

Productivity dynamics in the wake of the financial crisis: evidence from UK businesses

Rebecca Riley*, Chiara Rosazza Bondibene* and Garry Young**

*National Institute of Economic and Social Research & CFM

**Bank of England & CFM

23-24 September 2015

Understanding the Great Recession: from micro to macro

Bank of England

Disclaimers:

Any views expressed cannot be taken to represent those of the Bank of England or to state Bank of England policy.

This work contains statistical data which is Crown Copyright; it has been made available by the Office for National Statistics (ONS) through the Secure Data Service (SDS) and has been used by permission. Neither the ONS nor SDS bear any responsibility for the analysis or interpretation of the data reported here. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

Acknowledgements:

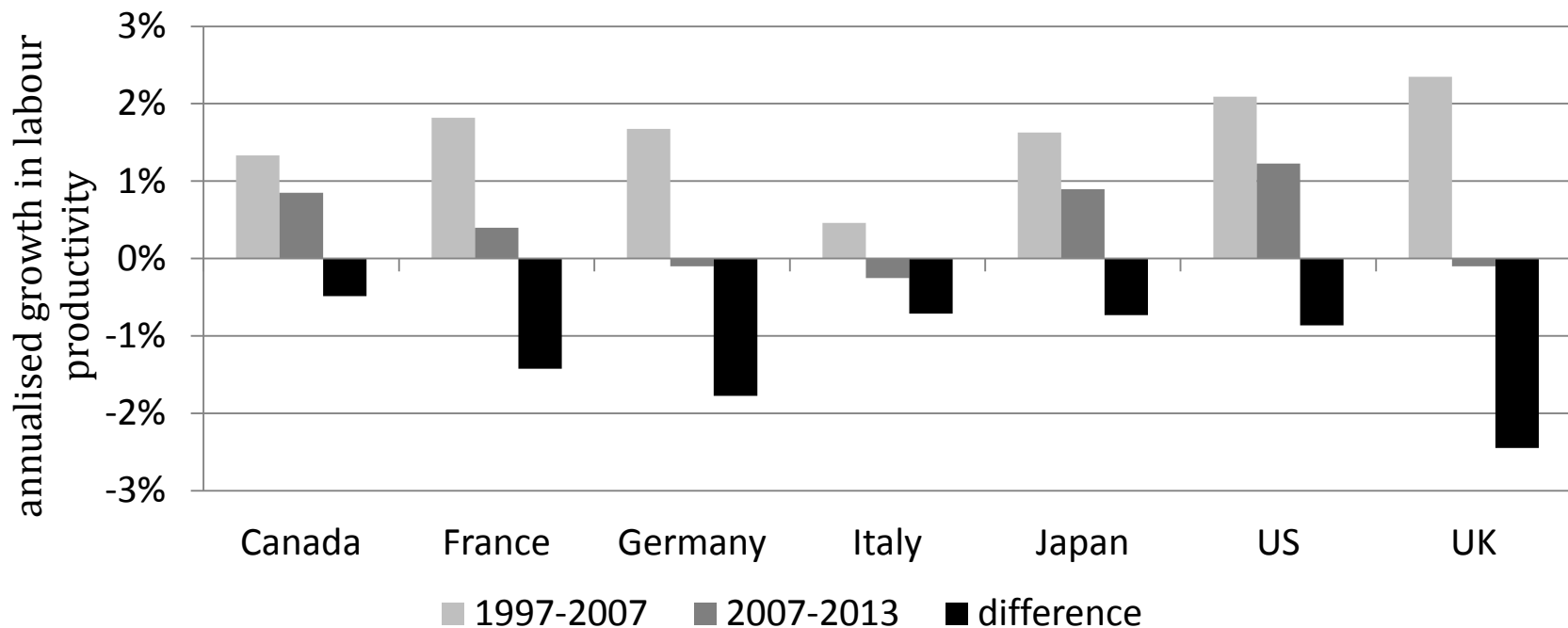
The financial support of the Economic and Social Research Council grant reference ES/K00378X/1 is gratefully acknowledged.



Stylised Facts

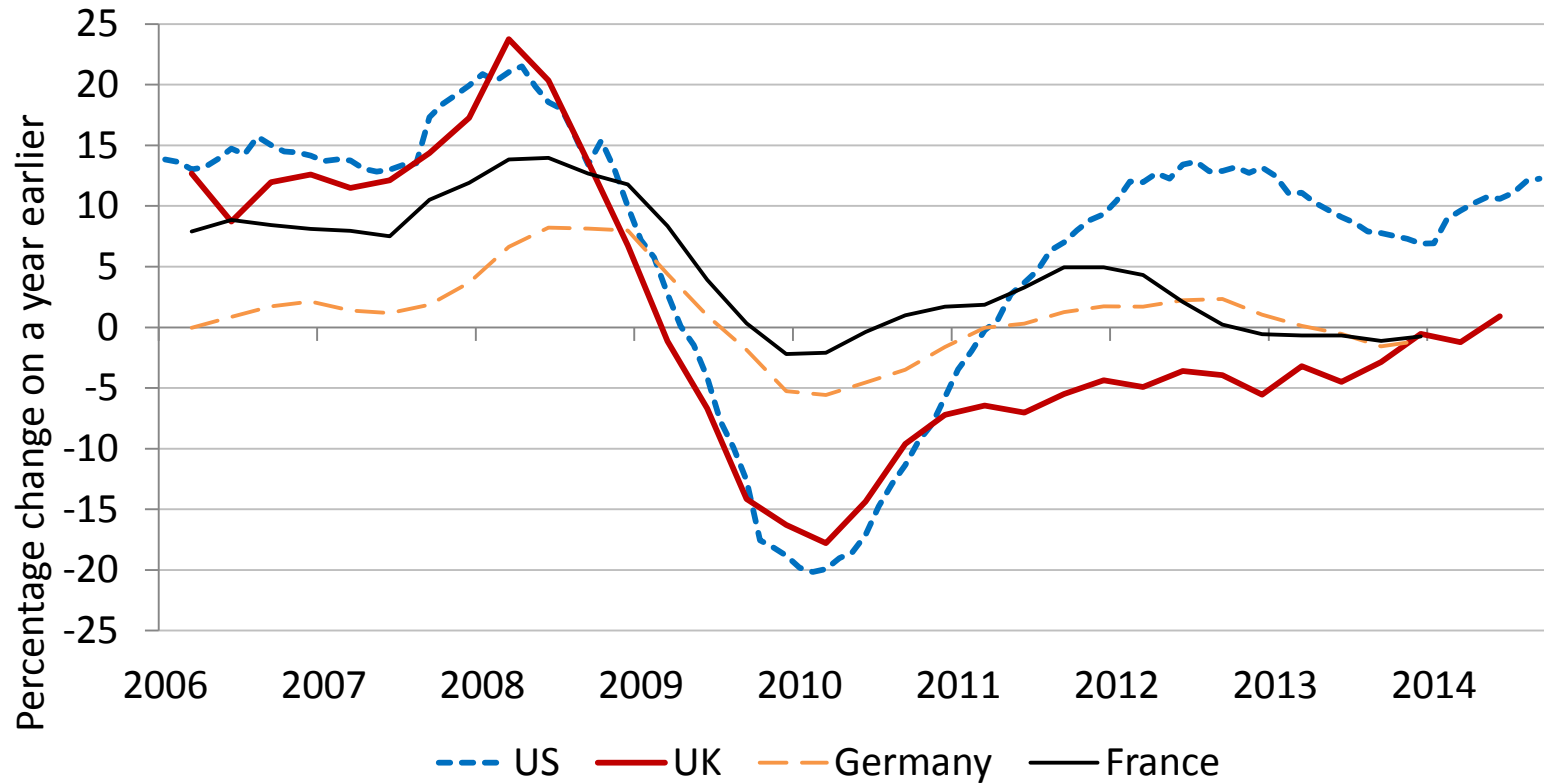
- UK labour productivity fell sharply during the recession of 2008-9 and recovered only sluggishly after that
 - In level terms productivity around 14% below a simple extrapolation of its pre-crisis trend in 2013
- In sharp contrast with the experience of other post-war recessions in the UK when the fall was less steep and the recovery was quicker
- By 2013 the stock of real bank debt held by UK corporations was more than 20% below its peak before the crisis, much of which reflected a tightening of credit supply

Dive in G7 labour productivity growth, particularly pronounced in the UK



Source: Table 3 Constant price GDP per hour worked, in *International Comparisons of Productivity, Final Estimates for 2013*, ONS Statistical Bulletin, 20 February (2015).

Related to sharp contraction in credit supply?



Source: Bank of England.

Notes: Bank lending to private non-financial corporations. UK and US data exclude commercial real estate loans. Germany and France data exclude loans to the construction sector.



Via distortions to resource allocation?

- **“Cleansing effects”** of recession: recession often considered a time when the economy is rid of its less productive units, making space for more productive firms to expand
- *However*, these effects **may be depressed** when capital markets are imperfect and firms face credit constraints as in a recession accompanied by a banking crisis and credit crunch, **reducing aggregate productivity**:
 - ➔ by preventing high productivity but bank dependent firms from expanding or causing them to exit
 - ➔ by deterring start-ups that require an initial capital outlay
 - ➔ by protecting more established, yet weak companies (directly via bank forbearance; indirectly via reduced competitive pressures)

What we do in this paper

- Map productivity developments amongst establishments in Britain before and after the global credit crisis
 - how can the weakness of productivity growth in the UK between 2007 and 2013 be accounted for by shifts in productivity within firms and by changes in the composition of the business population?
 - are some (typically bank dependent) groups of firm more adversely affected than others?
- Assess whether the link between firm growth and productivity has changed and why
 - examine how this link has changed in more or less bank dependent sectors
 - draw comparisons to a recession that was unrelated to a banking crisis

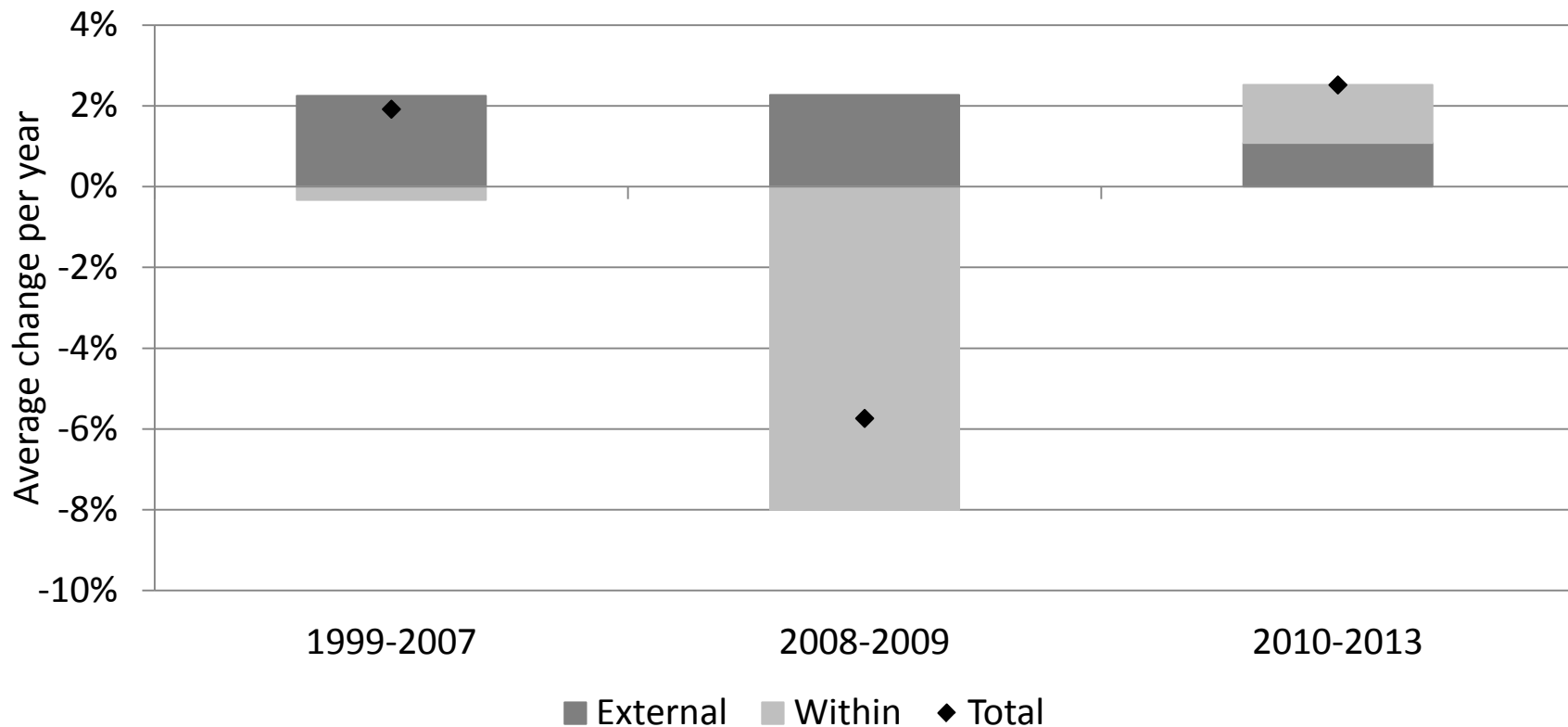
What we find in this paper

- The majority of labour productivity weakness since the crisis occurred within firms
 - Initial sharp drop followed by a failure to rebound sufficiently
 - Associated with declines in measured TFP growth relative to trend
 - Pattern pervasive across groups of firms which differ in their bank dependence
- Some signs that since the crisis composition effects added less to UK productivity growth than might have been expected
 - Positive link between growth and relative productivity ranking weakens amongst surviving firms post-2007/08
 - More so, at least initially, in bank dependent sectors
 - And in comparison to 1990s recession
 - Particularly after the first recession years had passed
 - Additional evidence from looking at companies' banking relationships

Productivity growth: From micro to macro

$$\begin{aligned} & \text{Aggregate productivity growth} \\ & = \\ & \text{Average productivity growth *within* surviving businesses} \\ & + \\ & \text{Reallocation towards more productive surviving businesses (*between*)} \\ & + \\ & \text{Reallocation towards new businesses (*entry*)} \\ & + \\ & \text{Reallocation from exiting businesses (*exit*)} \end{aligned}$$

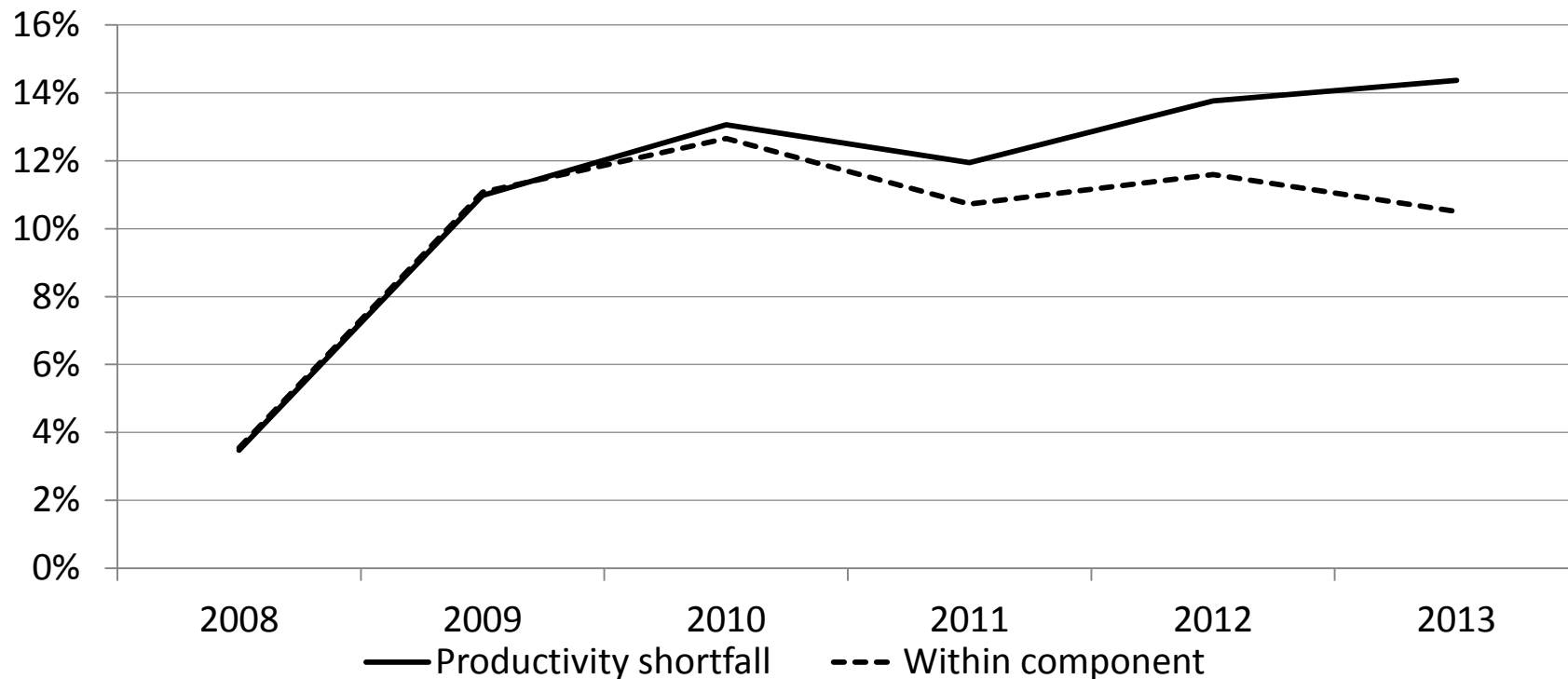
A labour productivity drop within firms and little bounce back



Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: DF decomposition. Growth components Within and External sum to Total. Non-farm non-financial market sectors excluding mining & quarrying, utilities and real estate activities. Britain.

Accounting for the productivity shortfall relative to trend

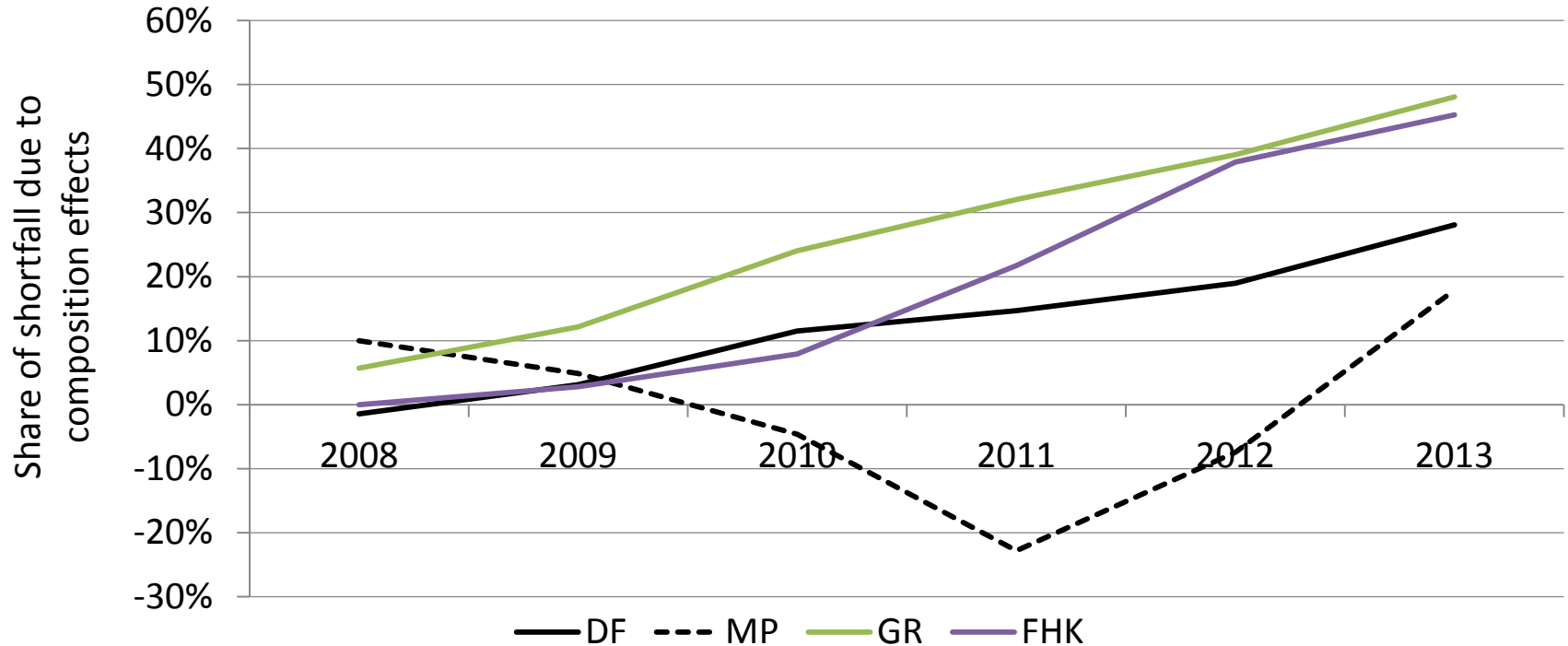


Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: Derived from DF decomposition of annual labour productivity growth. Shown as a 2-year backward looking moving average. Non-farm non-financial market sectors excluding mining & quarrying, utilities and real estate activities. Britain.



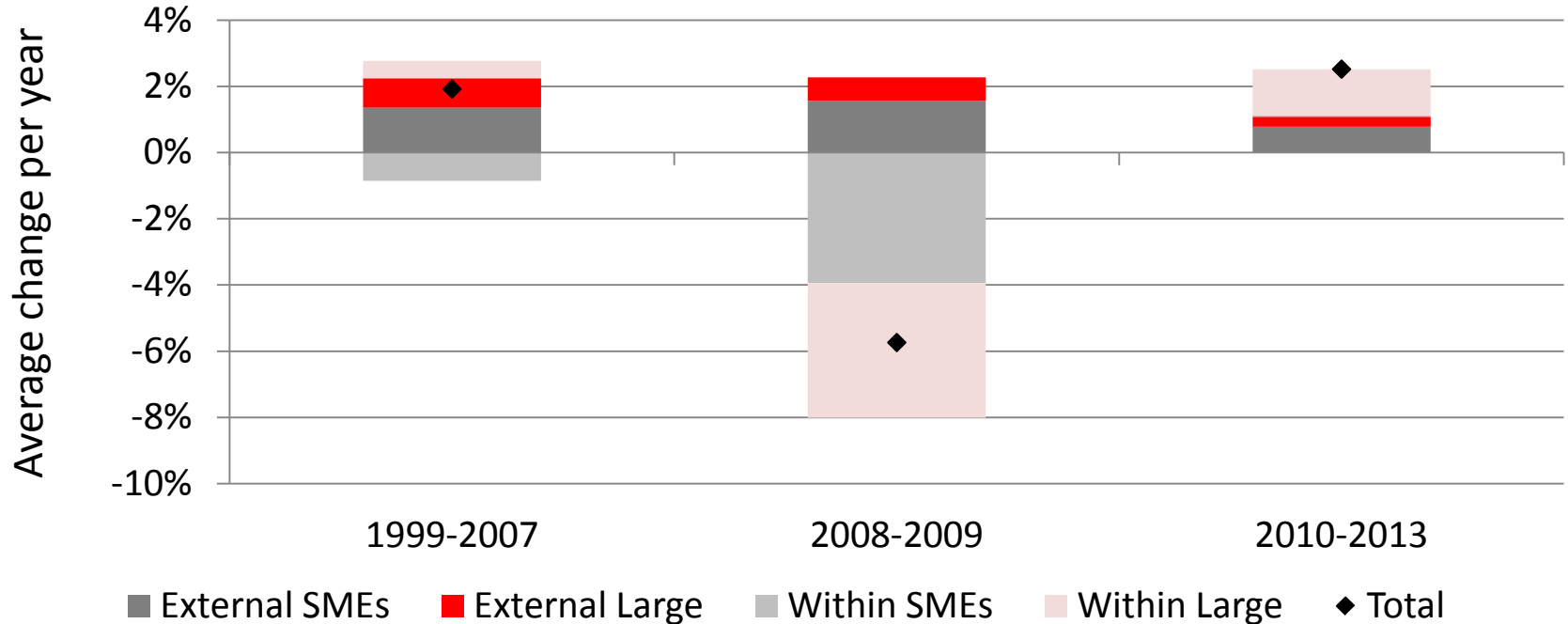
Importance of composition effects depends on how you look at it



Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: Derived from decompositions of labour productivity growth to different time horizons. Non-farm non-financial market sectors excluding mining & quarrying, utilities and real estate activities. Britain.

Patterns similar in large and small firms



Source: Annual Respondents Database, ONS, and authors' calculations.

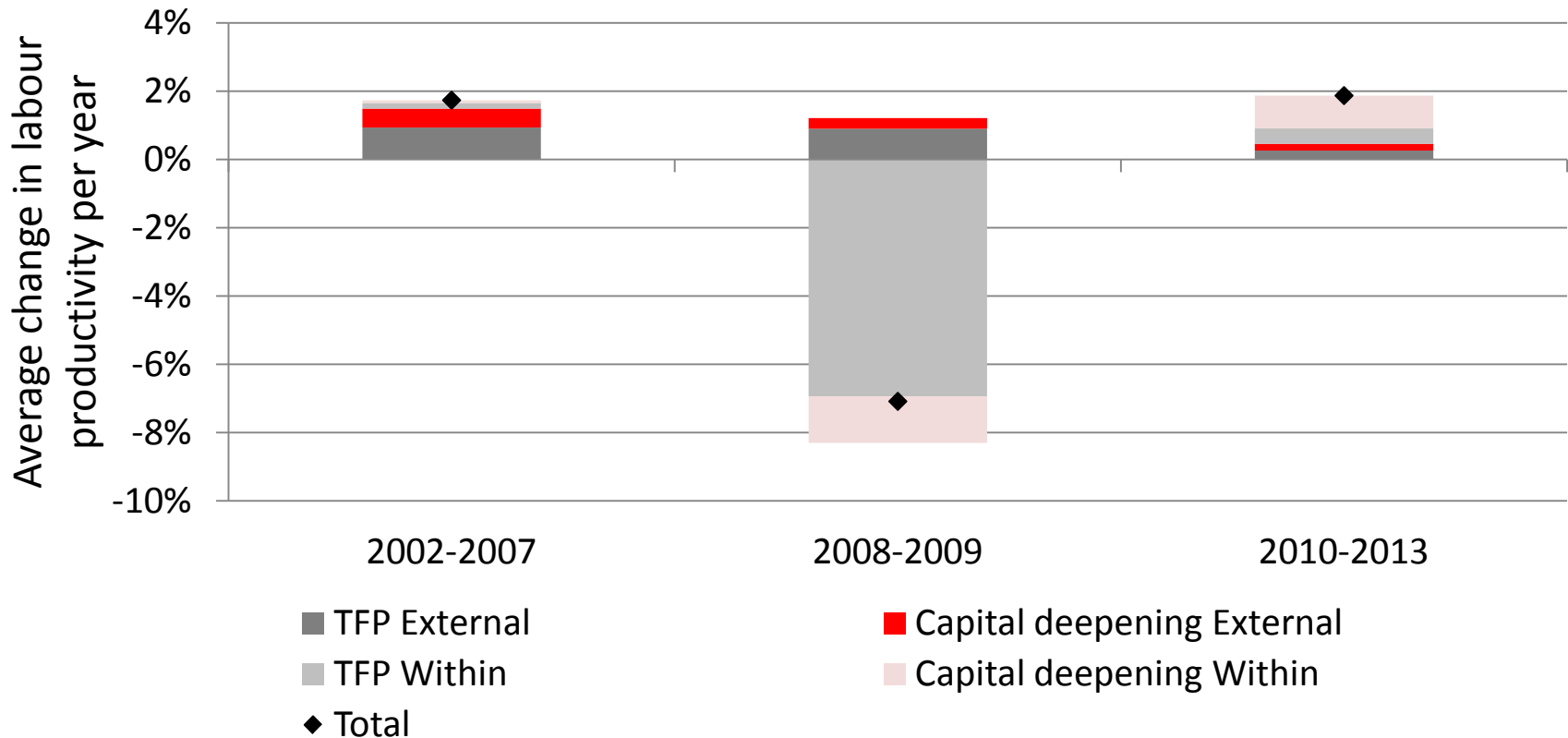
Notes: DF decomposition. Growth components Within and External sum to Total. Non-farm non-financial market sectors excluding mining & quarrying, utilities and real estate activities. Britain. SMEs have less than 250 employees.



Sector level evidence

- Decompose labour productivity growth in 9 market sectors
- Common across sectors
 - the within firm contribution to annual labour productivity growth 2008-2009 was negative
 - followed by a rebound 2010-2013, which was not sufficient to make up for the loss within firms in 2008-9
- Differences across sectors
 - the extent to which the external contribution to annual labour productivity growth weakened in comparison to the pre-crisis period
- Forthcoming NESTA report examines developments in more detailed sectors

Within firm drop in measured TFP



Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: Growth components Within and External sum to Total. Establishments with 10 or more employees. Non-farm non-financial market sectors excluding mining & quarrying, utilities and real estate activities. Britain.



Link between firms' productivity position and firm growth ...

$$y_{it} = \gamma LP_{it-k} + \gamma_p D_p LP_{it-k} + \delta_T + \delta_{IND} + \varepsilon_{it}$$

y_{it} = firm growth

LP_{it-k} = relative productivity

D_p = indicator variable equal to one post 2007

$\gamma > 0$ if higher labour productivity firms grow faster than lower labour productivity firms

$\gamma_p < 0$ if efficiency of resource allocation deteriorated after the crisis relative to pre-crisis period.

... deteriorated post crisis amongst survivors

Employment growth and firms' labour productivity position

DPV	$\Delta \log(1+EMP)$	$\Delta EMPShare$	Exit	Entry
LP	0.0279*** (5.43)	0.00034*** (4.74)	-0.0813*** (5.37)	-0.0097 (1.01)
LP x 2008-2013	-0.0167*** (2.89)	-0.00023*** (2.89)	-0.0129 (0.67)	-0.0229 (1.86)
LP	0.0279*** (5.44)	0.00034*** (4.75)	-0.0813*** (5.38)	-0.0097 (1.01)
LP x 2008-2009	-0.0180*** (2.94)	-0.00016 (1.46)	-0.0173 (0.77)	-0.0153 (1.29)
LP x 2010-2013	-0.0161*** (2.80)	-0.00027*** (3.57)	-0.0101 (0.52)	-0.0274** (2.08)
Observations	161164	161164	186631	201925

Source: ARD, FAME

Notes: Sample period 1998-2013. LP measures the percentage deviation of a firm's labour productivity from the industry year average for surviving firms. t-stats in brackets calculated using robust standard errors clustered at the industry sector level and time period. Controls for firm size effects and industry-year effects included. Population weighted. Columns 1 and 2 consider continuing firms. Column 3 estimated on the sample of continuing and exiting firms. Column 4 estimated on the sample of continuing and entering firms.



Sectoral bank dependence and the size/productivity link ...

$$y_{it} = \gamma LP_{it-k} + \gamma_p D_p LP_{it-k} + \gamma_{BD} BD LP_{it-k} + \gamma_{BDp} D_p BD LP_{it-k} + \delta_T + \delta_{IND} + \varepsilon_{it}$$

BD = sector level bank dependence before the crisis

$\gamma_{BD} > 0$ if correlation between productivity levels and firm growth more positive in more bank dependent sectors

$\gamma_{BDp} < 0$ if **efficiency of resource allocation deteriorated in more bank dependent sectors relative to less bank dependent sectors after the crisis**

→ *evidence of a distortion to resource allocation associated with a reduction in credit supply*

... allocation inefficiencies during recession linked to bank dependence, but little aggregate effect

DPV	$\Delta \log(1+EMP)$		$\Delta EMPShare$		Exit		Entry	
LP	0.0081	(0.99)	0.00051**	(2.05)	-0.0472*	(1.88)	-0.0257	(1.28)
LP x 2008-2013	-0.0029	(0.28)	-0.00032	(1.26)	-0.0050	(0.09)	-0.0130	(0.49)
LP x BD	0.0561**	(2.60)	-0.00047	(0.79)	-0.0948	(0.95)	0.0440	(0.73)
LP x BD x 2008-2013	-0.0394	(1.44)	0.00027	(0.44)	-0.0177	(0.11)	-0.0281	(0.35)
LP	0.0081	(1.00)	0.00051**	(2.06)	-0.0472*	(1.89)	-0.0257	(1.28)
LP x 2008-2009	0.0078	(0.86)	-0.00007	(0.24)	-0.0159	(0.31)	-0.0228	(0.84)
LP x 2010-2013	-0.0070	(0.62)	-0.00045*	(1.77)	0.0005	(0.01)	-0.0077	(0.28)
LP x BD	0.0561**	(2.61)	-0.00047	(0.80)	-0.0948	(0.95)	0.0440	(0.73)
LP x BD x 2008-2009	-0.0736***	(2.96)	-0.00026	(0.37)	0.0000	(0.00)	0.0177	(0.22)
LP x BD x 2010-2013	-0.0265	(0.89)	0.00052	(0.86)	-0.0256	(0.15)	-0.0540	(0.66)
Observations	161164		161164		186631		201925	

Source: ARD, FAME

Notes: Sample period 1998-2013. LP measures the percentage deviation of a firm's labour productivity from the industry year average for surviving firms. BD measures industry bank dependence calculated as the share of assets due to SMEs with bank finance by 2-digit industry 2005-2007 (calculated from company accounts data in FAME; 31 industry sectors; sector mean=0.33, sd=0.15, median=0.36). t-stats in brackets calculated using robust standard errors clustered at the industry sector level and time period. Controls for firm size effects and industry-year effects included. Population weighted. Columns 1 and 2 consider continuing firms. Column 3 estimated on the sample of continuing and exiting firms. Column 4 estimated on the sample of continuing and exiting firms.



Within firm drop explains difference to previous recession (in manufacturing)

	Total	Growth components				External	
	%	Within	Between	Entry	Exit	Net entry	Total
1984-1989	20.8	16.5	0.4	2.7	1.1	3.8	4.2
1989-1994	19.8	17.9	0.6	2.6	-1.3	1.3	1.9
<i>difference</i>	<i>-1.0</i>	<i>1.3</i>	<i>0.2</i>	<i>0.0</i>	<i>-2.4</i>	<i>-2.5</i>	<i>-2.3</i>
2002-2007	33.7	19.7	6.0	2.5	5.6	8.1	14.1
2007-2012	0.0	-6.4	2.5	1.5	2.3	3.8	6.3
<i>difference</i>	<i>-33.8</i>	<i>-26.0</i>	<i>-3.4</i>	<i>-1.0</i>	<i>-3.3</i>	<i>-4.3</i>	<i>-7.7</i>
difference 2007-2012 to 1989-1994	-19.8	-24.2	1.9	-1.1	3.6	2.5	4.4
difference 2007-2012 to 2002-2007 less difference 1989-94 to 1984-1989	-32.8	-27.3	-3.6	-1.0	-0.8	-1.8	-5.5

Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: DF decomposition. Growth components Within, Between, Entry and Exit sum to Growth Total. Entry and Exit sum to Net entry. Between, Entry and Exit sum to External Total. Britain. Firms are classified as live if they are active and have 20 or more persons employed.



Link between firms' productivity position and firm growth, benchmarking on the past ...

$$y_{it} = \gamma LP_{it-k} + \gamma_p D_p LP_{it-k} + \gamma_{00} D_{00} LP_{it-k} + \gamma_{00p} D_p D_{00} LP_{it-k} + \delta_T + \delta_{IND} + \varepsilon_{it}$$

D_p = indicator variable equal to one post recession

D_{00} = indicator variable equal to one during the 2000s

$\gamma > 0$ if higher labour productivity firms grow faster than lower labour productivity firms

$\gamma_p > 0$ if relationship between firm growth and productivity levels is counter-cyclical

γ_{00} captures secular changes

$\gamma_{00p} < 0$ if efficiency of resource allocation deteriorated since the financial crisis net of normal cyclical changes and secular trends

→ *evidence of a distortion to resource allocation associated with a reduction in credit supply*

... some evidence of a weakening in the efficiency of resource allocation amongst surviving firms

DPV	$\Delta \log(1+EMP)$		$\Delta EMPShare$		Exit		Entry	
LP	0.0937***	(4.05)	0.00602**	(2.15)	0.0084	(0.67)	0.0488***	(2.78)
LP x recession	-0.0081	(0.27)	0.00157	(0.37)	-0.0337	(1.62)	0.0147	(0.66)
LP x 2000s	0.0492	(1.53)	0.01063	(1.60)	-0.0568**	(2.53)	-0.0168	(0.78)
LP x recession x 2000s	-0.0313	(0.71)	-0.01324*	(1.72)	0.0116	(0.38)	-0.0100	(0.34)
Observations	20573		20573		33701		29515	

Source: Annual Respondents Database, ONS, and authors' calculations.

Notes: Start years included in the sample: 1984, 1989, 2002, 2007. LP measures the percentage deviation of a firm's labour productivity from the industry year average for surviving firms. t-stats in brackets calculated using robust standard errors clustered at the industry sector level and time period. Controls for firm size effects and industry-year effects included. Population weighted.



Evidence from banking relationships: A quasi-experiment

- Exploit exogenous variation induced by the financial crisis in credit availability to companies to investigate impacts of credit supply shocks
- Compare outcomes for companies who were subjected to tougher credit constraints to outcomes for companies that were less likely to be constrained
 - Quasi-experimental approach
 - Divide firm observations into ‘treatment’ (T) and ‘control’ (C) groups based on main bank lender
 - Difficulty switching to a new lender during the crisis
- Track difference in the development of outcomes between the T and C groups since bank rescue/financial crisis
 - FY 2007/8 or FY 2008/9 (PRE-period) - FY 2011/12 or FY 2012/13 (POST-period)
 - And compare this to differences in the development of outcomes between these two groups before the crisis
- Provide direct estimates of the impact of credit constraints on UK firms
 - Consider impacts on firm survival

Distressed Banks

LBG

BANK OF SCOTLAND
LLOYDS TSB
LLOYDS BANK
TSB BANK
BANK OF WALES

HALIFAX
HBOS
TRUSTEE SAVINGS BANK
TSB COMMERCIAL FINANCE
TSB ENGLAND & WALES
TSB ASSET FINANCE

RBS

NATIONAL WESTMINSTER BANK
ROYAL BANK OF SCOTLAND
ROYAL BANK OF SCOTLAND COMMERCIAL SERVICES
WESTMINSTER BANK
RBS INVOICE FINANCE

LOMBARD NORTH CENTRAL
WILLIAMS & GLYN'S BANK
ROYAL BANK OF SCOTLAND SECURITY TRUSTEE
NATIONAL PROVINCIAL BANK
ULSTER BANK

Other

AIB GROUP
GOVERNOR AND COMPANY OF BANK OF IRELAND
ANGLO IRISH BANK CORPORATION
ALLIED IRISH BANKS
CAPITAL HOME LOANS

FIRST TRUST BANK

NORRN ROCK
ALLIANCE & LEICESTER
BRADFORD & BINGLEY BUILDING SOCIETY
MORTGAGE EXPRESS

36% of companies with
outstanding charges



Not Distressed Banks

HSBC

HSBC BANK
MIDLAND BANK
HSBC INVOICE FINANCE
HSBC INVOICE FINANCE SECURITY HOLDER

Barclays

BARCLAYS BANK
WOOLWICH

Other

CLYDESDALE BANK
YORKSHIRE BANK
CO-OPERATIVE BANK
SANTANDER
ABBAY NATIONAL

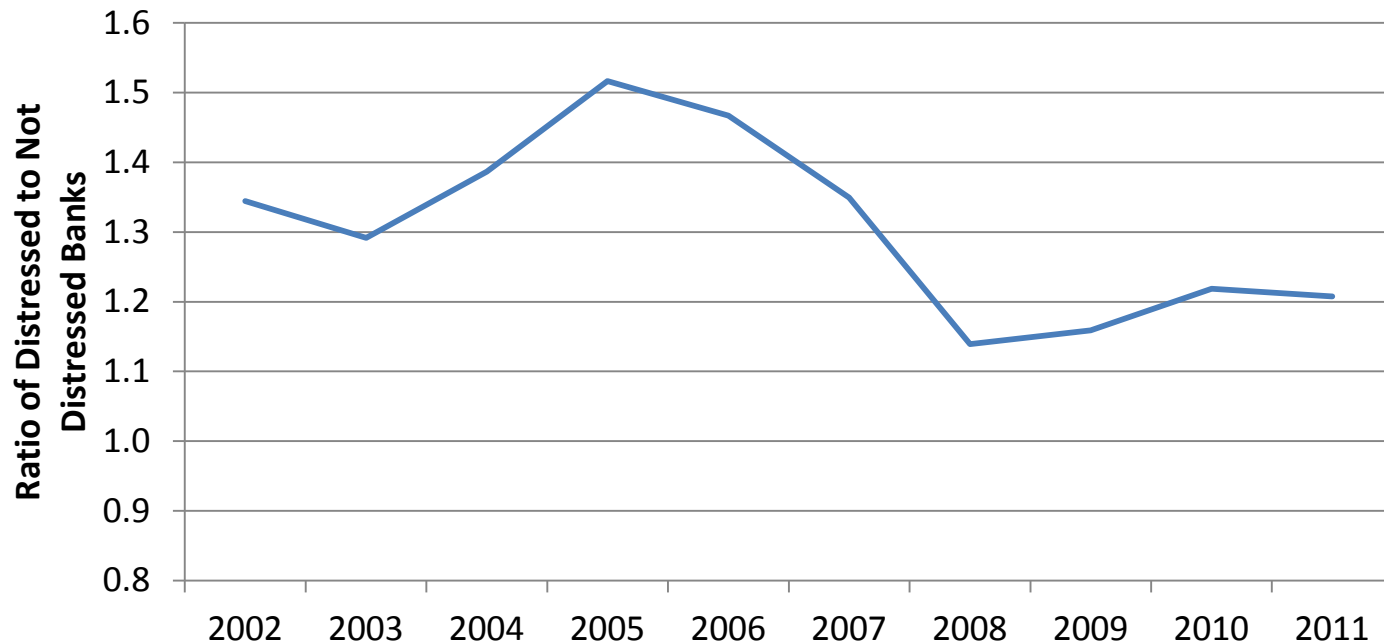
NATIONWIDE BUILDING SOCIETY
MORTGAGE WORKS
PARAGON MORTGAGES
MORTGAGE TRUST
COUTTS & CO

COUTTS & COMPANY
CLOSE BRORS
CLOSE INVOICE FINANCE
SKIPTON BUILDING SOCIETY
NORWICH UNION MORTGAGE FINANCE

BIBBY FINANCIAL SERVICES
VENTURE FINANCE
GRIFFIN CREDIT SERVICES
ROYAL TRUST CORPORATION OF CANADA TRUSTEE
SVENSKA HANDELSBANKEN AB PUBL

32% of companies with
outstanding charges

Short term loans and overdrafts held by companies with outstanding charges in DISTRESSED and NOT DISTRESSED banks



Source: FAME BvD and authors' calculations.

Notes: Companies in the non-financial non-farm business sectors excluding the Mining and Real Estate industries. Companies who do not have an outstanding charge with any other lender and who report their loans.

Exit Rate effect of being with a nationalised bank

Exit period		Full sample		Loan sample		Productivity sample				
4-year		0.006 ***	(0.0019)	0.011 ***	(0.0037)	0.009	(0.0070)			
3-year		0.007 ***	(0.0016)	0.009 ***	(0.0030)	0.005	(0.0053)			
	Leverage position						Productivity position			
4-year	BELOW 50th			0.010 **	(0.0045)	0.018 **	(0.0079)	BELOW 50th	-0.007	(0.0117)
4-year	ABOVE 50th			0.012 *	(0.0061)	-0.007	(0.0135)	ABOVE 50th	0.023 ***	(0.0083)
3-year	BELOW 50th			0.011 ***	(0.0035)	0.013 **	(0.0058)	BELOW 50th	-0.003	(0.0086)
3-year	ABOVE 50th			0.007	(0.0051)	-0.012	(0.0104)	ABOVE 50th	0.012 *	(0.0061)
4-year	BELOW 75th			0.013 ***	(0.0039)	0.014 *	(0.0071)	BELOW 75th	0.008	(0.0085)
4-year	ABOVE 75th			0.002	(0.0103)	-0.027	(0.0275)	ABOVE 75th	0.016	(0.0112)
3-year	BELOW 75th			0.010 ***	(0.0031)	0.008	(0.0053)	BELOW 75th	0.006	(0.0064)
3-year	ABOVE 75th			0.006	(0.0085)	-0.022	(0.0210)	ABOVE 75th	0.000	(0.0083)

Notes: OLS regression; robust standard errors in brackets clustered by firm.

Exit Rate effects (pre-crisis falsification test)

Exit period		Full sample		Loan sample		Productivity sample			
4-year		-0.002	(0.0019)	-0.003	(0.0034)	-0.008	(0.0067)		
3-year		-0.003 *	(0.0019)	-0.001	(0.0032)	-0.007	(0.0060)		
	Leverage position							Productivity position	
4-year	BELOW 50th			-0.001	(0.0044)	-0.003	(0.0078)	BELOW 50th	-0.004 (0.0109)
4-year	ABOVE 50th			-0.006	(0.0058)	-0.016	(0.0131)	ABOVE 50th	-0.012 (0.0085)
3-year	BELOW 50th			0.000	(0.0039)	-0.005	(0.0067)	BELOW 50th	-0.008 (0.0099)
3-year	ABOVE 50th			-0.002	(0.0054)	-0.011	(0.0119)	ABOVE 50th	-0.006 (0.0073)
4-year	BELOW 75th			0.000	(0.0037)	-0.005	(0.0069)	BELOW 75th	-0.009 (0.0080)
4-year	ABOVE 75th			-0.018 *	(0.0098)	-0.036	(0.0261)	ABOVE 75th	-0.005 (0.0124)
3-year	BELOW 75th			0.001	(0.0034)	-0.003	(0.0061)	BELOW 75th	-0.010 (0.0072)
3-year	ABOVE 75th			-0.011	(0.0093)	-0.036	(0.0238)	ABOVE 75th	0.003 (0.0105)

Notes: OLS regression; robust standard errors in brackets clustered by firm.

Productivity dynamics: Conclusions

- The reduction in UK labour productivity growth after 2007 (to 2013) was first and foremost the result of a broad-based decline in productivity within businesses
 - Not a reduction in the contribution of business reallocation to aggregate productivity growth.
 - The question of what has caused this productivity drop within firms remains (and banking sector collapse may be one reason).
 - Importance of a common factor.
- The recession does appear to have had some "cleansing effect" or been associated with creative destruction.
 - Albeit not sufficient to offset fully the large drop in productivity within firms.
- We do observe patterns that suggest an empirical link between banking sector collapse and aggregate productivity via less efficient resource allocation
 - The relationship between firm growth and relative labour productivity was weaker in the Great Recession in sectors with many small and bank dependent businesses (although we find no association with bank dependence during the later stagnation period).
 - Comparison of manufacturing firms in two different recessions (one caused by a financial crisis, the other not) suggests we might have expected a slightly higher productivity contribution from external restructuring (although key differences are due to the within component).
 - Evidence from banking relationships points to 'inefficient' allocation of finance.
- Issues
 - What is the appropriate counterfactual?
 - A banking crisis may affect productivity within and between firms.