

# DANMARKS NATIONALBANK

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## FIRM LEVERAGE AND INVESTMENT DURING THE CRISIS

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September 2015

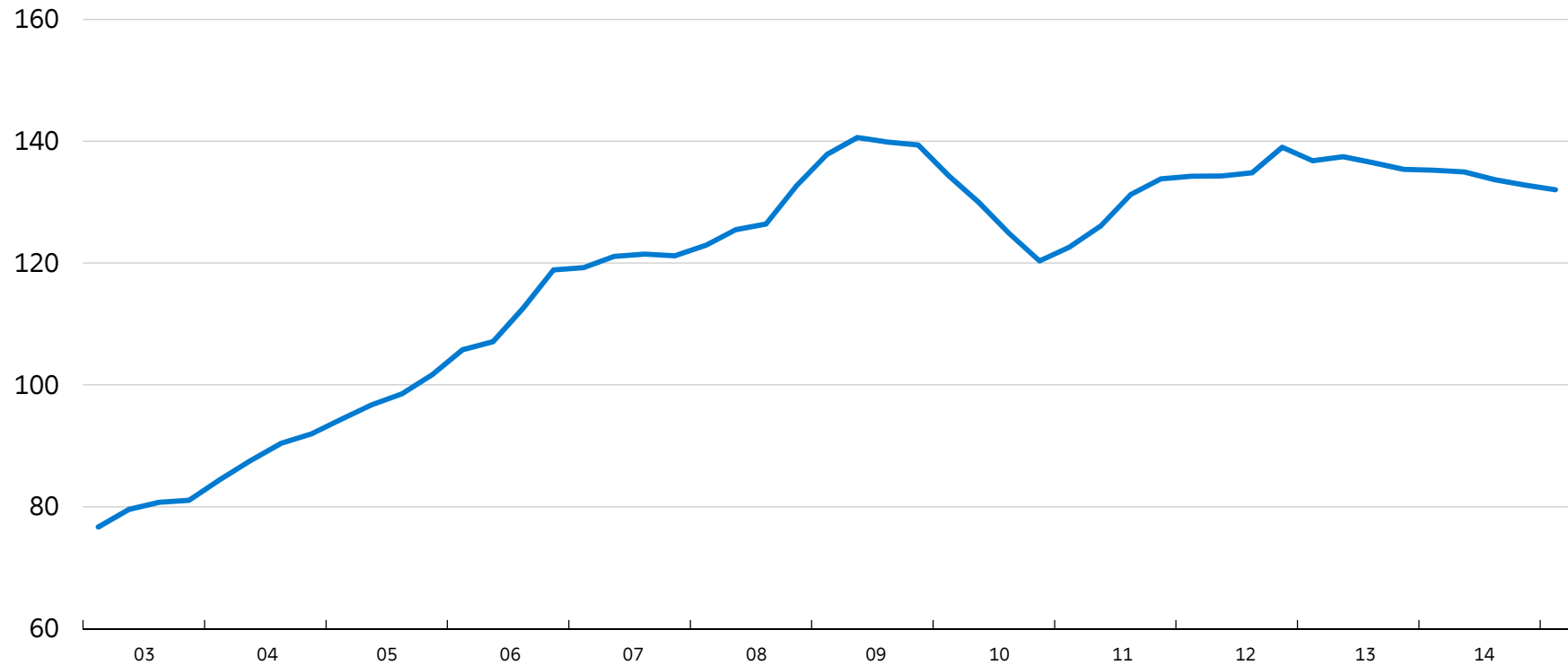


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# Firm debt increased during the 00's and is still high

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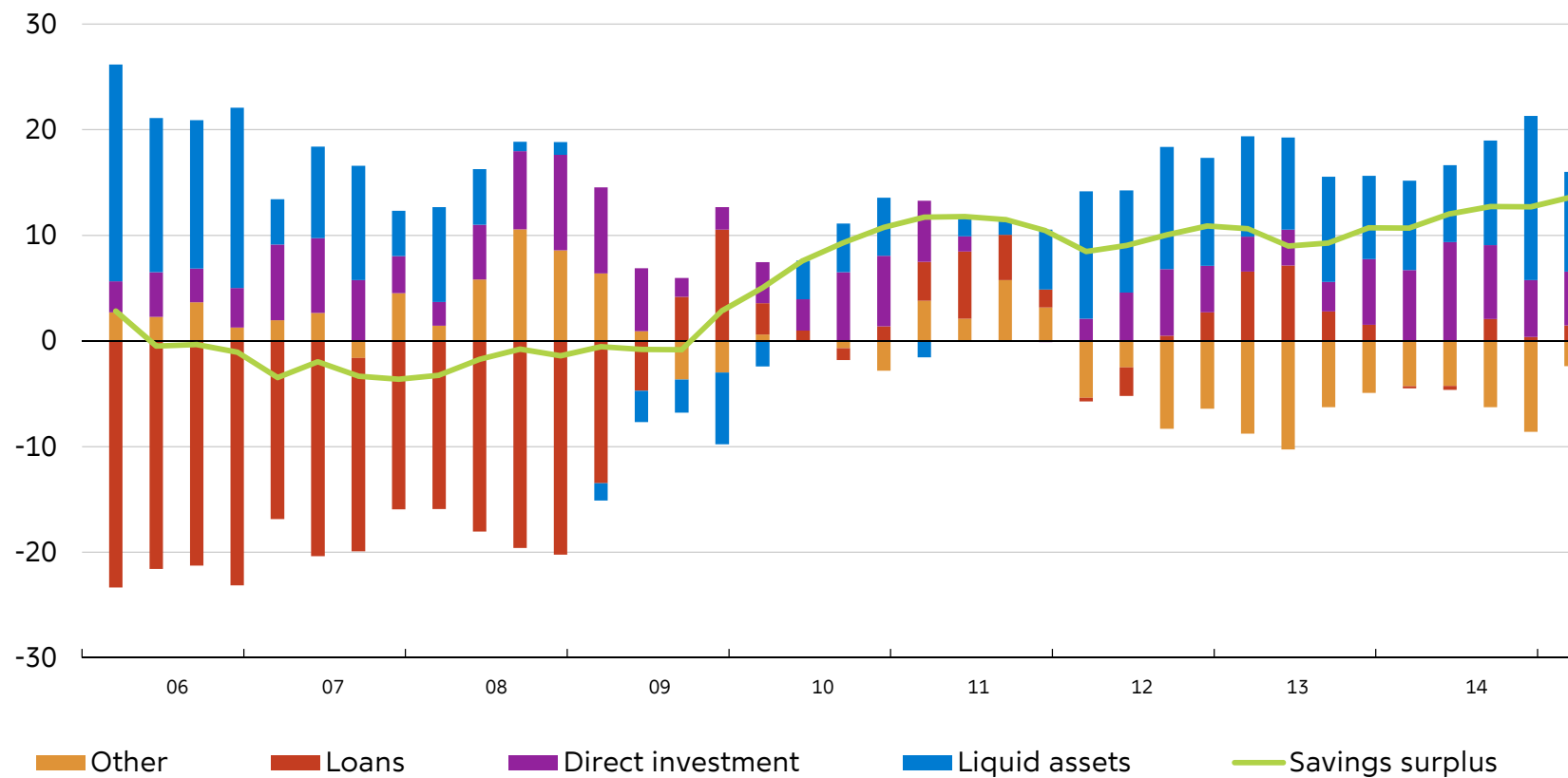
Debt of non-financial enterprises, per cent of GDP



Note: Debt is defined as total financial liabilities, except equity securities, stated at market value.  
Source: Danmarks Nationalbank and Statistics Denmark

# Danish firms' savings surplus

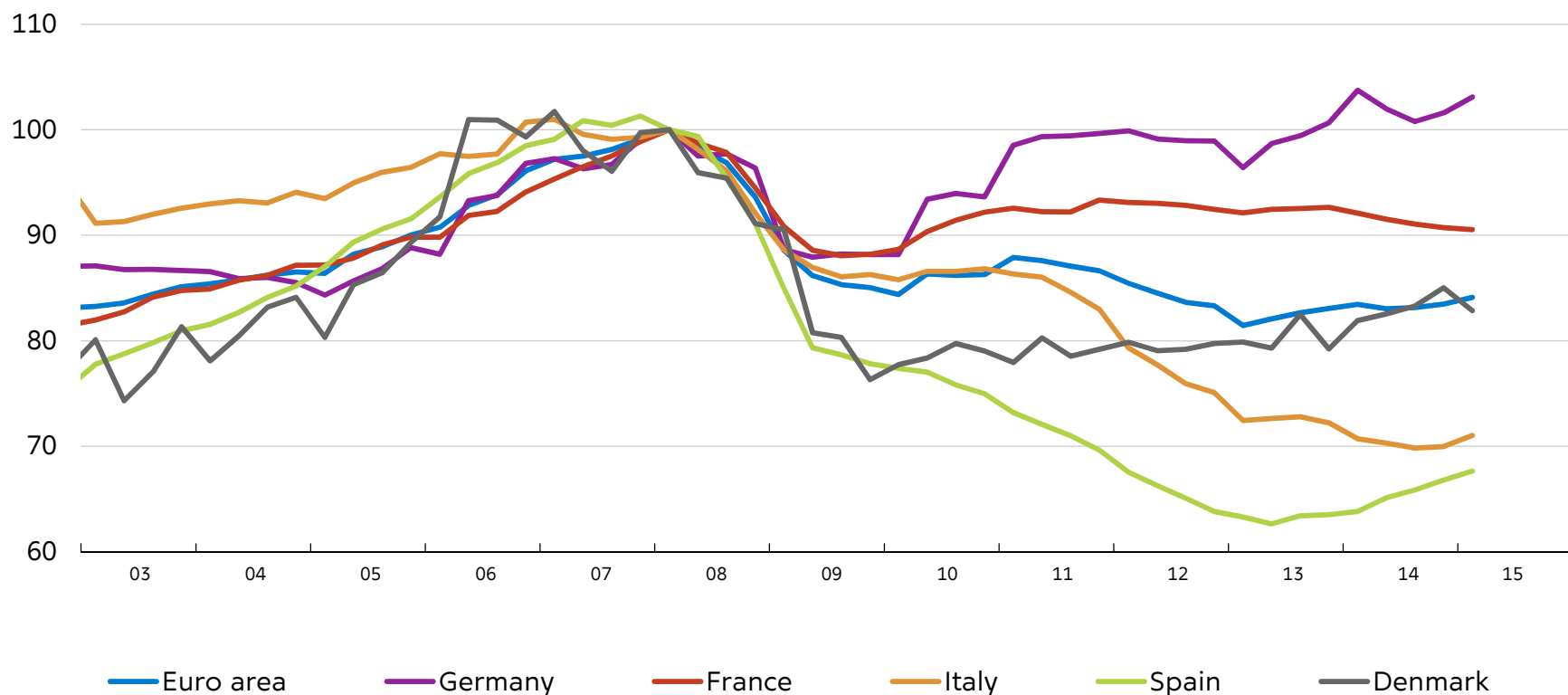
Per cent of value added



Source: Danmarks Nationalbank and Statistics Denmark

# Investment in selected countries

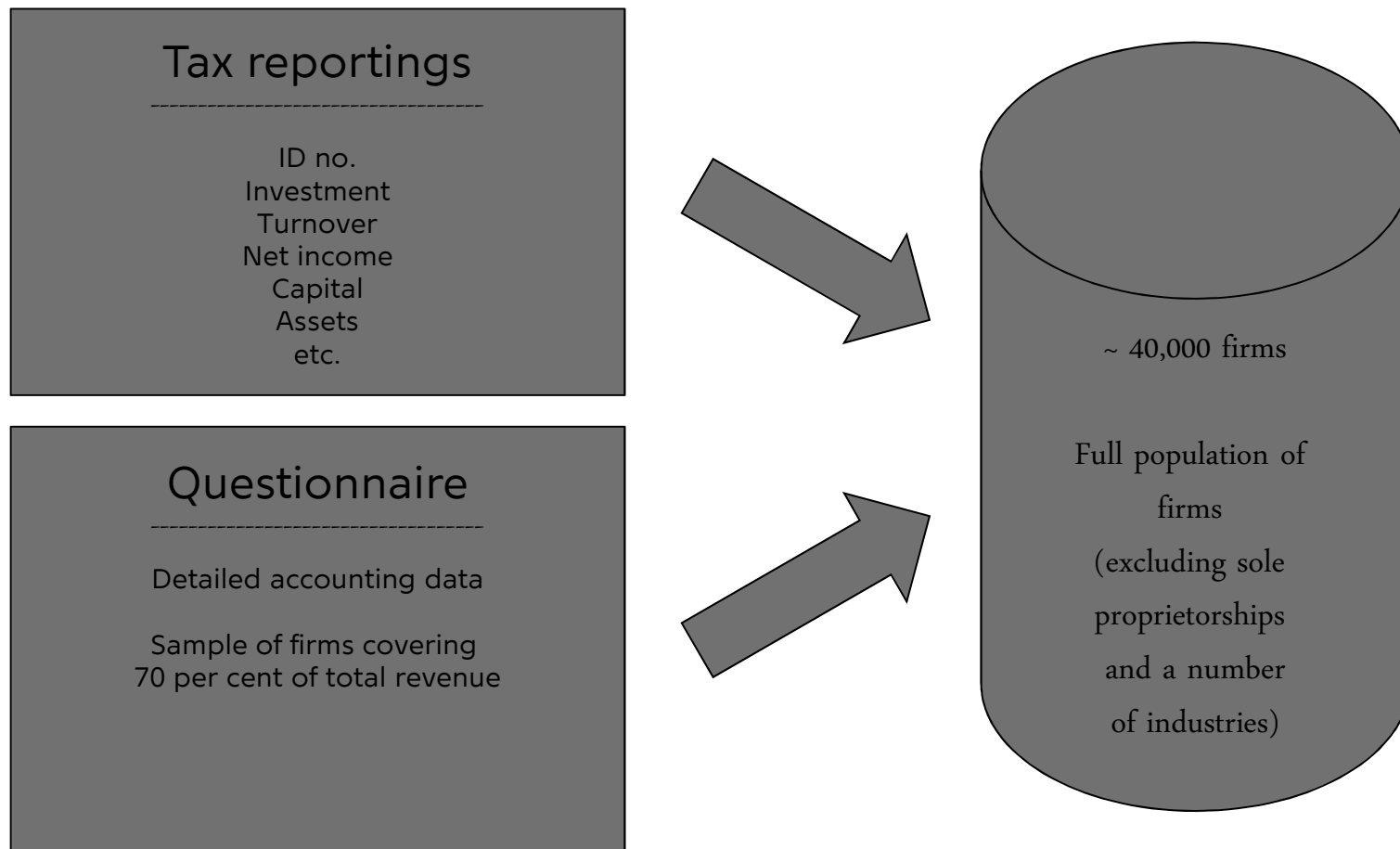
Index, 1st quarter 2008 = 100



Note: Total fixed gross investment in volume terms.  
Source: Ameco, Eurostat and own calculations.

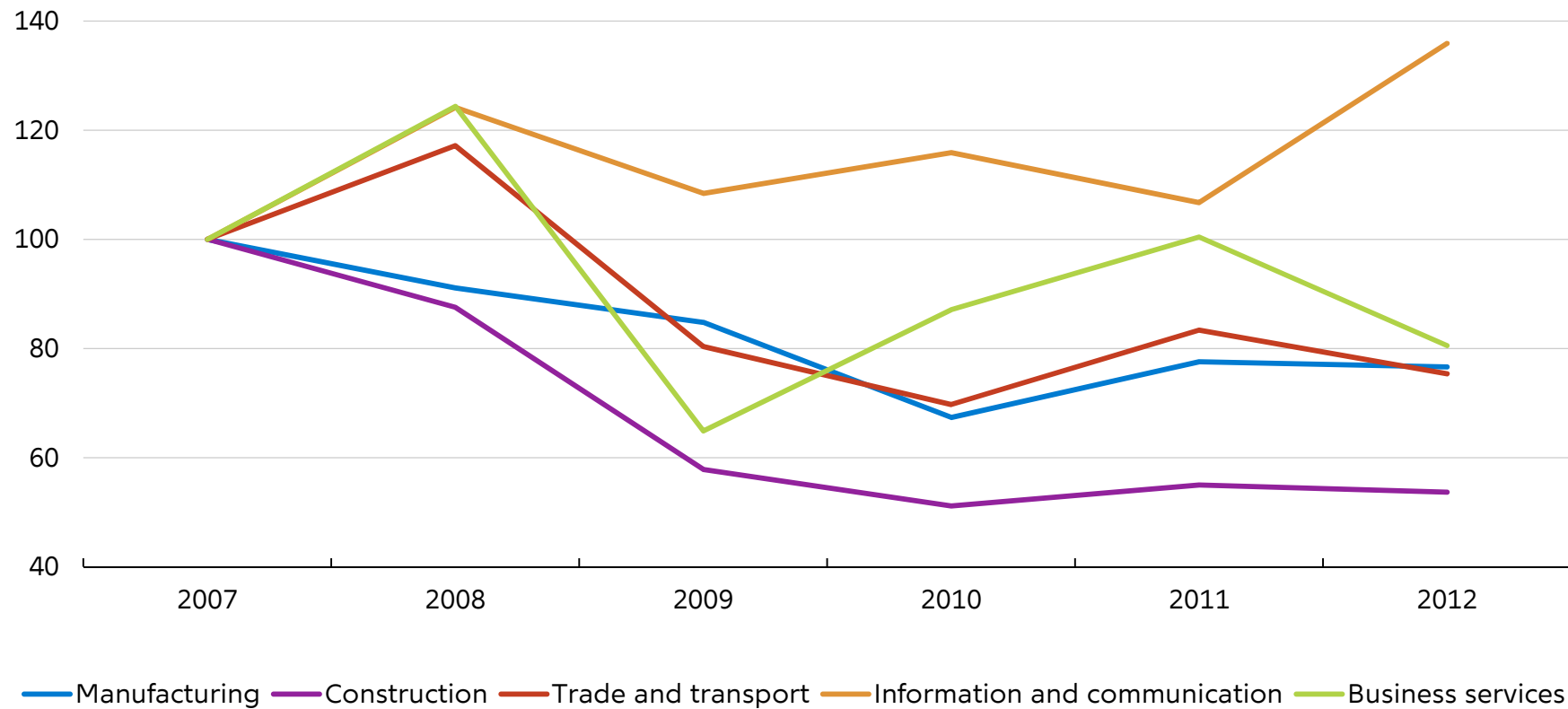
# Firm-level data from Statistics Denmark

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# Large variation in investment development across industries

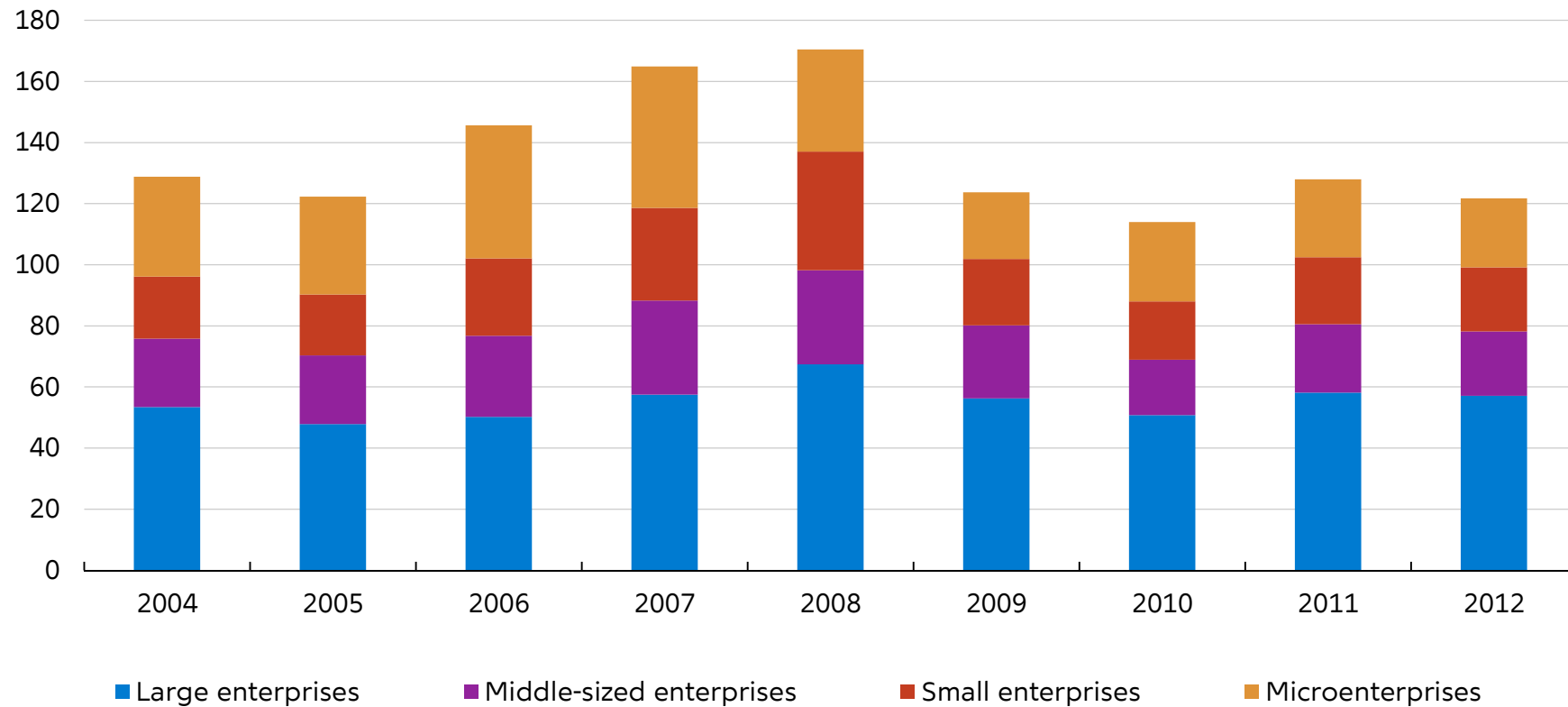
Index 2007 = 100



Source: Statistics Denmark

# Reduction in investment mainly driven by small and medium-sized firms

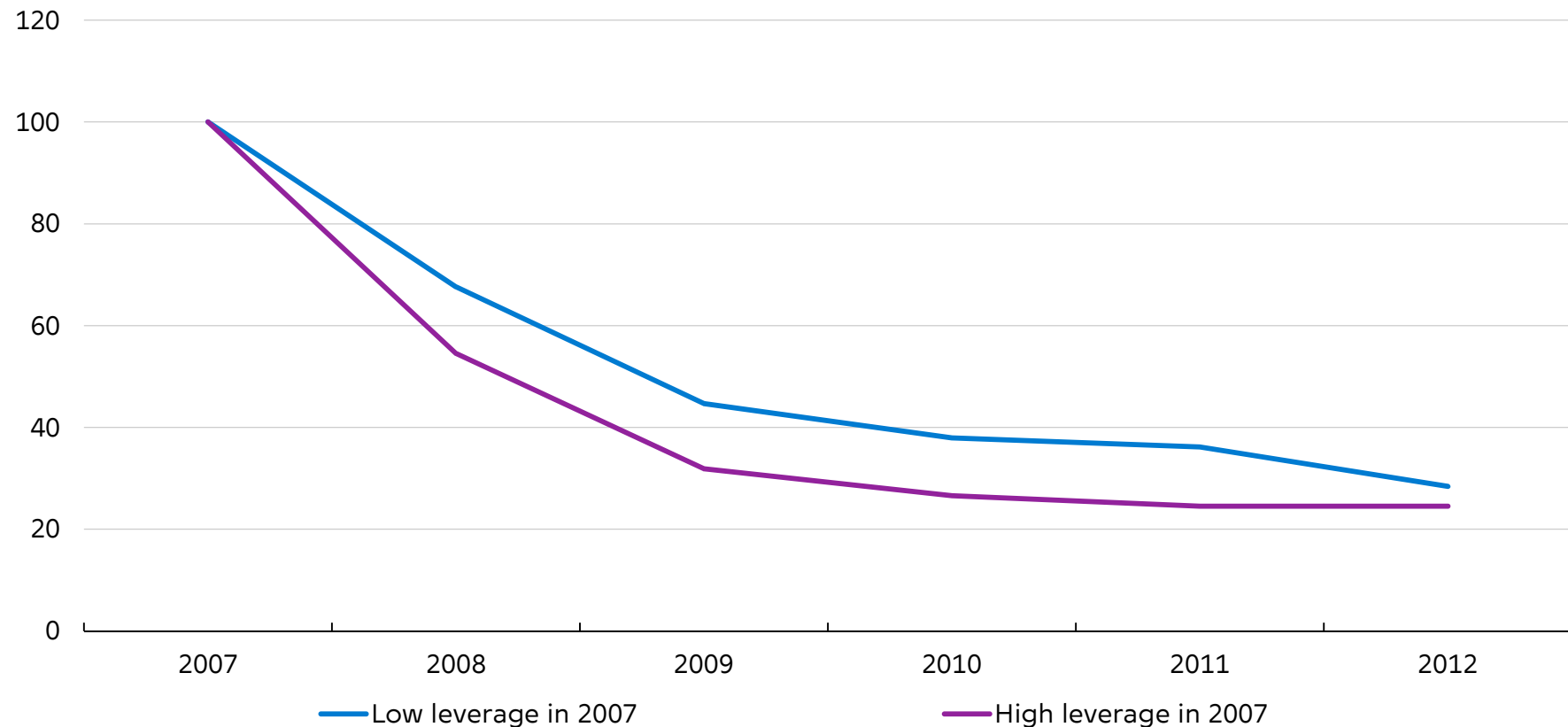
kr. Billion



Note: Gross investment. Firm sizes: Micro: less than 10 (full-time) employees; Small: 10-49 employees, Middle-sized: 50-249 employees, Large: 250 or more employees. Source: Own calculations based on firm-level data from Statistics Denmark.

# Highly leveraged firms reduced their investment rate more than other firms

Investment rate, median of index, 2007=100

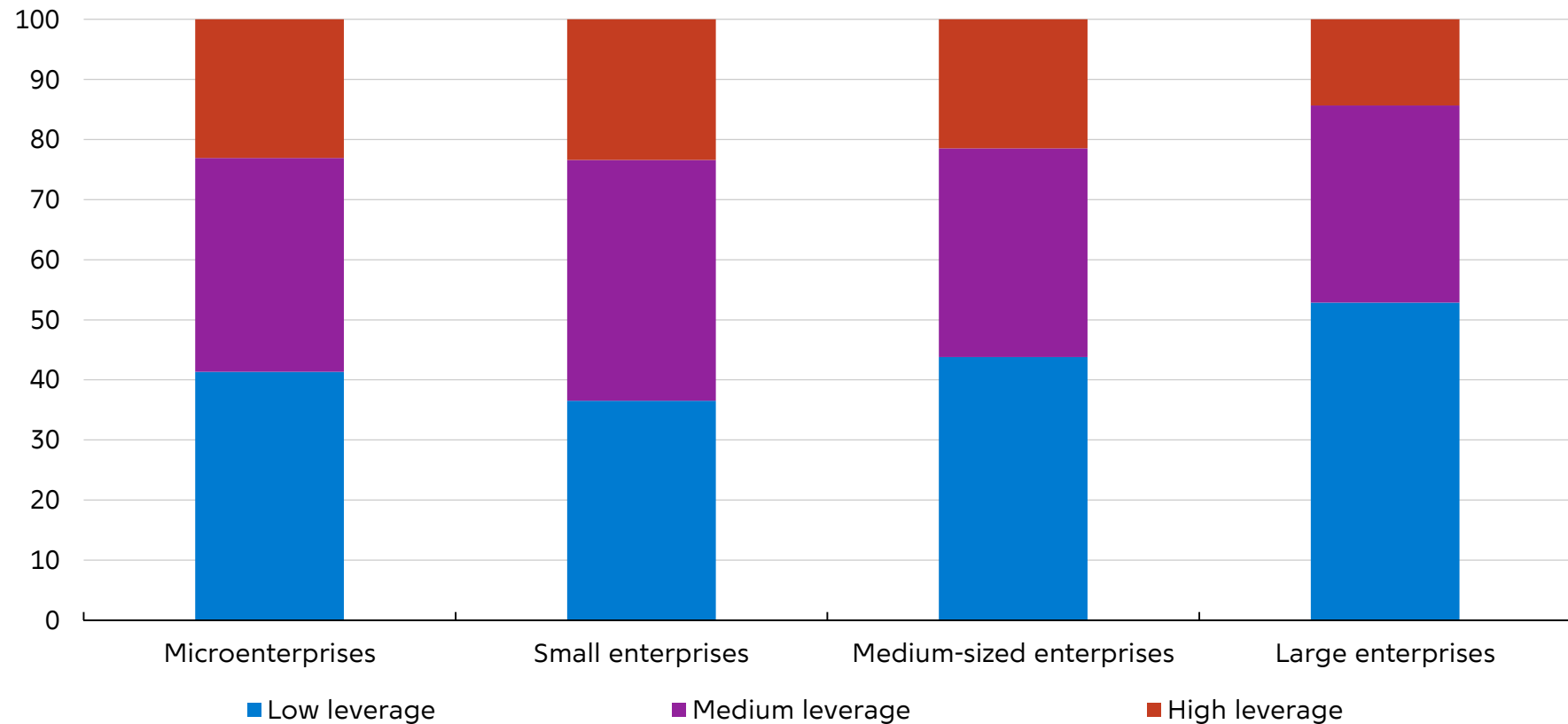


Note: Low leverage: leverage ratios up to 60 per cent (of total assets); high leverage: leverage ratios above 80 per cent.  
Source: Own calculations based on firm-level data from Statistics Denmark.



# Smaller firms have higher leverage than larger

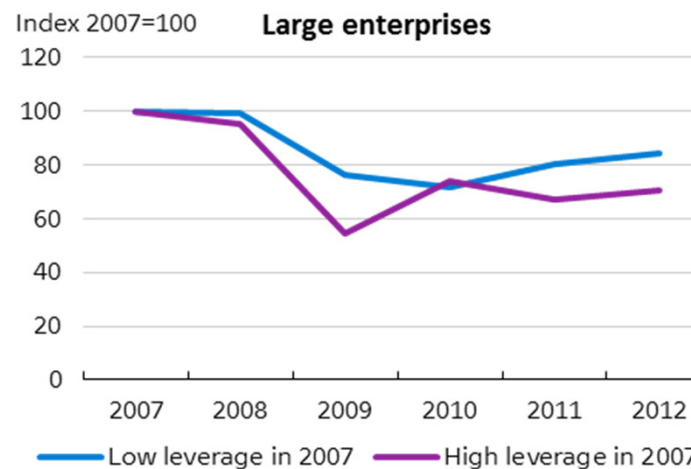
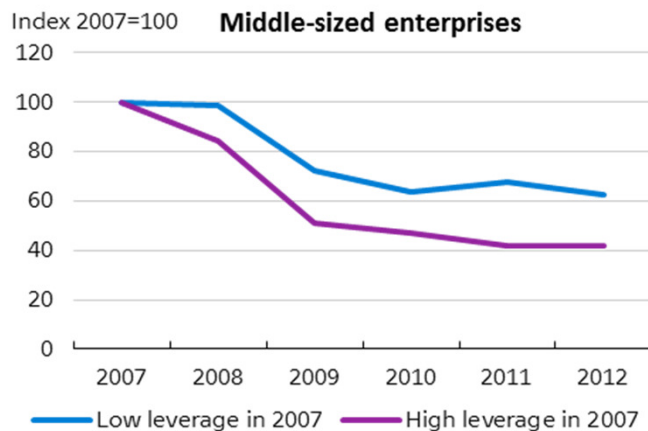
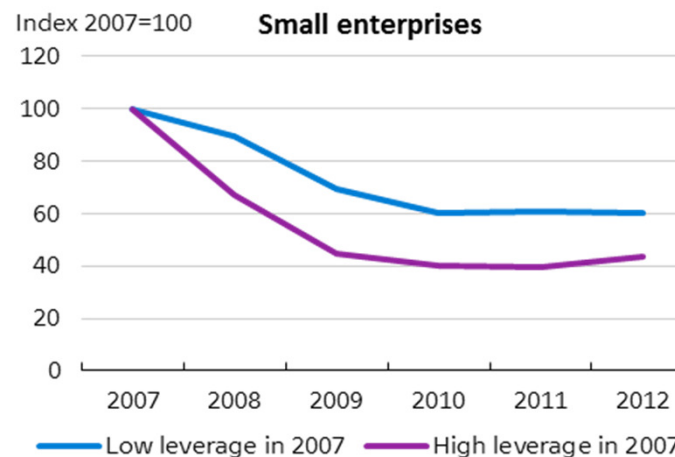
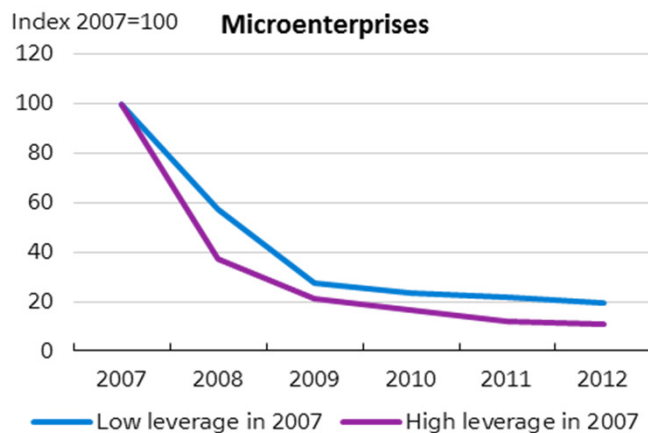
Per cent



Note: Gross investment. Firm sizes: Micro: less than 10 (full-time) employees; Small: 10-49 employees, Middle-sized: 50-249 employees, Large: 250 or more employees.

Source: Own calculations based on firm-level data from Statistics Denmark.

# But the relation is also found within size groups



Source: Own calculations based on firm-level data from Statistics Denmark.

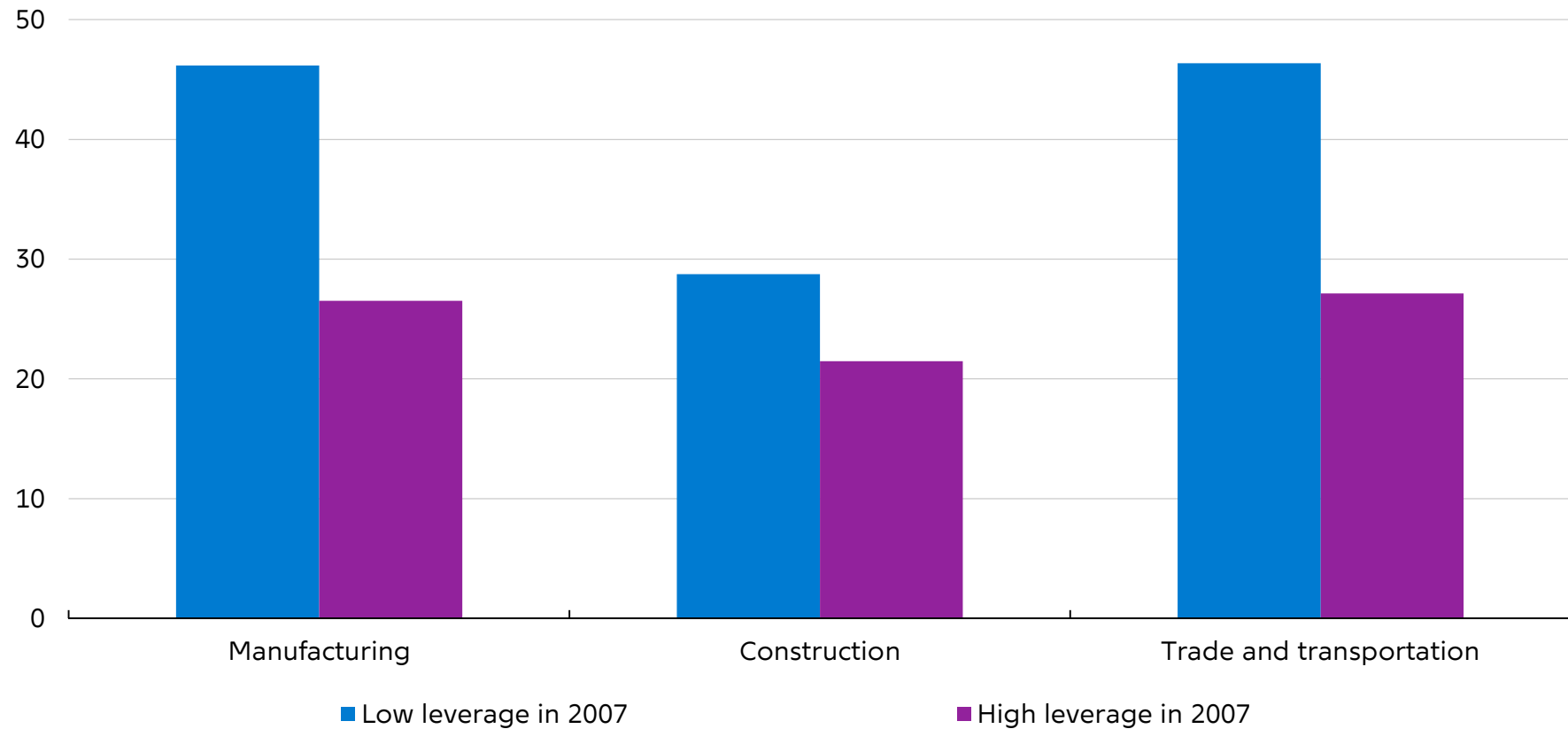
30. september 2015

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# Investment in 2011, selected industries

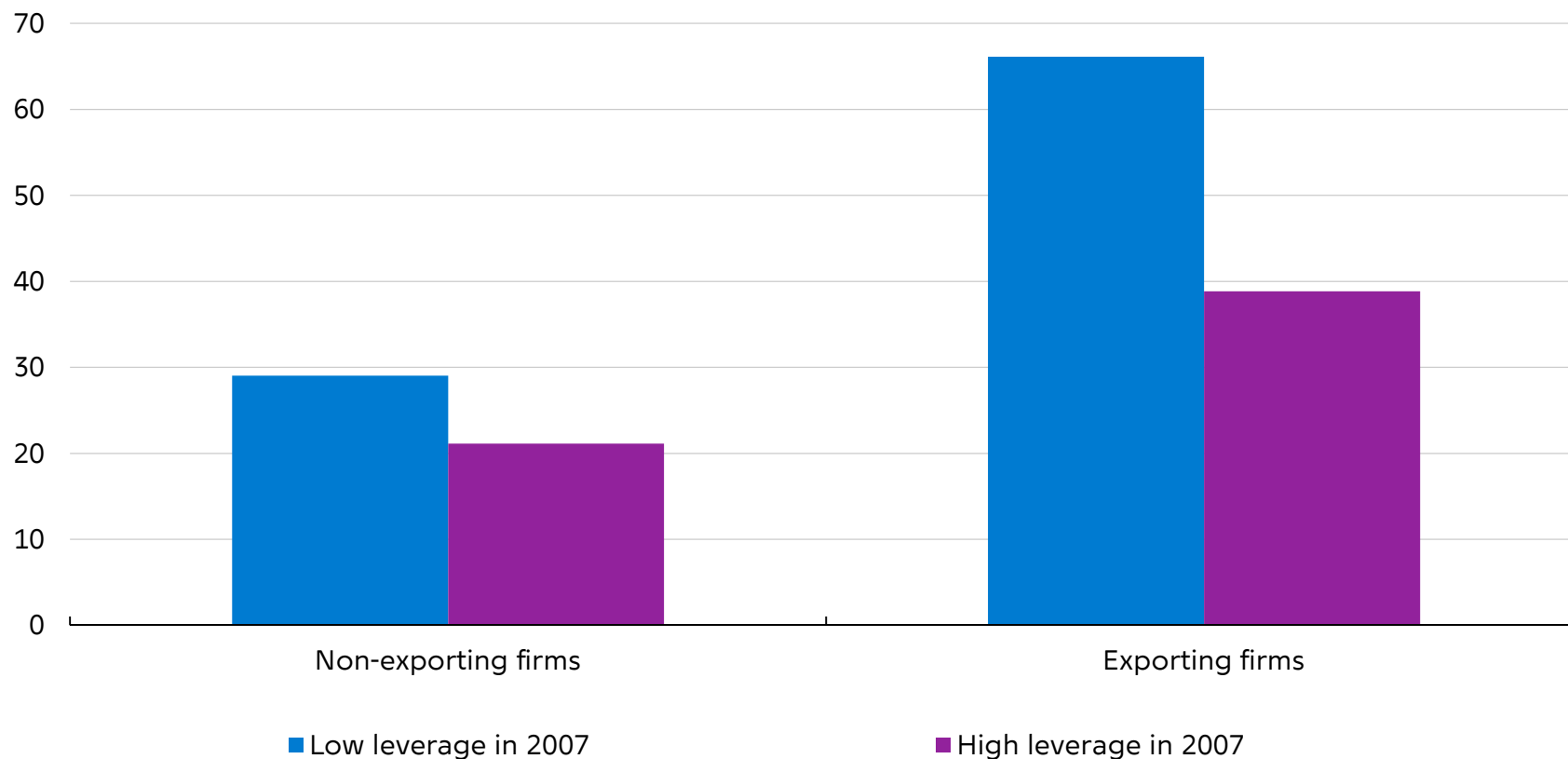
Investment rate, median of index, 2007 = 100



Source: Own calculations based on firm-level data from Statistics Denmark.

# Investment in 2011, exporting and non-exporting firms

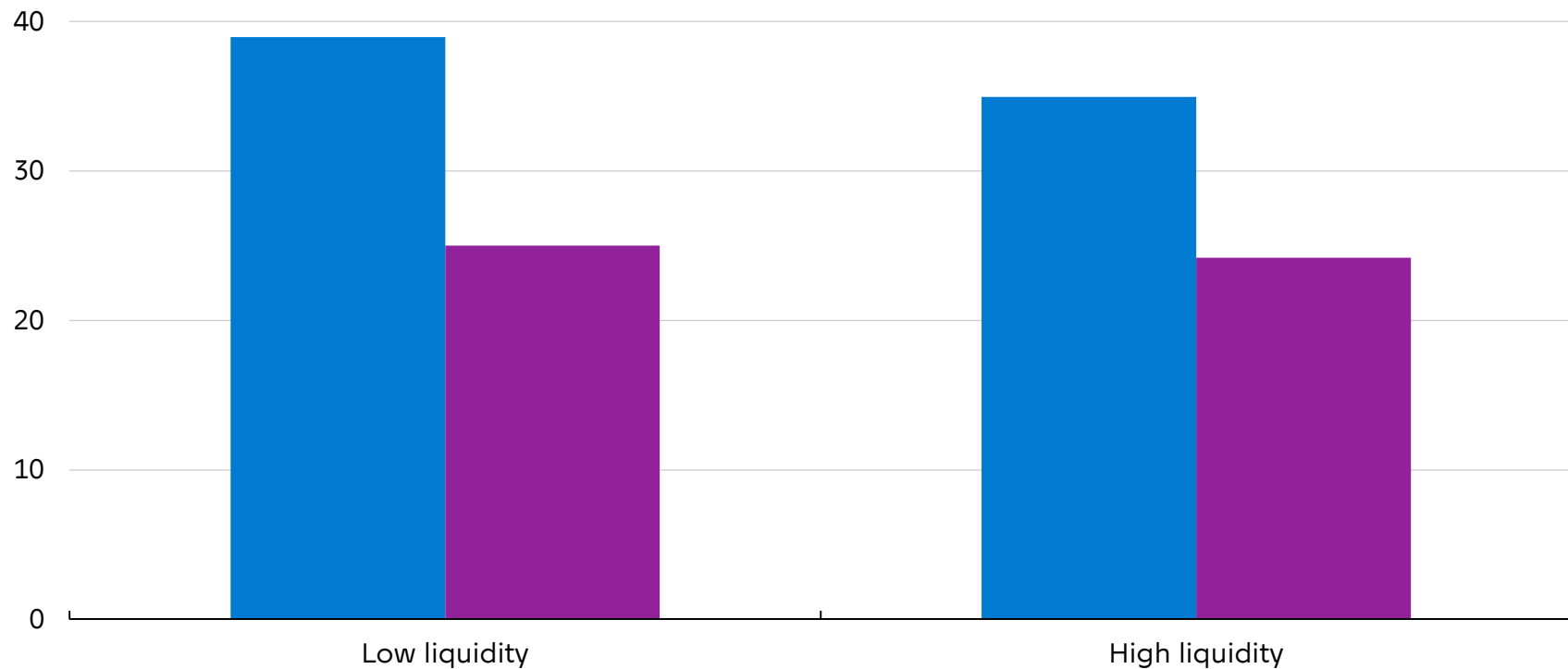
Investment rate, median of index in 2011, 2007 = 100



Note: Exporting firms are defined as firms which export more than 5 per cent of their turnover.  
Source: Own calculations based on firm-level data from Statistics Denmark.

# Investment in 2011, firms with high and low liquidity

Investment rate, median of index in 2011, 2007 = 100



■ Low leverage in 2007

■ High leverage in 2007

Note: Firms with high liquidity are defined as firms with liquidity ratio (liquid assets / total assets) higher than 10 per cent. Liquid assets are defined as the value of securities, other equity, cash and deposits.

Source: Own calculations based on firm-level data from Statistics Denmark.

# Econometric specification

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- Model: Change in investment rate from 2007 to  $t$  as a function of leverage + controls:

$$\Delta I_{i;s;r;2007-t} = \alpha + \delta_M M_{i;s;r;2007} + \delta_H H_{i;s;r;2007} + \beta x_{i;s;r;2007} + \theta \Delta I_{i;s;r;2006-2007} + \sum_{s=1}^6 \gamma_s S_s + \sum_{r=1}^4 \gamma_r R_r + \epsilon_{i;s;r;t}$$

- Controls:
  - Firm characteristics in 2007
  - Change in investment from 2006 to 2007
  - Industry and region dummies

# Regression results – Dependent variable: Change in investment rate since 2007

	2008	2009	2010	2011	2012
Medium leverage (2007)	-2.328*** (0.280)	-3.764*** (0.298)	-2.443*** (0.263)	-2.245*** (0.251)	-2.058*** (0.261)
High leverage (2007)	-3.877*** (0.387)	-5.321*** (0.405)	-3.710*** (0.379)	-3.267*** (0.374)	-2.946*** (0.391)
Control variables	Yes	Yes	Yes	Yes	Yes
Industry + region dummies	Yes	Yes	Yes	Yes	Yes
No. of obs.	35,658	34,814	34,341	33,954	33,602
R-squared	0.085	0.108	0.022	0.018	0.022

Note: Control variables include logarithm of no. of full-time employees, firm age, ROA, Sales Growth, Implied interest rate (capital costs), export share, equity/value added and change in investment from 2006 to 2007. All control variables, except sales growth, are measured in 2007. Significance: \*\*\*p<0.01, \*\*p<0.05, \*p<0.10. Robust standard errors in parentheses.

# Is the leverage channel economically relevant?

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- Counterfactual exercise using the model
- Scenario: How would investment have evolved if firms with high leverage instead had medium leverage?
- Result: High leverage can explain around 15-20 per cent of the average annual reduction in investment during the years 2008-12.



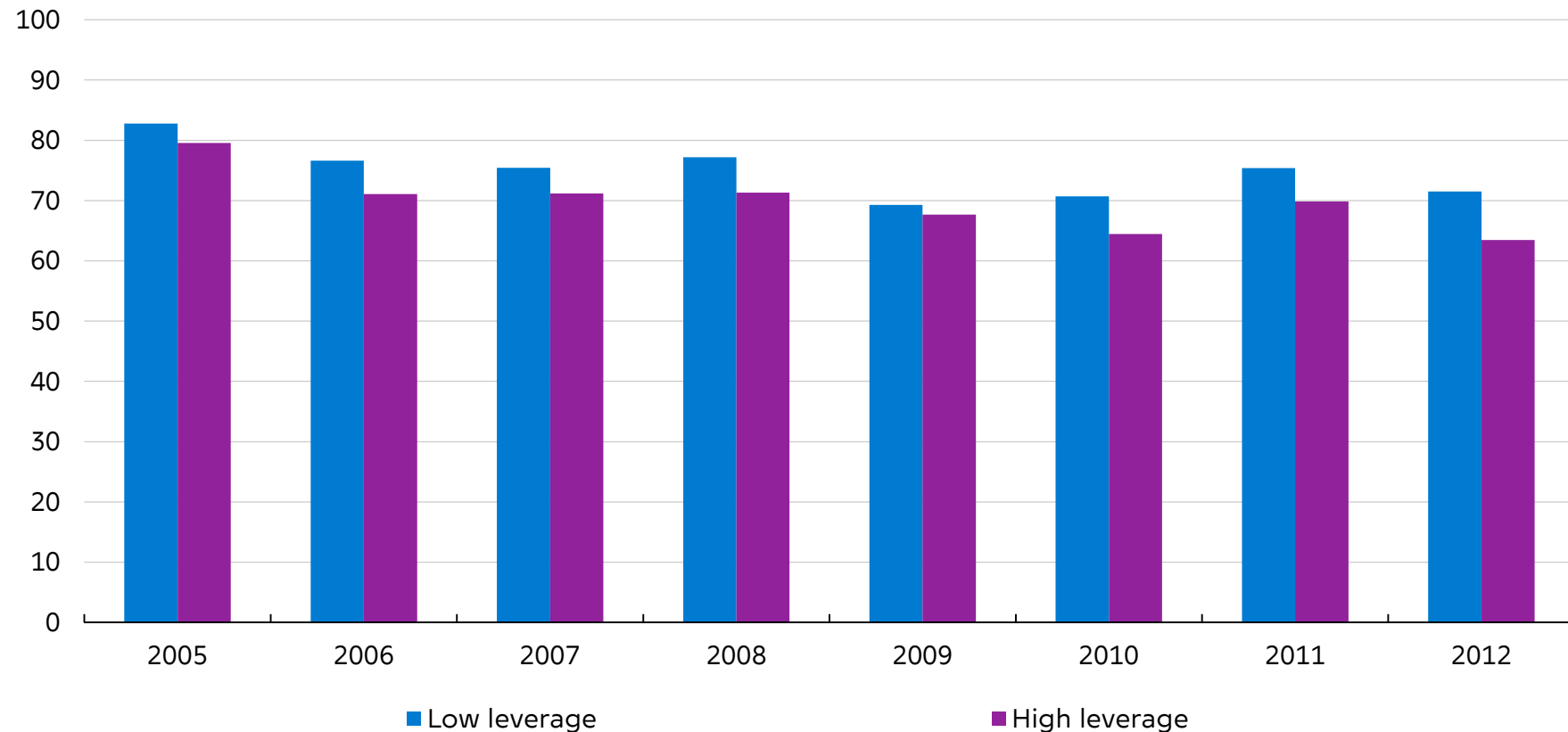
# Results robust to...

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- Estimation on various subsamples
- Alternative specifications of dependent variable
  - Change in investment relative to value added in 2007
  - Investment rate defined as investment relative to capital
- Inclusion of additional variables to control for 'regression to the mean'-effects
- Specification in levels in stead of changes
- Linear, quadratic, and non-linear effects of leverage
- Estimation on the (non-representative) subsample of firms covered by surveys (better data quality)

# Credit and the leverage channel

Share of firms, which increased their debt level (per cent)



Note: Increase in debt level is defined as an increase of at least 5 per cent in outstanding debt (excluding trade credits) since the previous year.  
Source: Own calculations based on firm-level data from Statistics Denmark.

# Conclusions

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- Firms which had high leverage before the crisis reduced their investment rate more during the crisis than firms with low leverage
- The build-up of debt before the crisis contributed to the reduction in investment during the crisis → High leverage increase macroeconomic volatility
- Results indicate the existence of a 'leverage channel'
- Evidence also suggests that the leverage channel mainly works through 'precautionary deleveraging' – credit constraints have not played a major role