30.93	52.90	32.40
31.12.02	5.85	12.89	38.79	31.96
31.12.03	14.30	15.35	27.87	25.13
31.12.04	19.15	23.66	52.53	50.69
31.12.05	18.20	20.00	34.32	35.73
31.12.06	18.31	19.78	33.91	32.41
31.12.07	22.25	23.66	39.05	30.68
31.12.08	8.80	9.56	18.91	23.68
31.12.09	10.98	11.65	20.08	19.65
31.12.10	12.37	13.05	19.30	19.09
31.12.11	9.70	10.21	14.61	14.50
31.12.12	10.12	10.71	15.30	12.72
31.12.13	7.24	8.22	13.38	10.95
31.12.14	9.69	11.13	15.87	13.64
31.12.15	11.58	15.16	24.06	17.71
31.12.16	12.29	16.17	24.41	19.24
31.12.17	11.90	15.15	21.18	21.32
31.12.18	14.06	17.67	23.91	24.84
31.12.19	15.82	20.50	27.24	24.90

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Apple, Microsoft Corporation, and Alphabet Inc.; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.3

Netherlands

Table 11 Median Dutch large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	P/E Forward-looking
31.12.96	7.90	8.37	13.57	0.00
31.12.97	0.00	0.00	25.87	0.00
31.12.98	12.86	15.29	57.98	6.83
31.12.99	9.93	11.97	26.76	22.87
31.12.00	16.74	18.74	29.14	19.61
31.12.01	11.40	16.83	16.48	21.31
31.12.02	10.01	14.38	14.62	24.58
31.12.03	8.51	11.49	13.06	17.54
31.12.04	10.68	13.05	17.73	16.82
31.12.05	10.77	12.44	17.08	14.41
31.12.06	7.66	8.39	14.27	15.06
31.12.07	8.60	9.82	14.94	15.72
31.12.08	6.82	7.69	9.88	13.41
31.12.09	11.22	9.42	14.43	4.61
31.12.10	8.02	8.97	12.30	12.11
31.12.11	6.18	6.78	9.41	8.04
31.12.12	10.92	12.80	17.78	14.54
31.12.13	10.60	12.22	17.09	18.78
31.12.14	10.80	12.72	17.83	19.25
31.12.15	14.13	20.94	25.63	21.83
31.12.16	13.22	26.06	30.84	21.21
31.12.17	14.83	17.49	24.22	21.73
31.12.18	9.56	11.20	13.54	20.13
31.12.19	14.52	17.73	23.83	20.73

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Royal Dutch Shell, Unilever, and ASML Holding; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.4

Germany

Table 12 Median German large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	Forward-looking P/E
31.12.96	0.00	0.00	0.00	15.74
31.12.97	0.00	0.00	0.00	9.94
31.12.98	0.00	0.00	16.30	11.97
31.12.99	0.00	11.99	13.47	12.01
31.12.00	1.70	19.07	18.37	12.50
31.12.01	4.14	35.34	22.20	34.17
31.12.02	4.59	13.60	3.71	13.55
31.12.03	6.28	30.70	10.08	11.24
31.12.04	5.74	27.18	14.51	13.79
31.12.05	6.78	24.79	11.38	14.54
31.12.06	5.90	24.49	11.22	13.81
31.12.07	5.43	10.68	9.57	15.85
31.12.08	6.72	9.68	3.18	7.83
31.12.09	8.30	9.35	9.39	8.40
31.12.10	6.36	10.95	7.99	12.80
31.12.11	5.69	8.47	6.38	8.61
31.12.12	5.88	6.88	6.86	7.94
31.12.13	6.38	12.02	9.85	9.19
31.12.14	6.86	11.66	10.02	9.31
31.12.15	7.97	12.85	10.54	10.17
31.12.16	5.69	13.44	10.25	8.10
31.12.17	6.50	12.68	7.46	7.50
31.12.18	6.54	12.55	6.78	6.75
31.12.19	7.83	11.69	11.55	7.88

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Volkswagen, Allianz SE, and Daimler AG; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.5

France

Table 13 Median French large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	Forward-looking P/E
31.12.96	16.56	20.00	34.08	0.00
31.12.97	10.59	14.17	19.19	0.00
31.12.98	12.52	17.30	59.88	0.00
31.12.99	24.26	31.27	65.08	45.29
31.12.00	15.25	19.03	52.59	46.86
31.12.01	13.27	31.24	44.62	40.16
31.12.02	10.53	17.57	34.34	29.82
31.12.03	13.66	21.48	29.41	26.74
31.12.04	12.31	15.30	22.10	24.01
31.12.05	13.62	16.71	24.53	21.27
31.12.06	11.48	18.14	22.59	20.68
31.12.07	10.69	14.50	19.36	19.48
31.12.08	6.87	13.59	15.44	13.79
31.12.09	10.99	13.54	21.13	16.41
31.12.10	10.88	12.61	19.36	19.79
31.12.11	10.05	13.47	17.45	18.99
31.12.12	10.78	15.61	20.23	17.49
31.12.13	10.03	18.77	25.80	18.40
31.12.14	10.77	17.30	16.38	18.52
31.12.15	11.41	18.93	23.95	20.94
31.12.16	11.80	17.57	22.92	19.27
31.12.17	13.34	16.36	24.04	22.65
31.12.18	12.21	21.01	21.91	23.00
31.12.19	18.13	26.40	39.41	24.76

Note. Median multiples are derived from the companies with the three largest market capitalization, which are LVHM, L’Oréal, and Sanofi; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.6

Sweden

Table 14 Median Swedish large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	Forward-looking P/E
31.12.96	7.31	8.97	0	0
31.12.97	9.27	12.52	0	0
31.12.98	6.39	9.04	0	0
31.12.99	9.86	15.4	0	19.96
31.12.00	11.57	16.53	34.19	19.70
31.12.01	9.06	17.48	26.39	18.38
31.12.02	10.63	13.1	20.43	15.42
31.12.03	8.94	16.2	24.77	22.98
31.12.04	6.79	10.57	15.94	19.57
31.12.05	9.48	12.07	17.63	16.17
31.12.06	11.43	13.38	23.12	15.08
31.12.07	10.28	11.89	15.95	13.00
31.12.08	6.23	7.12	10.66	9.24
31.12.09	7.18	8.28	14.52	7.55
31.12.10	7.76	8.98	17.97	7.69
31.12.11	7.43	8.91	13.86	6.78
31.12.12	8.91	11.42	15.57	7.55
31.12.13	11.11	13.02	20.89	9.77
31.12.14	13.48	16.42	21.82	16.30
31.12.15	11.13	13.49	21.65	15.88
31.12.16	13.72	17.9	24.61	14.73
31.12.17	18.5	25.07	25.78	16.66
31.12.18	13.69	18.86	18.78	16.64
31.12.19	18.98	28.31	34.88	19.96

Note. Median multiples are derived from the companies with the three largest market capitalization, which are AstraZeneca, Atlas Copco, and ABB; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.7

Denmark

Table 15 Median Danish large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	Forward-looking P/E
31.12.96	10.63	14.71	11.42	0.00
31.12.97	11.48	15.24	9.27	0.00
31.12.98	11.96	16.59	19.72	0.00
31.12.99	12.68	17.08	27.12	0.00
31.12.00	11.66	16.72	26.92	25.49
31.12.01	15.43	19.07	30.55	15.45
31.12.02	8.65	10.49	16.56	20.21
31.12.03	8.86	10.65	16.89	18.93
31.12.04	10.63	12.83	20.08	23.03
31.12.05	13.14	16.10	19.82	19.20
31.12.06	16.31	20.32	24.01	22.29
31.12.07	15.11	17.89	30.26	22.05
31.12.08	10.35	12.13	17.31	19.61
31.12.09	11.02	14.67	20.26	17.95
31.12.10	12.09	16.06	22.53	20.72
31.12.11	10.91	13.14	18.69	18.29
31.12.12	13.95	16.24	23.23	18.88
31.12.13	14.48	15.66	19.95	20.45
31.12.14	17.87	19.33	25.77	24.86
31.12.15	22.07	23.40	29.50	28.60
31.12.16	18.40	25.01	34.62	25.02
31.12.17	19.33	21.90	28.56	24.10
31.12.18	13.55	14.81	19.54	23.43
31.12.19	20.63	33.62	41.14	26.81

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Novo Nordisk, Coloplast, and DSV Panalpina; companies which did not have a multiple available value for a certain year are given a value zero (0).

A.8

Japan

Table 16 Median Japanese large cap valuation multiples from 1996-2019

Date	EV/EBITDA	EV/EBIT	P/E TTM	Forward-looking P/E
31.12.96	9.91	17.61	34.36	0.00
31.12.97	9.74	17.62	30.61	0.00
31.12.98	10.44	18.23	29.72	0.00
31.12.99	14.01	22.47	47.20	0.00
31.12.00	38.37	44.18	82.89	53.71
31.12.01	16.00	20.76	34.02	33.41
31.12.02	27.43	31.50	58.86	38.42
31.12.03	6.49	11.08	36.24	31.78
31.12.04	6.78	10.46	17.56	19.28
31.12.05	7.22	11.28	11.41	11.61
31.12.06	8.91	14.02	15.25	16.34
31.12.07	9.05	12.35	20.97	16.40
31.12.08	6.60	9.20	13.26	15.43
31.12.09	11.05	7.16	11.97	13.12
31.12.10	11.94	14.81	30.83	32.34
31.12.11	8.86	9.08	12.39	21.61
31.12.12	7.34	7.52	18.48	18.37
31.12.13	10.62	11.71	16.00	18.24
31.12.14	8.43	12.71	14.53	12.73
31.12.15	9.48	14.06	20.54	16.24
31.12.16	6.96	12.55	18.06	18.71
31.12.17	8.45	14.57	14.80	14.99
31.12.18	7.91	13.09	12.68	14.30
31.12.19	8.26	14.66	13.05	14.16

Note. Median multiples are derived from the companies with the three largest market capitalization, which are Novo Nordisk, Coloplast, and DSV Panalpina; companies which did not have a multiple available value for a certain year are given a value zero (0).

B. Multiple Structural Breakpoint Test – Break LS Regression Results of Bai-Perron tests of 1 to M globally determined break with Sequential Evaluation

B.1

Switzerland

Table 17 Break least squares regression results for the daily Swiss 1-month interbank rate

Dependent Variable: IBCHE1D_CLOSE

Method: Least Squares with Breaks		
Break type: Bai-Perron tests of 1 to M globally determined breaks		
Selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. level 0.05		
Breaks: 4/13/1990, 6/05/1995, 3/26/2002, 12/11/2008, 1/15/2015		
Variable	Coefficient	
1/02/1985 - 4/12/1990 -- 1324 obs		
C	4.7961	
	(3.2386)	
4/13/1990 - 6/04/1995 -- 1324 obs		
C	6.4279	***
	(2.4893)	
6/05/1995 - 3/25/2002 -- 1724 obs		
C	2.0669	***
	(0.4159)	
3/26/2002 - 12/10/2008 -- 1698 obs		
C	1.2113	
	(3.2936)	
12/11/2008 - 1/14/2015 -- 1373 obs		
C	0.0768	***
	(0.0180)	
1/15/2015 - 7/07/2020 -- 1385 obs		
C	-0.7963	***
	(0.0050)	
Observations	8828	
R-squared	0.8056	
S.E. of regression	1.2031	
F-statistic	7309.6190	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 01/02/1985 to 07/07/2020; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

B.2

USA

Table 18 Break least squares regression results for the daily federal funds market rate

Dependent Variable: FFYD_CLOSE		
Method: Least Squares with Breaks		
Break type: Bai-Perron tests of 1 to M globally determined breaks		
Selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. Level 0.05		
Breaks: 4/08/2001, 2/03/2005, 12/01/2008, 10/02/2012, 9/04/2016		
Variable	Coefficient	
1/01/1995 - 4/07/2001 -- 2289 obs		
C	5.5278	***
	(0.0359)	
4/08/2001 - 2/02/2005 -- 1397 obs		
C	1.7648	***
	(0.2558)	
2/03/2005 - 11/30/2008 -- 1397 obs		
C	3.8955	**
	(1.9287)	
12/01/2008 - 10/01/2012 -- 1401 obs		
C	0.1434	***
	(0.0061)	
10/02/2012 - 9/03/2016 -- 1433 obs		
C	0.1584	***
	(0.0325)	
9/04/2016 - 7/01/2020 -- 1397 obs		
C	1.4279	
	(1.1412)	
Observations	9314	
R-squared	0.8918	
S.E. of regression	0.7371	
F-statistic	15349.9200	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 01/01/1995 to 07/01/2020; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

B.3 **Netherlands**; B.4 **Germany**; B.5 **France**

Table 19 Break least squares regression results for the daily EURIBOR 1-month interbank rate

Dependent Variable: IBEUR1D_CLOSE		
Method: Least Squares with Breaks		
Break type: Bai-Perron tests of 1 to M globally determined breaks		
Selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. Level 0.05		
Breaks: 12/09/1997, 11/05/2001, 9/23/2005, 8/17/2009, 6/17/2014		
Variable	Coefficient	
1/04/1994 - 12/08/1997 -- 994 obs		
C	5.2018	***
	(1.0850)	
12/09/1997 - 11/04/2001 -- 994 obs		
C	3.9242	**
	(1.6385)	
11/05/2001 - 9/22/2005 -- 994 obs		
C	2.5192	***
	(0.3621)	
9/23/2005 - 8/16/2009 -- 994 obs		
C	3.2437	***
	(0.6808)	
8/17/2009 - 6/16/2014 -- 1234 obs		
C	0.5145	
	(3.4930)	
6/17/2014 - 12/31/2019 -- 1420 obs		
C	-0.2743	
	(0.1733)	
Observations	6630	
R-squared	0.8853	
S.E. of regression	0.7028	
F-statistic	10230.0100	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 01/04/1994 to 12/31/2019; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

B.6

Sweden

Table 20 Break least squares regression results for the daily Swedish 1-month interbank rate

Dependent Variable: IBSWE1D_CLOSE		
Method: Least Squares with Breaks		
Break type: Bai-Perron tests of 1 to M globally determined breaks		
Selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. Level 0.05		
Breaks: 4/23/1993, 4/27/1998, 5/28/2003, 1/04/2009, 7/03/2014		
Variable	Coefficient	
1/02/1987 - 4/22/1993 -- 1565 obs		
C	11.8718	***
	(0.2228)	
4/23/1993 - 4/26/1998 -- 1258 obs		
C	6.7686	***
	(0.1188)	
4/27/1998 - 5/27/2003 -- 1275 obs		
C	3.8938	***
	(0.0274)	
5/28/2003 - 1/03/2009 -- 1423 obs		
C	2.9812	***
	(0.0654)	
1/04/2009 - 7/02/2014 -- 1400 obs		
C	1.2988	***
	(0.0424)	
7/03/2014 - 6/02/2020 -- 1472 obs		
C	-0.3047	***
	(0.0179)	
Observations	8393	
R-squared	0.8210	
S.E. of regression	1.9324	
F-statistic	7690.9260	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 01/02/1987 to 06/02/2020; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

B.7

Denmark

Table 21 Break least squares regression results for the monthly Danish 3-month interbank rate

Dependent Variable: IBDNK3M_CLOSE		
Method: Least Squares with Breaks		
Break type: Bai-Perron tests of 1 to M globally determined breaks		
Selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. Level 0.05		
Breaks: 2001M10, 2005M07, 2009M04, 2013M01, 2016M10		
Variable	Coefficient	
1995M01 - 2001M09 -- 81 obs		
C	4.5016	***
	(0.5957)	
2001M10 - 2005M06 -- 45 obs		
C	2.7184	***
	(0.5556)	
2005M07 - 2009M03 -- 45 obs		
C	3.9955	***
	(1.0763)	
2009M04 - 2012M12 -- 45 obs		
C	1.2765	***
	(0.4448)	
2013M01 - 2016M09 -- 45 obs		
C	0.0979	
	(0.1868)	
2016M10 - 2020M06 -- 45 obs		
C	-0.2977	***
	(0.0526)	
Observations	306	
R-squared	0.8652	
S.E. of regression	0.7554	
F-statistic	384.9685	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations are measured at a monthly frequency and the observations included have been adjusted to match the adjusted sample length, which is from 01/01/1995 to 06/31/2020; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

B.8

Japan

Table 22 Break least squares regression results for the daily Japanese 1-month interbank rate

Dependent Variable: IBJPN1D_CLOSE		
Method: Least Squares with Breaks		
Break type: Compare information criteria for 0 to M globally determined breaks		
Selection: LWZ criterion, Trimming 0.15, Max. breaks 5		
Breaks: 2/03/1993, 3/09/1998, 6/21/2006, 8/22/2011		
Variable	Coefficient	
1/02/1986 - 2/02/1993 -- 1815 obs		
C	5.5434	
	(3.7097)	
2/03/1993 - 3/08/1998 -- 1291 obs		
C	1.4731	**
	(0.7601)	
3/09/1998 - 6/20/2006 -- 2093 obs		
C	0.1494	
	(0.3487)	
6/21/2006 - 8/21/2011 -- 1291 obs		
C	0.4150	
	(0.7658)	
8/22/2011 - 7/13/2020 -- 2119 obs		
C	0.0112	
	(0.0842)	
Observations	8609	
R-squared	0.8800	
S.E. of regression	0.7934	
F-statistic	15769.6900	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 01/02/1986 to 07/13/2020; HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth); allow heterogeneous error distributions across breaks; Break dates prior to 1996 are excluded; *p<0.10, **p < 0.05, ***p < 0.01.

C. Regression Results

C.1 **Switzerland**

Table 23 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	19.7001	***
	(2.6839)	
IBCHE1D_CLOSE	-0.1778	
	(0.3633)	
IGCHE10D_CLOSE	-1.2647	***
	(0.4229)	
SMI_VALUE	-0.0001	
	(0.0002)	
SMI_MONTHLY_RETURN	-0.0373	
	(1.6041)	
SYCHEPM	0.1005	***
	(0.0211)	
SYCHEYM	-2.2947	***
	(0.5826)	
CPXCHEMAPC_CLOSE	0.1873	
	(0.3908)	
GDPCCHEAPC	-0.9438	
	(17.0762)	
DUMDATE_SBP1	-1.4746	***
	(0.4210)	
DUMDATE_SBP2	-1.0797	**
	(0.4734)	
Observations	5800	
R-squared	0.6744	
S.E. of regression	1.2163	
F-statistic	1198.8840	
Prob(F-statistic)	0.0000	
Wald F-statistic	36.7872	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 692.7875); *p<0.10, **p < 0.05, ***p < 0.01.

Table 24 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	27.6421	***
	(2.8357)	
IBCHE1D_CLOSE	-0.4327	
	(0.4524)	
IGCHE10D_CLOSE	-1.6030	***
	(0.4749)	
SMI_VALUE	0.0001	
	(0.0002)	
SMI_MONTHLY_RETURN	2.2869	
	(2.4420)	
SYCHEPM	-0.1151	**
	(0.0521)	
SYCHEYM	-2.5535	***
	(0.5536)	
CPXCHEMAPC_CLOSE	0.0813	
	(0.4277)	
GDPCCHEAPC	16.7968	
	(27.6736)	
DUMDATE_SBP1	-2.9445	***
	(0.5903)	
DUMDATE_SBP2	-2.3683	***
	(0.9139)	
Observations	5800	
R-squared	0.5764	
S.E. of regression	1.8323	
F-statistic	787.7916	
Prob(F-statistic)	0.0000	
Wald F-statistic	118.6562	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1015.0922);*p<0.10, **p < 0.05, ***p < 0.01.

Table 25 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	42.3095	***
	(8.4366)	
IBCHE1D_CLOSE	2.3435	
	(2.2580)	
IGCHE10D_CLOSE	-3.9379	*
	(2.2848)	
SMI_VALUE	-0.0001	
	(0.0004)	
SMI_MONTHLY_RETURN	8.8031	
	(7.2555)	
SYCHEPM	-0.0887	
	(0.0638)	
SYCHEYM	-4.3619	***
	(1.3182)	
CPXCHEMAPC_CLOSE	-0.5528	
	(0.8327)	
GDPCCHEAPC	-23.5285	
	(63.5942)	
DUMDATE_SBP1	-7.1564	***
	(1.3405)	
DUMDATE_SBP2	-5.2401	***
	(1.2578)	
Observations	5800	
R-squared	0.4652	
S.E. of regression	4.4206	
F-statistic	503.4837	
Prob(F-statistic)	0.0000	
Wald F-statistic	164.8781	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 930.8395) ;*p<0.10, **p < 0.05, ***p < 0.01.

Table 26 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward-looking		
Method: Least Squares		
Variable	Coefficient	
C	41.2373	***
	(5.0567)	
IBCHE1D_CLOSE	-0.1181	
	(0.7835)	
IGCHE10D_CLOSE	0.4263	
	(0.7827)	
SMI_VALUE	-0.0008	***
	(0.0003)	
SMI_MONTHLY_RETURN	-6.3077	*
	(3.4351)	
SYCHEPM	0.1530	***
	(0.0501)	
SYCHEYM	-6.4725	***
	(1.1893)	
CPXCHEMAPC_CLOSE	-1.4649	***
	(0.5068)	
GDPCCHEAPC	16.3281	
	(36.1474)	
DUMDATE_SBP1	-5.9095	***
	(1.1561)	
DUMDATE_SBP2	-6.1603	***
	(1.3716)	
Observations	5800	
R-squared	0.9189	
S.E. of regression	2.1283	
F-statistic	6558.8560	
Prob(F-statistic)	0.0000	
Wald F-statistic	324.5204	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 503.5478); *p<0.10, **p < 0.05, ***p < 0.01.

2.2 **USA**

Table 27 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	-20.0786	***
	(7.0051)	
FFYD_CLOSE	1.9207	**
	(0.7758)	
IGUSA10D_CLOSE	1.2489	
	(0.9347)	
SP_500_VALUE	0.0048	***
	(0.0013)	
SP_500_MONTHLY_RETURN	19.7682	***
	(3.7791)	
SYUSAPM	-0.1024	***
	(0.0337)	
SYUSAYM	9.7266	***
	(1.9676)	
CPXUSAMAPC	-1.1041	
	(1.1020)	
GDPCUSAAPC	0.0767	
	(0.5857)	
DUMDATE_SBP1	10.2920	***
	(1.6672)	
DUMDATE_SBP2	3.8621	**
	(1.5785)	
DUMDATE_SBP3	5.1100	**
	(2.4775)	
DUMDATE_SBP4	1.8698	
	(1.8381)	
Observations	5972	
R-squared	0.3833	
S.E. of regression	4.1494	
F-statistic	308.6068	
Prob(F-statistic)	0.0000	
Wald F-statistic	4322.2430	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 11/29/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1071.6730); *p<0.10, **p < 0.05, ***p < 0.01.

Table 28 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	-23.7610	***
	(7.0621)	
FFYD_CLOSE	1.9140	**
	(0.8236)	
IGUSA10D_CLOSE	1.3299	
	(1.0171)	
SP_500_VALUE	0.0063	***
	(0.0014)	
SP_500_MONTHLY_RETURN	16.4843	***
	(4.9431)	
SYUSAPM	-0.0980	**
	(0.0471)	
SYUSAYM	9.3610	***
	(2.6119)	
CPXUSAMAPC	0.9576	
	(2.2171)	
GDPCUSAAPC	-0.0657	
	(0.6994)	
DUMDATE_SBP1	13.8317	***
	(1.9655)	
DUMDATE_SBP2	2.7394	
	(2.0025)	
DUMDATE_SBP3	4.9461	**
	(2.4363)	
DUMDATE_SBP4	1.9803	
	(1.6953)	
Observations	5972	
R-squared	0.3800	
S.E. of regression	4.9574	
F-statistic	304.3075	
Prob(F-statistic)	0.0000	
Wald F-statistic	408331.60 00	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 11/29/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1291.1927); *p<0.10, **p < 0.05, ***p < 0.01.

Table 29 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	17.9033	
	(24.3677)	
FFYD_CLOSE	2.4378	
	(1.4873)	
IGUSA10D_CLOSE	-3.3566	*
	(1.9185)	
SP_500_VALUE	0.0090	**
	(0.0039)	
SP_500_MONTHLY_RETURN	-19.2214	***
	(6.9941)	
SYUSAPM_CLOSE	0.1690	***
	(0.0532)	
SYUSAYM_CLOSE	-9.4027	***
	(3.1963)	
CPXUSAMAPC	0.3814	
	(3.8800)	
GDPCUSAAPC	0.0895	
	(1.4696)	
DUMDATE_SBP1	34.4572	***
	(4.6956)	
DUMDATE_SBP2	20.4860	***
	(3.5741)	
DUMDATE_SBP3	12.7000	*
	(7.1322)	
DUMDATE_SBP4	6.0531	*
	(3.6704)	
Observations	5972	
R-squared	0.7538	
S.E. of regression	6.5063	
F-statistic	1520.3840	
Prob(F-statistic)	0.0000	
Wald F-statistic	406.0374	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 11/29/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 893.8908); *p<0.10, **p < 0.05, ***p < 0.01.

Table 30 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward Looking

Method: Least Squares		
Variable	Coefficient	
C	-30.3294	***
	(11.6495)	
FFYD_CLOSE	0.8718	
	(1.2307)	
IGUSA10D_CLOSE	3.5406	***
	(0.8772)	
SP_500_VALUE	0.0061	***
	(0.0008)	
SP_500_MONTHLY_RETURN	11.0027	
	(8.6807)	
SYUSAPM_CLOSE	-0.0265	
	(0.0648)	
SYUSAYM_CLOSE	11.0721	***
	(2.6353)	
CPXUSAMAPC	1.1669	
	(2.6354)	
GDPCUSAAPC	1.5513	
	(1.5423)	
DUMDATE_SBP1	18.8835	***
	(2.0672)	
DUMDATE_SBP2	6.8632	**
	(2.9814)	
DUMDATE_SBP3	3.7101	
	(2.4339)	
DUMDATE_SBP4	-2.1318	**
	(1.0461)	
Observations	5972	
R-squared	0.6803	
S.E. of regression	5.2982	
F-statistic	1056.6140	
Prob(F-statistic)	0.0000	
Wald F-statistic	3546113.000 0	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 11/29/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1352.1726); *p<0.10, **p < 0.05, ***p < 0.01.

2.3 **Netherlands**

Table 31 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	10.3039	***
	(0.3637)	
IBEUR1D_CLOSE	-0.7312	***
	(0.2040)	
IGNLD10D_CLOSE	-0.5330	*
	(0.2889)	
AEXD_VALUE	0.0109	***
	(0.0030)	
AEXD_MONTHLY_RETURN	0.5495	***
	(0.0331)	
SYNLDPM	-0.1354	
	(0.0933)	
SYNLDYAM	0.3858	***
	(0.0769)	
CPXNLDMAPC	0.1964	***
	(0.0743)	
GDPCNLDAPC	-0.6035	***
	(0.0918)	
DUMDATE_SBP1	6.2240	***
	(0.0666)	
DUMDATE_SBP2	0.4993	
	(0.7778)	
DUMDATE_SBP3	-0.5288	
	(0.9727)	
DUMDATE_SBP4	-2.5794	***
	(0.5648)	
Observations	6009	
R-squared	0.5921	
S.E. of regression	2.1587	
F-statistic	725.4326	
Prob(F-statistic)	0.0000	
Wald F-statistic	7.15E+10	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/31/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 21354.6314); *p<0.10, **p < 0.05, ***p < 0.01.

Table 32 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	19.2108	***
	(2.9609)	
IBEUR1D_CLOSE	0.5203	
	(0.9536)	
IGNLD10D_CLOSE	-2.4829	**
	(1.0855)	
AEXD_VALUE	0.0062	
	(0.0125)	
AEXD_MONTHLY_RETURN	-3.3273	***
	(0.3062)	
SYNLDPM	-0.0568	
	(0.2582)	
SYNLDYAM	-0.2384	
	(0.2797)	
CPXNLDMAPC	0.5689	
	(0.3670)	
GDPCNLDAPC	-0.9925	***
	(0.2058)	
DUMDATE_SBP1	7.7981	***
	(0.7854)	
DUMDATE_SBP2	2.0261	
	(2.0125)	
DUMDATE_SBP3	-1.0832	
	(2.1327)	
DUMDATE_SBP4	-4.8442	***
	(1.3932)	
Observations	6009	
R-squared	0.6251	
S.E. of regression	3.2111	
F-statistic	833.0429	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/31/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 10036.5212); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 33 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	37.8627	***
	(14.0456)	
IBEUR1D_CLOSE	4.5268	*
	(2.5936)	
IGNLD10D_CLOSE	-6.0068	**
	(2.3574)	
AEXD_VALUE	-0.0536	***
	(0.0179)	
AEXD_MONTHLY_RETURN	12.7418	*
	(6.8115)	
SYNLDPM	1.0346	***
	(0.3421)	
SYNLDYAM	-1.9161	**
	(0.8747)	
CPXNLDMAPC	-1.9470	
	(1.3412)	
GDPCNLDAPC	1.1530	
	(1.1983)	
DUMDATE_SBP1	16.3894	**
	(6.4429)	
DUMDATE_SBP2	6.5837	
	(4.0902)	
DUMDATE_SBP3	3.1607	
	(3.0752)	
DUMDATE_SBP4	0.6616	
	(4.3923)	
Observations	6009	
R-squared	0.6460	
S.E. of regression	5.9042	
F-statistic	911.6825	
Prob(F-statistic)	0.0000	
Wald F-statistic	970.0449	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/31/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 982.0675); *p<0.10, **p < 0.05, ***p < 0.01.

Table 34 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward-looking		
Method: Least Squares		
Variable	Coefficient	
C	3.5123	
	(7.0139)	
IBEUR1D_CLOSE	-0.9701	
	(1.6876)	
IGNLD10D_CLOSE	-1.8873	
	(1.6007)	
AEXD_VALUE	0.0362	***
	(0.0137)	
AEXD_MONTHLY_RETURN	-19.1470	***
	(1.6647)	
SYNLDPM	-0.0084	
	(0.1699)	
SYNLDYAM	-0.7536	
	(0.6885)	
CPXNLDMAPC	2.4363	***
	(0.8925)	
GDPCNLDAPC	-0.5742	***
	(0.1758)	
DUMDATE_SBP1	4.7550	***
	(0.9912)	
DUMDATE_SBP2	10.3232	***
	(1.7657)	
DUMDATE_SBP3	6.1880	***
	(1.1765)	
DUMDATE_SBP4	0.0496	
	(1.6250)	
Observations	6009	
R-squared	0.7850	
S.E. of regression	3.1789	
F-statistic	1824.8330	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 12/31/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 4432.1674); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

2.4 **Germany**

Table 35 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	2.6135	*
	(1.4607)	
IBEUR1D_CLOSE	0.0072	
	(0.2677)	
IGDEU10D_CLOSE	-0.1356	**
	(0.0585)	
DAX_VALUE	0.0005	***
	(0.0001)	
DAX_MONTHLY_RETURN	-1.5562	***
	(0.2431)	
SYDEUPM	-0.1100	***
	(0.0266)	
SYDEUYM	0.4418	***
	(0.1355)	
CPXDEUMAPC	-0.3935	*
	(0.2128)	
GDPCDEUAPC	-0.3479	***
	(0.0626)	
DUMDATE_SBP1	-0.7099	***
	(0.1175)	
DUMDATE_SBP2	2.7618	***
	(0.2808)	
DUMDATE_SBP3	2.4955	***
	(0.2123)	
DUMDATE_SBP4	1.3539	***
	(0.3847)	
Observations	6011	
R-squared	0.8951	
S.E. of regression	0.8401	
F-statistic	4266.8230	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 3999.7358); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 36 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	23.4661	
	(17.7919)	
IBEUR1D_CLOSE	-0.2305	
	(1.5629)	
IGDEU10D_CLOSE	2.3962	
	(1.8941)	
DAX_VALUE	0.0017	
	(0.0014)	
DAX_MONTHLY_RETURN	-4.1866	
	(2.8742)	
SYDEUPM	-0.9102	***
	(0.2533)	
SYDEUYM	-2.3041	
	(2.6710)	
CPXDEUMAPC	-6.1143	***
	(1.7379)	
GDPCDEUAPC	-0.8033	*
	(0.4492)	
DUMDATE_SBP1	6.2643	*
	(3.7788)	
DUMDATE_SBP2	12.1029	***
	(0.8681)	
DUMDATE_SBP3	1.0147	
	(4.1752)	
DUMDATE_SBP4	-3.4516	***
	(0.9193)	
Observations	6011	
R-squared	0.6522	
S.E. of regression	5.2986	
F-statistic	937.4846	
Prob(F-statistic)	0.0000	
Wald F-statistic	1.14E+13	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1831.0927); *p<0.10, **p < 0.05, ***p < 0.01.

Table 37 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	14.2682	***
	(3.0435)	
IBEUR1D_CLOSE	-0.3372	
	(0.2366)	
IGDEU10D_CLOSE	-0.4789	
	(0.3652)	
DAX_VALUE	0.0004	
	(0.0003)	
DAX_MONTHLY_RETURN	0.4473	*
	(0.1664)	
SYDEUPM	-0.2431	***
	(0.0298)	
SYDEUYM	-1.6152	***
	(0.3210)	
CPXDEUMAPC	-0.1426	
	(0.4409)	
GDPCDEUAPC	-0.3756	***
	(0.0239)	
DUMDATE_SBP1	14.7645	***
	(0.7155)	
DUMDATE_SBP2	4.9935	***
	(0.2846)	
DUMDATE_SBP3	3.2674	***
	(0.4203)	
DUMDATE_SBP4	1.1526	***
	(0.1752)	
Observations	6011	
R-squared	0.7252	
S.E. of regression	2.6854	
F-statistic	1319.1910	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 11450.7314); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 38 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward looking		
Method: Least Squares		
Variable	Coefficient	
C	9.8305	
	(6.9639)	
IBEUR1D_CLOSE	1.8251	**
	(0.8673)	
IGDEU10D_CLOSE	1.0444	*
	(0.5742)	
DAX_ VALUE	0.0006	
	(0.0005)	
DAX_MONTHLY_RETURN	1.0020	
	(0.9076)	
SYDEUPM	-0.3593	***
	(0.1343)	
SYDEUYM	-0.0186	
	(1.6583)	
CPXDEUMAPC	-1.4092	
	(0.7768)	
GDPCDEUAPC	-0.3610	***
	(0.1034)	
DUMDATE_SBP1	2.3304	
	(1.4429)	
DUMDATE_SBP2	0.1026	
	(0.1641)	
DUMDATE_SBP3	-4.0661	**
	(1.9762)	
DUMDATE_SBP4	-0.7622	***
	(0.2406)	
Observations	6011	
R-squared	0.4093	
S.E. of regression	4.1557	
F-statistic	346.2921	
Prob(F-statistic)	0.0000	
Wald F-statistic	4.87E+11	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 5033.0345); *p<0.10, **p < 0.05, ***p < 0.01.

2.5 **France**

Table 39 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	12.4607	***
	(4.1239)	
IBEUR1D_CLOSE	-2.1942	**
	(0.9756)	
IGFRA10D_CLOSE	1.3480	*
	(0.6955)	
FCHID_VALUE	-0.0004	
	(0.0005)	
FCHID_MONTHLY_RETURN	5.1506	**
	(2.6073)	
SYFRAPM	0.0698	**
	(0.0336)	
SYFRAYM	-0.3305	
	(0.5223)	
CPXFRAMAPC	0.0851	
	(0.4878)	
GDPCFRAAPC	0.6887	**
	(0.3277)	
DUMDATE_SBP1	4.3392	***
	(0.5965)	
DUMDATE_SBP2	0.1578	
	(0.6605)	
DUMDATE_SBP3	0.7320	
	(1.3119)	
DUMDATE_SBP4	-3.3992	***
	(0.9592)	
Observations	6018	
R-squared	0.5420	
S.E. of regression	2.2248	
F-statistic	592.2965	
Prob(F-statistic)	0.0000	
Wald F-statistic	9.82E+11	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 2274.3142); *p<0.10, **p < 0.05, ***p < 0.01.

Table 40 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT

Method: Least Squares		
Variable	Coefficient	
C	23.9965	***
	(1.7123)	
IBEUR1D_CLOSE	-0.4433	
	(0.7156)	
IGFRA10D_CLOSE	-0.9358	
	(0.7124)	
FCHID_ VALUE	0.0000	
	(0.0002)	
FCHID_MONTHLY_RETURN	-0.8921	
	(1.9264)	
SYFRAPM	0.0073	
	(0.0071)	
SYFRAYM	-1.6711	***
	(0.2035)	
CPXFRAMAPC	3.4132	***
	(0.2606)	
GDPCFRAAPC	-0.4485	***
	(0.0544)	
DUMDATE_SBP1	9.3452	***
	(0.2813)	
DUMDATE_SBP2	-0.7965	
	(0.5213)	
DUMDATE_SBP3	-2.0155	***
	(0.4798)	
DUMDATE_SBP4	-3.3595	***
	(1.0882)	
Observations	6018	
R-squared	0.4783	
S.E. of regression	3.5162	
F-statistic	458.8295	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 7841.4618); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 41 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	32.2698	***
	(9.4388)	
IBEUR1D_CLOSE	-0.7895	
	(1.0925)	
IGFRA10D_CLOSE	-0.4539	
	(0.7342)	
FCHID_VALUE	-0.0018	
	(0.0013)	
FCHID_MONTHLY_RETURN	9.3945	
	(7.3801)	
SYFRAPM	0.3306	***
	(0.0468)	
SYFRAYM	-0.7052	
	(1.3164)	
CPXFRAMAPC	-4.4375	**
	(1.8497)	
GDPCFRAAPC	0.2910	
	(0.4883)	
DUMDATE_SBP1	31.1023	***
	(0.8131)	
DUMDATE_SBP2	11.1863	***
	(1.9055)	
DUMDATE_SBP3	4.3317	
	(3.2712)	
DUMDATE_SBP4	-1.6729	*
	(1.0133)	
Observations	6018	
R-squared	0.8487	
S.E. of regression	5.2355	
F-statistic	2807.4160	
Prob(F-statistic)	0.0000	
Wald F-statistic	5.09E+12	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 3923.9792); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 42 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward looking

Method: Least Squares		
Variable	Coefficient	
C	-39.2578	**
	(17.9119)	
IBEUR1D_CLOSE	-4.8756	*
	(2.5130)	
IGFRA10D_CLOSE	4.4344	
	(2.9566)	
FCHID_VALUE	0.0093	***
	(0.0022)	
FCHID_MONTHLY_RETURN	-22.2028	***
	(5.4013)	
SYFRAPM	-0.0221	
	(0.0723)	
SYFRAYM	3.1093	
	(1.9870)	
CPXFRAMAPC	2.8443	**
	(1.2554)	
GDPCFRAAPC	-0.3375	
	(1.4032)	
DUMDATE_SBP1	17.4185	***
	(4.0558)	
DUMDATE_SBP2	10.0499	***
	(2.6976)	
DUMDATE_SBP3	-2.6269	
	(2.9908)	
DUMDATE_SBP4	-0.2794	
	(2.7981)	
Observations	6018	
R-squared	0.7142	
S.E. of regression	6.1601	
F-statistic	1250.5120	
Prob(F-statistic)	0.0000	
Wald F-statistic	151286.0000	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1359.1578); *p<0.10, **p < 0.05, ***p < 0.01.

2.6 **Sweden**

Table 43 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA

Method: Least Squares

Variable	Coefficient	
C	9.4731	***
	(2.5759)	
IBSWE1D_CLOSE	-0.3980	
	(0.3113)	
IGSWE10D_CLOSE	-0.1191	
	(0.3338)	
OMXS30_VALUE	0.0045	***
	(0.0010)	
OMXS30_MONTHLY_RETURN	-1.7755	
	(1.2931)	
SYSWEPM	0.0517	
	(0.0556)	
SYSWEYM	-0.5524	
	(0.3944)	
CPXSWEMAPC	0.7439	**
	(0.2962)	
GDPCSWEAPC	-0.3971	**
	(0.1942)	
DUMDATE_SBP1	-0.5956	
	(0.4568)	
DUMDATE_SBP2	-1.1847	**
	(0.5857)	
DUMDATE_SBP3	-3.3619	***
	(1.0587)	
Observations	5818	
R-squared	0.7403	
S.E. of regression	1.5919	
F-statistic	1504.8510	
Prob(F-statistic)	0.0000	
Wald F-statistic	11521.4000	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1220.5484); *p<0.10, **p < 0.05, ***p < 0.01.

Table 44 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	18.1666	***
	(3.9167)	
IBSWE1D_CLOSE	-0.6669	
	(0.5019)	
IGSWE10D_CLOSE	-0.5632	
	(0.5589)	
OMXS30_VALUE	0.0036	**
	(0.0015)	
OMXS30_MONTHLY_RETURN	-0.2487	
	(2.0461)	
SYSWEPM	0.1210	*
	(0.0682)	
SYSWEYM	-1.4401	***
	(0.5269)	
CPXSWEMAPC	1.5420	***
	(0.4816)	
GDPCSWEAPC	-0.6773	**
	(0.3255)	
DUMDATE_SBP1	0.7655	
	(0.7859)	
DUMDATE_SBP2	-1.4693	*
	(0.8652)	
DUMDATE_SBP3	-5.8686	***
	(1.7809)	
Observations	5818	
R-squared	0.7115	
S.E. of regression	2.5037	
F-statistic	1301.6880	
Prob(F-statistic)	0.0000	
Wald F-statistic	93182.920 0	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1215.3195); *p<0.10, **p < 0.05, ***p < 0.01.

Table 45 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	11.2560	***
	(1.7616)	
IBSWE1D_CLOSE	-1.1802	***
	(0.0352)	
IGSWE10D_CLOSE	-0.9422	***
	(0.1869)	
OMXS30_VALUE	0.0124	***
	(0.0010)	
OMXS30_MONTHLY_RETURN	-21.3533	***
	(1.8910)	
SYSWEPM	0.3711	***
	(0.0224)	
SYSWEYM	-2.9644	***
	(0.0591)	
CPXSWEMAPC	3.2771	***
	(0.3345)	
GDPCSWEAPC	-1.6543	***
	(0.1442)	
DUMDATE_SBP1	7.3943	***
	(0.3307)	
DUMDATE_SBP2	9.9796	***
	(0.2733)	
DUMDATE_SBP3	2.0219	***
	(0.1225)	
Observations	5818	
R-squared	0.5963	
S.E. of regression	5.9930	
F-statistic	779.6732	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 23928.5444); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 46 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward-looking		
Method: Least Squares		
Variable	Coefficient	
C	9.5303	*
	(5.2613)	
IBSWE1D_CLOSE	-3.0349	***
	(1.0960)	
IGSWE10D_CLOSE	0.3978	
	(0.9576)	
OMXS30_CLOSE	0.0021	
	(0.0039)	
OMXS30_MONTHLY_RETURN	0.6126	
	(2.7826)	
SYSWEPM	0.2399	
	(0.1574)	
SYSWEYM	-0.5732	
	(0.4613)	
CPXSWEMAPC	2.0545	*
	(1.0711)	
GDPCSWEAPC	-0.5397	*
	(0.3001)	
DUMDATE_SBP1	11.1297	***
	(1.0416)	
DUMDATE_SBP2	9.5380	***
	(1.5430)	
DUMDATE_SBP3	-1.9658	
	(1.2016)	
Observations	5818	
R-squared	0.7356	
S.E. of regression	3.3960	
F-statistic	1468.5700	
Prob(F-statistic)	0.0000	
Wald F-statistic	54.3609	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 972.6412); *p<0.10, **p < 0.05, ***p < 0.01.

2.7 **Denmark**

Table 47 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	12.0016	***
	(0.0857)	
IBDNK3M_CLOSE	-0.0790	***
	(0.0118)	
IGDNK10D_CLOSE	-0.4660	***
	(0.0731)	
OMXC20D_VALUE	0.0048	***
	(0.0003)	
OMXC20D_MONTHLY_RETURN	3.6743	*
	(1.9895)	
SYDNKPM	0.0678	***
	(0.0091)	
SYDNKYM	-0.3814	
	(0.2469)	
CPXDNKMAPC	-0.0218	
	(0.3660)	
GDPCDNKAPC	0.2902	***
	(0.0529)	
DUMDATE_SBP1	-1.4774	***
	(0.1362)	
DUMDATE_SBP2	0.9732	***
	(0.0841)	
DUMDATE_SBP3	-1.3226	***
	(0.1255)	
DUMDATE_SBP4	1.5863	***
	(0.0625)	
Observations	5981	
R-squared	0.7680	
S.E. of regression	1.7179	
F-statistic	1646.1200	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 10922.8258); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 48 Ordinary least squares regression results for the relationship between the median EV/EBIT and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT

Method: Least Squares		
Variable	Coefficient	
C	15.1360	***
	(4.4943)	
IBDNK3M_CLOSE	0.0515	
	(0.4365)	
IGDNK10D_CLOSE	-0.8098	
	(0.6243)	
OMXC20D_VALUE	0.0034	**
	(0.0017)	
OMXC20D_MONTHLY_RETURN	5.7566	
	(4.1403)	
SYDNKPM	0.1777	**
	(0.0723)	
SYDNKYM	0.3892	
	(0.6072)	
CPXDNKMAPC	-0.5735	
	(0.8655)	
GDPCDNKAPC	0.2809	
	(0.2908)	
DUMDATE_SBP1	-3.2865	***
	(0.5905)	
DUMDATE_SBP2	-0.0396	
	(0.7446)	
DUMDATE_SBP3	-2.3532	***
	(0.6784)	
DUMDATE_SBP4	-0.9595	
	(0.8728)	
Observations	5981	
R-squared	0.5965	
S.E. of regression	2.9994	
F-statistic	735.1430	
Prob(F-statistic)	0.0000	
Wald F-statistic	1.83E+12	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 2981.7366); *p<0.10, **p < 0.05, ***p < 0.01.

Table 49 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	25.1639	***
	(1.3484)	
IBDNK3M_CLOSE	1.9559	***
	(0.3145)	
IGDNK10D_CLOSE	-3.4675	***
	(0.3140)	
OMXC20D_VALUE	0.0061	***
	(0.0019)	
OMXC20D_MONTHLY_RETURN	-0.2575	
	(4.4387)	
SYDNKPM	0.3069	***
	(0.0747)	
SYDNKYM	-3.1014	***
	(0.7951)	
CPXDNKMAPC	0.9416	
	(0.8623)	
GDPCDNKAPC	0.0324	
	(0.1065)	
DUMDATE_SBP1	0.7456	
	(0.5435)	
DUMDATE_SBP2	0.2372	
	(0.3046)	
DUMDATE_SBP3	-3.5702	***
	(1.1312)	
DUMDATE_SBP4	-1.7865	***
	(0.6421)	
Observations	5981	
R-squared	0.5820	
S.E. of regression	4.4580	
F-statistic	692.4630	
Prob(F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 9107.0283); No Wald F-statistic and corresponding critical value are given as was not produced in regression output; *p<0.10, **p < 0.05, ***p < 0.01.

Table 50 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward looking		
Method: Least Squares		
Variable	Coefficient	
C	4.4081	
	(14.7737)	
IBDNK3M_CLOSE	1.6605	
	(1.1299)	
IGDNK10D_CLOSE	-1.3070	
	(1.3575)	
OMXC20D_VALUE	0.0265	**
	(0.0105)	
OMXC20D_MONTHLY_RETURN	-4.4596	*
	(2.6988)	
SYDNKPM	0.0857	
	(0.1568)	
SYDNKYM	-2.9049	
	(2.2675)	
CPXDNKMAPC	-0.1096	
	(0.9035)	
GDPCDNKAPC	-0.2155	
	(0.2998)	
DUMDATE_SBP1	14.8052	***
	(3.1525)	
DUMDATE_SBP2	8.6356	**
	(3.4080)	
DUMDATE_SBP3	7.5222	*
	(4.0164)	
DUMDATE_SBP4	4.3659	*
	(2.2334)	
Observations	5981	
R-squared	0.7549	
S.E. of regression	4.2871	
F-statistic	1531.9570	
Prob(F-statistic)	0.0000	
Wald F-statistic	438.3371	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 709.3559); *p<0.10, **p < 0.05, ***p < 0.01.

2.8 **Japan**

Table 51 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBITDA		
Method: Least Squares		
Variable	Coefficient	
C	10.2867	
	(7.7265)	
IBJPN1D_CLOSE	3.8040	
	(2.7043)	
IGJPN10D_CLOSE	-4.5630	***
	(0.5680)	
N225D_VALUE	0.0000	
	(0.0002)	
N225D_MONTHLY_RETURN	-18.0537	
	(12.1038)	
SYJPNPTM	0.2170	***
	(0.0462)	
SYJPNYM	-1.4390	
	(1.7195)	
CPXJPNMAPC	-2.3988	
	(1.5137)	
GDPCJPNAPC	-0.3115	
	(0.2458)	
DUMDATE_SBP1	2.7369	
	(2.2084)	
DUMDATE_SBP2	1.8377	
	(1.1457)	
Observations	5673	
R-squared	0.3583	
S.E. of regression	5.8071	
F-statistic	316.1626	
Prob(F-statistic)	0.0000	
Wald F-statistic	8.94E+08	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 2703.2116); *p<0.10, **p < 0.05, ***p < 0.01.

Table 52 Ordinary least squares regression results for the relationship between the median EV/EBITDA and the SBPs in the corresponding interbank rate

Dependent Variable: EV/EBIT		
Method: Least Squares		
Variable	Coefficient	
C	7.8472	
	(6.6192)	
IBJPN1D_CLOSE	5.7689	**
	(2.8547)	
IGJPN10D_CLOSE	-6.0365	***
	(1.3324)	
N225D_VALUE	0.0003	
	(0.0002)	
N225D_MONTHLY_RETURN	-21.0650	*
	(11.4122)	
SYJPNPTM	0.2844	***
	(0.0476)	
SYJPNYM	-1.0760	
	(1.6224)	
CPXJPNMAPC	-1.4659	
	(1.6288)	
GDPCJPNAPC	0.0795	
	(0.5161)	
DUMDATE_SBP1	5.2685	**
	(2.5857)	
DUMDATE_SBP2	1.9833	
	(1.5635)	
Observations	5673	
R-squared	0.5111	
S.E. of regression	5.6668	
F-statistic	591.8994	
Prob(F-statistic)	0.0000	
Wald F-statistic	2237922.0000	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1760.7656); *p<0.10, **p < 0.05, ***p < 0.01.

Table 53 Ordinary least squares regression results for the relationship between the median P/E TTM and the SBPs in the corresponding interbank rate

Dependent Variable: P/E TTM		
Method: Least Squares		
Variable	Coefficient	
C	25.7550	*
	(13.6773)	
IBJPN1D_CLOSE	14.2496	*
	(7.6750)	
IGJPN10D_CLOSE	-16.5219	***
	(4.6956)	
N225D_VALUE	-0.0008	**
	(0.0003)	
N225D_MONTHLY_RETURN	-28.4729	*
	(16.4462)	
SYJPNPTM	0.8709	***
	(0.1410)	
SYJPNYM	-1.8940	
	(3.4689)	
CPXJPNMAPC	-1.8602	
	(2.2109)	
GDPCJPNAPC	0.6942	
	(0.7693)	
DUMDATE_SBP1	7.5244	
	(6.3960)	
DUMDATE_SBP2	6.4562	**
	(2.6173)	
Observations	5673	
R-squared	0.5941	
S.E. of regression	10.9720	
F-statistic	828.7791	
Prob(F-statistic)	0.0000	
Wald F-statistic	24103.4600	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 1323.3854); *p<0.10, **p < 0.05, ***p < 0.01.

Table 54 Ordinary least squares regression results for the relationship between the median P/E forward-looking and the SBPs in the corresponding interbank rate

Dependent Variable: P/E Forward looking

Method: Least Squares		
Variable	Coefficient	
C	39.7698	***
	(9.3506)	
IBJPN1D_CLOSE	-3.1213	
	(6.2218)	
IGJPN10D_CLOSE	-12.0869	***
	(2.7836)	
N225D_VALUE	-0.0010	***
	(0.0002)	
N225D_MONTHLY_RETURN	-24.2591	*
	(13.7734)	
SYJPNPTM	0.2551	**
	(0.1169)	
SYJPNYM	-3.4535	
	(3.0903)	
CPXJPNMAPC	-4.4449	**
	(2.0835)	
GDPCJPNAPC	1.8101	*
	(0.9312)	
DUMDATE_SBP1	3.7835	**
	(1.5475)	
DUMDATE_SBP2	8.6968	***
	(1.5396)	
Observations	5673	
R-squared	0.4592	
S.E. of regression	9.4582	
F-statistic	480.6781	
Prob(F-statistic)	0.0000	
Wald F-statistic	632429.6000	
Prob(Wald F-statistic)	0.0000	

Note. Standard errors are in parentheses; the observations included have been adjusted to match the adjusted sample length, which is from 1/02/1996 to 9/30/2019; HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth = 2034.5035); *p<0.10, **p < 0.05, ***p < 0.01.

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