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Increasing equity prices support investments

- The value of all firms listed on the Copenhagen Stock Exchange exceeds Denmark's annual gross domestic product. Developments in the equity market have an impact on the Danish economy – via both firms and households.
- The analysis finds that an increase of 10 per cent in the equity prices of listed firms leads to an increase of 1.8 per cent in their business investments.
- Danish firms invest both at home and abroad, and likewise, a large number of foreign firms have production facilities in Denmark. Hence, fluctuations in the equity prices of foreign firms can also affect the volume of investments in Denmark.



The market value

of Danish equities has been increasing

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Rising equity prices

support firms' investments

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Fluctuations in equity prices

have real economic implications

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The value of all firms listed on the Copenhagen Stock Exchange is approximately kr. 2,500 billion, cf. Chart 1. That exceeds Denmark's annual gross domestic product, GDP, and the value rose by around 200 per cent from 2000 to 2018. Developments in the equity market affect the Danish economy – via firms' investments and via household consumption. A good understanding of the effects of equity price fluctuations strengthens the foundation for an overall assessment of developments in the Danish economy.

This analysis focuses primarily on how fluctuations in equity prices affect business investments in fixed capital. More specifically, it is quantified how investments in Danish listed companies are affected by changes in equity prices via a "Tobin's Q channel". The main conclusion is that an increase of 10 per cent in the prices of listed firms leads to an increase of 1.8 per cent in those firms' investments.

Previous studies of the effects of fluctuations in Danish equity prices have focused on the extent to which they affect household consumption via a wealth channel. Hence, this analysis contributes to an understanding of whether equity prices have real economic implications via other channels than private consumption.

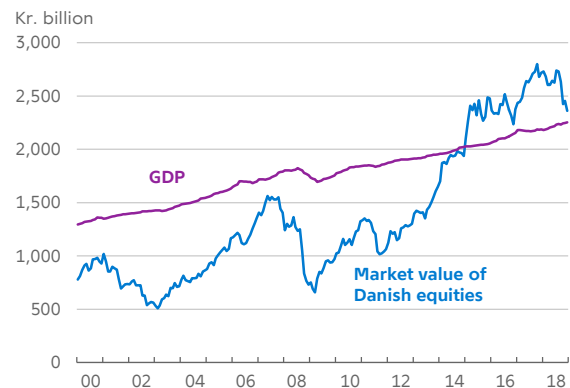
Danish listed firms invest in fixed capital in Denmark and abroad. The analysis does not provide a basis for assessing the share of the investments that will take place in Denmark. So the effect of an increase in equity prices cannot be translated directly into an effect on Denmark's GDP.

Danish firms invest abroad, and likewise, a large number of foreign firms have production facilities in Denmark. Consequently, the equity prices of foreign firms can affect the volume of investments in Denmark.

Equity issues and retained profits are important sources of funding for firms

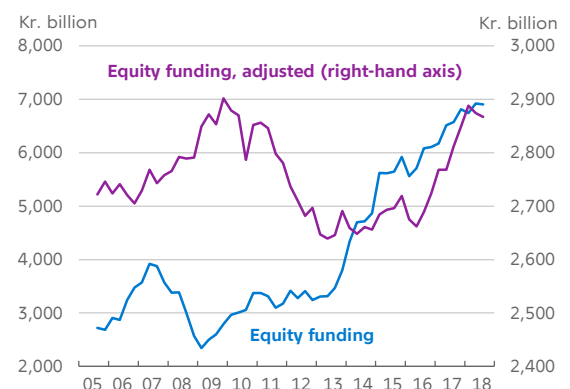
Firms often finance investments via external capital in the form of debt or issuance of equity securities – typically equities. Since 2016, a larger share of firms' external net funding has been raised by issuing equities, cf. Chart 2. Of this, the largest share has been net issuance of unlisted equities, while listed firms have, on a net basis, been repurchased shares.

The market value of Danish equities has been increasing Chart 1



Note: The market value is based on all listed Danish equities. GDP is seasonally adjusted annual levels at current prices.
Source: Danmarks Nationalbank and Statistics Denmark.

Equity issues have supported corporate funding needs Chart 2



Note: Equity funding comprises equities and other equity securities. The adjusted series shows the market value in the 3rd quarter of 2005 projected by net transactions. In this way, adjustment is made for revaluation/value adjustments and other volume changes.
Source: Danmarks Nationalbank and own calculations.

Firms also to some extent finance their investments using internal funds in the form of retained profits.¹ That has extensively been the case since the financial crisis in the 2000s.

Lending by banks and mortgage credit institutions to the corporate sector has shown a moderate trend for some years. This means that the corporate sector has increasingly relied on equity funding, which accounted for around 55 per cent of corporate equity and liabilities in 2018. Increasing use of equity funding has taken place in spite of the fact that the banks' and mortgage credit institutions' lending rates have declined considerably during the same period.

Equity prices affect business investments via Tobin's Q

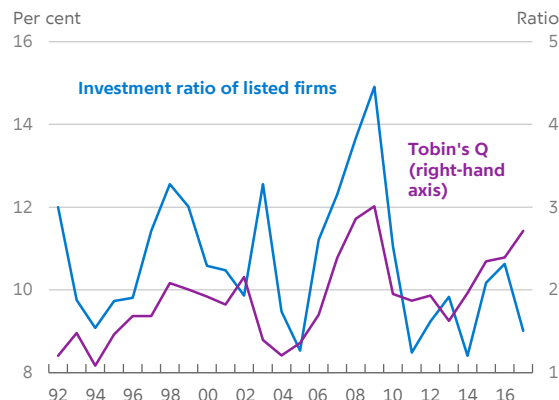
The ratio between a firm's equity price and its book value is often referred to as Tobin's Q after the economist James Tobin.² If the equity price exceeds the book value (i.e. Tobin's Q is larger than one), this is an indication that the market value of one krone in equity (in accounting terms) is greater than one. In that situation it is, in principle, profitable for the firm to invest in expanding its capital stock. The reason is that the increase in the market value of the firm as a result of a new investment is expected to exceed the capital cost of the investment itself.³ Financial statements from Danish listed firms indicate that across the line there is a positive relationship between Tobin's Q and investments in the coming year, cf. Chart 3.

Although a Tobin's Q larger than one indicates that it would be profitable to increase the firm's capital stock, it does not necessarily lead to higher investment in practice. Often it may be expedient to spread a firm's investments over time. Furthermore, in a situation where Tobin's Q is low, it may be difficult to quickly reduce the size of the firm's capital stock as it is not always easy to sell physical production equipment to other firms.

Equity prices typically rise at the start of an upswing, when expectations regarding the economy improve.

Fluctuating equity prices contribute to movements in investment volume

Chart 3



Note: The investment ratio is the sum of listed firms' investments relative to the sum of their aggregate capital stock. The firms' individual investments are based on their capital expenditure (CAPEX), cf. Box 2. Tobin's Q is an unweighted average of all listed firms. The individual Tobin's Qs have been calculated as the ratio of each firm's market value to its book value, cf. Box 2.

Source: Refinitiv Datastream and own calculations.

All else equal, this will be reflected in a higher Tobin's Q and hence higher business investment. Conversely, an economic downturn will often go hand in hand with a fall in equity prices and hence a lower Tobin's Q. It will also contribute to a fall in capital investment. Hence, business investments contribute to strengthening fluctuations in aggregate demand.

Equity prices and access to internal funding both affect investments

To determine how business investments are affected by fluctuations in equity prices and by access to internal funding, an econometric model is applied, cf. Box 1.⁴ This model is based on the financial statements of 159 Danish listed companies for the period 1990-2017, cf. Box 2.

The analysis indicates that an increase of 10 per cent in equity prices for an unchanged book value leads

1 Cf. Danmarks Nationalbank (2019).

2 See Tobin (1969).

3 Strictly speaking, it is the marginal, not the average, investment that determines a firm's incentive to invest, see Box 2.

4 The model basically follows Blundell et al. (1992), Audretsch and Elston (2002) and Bond et al. (2004).

to an increase in capital investment of around 1.4 per cent over a 1-year horizon, cf. Chart 4. The long-term effect is slightly stronger: in the long term, a permanent increase of 10 per cent in the equity price boosts annual capital investment by 1.8 per cent. This effect is statistically significant. In view of the large fluctuations observed in a firm's investments from one year to the next, only a modest share reflects fluctuations in equity prices, however.

There are also indications that a firm's cash flow can affect its investment activity. The cash flow, which is calculated as the difference between a firm's incoming and outgoing payments from operating activities, is used as an indicator of its access to internal funding.⁵ A 10 per cent increase in a firm's cash flow is reflected in an increase of 1.1 per cent in the following year's capital investment, while the long-term effect is an increase of 1.4 per cent in capital investment. This relationship is also statistically significant.

Macroeconomic implications

It is difficult directly to translate the result into an effect of equity price fluctuations on the overall volume of investments in Denmark. For example, Danish listed companies often have activities both at home and abroad. The analysis cannot distinguish between investments made in different countries. At the same time, the analysis only includes listed companies. However, there is a clear link between aggregate investments of the firms included in the data set and Statistics Denmark's compilation of gross investments in Denmark, cf. Chart 5.

On the basis of a different methodological approach, a recently published study from Danmarks Nationalbank finds that an increase of 10 per cent in equities increases gross investment in Denmark by 0.6 per cent.⁶ According to a multiplier experiment using Danmarks Nationalbank's macroeconomic model, MONA, an increase of 10 per cent in equity prices will increase business investments by 0.18 per cent. However, neither of these methods models the relationship between investment and fluctuations in equity prices via the Tobin's Q channel.

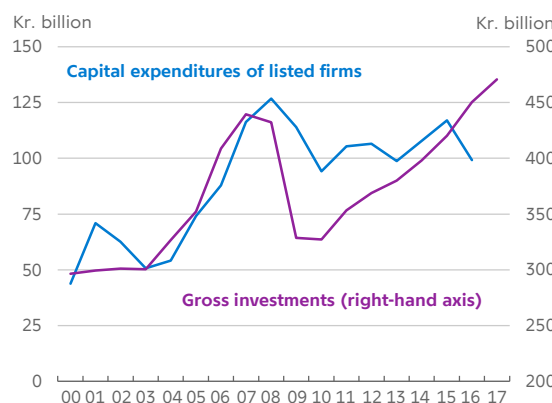
Effect on investments of 10 per cent increase in equity prices and cash flow, respectively Chart 4



Note: The pass-throughs are based on the estimates of the regression model, cf. Box 1. Both short- and long-term effects have been calculated on the basis of a mean value approach.

Source: Refinitiv Datastream and own calculations.

Listed firms' business investments follow gross investments Chart 5



Note: Gross investments at current prices. Capital expenditures are the sum of the capital expenditures of all listed firms. Capital expenditure is lagged by one period due to the fact that capital expenditures are stated at the beginning of the period, cf. Box 2.

Source: Refinitiv Datastream, Statistics Denmark and own calculations.

⁵ Cash flow is defined in Box 2.

⁶ See Jensen and Pedersen (2019), which sheds light on a number of important macro-financial linkages in Denmark on the basis of a structural vector auto-regressive (VAR) model.

Fluctuations in equity prices are reflected not only in business investments, but also in other parts of the economy. Danish households own listed Danish equities with a total value of kr. 334 billion, either directly or indirectly via pension savings. So a 10 per cent increase in equity prices will increase household wealth by around kr. 30 billion. The households may choose to convert part of the increased wealth into higher consumption. But there are indications that fluctuations in equity wealth have a lower impact on consumption than other wealth components such as housing wealth.⁷

⁷ See Bang-Andersen et al. (2013).

Econometric model for investments

Box 1

Optimal behaviour entails that firms maximise the present value of all expected future profits. Assuming that an increase of the capital stock involves rising marginal costs, it implies that firms gradually adjust their investments in line with the economic developments. This can be modelled by the following dynamic panel data specification:¹

$$\frac{I_{ft}}{K_{ft-1}} = \beta_1 Q_{ft-1} + \sum_{j=1}^S \eta_j \frac{I_{ft-j}}{K_{ft-j-1}} + \beta_2 \frac{CF_{ft-1}}{K_{ft-1}} + \mathbf{X}'_{ft} \gamma + \alpha_f + \delta_t + \varepsilon_{ft},$$

where I_{ft} and K_{ft} denote investments and capital stock, respectively, of firm f at the time t . CF_{ft} and Q_{ft} are firm-related variables stating cash flow and Tobin's Q , measured as the ratio of the marked value to the book value. The vector \mathbf{X}'_{ft} is control variables², δ_t is time dummies, α_f is a firm-specific factor and ε_{ft} is the error term. Time dummies take into account that general macroeconomic conditions affect investments. This could be e.g. falling interest rates or an increase in aggregate demand. The control variables capture other firm-specific conditions that might affect investments and/or Tobin's Q .

The model measures the average change in firms' investments relative to the total capital stock when Tobin's Q is increased in the preceding year. In that way, the effect of an increased market value on firms' investments is quantified.

Assuming exogeneity and stationarity, the model can be estimated using Arellano and Bond's (1991) GMM estimator. The GMM estimator is used due to the "standard within estimator" in dynamic panel data models entails an asymptotic bias of the order $1/T$ (also known as "Nickell bias", see Nickell 1981). The GMM estimator takes this into account by applying instruments consisting of the lagged explanatory variables. The instruments are valid if they are highly correlated with the differences of $\frac{I_{ft}}{K_{ft-1}}$, and are uncorrelated with the difference in the error terms.

The construction of the moment condition implies that the number of instruments may exceed the number of firms. This entails an asymptotic bias of the $1/N$ order, see Alvarez and Arellano (2003). Consequently, the number of lags in the instrument variables is limited to four.

The results are shown in Table A. Tests indicate that one lag of the investment ratio is sufficient. The coefficient of

the lagged investment ratio is considerably lower than one, which is consistent with the stationarity assumption.³

All estimates are based on model specification (2) in Table A. The estimation results show that the estimates of Tobin's Q and cash flow are both positive and they are highly significant. In the short term, an increase of one per cent in the equity price, evaluated in the mean values, will lead to an average increase of 0.14 per cent in investments. In the long term, i.e. when the gradual adjustment of the pass-through has been realised, the effect is 0.18 per cent on average. The small difference between the short- and long-term effects reflects that the sluggishness in the adjustment of investments is moderate.

The outcomes are not driven by specific groups of firms (such as large firms, small firms or firms from different industries).

Model results

Table A

	(1)	(2)
Tobin's Q	0.0144***	0.0092***
Cash flow ratio	0.0150	0.0708**
Investment ratio, first lag	0.2209***	0.1917***
Short-term effect equity prices, per cent	0.22***	0.14***
Long-term effect equity prices, per cent	0.29***	0.18***
Control variables	No	Yes
Time dummies	Yes	Yes
AR2 test p-value	(0.94)	(0.56)
Observations	1,790	1,544
Number of firms	133	130

Note: * p-value <0.10, ** p-value <0.05, *** p-value <0.01. The estimates are based on Arellano and Bond's GMM estimator. Standard errors are cluster robust. The AR2 test reports the p-values from the test for autocorrelation of the second order in the residuals.

Source: Refinitiv Datastream and own calculations.

1. The regression model is a standard specification in the empirical literature on the relationship between investments and the stock market. The empirical model can be derived on the basis of a general Tobin's Q model, see Audretsch and Elston (2002) or Bond et al. (2004).
2. Control variables are: net sales ratio, debt ratio, liquidity ratio, growth in net sales and log of net sales (controls for firm size). All control variables are included as lagged values.
3. "Fisher-type" stationarity tests (see Choi (2001)) indicate that the individual time series in the variables Tobin's Q and cash flow can be characterised as stationary.

Description of data

Box 2

The analysis is based on firm-specific financial data for Danish companies collected by Refinitiv Datastream. Financial enterprises, i.e. banks, insurance and pension companies and investment firms, etc., are not included in the data. Outliers have been eliminated from the data. This means that observations with an investment ratio and a cash flow ratio of less than -1 and more than 1, respectively, have been removed. Moreover, observations are eliminated if Tobin's Q exceeds 20. Finally, "A" shares have also been eliminated if a corresponding "B" share is listed.

A total of 159 firms are included distributed on observations covering the period 1990-2017, cf. Table A. The data set is unbalanced, and each firm enters 14.2 years on average. This means that observations from an average of 84 firms are included every year. The industry breakdown is shown in Chart A.

Capital expenditures (CAPEX) are used as a measure of firms' investments. CAPEX is defined as the funds a firm spends on acquiring, upgrading and maintaining tangible assets and housing, building and fixed assets. Hence, this investment measure reflects actual investments in fixed capital. The firms' capital stock is the sum of total investments in fixed assets less depreciation of the existing capital stock. The capital stock is stated at the end of the period.

Tobin's Q is calculated as the market value of all the firm's assets relative to the book value of the firm's equity. The book value is calculated as the accounting value of the firm's assets less depreciation or amortisation of the individual assets in the current financial year. The market value is calculated as the total number of the shares multiplied by their price at the beginning of the year.

In reality, it is the marginal increase of the market value that determines whether the firm wants to invest. The reason is that if the marginal increase is greater than one, then the increase in market value is higher than the investment cost itself. As the marginal Tobin's Q cannot be observed, the average Tobin's Q is applied in the analysis. However, the two measures of Tobin's Q are identical only under the assumption of perfect competition and special requirements for the functionality of the production function and installation costs, cf. Hayashi (1982).

The cash flow is defined as the firm's free funds from its operating activities. Consequently, the cash flow is calculated as the firm's net earnings (or losses) plus its depreciation or amortisation of assets less the net gain on sale of assets.

Descriptive statistics

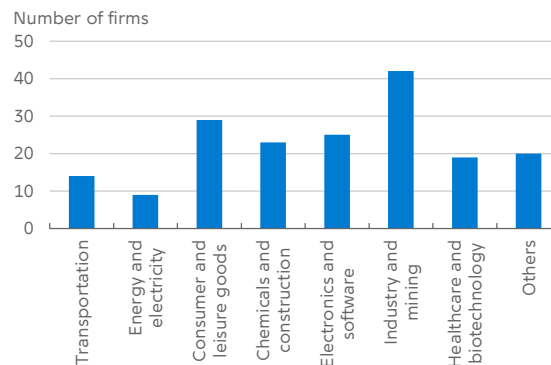
Table A

	Obs.	Mean	Min.	Max.	Std.-dev.
Investment ratio	2,264	0.10	0	0.96	0.01
Tobin's Q	2,264	1.96	0.18	19.34	2.05
Cash flow ratio	2,174	0.13	-0.97	0.90	0.15
No. of employees	2,163	4,521	0	616,326	22,417

Note: Number of employees is used as a measure of the firm's size.
Source: Refinitiv Datastream and own calculations.

Industry breakdown

Chart A



Note: The industry breakdown is based on the Refinitiv Datastream categorisation.
Source: Refinitiv Datastream.

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ABOUT ANALYSIS



As a consequence of Danmarks Nationalbank's role in society we conduct analyses of economic and financial conditions.

Analyses are published continuously and include e.g. assessments of the current cyclical position and the financial stability.

The analysis consists of a Danish and an English version. In case of doubt regarding the correctness of the translation the Danish version is considered to be binding.

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