The Effect of Investor Short-Termism on the Capital Demand of European Listed Firms*

Zoltán Schepp – József Ulbert – Ákos Tóth-Pajor

The study examines the relationship between investors' intertemporal preferences and capital demand in European listed firms' practices. It seeks to find out how investor short-termism influenced European companies' capital demand in 2004–2016. The analysis of the link between the cost of equity and businesses' capital demand reveals the effects of macro-level shocks such as the recession, the change in the interest rate environment and the shifting equity risk premium on capital markets. To answer the question that our research focused on, we estimated the implicit intertemporal discount surplus typical of the companies under review and thus determined the discount rate in excess of the cost of capital that describes investors' intertemporal preferences. We then explored the relationship between the cost of equity and capital demand using regression models. We found that in the practices of European listed firms, the decrease in capital demand and the resulting restrictions on investment are attributable to growth in the intertemporal discount surplus. If investors prioritise their short-term interests on the capital markets and companies adapt to investors' intertemporal preferences, long-run shareholder value accumulation is undermined. Additionally, and in connection with the above, growth in the intertemporal discount surplus can also delay the effects of monetary easing.

Journal of Economic Literature (JEL) codes: G31, E22, E52

Keywords: capital demand, investment decisions, intertemporal preferences, intertemporal discount surplus, hyperbolic discounting, investor short-termism

---

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Zoltán Schepp is a Professor at the University of Pécs, Faculty of Business and Economics.
Email: schepp@ktk.pte.hu
József Ulbert is an Associate Professor at the University of Pécs, Faculty of Business and Economics.
Email: ulbert@ktk.pte.hu
Ákos Tóth-Pajor is an Assistant Lecturer at the University of Pécs, Faculty of Business and Economics.
Email: toth-pajor.akos@ktk.pte.hu

The study was financed by the Higher Education Institutional Excellence Programme of the Hungarian Ministry of Human Capacities, under the 4th Thematic Programme 'Enhancing the Role of Domestic Companies in the Reindustrialisation of Hungary' of the University of Pécs (Contract No.: 20765-3/2018/FEKUTSTRAT).

The Hungarian manuscript was received on 5 March 2020.

DOI: http://doi.org/10.33893/FER.19.2.88106

1. Introduction

The study aims to analyse the impact of investor short-termism on corporate capital demand in the practices of European listed firms. It examines how the changes in the interest rate environment and capital market trends influenced investors' intertemporal preferences and what changes were thus triggered in European companies' capital demand in 2004–2016.

Companies' capital demand can be interpreted as the aggregate outlay for the investments they implement. Consequently, capital demand is shaped by businesses' investment decisions. Investors' intertemporal preferences influence companies' investment decisions through the cost of capital channel, and therefore they also have an indirect effect on firms' capital demand.

In the equilibrium baseline model of asset pricing, i.e. the capital asset pricing model, the cost of equity is determined by the risk-free rate, companies' market risk and development of the equity risk premium. The cost of equity helps track the effects of interest rate movements and capital market developments, which respond to the changes in companies' macro-environment.

The study builds on the model framework used by *Blundell-Wignall – Roulet* (*2013*) to describe the relationship between companies' capital demand and the cost of equity, and expands it with the intertemporal discount surplus, defined based on *Davies et al.* (*2014*) and *Miles* (*1993*), which describes the implicit intertemporal preferences of capital market investors. In contrast to *Davies et al.* (*2014*), the asset pricing model used in this paper does not use a fixed risk premium, so the equity risk premium can change. Here, the amount of the intertemporal discount surplus is shaped by the shifts in the interest rate environment as well as capital market developments.

The study finds that the rise in the implicit intertemporal discount surplus foreshadows a decrease in companies' capital demand and thus can also delay the capital demand-increasing effect of monetary easing.

The paper first provides an overview of the literature on the relationship between investors' intertemporal preferences and capital demand. We then formulate the empirically verifiable research questions that are deemed important based on the literature. Next, we briefly describe our sample as well as the related descriptive statistics. After that, we present the methods used to answer our research questions and assess the findings linked to each of them. Finally, we draw the conclusions based on the results.

2. Intertemporal preferences of capital market investors

Blundell-Wignall – Roulet (*2013*), *Campbell et al.* (*2012*) and *Simmons-Süer* (*2016*) demonstrate that there is an inverse relationship between shareholders' required rate of return and companies' capital demand. If the cost of equity increases, it implies a contraction in companies' capital demand. Examining the relationship between production volume and organisational learning, *Vörös* (*2020*) argues that in discrete cases an increase in the required rate of return decreases the present value of the production knowledge arising from the larger production volume, and therefore firms opt for a lower production volume in the context of a high discount rate and a higher production volume in the case of a low discount rate. Therefore, on the basis of the basic tenet of neoclassical investment theory, assuming a positive correlation between production volume and capital demand, companies' capital demand will decline against the backdrop of a higher required rate of return.

Fazzari et al. (*1988*) show that businesses that pay low dividends reinvest their profits because for them external borrowing is more costly than tapping internal sources of financing. The growing difference observed between the costs of equity and interest-paying debt encourages distributions to shareholders. *Mankins et al.* (*2017*) prove that while capital was a scarce resource in the 1980s and 1990s, nowadays abundant and cheap capital is looking for profitable investment opportunities. The hurdle rates determined by decision-makers do not reflect the cost of capital, which often leads to the rejection of investments.

According to *Simmons-Süer* (*2018*), there are periods at listed companies when their low capital demand is attributable to neither the interest rate environment nor growth opportunities. In such periods, the required rate of return does not reflect the cost of capital, which contradicts the irrelevance hypothesis by Miller–Modigliani. *Davies et al.* (*2014*) demonstrate that investor short-termism on capital markets can lead to a decrease in investments through the cost of capital channel. A negative relationship between the cost of equity and investment can be observed, and thus an increase in shareholders' required rate of return entails a decline in the growth rate of the capital stock.

First *Miles* (*1993*) and then *Davies et al.* (*2014*) found evidence for investor short-termism on capital markets, and they showed that the myopic investor approach destroys shareholder value in the long run. If listed firms serve investors' short-term interests on capital markets, they focus on quarterly reports and favour distributions to shareholders, thereby increasing the short-term returns from investments. *Stein* (*1989*) argues that managers prefer investments that boost profitability in the short run. The market responds to these immediately and incorporates them into the prices. Due to investor short-termism, the equilibrium between short- and long-term interests is undermined (*Martin 2015*; *Summers 2017*; *Favaro 2014*; *Mauboussin – Rappaport 2016*).

Asker et al. (*2014*) maintain that investor short-termism is much stronger in the case of listed companies than private ones. *Feldman et al.* (*2018*) write that capital markets facilitate uncollateralised investments in research and development. *Hackbarth et al.* (*2018*) believe that if businesses serve investors' short-term interest, long-term value creation costs more. Shareholders are looking to balance short- and long-term cash flows.

Consequently, the literature clearly argues that, assuming a constant discount rate, the rules of exponential discounting often fail to capture intertemporal preferences involved in making decisions. The non-stationary nature of intertemporal preferences and their time inconsistency can be taken into account with time-varying discount rates or using the tools offered by hyperbolic discounting (*Janssens et al. 2017*). Therefore, this paper uses hyperbolic discounting to examine investors' intertemporal preferences and model intertemporal decisions, which facilitates the incorporation of the effects of short-termism into the study.

Phelps and Pollack (*1968*) first used this method to model intertemporal decisions across generations, and demonstrated that when making decisions, people assign greater significance to the welfare of their own generation than that of future generations. *Laibson* (*1997*) argues that when making decisions, people constrain their own future choices if they give larger prominence to short-term outcomes. *Rasmusen* (*2008*) writes that the main point of hyperbolic discounting is the relative treatment of time, and the author deduces the marginal rate of substitution in the case of the various functional forms. *Bölcskei* (*2009*) also points out that intertemporal preferences are often biased towards the present. Decisions are taken focusing on short-term interests. *Neszveda – Dezső* (*2012*) also argue that hyperbolic discounting is better suited for describing intertemporal preferences. *Davies et al.* (*2014*) and *Miles* (*1993*) also used similar discount functions to model the intertemporal preferences of capital market investors.

Following in the footsteps of *Davies et al.* (*2014*), investors' intertemporal preferences can be modelled using quasi-hyperbolic discount functions. The authors decided to use hyperbolic discounting to present investor short-termism. Intertemporal preferences appear in the discount function as an intertemporal discount factor, denoted by x in equation (1). The intertemporal discount surplus can be interpreted as an additional discount rate describing intertemporal preferences, and therefore the x intertemporal discount factor is the function of the intertemporal discount surplus.

If $x < 1$, that indicates short-termism, because decisions are made while assigning greater significance to short-term cash flows and setting greater required returns than the cost of capital.

If $x > 1$, that indicates a long-term approach, because decisions are made while assigning greater significance to long-term cash flows and setting lower required returns than the cost of capital.

$$D_I(T) = \frac{x^T}{(1+r)^T}, \quad (1)$$

where $D_I(T)$ denotes the discount function describing the intertemporal preferences of the decision maker, r stands for the cost of capital, T is the maturity and x is the intertemporal discount factor.

Davies et al. (*2014*) also manage to empirically prove short-termism in intertemporal capital allocation decisions. According to *Davies et al.* (*2014*), who examined the capital markets of the UK and the US in 1995–2004, the intertemporal discount factor is $x = 0.938$. Therefore, the intertemporal discount surplus can be determined based on equation (2).

$$itp = x^{-1} - 1, \quad (2)$$

where *itp* is the discount surplus describing intertemporal preferences.

Based on equation (2), the average implicit intertemporal discount surplus was 6.6 per cent between 1995 and 2004. This was the return expected by investors in excess of companies' cost of capital.

Davies et al. (*2014*) also demonstrate that investor short-termism shifts companies' allocation of capital towards distributions to shareholders rather than investments. These observations have proven that the intertemporal preferences of decision makers on capital markets are non-stationary; investors focus on short-term interests during their intertemporal capital allocation decisions, which decreases corporate investment through the cost of capital channel. The examination of the relationship between implicit intertemporal preferences and capital demand highlights new aspects in the studies analysing the causality between the required rate of return and investments.

After reviewing the literature, the focus will now be shifted towards two empirically verifiable research questions. First, it will be examined how the intertemporal discount surplus changed in 2004–2016. Second, it will be explored how this change affected companies' capital demand and how it influenced the economic stimulus provided by monetary policy measures. The following hypotheses are formulated based on our preliminary expectations:

1. The intertemporal discount surplus increased in the period under review (2004–2016).
2. Its increase overshadowed long-run shareholder value accumulation by restricting investments and thus probably also delayed the capital demand-boosting effects of monetary easing.

3. Sample and descriptive statistics

The financial statement data necessary for calculating the key variables for 2004–2017 were compiled from the database of *Refinitiv*. The resulting panel database contains the balance sheet, income statement and cash flow statement data of listed firms registered in Europe. Besides the financial statement data, the dataset also contains market information. The available data allowed for the estimation of the intertemporal discount surplus in 2004–2016, and thus the descriptive statistics are also presented for this period.

Sample selection criteria:

- companies with negative equity were excluded from the sample;
- companies with zero sales revenue were excluded from the sample;
- only those listed firms were permitted in the sample which were listed on the stock exchange during the entire sample period;
- the corporate financial statement data and market information from 27 countries are presented in euros based on the calculations of Refinitiv;
- the financial sector, public services and the real estate sector were excluded from the sample in line with the Global Industry Classification Standard (GICS), due to the variation in accounting regulations; therefore, companies from 55 different industries are included.

The dataset that serves as the basis for the empirical study comprises firms that have been publicly listed for 30 years on average, and thus the sample allows for the examination of mature listed companies. The Refinitiv database contained 2,984 listed firms registered in Europe where the information necessary for calculating the key variables was available. After filtering by the selection criteria, the study analysed a total of 14 financial years with the 527 listed firms that remained in the sample. This represents 17.66 per cent of the available companies.

In terms of the key variables, outliers were filtered out with the interquartile range method. If the given values of a variable were further away from the 25th and 75th percentile than three times the interquartile range, they were replaced with the values at the 5th and 95th percentile (*Hastings et al. 1947*; *Dixon 1960*; *Tukey 1977*). The sample appropriately represents the capital markets of Europe and is thus suitable for examining the relationship between capital demand and intertemporal preferences.

Table 1 shows the calculation method used for the variables in the models analysing the link between corporate capital demand and the cost of equity and in estimating the implicit intertemporal discount surplus. Capital demand (*I*) is determined by capital expenditures (*CAPEX*), which is defined as the sum of the investments in tangible and intangible assets in the cash flow statements of listed firms. Therefore, capital demand can be construed as the spending on investment in tangible and intangible assets.

Similar to *Blundell-Wignall – Roulet* (*2013*), we analysed capital demand relative to sales revenue (*S*) to enable the comparison of companies of different sizes.

Table 1
Definitions of key variables

Variable	Notation	Calculation method
Capital demand relative to sales revenue	$I_{i,t}/S_{i,t}$	Capital expenditures $(CAPEX)_{i,t}$ / Net sales $revenue_{i,t}$
Capital intensity	$K_{i,t}/S_{i,t}$	(Intangible $assets_{i,t}$ + Tangible $assets_{i,t}$) / Net sales $revenue_{i,t}$
Cost of equity	$COE_{i,t}$	$r_{f,t} + \beta_i ERP_{i,t}$
	$r_{f,t}$	10-year ECB zero-coupon yield
	β_i	CAPM Beta (Refinitiv estimate)
	$ERP_{i,t}$	Equity risk premium
Dividend per share (EUR)	$DPS_{i,t}$	Dividend $paid_{i,t}$ / Number of $shares_{i,t}$
Earnings per share (EUR)	$EPS_{i,t}$	Profits after $tax_{i,t}$ / Number of $shares_{i,t}$

The targeted long-term capital stock necessary for operations is determined by companies' output. In the long run, businesses' output and capital stock are in line with each other, and this is referred to as capital intensity. It measures the amount of capital necessary in a firm to produce one unit of sales revenue (*S*). Capital intensity determines the targeted long-term capital stock necessary for operations. The capital stock (*K*) is defined as the sum of intangible and tangible assets. The cost of equity (*COE*) is defined as the sum of the 10-year ECB zero-coupon yield (r_f) and the risk premium characteristic of the companies. The 10-year ECB zero-coupon yield was chosen because the sample largely comprises euro area countries, and the ECB zero-coupon yield accurately represents the risk-free rate of the countries in the sample.

We determined the risk premium as the product of the implied equity risk premium (*ERP*) based on the work of *Damodaran* (*2019*), observed in the country where the company is registered on the one hand, and the market risk characteristic of the company (β_i) on the other hand. We measured market risk by the betas estimated by Refinitiv. As per the definition, the change in the cost of equity is entailed by the variation in the interest rate environment and the equity risk premium. The intensity of the comovement between stock returns and the market return was assumed to be constant in the sample period. Therefore, the changes in the cost of equity help track the effects of macro-level shocks.

Stock price (*P*), earnings per share (*EPS*) and dividends per share (*DPS*) are presented in euros. Financial years are indexed with *t*, companies with *i*.

Table 2
Descriptive statistics of the key variables based on the entire sample

Variable	Average	Standard deviation	Minimum	Median	Maximum	Number of observations
$I_{i,t}/S_{i,t}$	0.058	0.052	0	0.041	0.224	6,851
$K_{i,t}/S_{i,t}$	0.353	0.316	0.005	0.247	1.317	6,851
$COE_{i,t}$	0.077	0.024	0.004	0.076	0.184	6,851
$r_{f,t}$	0.032	0.012	0.009	0.037	0.044	6,851
β_i	0.81	0.392	–0.082	0.809	2.312	6,851
$ERP_{i,t}$	0.056	0.011	0.045	0.05	0.2	6,851
$DPS_{i,t}$	0.578	0.809	0	0.263	4.077	6,851
$EPS_{i,t}$	1.221	1.9	–4.97	0.569	9.699	6,851
$P_{i,t}$	22.451	30.288	0.01	10.54	170.309	6,851

Table 2 shows the descriptive statistics of the key variables based on the entire sample. In 2004–2016, companies expanded their capital stock relative to sales revenue by 5.8 per cent on average annually. In terms of capital intensity, the generation of one unit of sales revenue required 0.353 units of capital. The beta, measuring market risk, was 0.81 on average. The cost of equity fluctuated around 7.7 per cent, while the equity risk premium was 5.6 per cent on average.

Average earnings per share were EUR 1.22, the average dividend per share was EUR 0.578, and the average 10-year ECB zero-coupon yield was 3.2 per cent in the financial years under review.

Figure 1
Capital demand relative to sales revenue in 2004–2016

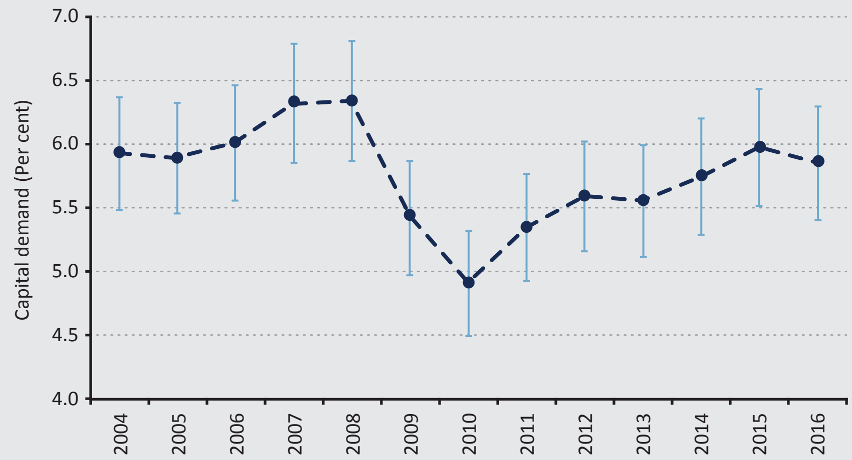
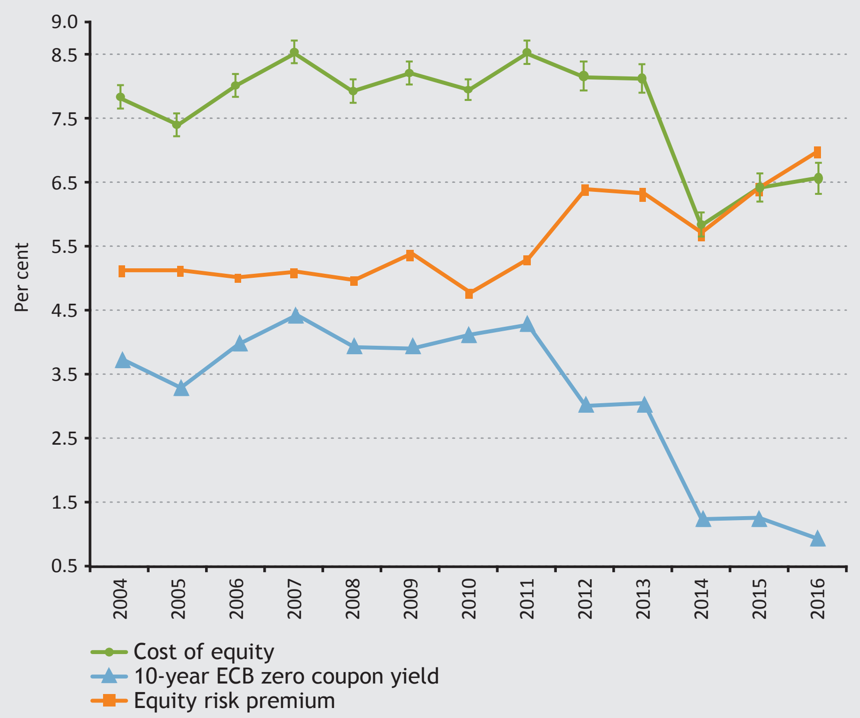


Figure 1 shows the development of average capital demand relative to sales revenue, broken down by financial years, in the sample period. While in 2007 companies increased their capital stock by 6.3 per cent on average, the investment rate dropped to under 5 per cent during the crisis years, before climbing back to 5.8 per cent in the low interest rate environment by 2016. *Duchin et al.* (*2010*) argue that the decline in investments was the result of the shock to the external capital supply on account of the crisis. The 2009–2010 investment shock entailed a massive reduction in the growth rate of the capital stock.

When analysing intertemporal preferences, important information can be gained from the trends in risk-free returns and the equity risk premium, as well as the change in the cost of equity. *Figure 2* clearly shows that the sampled average 10-year ECB zero-coupon yield varied in the range of 3–4.5 per cent until 2011. After the 2011 financial year, as the euro area debt crisis receded, the 10-year ECB zero-coupon yield declined. The analysis of the implied equity risk premium estimated based on *Damodaran* (*2019*) and observed on the capital markets broken down by the firms' country of incorporation shows that the sampled average of the equity risk premium rose from 5 to 7 per cent after the crisis. Due to the combined impact of the risk-free rate and the equity risk premium, the sampled average of the cost of equity only diminished by 2014. *Figure 2* provides a good overview of the effects exerted by the changes in the interest rate environment and capital market developments on the cost of equity of European listed firms.

Figure 2
Change in the cost of equity



4. Changes in the intertemporal discount surplus in 2004–2016

The implicit intertemporal discount surplus is estimated based on *Davies et al.* (*2014*). The authors use quasi-hyperbolic discount functions in an asset pricing model to estimate the intertemporal discount surplus. Thus, the asset pricing model used in their estimations includes an additional discount factor describing intertemporal preferences.

The asset pricing model used here differs from the one employed by *Davies et al.* (*2014*) in that, with regard to the cost of equity, we defined the risk premium as the product of the implied equity risk premium and the beta. This definition of the cost of equity is based on the capital asset pricing model (CAPM). We assumed that the comovement between the market return and stock returns is constant in the sample period. Consequently, in contrast to *Davies et al.* (*2014*), here the cost of equity is derived not only from the interest rate changes but also from the time-varying risk premium, and the heterogeneity between companies is only influenced by market risk. Unlike in *Davies et al.* (*2014*), the risk premium may vary in the sample period in the asset pricing model used here, and therefore the intertemporal discount surplus is shaped by the shifts in the interest rate environment as well as capital market developments. Based on *Davies et al.* (*2014*), the asset pricing model used for estimating intertemporal preferences can be established with the help of equation (3):

$$P_{i,t} = \sum_{j=1}^{N} \frac{E_t(DPS_{i,t+j}) x_t{}^j}{(1 + COE_{i,t+j})^j} + \frac{E_t(P_{i,t+N}) x_t{}^N}{(1 + COE_{i,t+N})^N}, \qquad (3)$$

where i is used to index companies, j is used to index the years of the holding period, and t is the index for financial years, $P_{i,t}$ denotes the share price, N stands for the holding period, $DPS_{i,t}$ is the dividend per share, $COE_{i,t} = r_{f,t} + \beta_i ERP_{i,t}$ is the cost of equity, and x_t denotes the implicit intertemporal discount factor for the given year.

Wickens (*1982*) argues that the expected values for equation (3) are identical to the difference between the realised values and the forecast error. In this case, the expected value of the share price N periods later at time t can be determined by equation (4).

$$E_t(P_{i,t+N}) = P_{i,t+N} - U_{i,t+N}, \qquad (4)$$

where $U_{i,t+N}$ denotes the forecast error.

Here, the parameter x can be estimated with instrumental variables estimation methods where the instrumental variables correlate with the $P_{i,t+N}$ share price but not with the forecast error. Therefore, the parameter x in equation (3) can be estimated using the non-linear two-stage least squares method. In the case of future dividends per share and future share prices, the lagged earnings per share and dividends per share can be used as instrumental variables. Thus, the x intertemporal discount factor can be estimated for all financial years to track changes in investors' intertemporal preferences on the capital markets. *Neszveda – Dezső* (*2012*) argue that in the long run quasi-hyperbolic discount functions produce markedly different results than generalised hyperbolic discounting. Accordingly, the model developed here used an N holding period of 5 years, except when there were not enough observations for the 5-year period. Therefore, the holding period was shortened by one year in each year after 2012. Thus, the model examines a medium-term investment horizon. The intertemporal discount surplus cannot be estimated based on the data available for the 2017 financial year.

Figure 3 tracks the development of the implicit intertemporal discount surplus in 2004–2016. First, we estimated the *x* intertemporal discount factor using the asset pricing model presented in equation (3) and then we expressed the implicit intertemporal discount surplus from that based on the formula in equation (2). Due to the forecast errors, we estimated the parameter *x* using the non-linear two-stage least squares method for each financial year.

In the case of cross-sectional regressions, the R^2 varies between 72 and 95 per cent. The estimated intertemporal discount factor is significant at 1 per cent in every year. Following the parameter estimation, the *Wald test* was used to examine whether the intertemporal discount factor significantly differed from 1, since if $x = 1$, then the implicit intertemporal discount surplus is 0. The results of the *Wald tests* showed significant differences in all years. Based on Hansen's J-statistics, the null hypothesis, according to which the set of instrumental variables was appropriate, was never rejected. *Figure 3* shows point estimates as well as the 95 per cent confidence interval calculated from the standard errors taking into account heteroscedasticity based on *White* (*1980*).

Figure 3
Changes in the implicit intertemporal discount surplus in 2004–2016

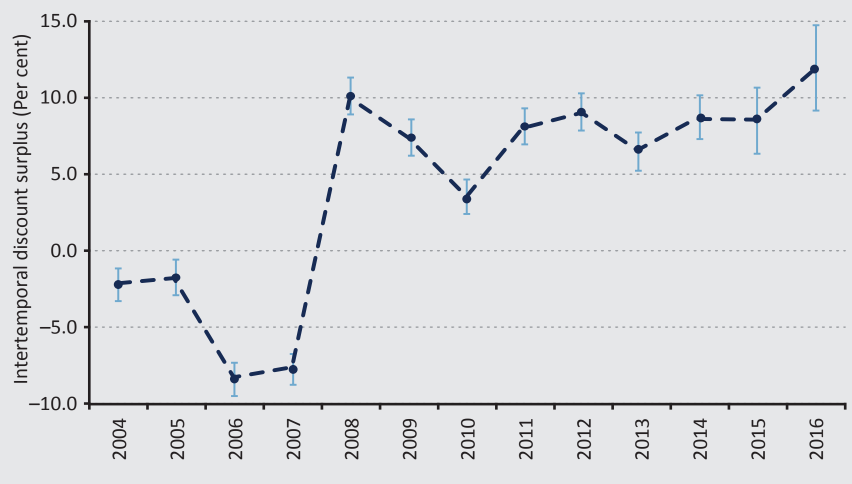


Figure 3 demonstrates that the implicit intertemporal discount surplus was negative before 2008. Accordingly, investors' average required rate of return on the capital market was below the cost of equity. This suggests that investors were characterised by a long-term approach before 2008: they were more likely to forego their present income for the promise of future returns. The largest negative intertemporal discount surplus was seen in 2006, when investors' average required rate of return was 8.4 per cent lower than the cost of equity. The intertemporal discount surplus has been positive since 2008, which indicates that investors' average required rate of return moved above the cost of equity. In such a situation, investors focus on their short-term interests on the capital markets, and therefore they are less inclined to make a trade-off between their present income and the promise of future returns. In 2008, the intertemporal discount surplus was 10.1 per cent, i.e. investors' average required rate of return on the capital markets exceeded the cost of equity by this percentage.

5. The effect of investor short-termism on the capital demand of European listed firms

Investors' required rate of return also affects companies' capital demand through the cost of capital channel, since – from the perspective of firms – the investors' required rate of return can also be seen as the cost of equity. An increase in the implicit intertemporal discount surplus may boost the discount rate used during investment decisions and thus decrease companies' capital demand.

After estimating the intertemporal discount surplus, we analysed the effects of intertemporal preferences on capital demand. *Blundell-Wignall – Roulet* (*2013*) argue that there is an inverse relationship between the required rate of return and companies' capital demand. They also show that there is a negative relationship between the cost of equity and capital demand. The cost of equity is a good point of reference as regards the required rate of return, but when making investment decisions, decision makers usually use different hurdle rates, which is not captured very well by using the cost of equity. That is why the examination of the implicit intertemporal discount surplus is considered important here, because it captures the difference between the hurdle rates and the cost of equity.

In analysing the impact of the growth in intertemporal discount surplus, a model similar to the one employed by *Blundell-Wignall – Roulet* (*2013*) is used here, which has been expanded by taking into account the effects of the implicit intertemporal discount surplus and the intertemporal discount factor. With the help of our model we can capture investors' required rate of return in a more precise way.

The baseline model is presented in equation (5).

$$\frac{I_{i,t}}{S_{i,t}} = \beta_1 COE_{i,t-1} + \beta_2 \frac{K_{i,t}}{S_{i,t}} + \mu_i + \varepsilon_{i,t}, \tag{5}$$

where $I_{i,t}/S_{i,t}$ is the capital demand for a unit of sales revenue, $COE_{i,t-1}$ is the cost of equity, $K_{i,t}/S_{i,t}$ is the capital intensity, μ_i denotes fixed effects, $\varepsilon_{i,t}$ is the error term, and β stands for the parameters of the regression model.

Further explanatory variables incorporated into the baseline model include the trends of the intertemporal discount factor (*x*) and the intertemporal discount surplus (*itp*). We use two different trend variables to show that the model definitely captures the effects of intertemporal preferences, and the trend variables do not merely reflect the passage of time. The preliminary expectations include that a positive relationship will be observed between capital demand and the trend of the discount factor, and a negative one in the case of the intertemporal discount surplus. The models incorporate the lagged trend variables, because we seek to analyse the predictive features of these trend variables.

In equation (6), we expanded the model with the trend of the intertemporal discount factor.

$$\frac{I_{i,t}}{S_{i,t}} = \beta_1 x_{t-1} + \beta_2 COE_{i,t-1} + \beta_3 \frac{K_{i,t}}{S_{i,t}} + \mu_i + \varepsilon_{i,t}, \tag{6}$$

where x_{t-1} denotes the lagged trend of the intertemporal discount factor.

Equation (7) incorporates the trend of the discount surplus describing implicit intertemporal preferences as an explanatory variable.

$$\frac{I_{i,t}}{S_{i,t}} = \beta_1 itp_{t-1} + \beta_2 COE_{i,t-1} + \beta_3 \frac{K_{i,t}}{S_{i,t}} + \mu_i + \varepsilon_{i,t}, \tag{7}$$

where itp_{t-1} denotes the lagged trend of the discount surplus describing intertemporal preferences.

The models aim to demonstrate that growth in the intertemporal discount surplus reduces firms' capital demand, which suggests that investor short-termism entails the rejection or postponement of investment through the cost of capital channel, thereby destroying value for companies. Investor short-termism undermines long-run shareholder value accumulation.

Table 3 examines the link between the required rate of return and capital demand. The data necessary for the estimation were available for 527 companies in the sample under review, and we could analyse 12 financial years due to the time lags. We estimated the models using 'within' transformation. The table shows the

Newey–West standard errors. Model *C1* was estimated based on equation (5), *C2* was based on equation (6), while *C3* was estimated from equation (7).

Model *C1* shows that a 1 per cent increase in the cost of equity cuts companies' capital demand by 0.1 per cent. This demonstrates the inverse relationship between capital demand and the cost of equity. Unsurprisingly, the growth in capital intensity lifts capital demand. In Model *C2*, the variable x_{t-1} denotes the trend of the intertemporal discount factor. While before 2009 the value of x_{t-1} is over 1, in 2009 it dips below 1, which shows the emergence of investor short-termism. The positive parameter related to the trend of the intertemporal discount factor suggests that investor short-termism foreshadows a drop in companies' capital demand.

Model *C3* arrives at the same conclusions, when the model is expanded with the lagged trend of the intertemporal discount surplus. The negative parameter of the variable itp_{t-1} suggests that the increase in the intertemporal discount surplus reduced firms' capital demand through the cost of capital channel. A 1 per cent growth in the intertemporal discount surplus cuts capital demand by 0.048 per cent.

Table 3
Relationship between the required rate of return and capital demand

$I_{i,t} / S_{i,t}$	C1	C2	C3
x_{t-1}		0.049*** (0.006)	
itp_{t-1}			–0.048*** (0.005)
$COE_{i,t-1}$	–0.100*** (0.038)	–0.187*** (0.038)	–0.186*** (0.038)
$K_{i,t} / S_{i,t}$	0.092*** (0.006)	0.092*** (0.006)	0.092*** (0.006)
R^2	0.118	0.131	0.131
Adjusted R^2	0.037	0.052	0.052
Wooldridge test: p-value	0.000	0.000	0.000
Number of observations	6,324	6,324	6,324
Number of firms	527	527	527
Number of financial years	12	12	12

*Note: Standard errors are shown in brackets. ***p < 0.01, **p < 0.05, *p < 0.1.*

The examination of the relationship between intertemporal preferences and capital demand clearly shows that a rise in the implicit intertemporal discount surplus reduces capital demand through the cost of capital channel. Investor short-termism entails the rejection or postponement of investments with positive net present value and thus destroys shareholder value.

The models also indicate that a decrease in the cost of equity heralds a rise in capital demand. As *Figure 2* showed, in the aftermath of the 2009 investment shock, the impact of monetary easing only reduced the cost of equity considerably by 2014, even though interest rate cuts started in 2011 as the euro area debt crisis ebbed. This suggests that capital market developments following the crisis probably delayed the investment-boosting effect of the monetary policy measures aimed at crisis management. Moreover, the rising intertemporal discount surplus also ran counter to monetary easing.

6. Conclusions

The paper has shown that the implicit intertemporal discount surplus increased in 2004–2016. Before 2008, the intertemporal discount factor was over 1 and then it dropped below 1. While investors were characterised by a long-term approach prior to 2008, they switched to short-termism in the aftermath of the crisis. The difference between investors' required rate of return and the cost of capital widened. After the crisis, investors were less inclined to make a trade-off between their present income and future promised returns. If the implicit intertemporal discount surplus is incorporated into companies' cost of capital, capital demand is reduced and investments with a positive net present value are rejected or postponed. This overshadows long-run shareholder value accumulation by restricting investments. The analysis of the link between the cost of equity and capital demand reveals the effects of macro-level shocks such as the recession, the change in the interest rate environment or the shifting equity risk premium on capital markets. The sample under review shows a major drop in the cost of equity in 2014, attributable to the falling interest rates and the change in the equity risk premium. This suggests that – in view of the changes in the cost of equity and the rise in the intertemporal discount surplus – the capital market developments following the crisis probably delayed the capital demand-boosting effect of monetary easing.

References

Asker, J. – Farre-Mensa, J. – Ljungqvist, A. (2014): *Corporate Investment and Stock Market Listing: A Puzzle?* Review of Financial Studies, 28(2): 342–390. http://doi.org/10.1093/rfs/hhu077

Blundell-Wignall, A. – Roulet, C. (2013): *Long-term investment, the cost of capital and the dividend and buyback puzzle*. OECD Journal: Financial Market Trends, 2013(1): 39–52. http://doi.org/10.1787/fmt-2013-5k41z8t05l8s

Bölcskei, V. (2009): *Az intertemporális döntések viselkedési közgazdaságtani modelljeinek áttekintése* (*A review of the models of inter-temporal* decision-*making in behavioural economics*). Közgazdasági Szemle, 56(November): 1025–1040.

Campbell, J.L. – Dhaliwal, D.S. – Schwartz, W.C. (2011): *Financing Constraints and the Cost of Capital: Evidence from the Funding of Corporate Pension Plans*. Review of Financial Studies, 25(3): 868–912 http://doi.org/10.1093/rfs/hhr119

Damodaran, A. (2019): *Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2019 Edition*. http://doi.org/10.2139/ssrn.3378246

Davies, R. – Haldane, A. G. – Nielsen, M. – Pezzini, S. (2014): *Measuring the costs of short-termism*. Journal of Financial Stability, 12(June): 16–25. http://doi.org/10.1016/j.jfs.2013.07.002

Dixon, W.J. (1960): *Simplified Estimation from Censored Normal Samples*. The Annals of Mathematical Statistics, 31(2): 385–391. http://doi.org/10.1214/aoms/1177705900

Duchin, R. – Ozbas, O. – Sensoy, B.A. (2010): *Costly external finance, corporate investment, and the subprime mortgage credit crisis*. Journal of Financial Economics, 97(3): 418–435. http://doi.org/10.1016/j.jfineco.2009.12.008

Favaro, K. (2014): *Long-Termism Is Just as Bad as Short-Termism*. Harvard Business Review, September 25.

Fazzari, S. – Hubbard, R. G. – Petersen, B. (1988): *Financing Constraints and Corporate Investment*. Brookings Papers on Economic Activity, 1988(1): 141–206. http://doi.org/10.2307/2534426

Feldman, N. – Kawano, L. – Patel, E. – Rao, N. – Stevens, M. (2018): *The Long and Short of It: Do Public and Private Firms Invest Differently?* Finance and Economics Discussion Series, 2018–068. Washington: Board of Governors of the Federal Reserve System. http://doi.org/10.17016/feds.2018.068

Hackbarth, D. – Rivera, A. – Wong T.Y. (2018): *Optimal Short-Termism*. ECGI Finance Working Paper no. 546/2018. European Corporate Governance Institute. http://people.bu.edu/dhackbar/HRW-2018.pdf. Downloaded: 8 May 2020.

Hastings, C. – Mosteller, F. – Tukey, J.W. – Winsor, C.P. (1947): *Low Moments for Small Samples: A Comparative Study of Order Statistics*. The Annals of Mathematical Statistics, 18(3): 413–426. http://doi.org/10.1214/aoms/1177730388

Janssens, W. – Kramer, B. – Swart, L. (2017): *Be patient when measuring hyperbolic discounting: Stationarity, time consistency and time invariance in a field experiment*. Journal of Development Economics, 126(May): 77–90. https://doi.org/10.1016/j.jdeveco.2016.12.011

Laibson, D. (1997): *Golden Eggs and Hyperbolic Discounting*. The Quarterly Journal of Economics, 112(2): 443–478. https://doi.org/10.1162/003355397555253

Mankins, M. – Harris, K. – Harding, D. (2017): *Strategy in the Age of Superabundant Capital*. Harvard Business Review, March-April.

Martin, R.L. (2015): *Yes, Short-Termism Really Is a Problem*. Harvard Business Review, October.

Mauboussin, M.J. – Rappaport, A. (2016): *Reclaiming the Idea of Shareholder Value*. Harvard Business Review, July.

Miles, D. (1993): *Testing for Short Termism in the UK Stock Market*. The Economic Journal, 103(421): 1379–1396. https://doi.org/10.2307/2234472

Neszveda, G. – Dezső, L. (2012): *A kvázi- és általánosított hiperbolikus diszkontálás hosszú távon* (*Quasi- and Generalized Hyperbolic Discounting in Long Term*). Szigma, 43(3–4): 163–177.

Phelps, E.S. – Pollak, R.A. (1968): *On Second-Best National Saving and Game-Equilibrium Growth*. The Review of Economic Studies, 35(2): 185–199. https://doi.org/10.2307/2296547

Rasmusen, E.B. (2008): *Some Common Confusions About Hyperbolic Discounting*. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1091392

Simmons-Süer, B. (2016): *Cost of capital and US investment: Does financing matter after all?* The Quarterly Review of Economics and Finance, 60(May): 86–93. https://doi.org/10.1016/j.qref.2015.11.008

Simmons-Süer, B. (2018): *How relevant is capital structure for aggregate investment? A regime-switching approach*. International Review of Economics & Finance, 53(January): 109–117. https://doi.org/10.1016/j.iref.2017.10.002

Stein, J. (1989): *Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior*. Quarterly Journal of Economics, 104(November): 655–669. https://doi.org/10.2307/2937861

Summers, L.H. (2017): *Is Corporate Short-Termism Really a Problem? The Jury's Still Out*. Harvard Business Review, February.

Tukey, J.W. (1977): *Exploratory Data Analysis*. Addison-Wesley.

Vörös, J. (2020): *Production dynamics in case of organizational learning*. Mimeo, University of Pécs.

White, H. (1980): *A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity*. Econometrica, 48(4): 817–838. http://doi.org/10.2307/1912934

Wickens, M.R. (1982): *The Efficient Estimation of Econometric Models with Rational Expectations*. The Review of Economic Studies, 49(1): 55–67. https://doi.org/10.2307/2297140