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EUROSYSTEM

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Capital and labour (mis)allocation in the euro-area: Stylized facts and possible determinants

CompNet Workshop
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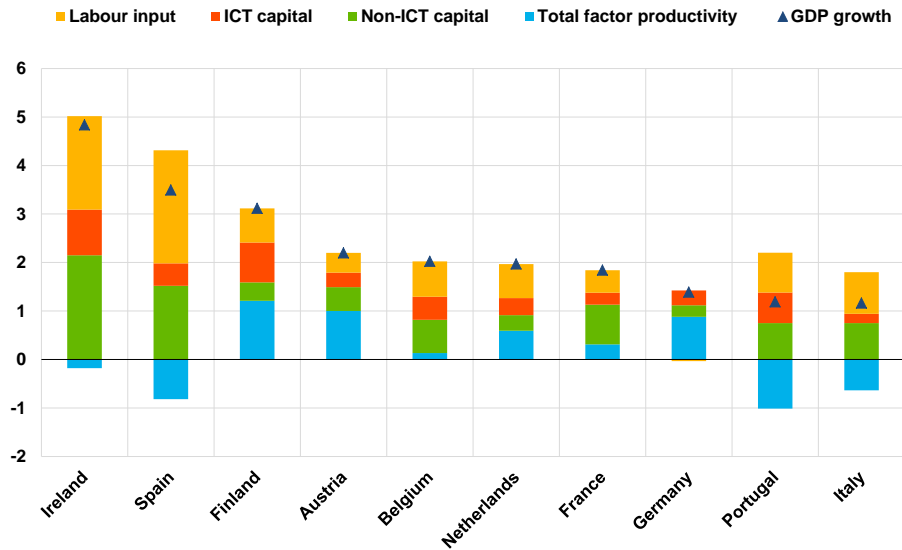Corresponding author: Elisa.Gamberoni@ecb.europa.eu

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Trend and cross-country differences in GDP growth related to TFP growth developments
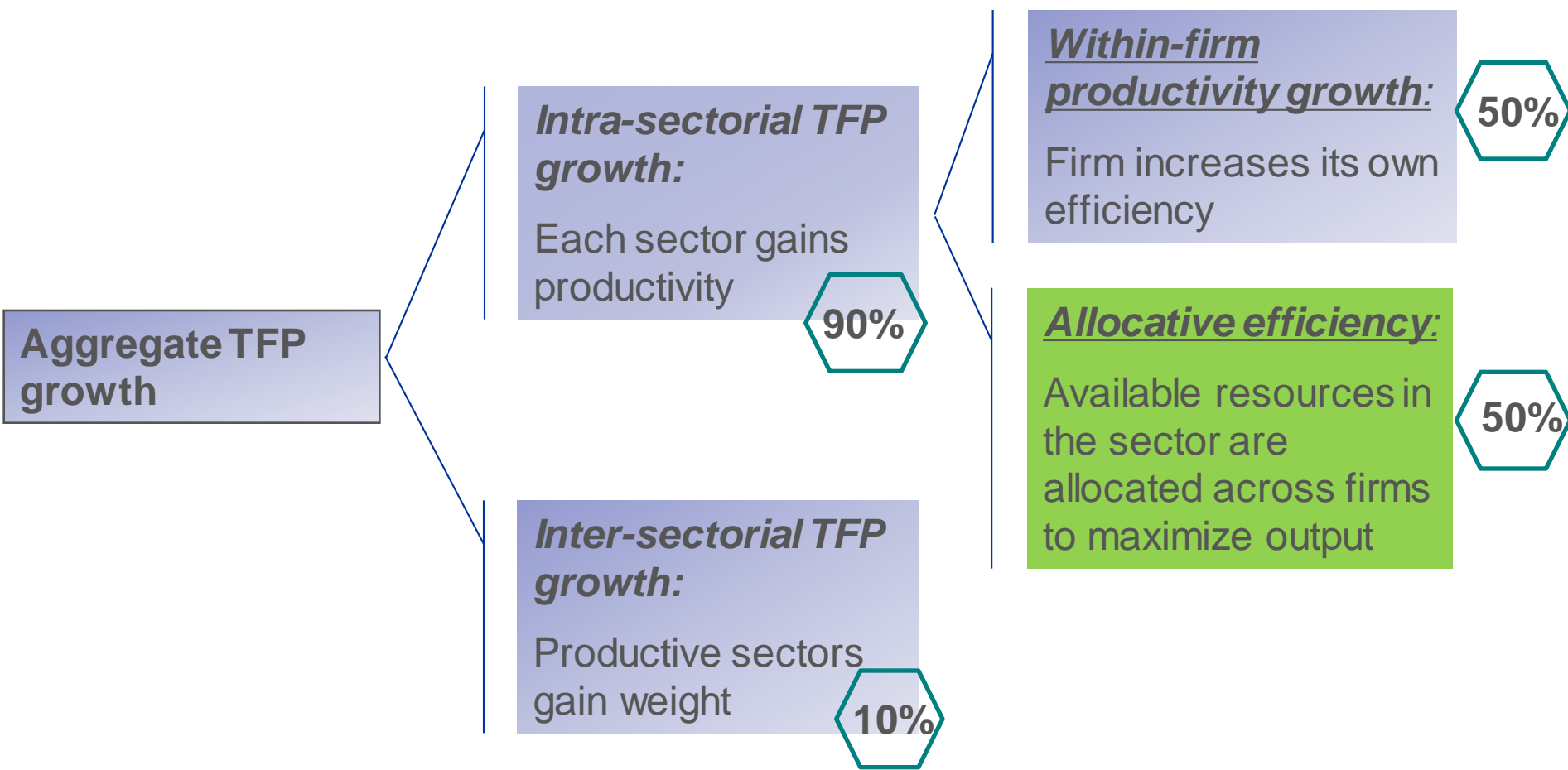
2002-2007

2008-2014
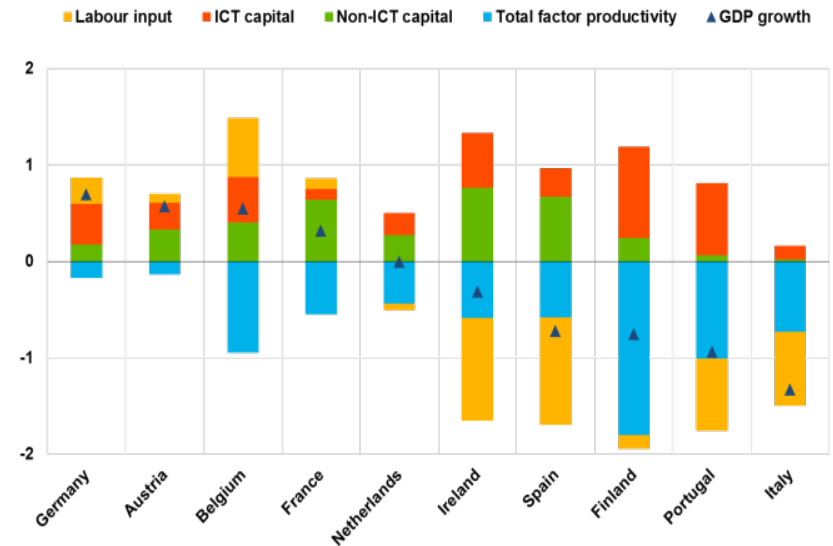
Source: Conference Board.

Intra-sectorial TFP growth = Within-firm + across-firm TFP growth

TOTAL ECONOMY

SECTORS

WITHIN SECTORS

Aggregate TFP growth

Intra-sectorial TFP growth:

Each sector gains productivity

90%

Inter-sectorial TFP growth:

Productive sectors gain weight

10%

Within-firm productivity growth:

Firm increases its own efficiency

50%

Allocative efficiency:

Available resources in the sector are allocated across firms to maximize output

50%

Notes: The contribution of intra vs. inter sector TFP growth is an average of OECD (2003), Employment in Europe (2003), and EC (2004).The "within sectors" numbers refer to the percentage contributions to U.S. manufacturing TFP growth taken from selected studies, averaged over various time spans.

There is resource misallocation when available inputs are not allocated efficiently across firms in a sector

- Measurement? Different possibilities but the most popular is the one proposed by *Hsieh and Klenow (2009)*:

  - Model of monopolistic competition with firm heterogeneity where firms face the same marginal cost of inputs but differ in terms of their physical TFP.

  - In the *absence* of distortions profit maximization ensures that: Returns to K and L ("marginal revenue product" of K and L) are the same across all firms in a sector => **dispersion in MRPK(MRPL) = 0**
  - In the *presence* of distortions: reallocation of K to L from low to high productive firms is prevented => dispersion in MRPK(MRPL) > 0

  - Sector TFP is proportional to changes in the within-sector dispersion of the marginal revenue product of capital and labour (MRPK and MRPL)

  - Hence we measure misallocation of capital and labour as the within-sector dispersion of the MRPK (or MRPL) of firms operating in that sector using CompNet data

Recent surge of papers based on firm-level data using the HK indicator of misallocation: common findings

Gopinath et al (2015):

- Dispersion in MRPK within the manufacturing sector in Italy and Spain increased during 1999-2014 not so much of labour

- Observed pre-crisis trends in MRPK dispersion in manufacturing consistent with a model in which firms face financial frictions and adjustment costs

- Post-crisis trends better fit a model characterized by uncertainty shocks.

Garcia-Santana et al (2015):

- Within-sector productivity dispersions increased Spain during the period 1995-2007

- Particularly in industries characterized by larger state intervention (e.g. through licensing)

- Calligaris (2015):

- Significant and increasing input misallocation in Italian manufacturing sector in 1993-2011

- Higher for firms located in South Italy, low-technological intensity, small or young firms.

- Dias et al (2014):

- Dispersion in TFP in Portugal increased during the period 1996-2011, particularly in services.

We use data for both inputs, labour and capital, of 5 countries (BE, IT, FR, DE, ES); 2002-2012; 8 macro-sectors*

*manufacturing, construction, wholesale and retail trade, transportation and storage, information and communication, food and accommodation, administrative and support service activities, professional scientific and technical activities

Dispersion in MRPK
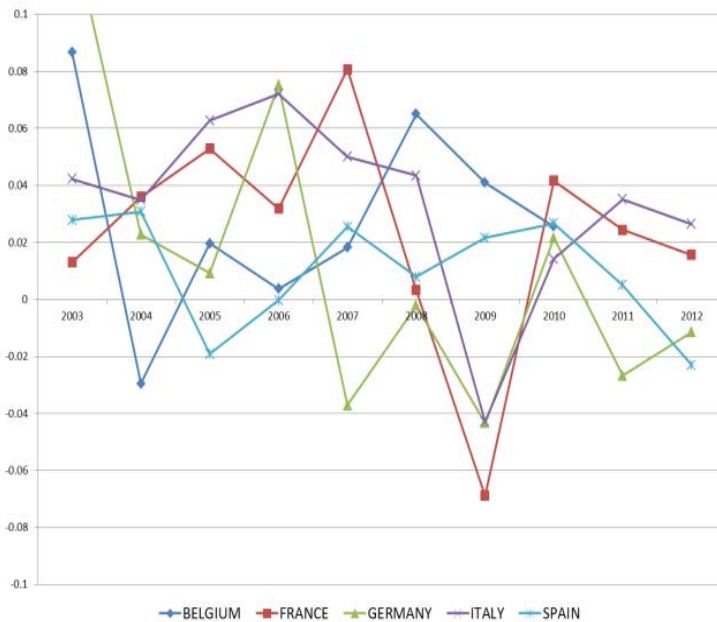
Dispersion in MRPL

Source: Authors' calculations based on CompNet data
Note: Weighted averages across sectors, where the weights are the 2002 sectorial value added shares within a country.

Pre-2001 dispersion trends

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Changes in dispersion in MRPK

Changes in dispersion in MRPL

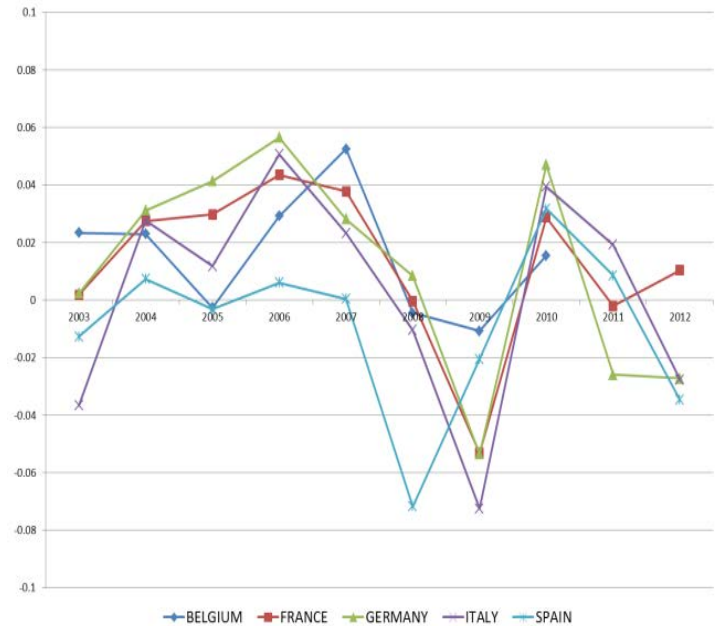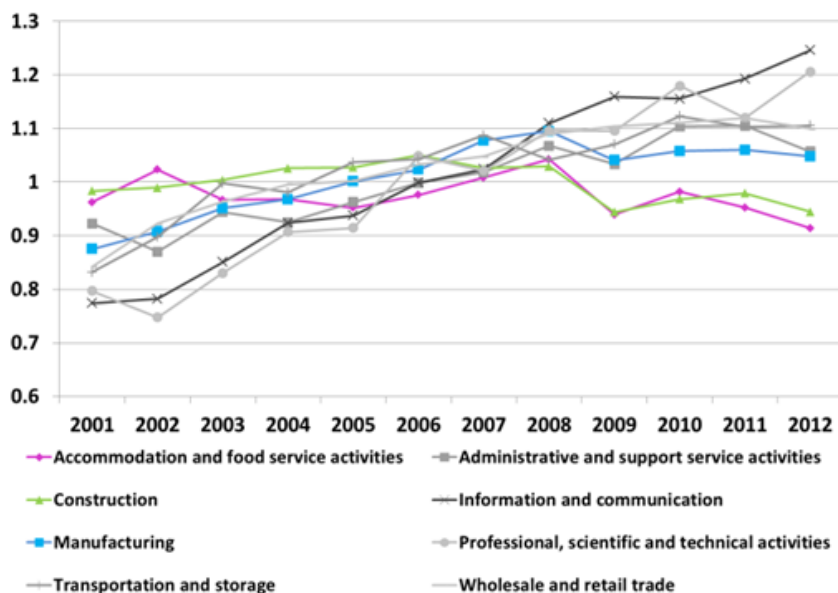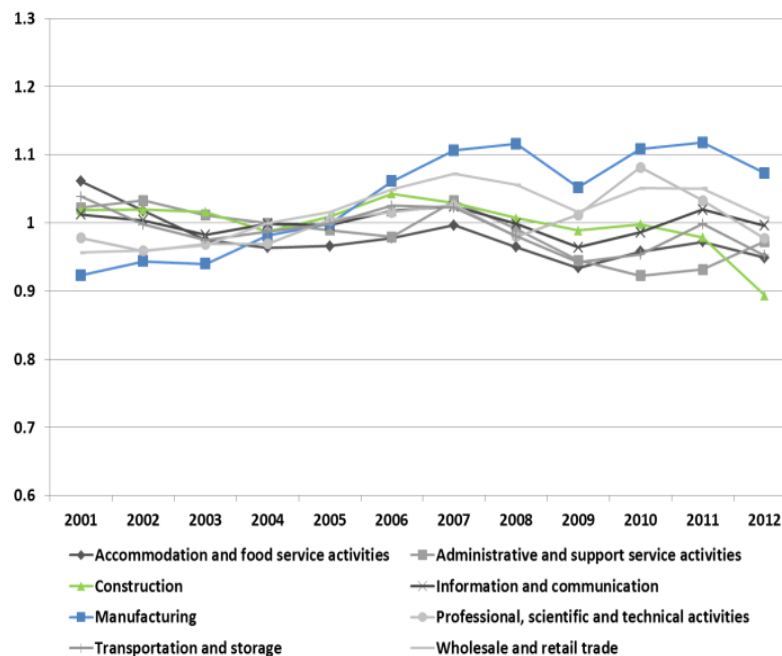Source: Authors' calculations based on CompNet data
Note: Weighted averages across sectors, where the weights are the 2002 sectorial value added shares within a country.

Stylized fact #3: K misallocation has been driven by the service sectors

Dispersion in MRPK by sector
(unweighted averages across countries)

Dispersion in MRPL by sector
(unweighted averages across countries)

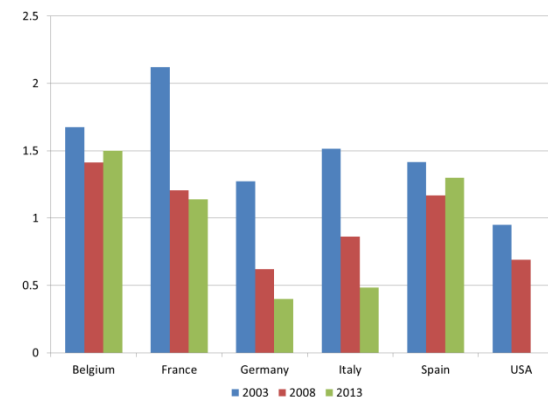Source: Authors' calculations based on CompNet data

- **Product market regulation (PMR):** Sheltering firms from competition might imply that low productive firms will keep operating instead of downsizing or exiting (Restuccia and Rogerson 2013; Andrews and Cingano 2014)

- **Labour market regulation (EPL):** Stringent labour market regulation affect productive firms if they need to scale up or down quickly after a demand or technological shock (Haltiwanger, Scarpetta and Schweizer 2014; Bartelsman, Gautier and de Wind 2011)

But they cannot explain the overall trend….

Employment Protection Legislation
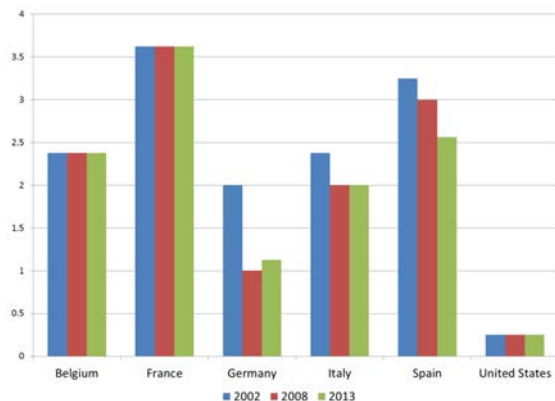
Product Market Regulations- legal barrier to entry sub-component

Source: Authors' calculations based on OECD

- **Crisis:** Preliminary evidence shows that misallocation have decreased - albeit temporarily - towards the end of the Great Recession

- **Realized demand:** Control for boom and boost in the business cycle

- **Demand uncertainty:** Uncertain prospects on a firm's activity can lead to delaying investment projects, possibly to a different extent across firms due to risk aversion (Bloom et al, 2014)

- **Financial constraints:** Frictions might prevent productive firms from obtaining the resources needed to expand, so that input choices differ systematically across firms in ways that are unrelated to their productivity (Gilchrist, Sim and Zakrajsek 2013).

Cost of credit
Demand uncertainty

$$\Delta var(MRPI)_{t,i,j} = \beta_0 + \beta_1 var(MRPI)_{2002,i,j} + \beta_2 crisis + \beta_3 uncertainty_{t-1,i,j} + \beta_4 real\ turnover_{t/t-1,i,j}$$
$$+ \beta_5 creditcost_{t/t-1,i,j} + \beta_6 PMR_{t/t-1,i,j} + \beta_7 EPL_{t/t-1,i,j} + \gamma_j + \theta_i + \varepsilon_{t,i,j}$$

$\Delta var(MRPI)_{t,i,j}$: Change in dispersion of capital or labour – *Source: CompNet database*

Crisis: equals one from 2008 onwards

$Uncertainty_{t-1,i,j}$ cross-sectional dispersion in the expectations of firms to future production/demand expectations relative to the current situation (Fuss and Vermeulen, 2008 and Busetti, Giordano and Zevi, 2015)- *Source: European Commission Business Survey.*

$Real\ turnover_{t/t-1,i,j}$ Change in the average growth in turnover across firms within a sector based on ECB CompNet

$creditcost_{t/t-1,i,j}$: Change in the average interest rate on bank loans to firms by country sectorialized based on US sectorial external financial dependence (Rajan and Zingales, 1998)- *Source: ECB and Compustat*
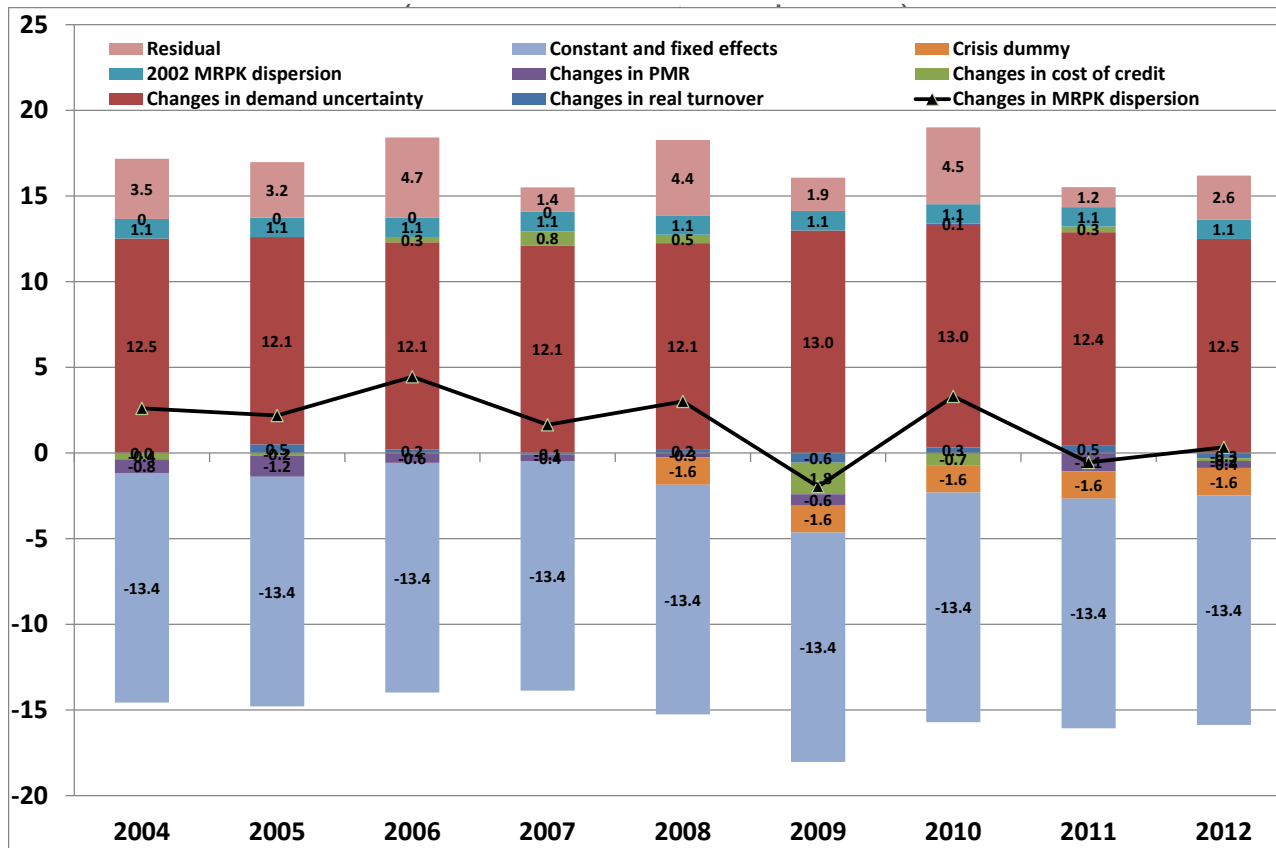
$PMR_{t/t-1,i,j}$: product market regulation sub-index on legal barriers to entry sectorialized with US establishment entry rate - natural" sectorial exposure to entry barriers (Andrews and Cingano, 2012) - *Source: OECD and US Census Bureau Longitudinal database*

$EPL_{t/t-1,i,j}$ sub-index for temporary employment or which measures the strictness of regulation on the use of fixed-term sectorialized with US job entry rate (Andrews and Cingano, 2012) - *Source: OECD and US Census Bureau Longitudinal database*

Baseline results: MRPK dispersion

Dependent variable: Changes in MRPK dispersion	(1)	(2)	(3)
Dispersion in MRPK in 2002 (ln)	-0.090	-0.088	-0.090
	0.06	0.07	0.07
Changes in real turnover (t/t-1)	0.124***	0.127***	0.125***
	0.04	0.04	0.04
Demand uncertainty (t-1)	0.205**	0.211**	0.206**
	0.1	0.1	0.1
Changes in cost of credit (t/t-1)	0.361**	0.346**	0.336**
	0.17	0.16	0.16
Changes in PMR (t/t-1)		0.211**	0.212**
		0.1	0.1
Changes in EPL (t/t-1)			-0.082
			0.08
Crisis dummy	-0.012	-0.016*	-0.015
	0.01	0.01	0.01
Constant	-0.099*	-0.097*	-0.095*
	0.06	0.06	0.05
Adjusted R-squared	0.096	0.107	0.106
N	283	283	283
* p<0.10, ** p<0.05, *** p<0.01			

Contribution of selected covariates to the explanation of changes in MRPK dispersion

Legend:
- Residual
- 2002 MRPK dispersion
- Changes in demand uncertainty
- Constant and fixed effects
- Changes in PMR
- Changes in real turnover
- Crisis dummy
- Changes in cost of credit
- Changes in MRPK dispersion

Source: Authors' calculations based on standard regression analysis.

Baseline results: MRPL dispersion

Dependent variable: Changes in MRPL dispersion					
	(1)	(2)	(3)	(4)	(5)
Dispersion in MRPL in 2002 (ln)	-0.139*	-0.142*	-0.141*	-0.145*	
	0.08	0.08	0.08	0.08	
Changes in cost of credit (t/t-1)	0.061	0.05	0.05	0.011	
	0.11	0.11	0.11	0.11	
Changes in real turnover (t/t-1)	0.099***	0.101***	0.101***	0.095***	0.098***
	0.04	0.04	0.04	0.04	0.04
Demand uncertainty (t-1)	0.062	0.066	0.066	0.06	
	0.06	0.06	0.06	0.06	
Changes in PMR (t/t-1)		0.156**	0.156**	0.189***	0.182**
		0.07	0.07	0.07	0.07
Changes in EPL (t/t-1)			-0.007	0.081	0.071
			0.06	0.07	0.07
Changes in PMR*changes in EPL (t/t-1)				3.256**	3.142**
				1.36	1.34
Crisis dummy	-0.024***	-0.027***	-0.027***	-0.030***	-0.029***
	0.01	0.01	0.01	0.01	0.01
Constant	-0.018	-0.017	-0.016	-0.011	0.037***
	0.04	0.04	0.04	0.04	0.01
Adjusted R-squared	0.116	0.13	0.127	0.135	0.117
N	283	283	283	283	283
* p<0.10, ** p<0.05, *** p<0.01					

Contribution of selected covariates to the explanation of changes in MRPL dispersion
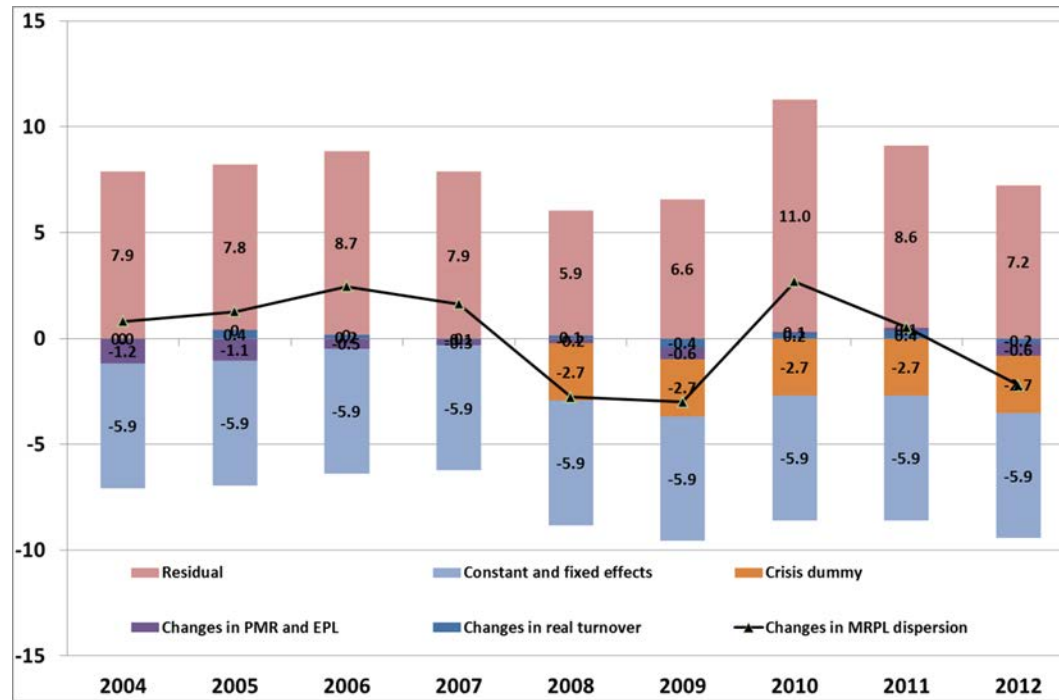
Source: Authors' calculations based on standard regression analysis.

Sign of the covariates (although sometimes SS lost) for:
- **Using alternative proxies:**
    - Year FE at the place of the *crisis* dummy:
        - 2009 associated with a negative coefficient.
        - For the MRPL dispersion specification, also 2008 and 2012 had a cleansing effect
    - *EPL sub-indicator on temporary workers* with the EPL strictness of employment protection considering individual and collective dismissals
    - Changes in median sectorial profit margins rather than *PMR*
    - Lag dispersion rather than *initial 2002 dispersion*
    - PCA on restrictiveness of credit standards rather than *cost of credit*
    - Net percentages of banks' perceptions on the riskiness of borrowing firms' collateral rather demand uncertainty
- **Dropping one country at the time**

- **TFPR, OP-GAP:**
    - TFPR: Misallocation positively correlates with business cycle dynamics, EPL, and PMR.
    - OP gap not SS but signs are in line with the results obtained in the baseline regressions related to changes in labour misallocation.

Overview

a) **Capital misallocation:**
- Increased in most EA countries
- Large increases in **services**
- **Demand uncertainty** largely explained capital misallocation dynamics, but also rises in the cost of credit boosted growth in MRPK dispersion; conversely, the reduction in PMR helped dampen these dynamics

b) **Labour misallocation:** was on the whole broadly stable:
- Increases observed in **manufacturing**
- **PMR and EPL, also jointly,** explain most of the dynamics

Controlling for all other explanatory variables, the crisis had an efficiency-enhancing effect on both capital and labour

THANK YOU FOR YOUR ATTENTION

RESERVE SLIDES

Contributions to manufacturing TFP growth, selected studies
(contribution expressed in percentage shares)

	Baily, Hulten and Campbell (1992)	Aw, Chen and Roberts (1997)*	Foster, Haltiwanger and Krizan (2006)	De Loeker and Konings (2006)	Petrin, White and Reiter (2011)
Reference					
Country	**US**	**Taiwan**	**US**	**Slovenia**	**US**
Years	1972-1987	1981-1991	1977-1987	1995-2000	1977-1996
Within-firm productivity growth	37	63	57	62	45
Reallocation	63	37	44	38	55

*Contributions to median growth rates

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The OP gap and the Petrin and Sivadasan (2013) wedge between input MRP and cost are also used in the literature

- The Olley-Pakes gap is the within-sector covariance between relative firms' size and productivity

$$\Omega_t = \overline{\Omega}_t + \sum_i \Delta s_{it} \Delta \omega_{it}$$

where: $\overline{\Omega}_t$ is the unweighted average sector productivity; s_{it} in firm's size and ω_{it} firm's productivity

- The Petrin-Sivadasan wedge measures the average absolute gap between the marginal productivity and cost of a given input of firms in a sector

- We will consider them as alternative variables in our robustness tests

A significant driver of labour productivity growth is TFP growth

- This result is confirmed also when considering labour productivity growth, and its components, relative to the EA average

Contribution of TFP and capital deepening to changes in labour productivity relative to the EA average
(average annual changes)
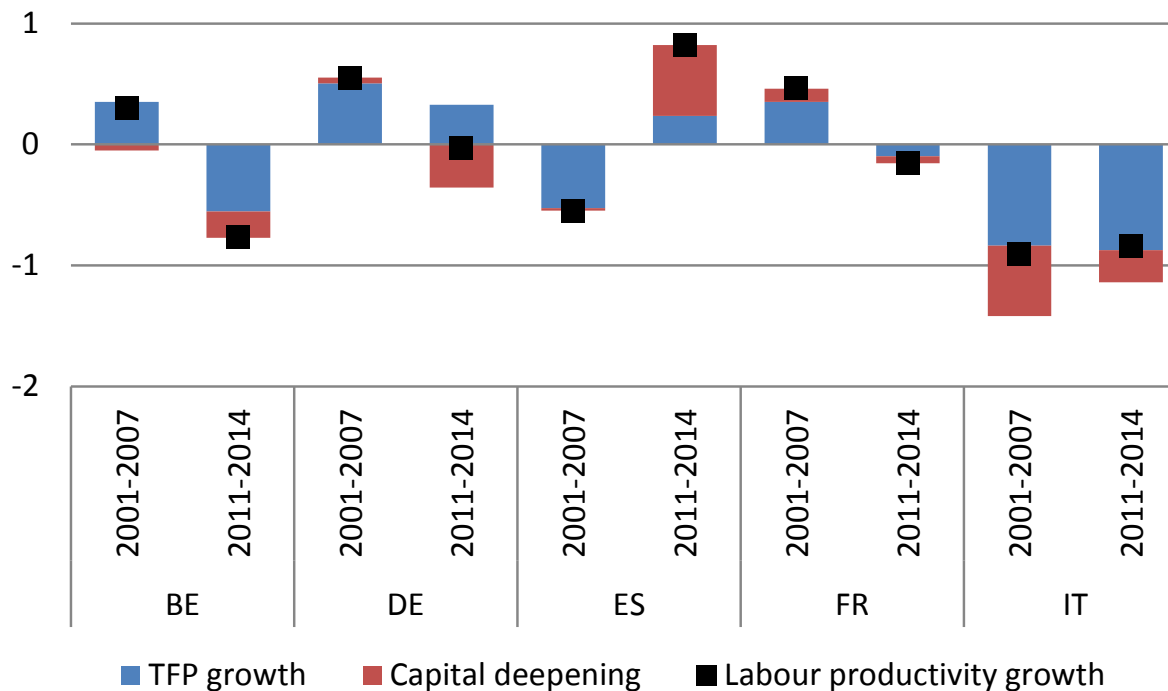
Source: Bergeaud, Cette and Lecat (2014)

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- $$\Delta TFP_{(t,t-1)} = \sum_s \Delta TFP_{s,(t,t-1)}\theta_{st} + \sum_s (TFP_{st-1} - TFP_{t-1})\Delta\theta_{s,(t,t-1)} + \sum_s \Delta TFP_{s,(t,t-1)}\Delta\theta_{s,(t,t-1)}$$

Aggregate TFP growth

Intra-sectorial TFP growth

Inter-sectorial TFP growth

Residual

back

- The TFP gains from efficient input allocation in selected EA countries are comparable to those in the US but lower than those estimated for emerging economies
- China is the only country recording a decline in the TFP gains to be reaped

Potential TFP gains from reallocation
(percentage values)

Sources: Hsieh and Klenow (2009); Calligaris (2015); Dias et al (2013); Garcia-Santana et al (2015
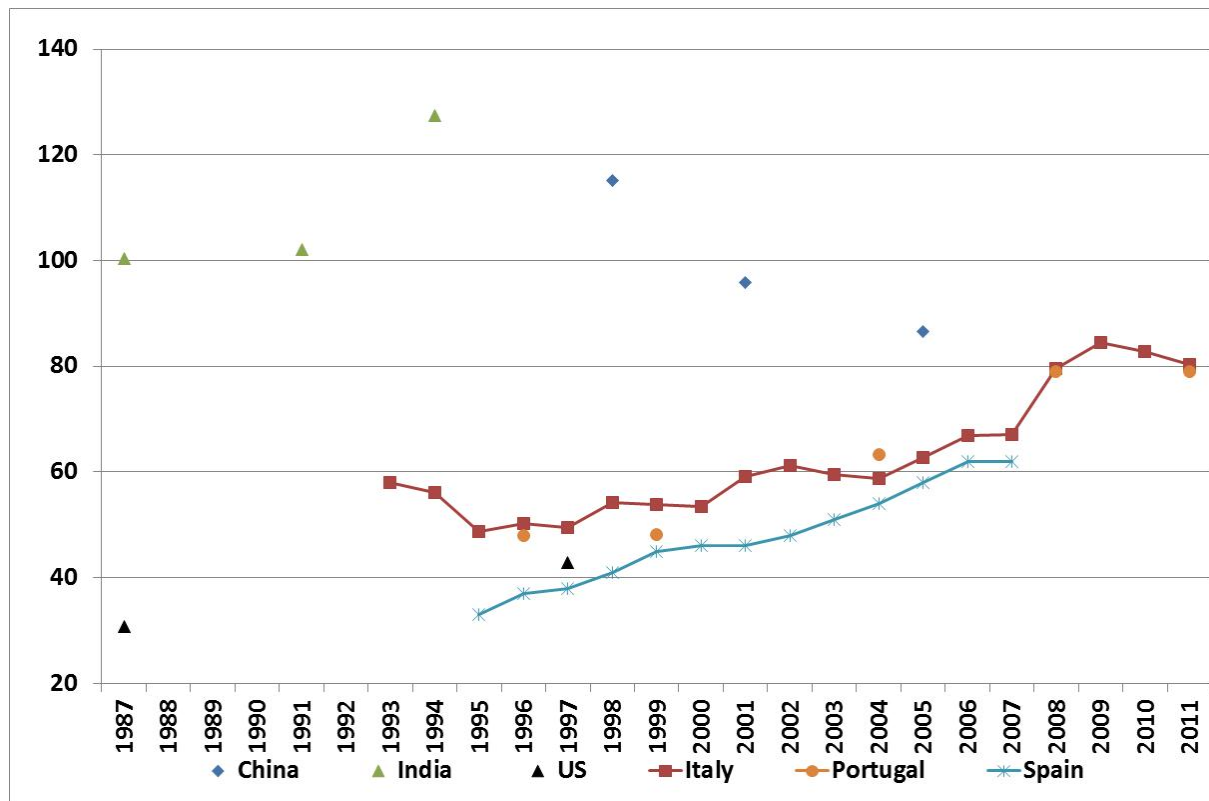
Sector-specific growth depends on allocative efficiency and within-firm growth

- The relative size of the within-firm effect and allocative efficiency contributions is dependent on the country, sector, time-span and decomposition method considered
- The contribution of allocative efficiency is anyhow not negligible

Contributions to TFP growth in 2006-2010
(percentage values)
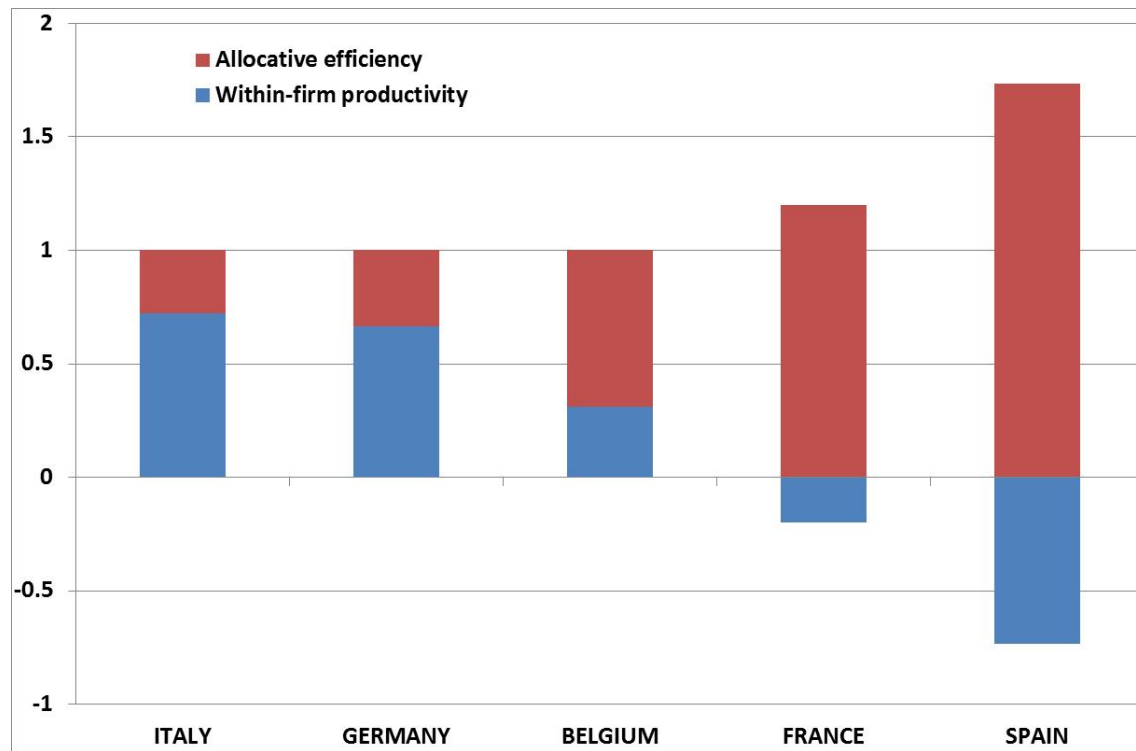
Source: Authors' calculations on CompNet data
Note: The decomposition is based on Foster, Haltiwanger and Krizan (2000). The across-firm contribution includes the between effect and the covariance term. It is not possible to disentangle the entry-exit effect. Data refer to firms with more than 20 employees.

According to a Cobb-Douglas production function, MRPK can be expressed as:

$$\frac{\delta Y}{\delta K} \propto \frac{Y}{K}$$

Where $\propto$ is the elasticity of output to capital and Y/K is the average capital productivity

The elasticities are not observable but can be estimated:

- We estimate a production function, pooling all firms in a given country-sector in 2002-2012
- Given that unobserved TFP (for the econometrician) and input choices can be correlated, we adopt a semi-parametric approach which uses instrumental variables to reduce the simultaneity bias

Average capital productivity is then computed for each firm and then multiplied by the corresponding country/sector elasticity

back
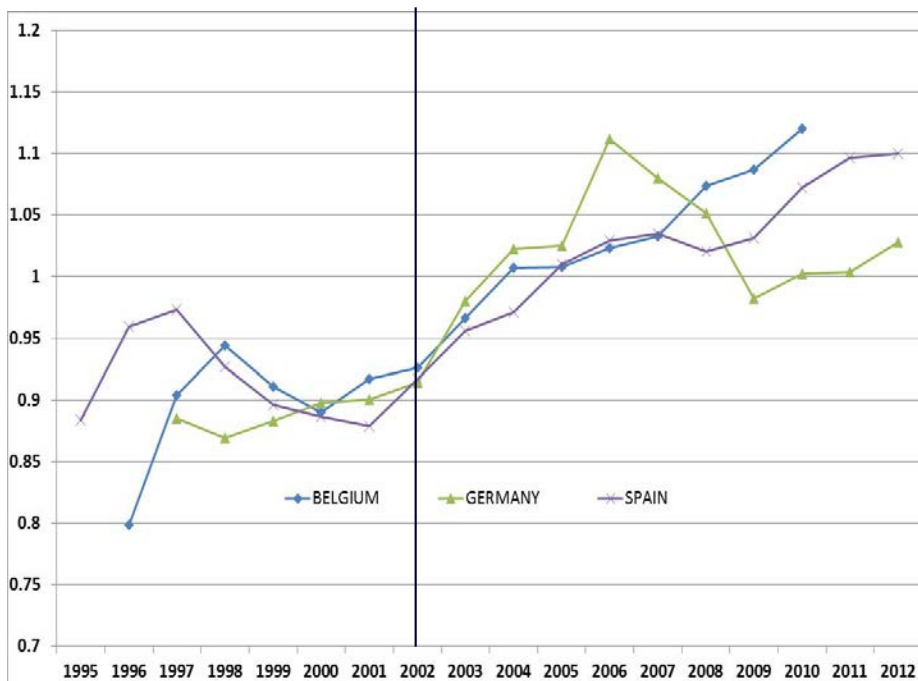
Dispersion in MRPK

Dispersion in MRPL
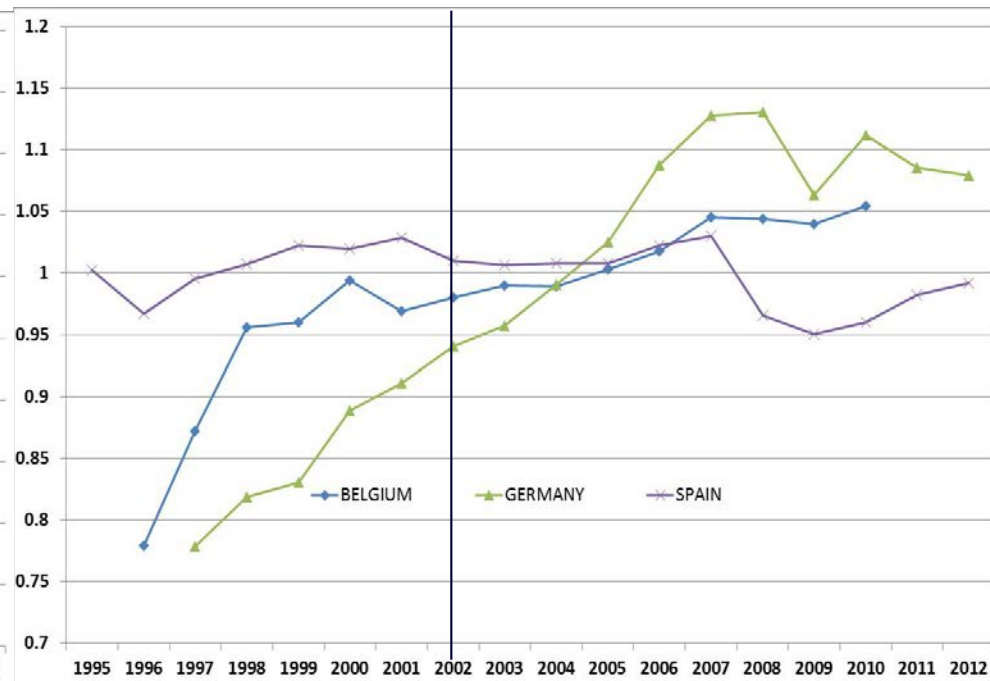
Source: Authors' calculations based on CompNet data on the sample of firms with more than 1 employee, not available, prior to 2002, for Italy and not at all available for France.

Note: Weighted averages across sectors, where the weights are time-varying sectorial value added shares within a country.

back

Services depend more on external finance and are more exposed to PMR

External Financial Dependence
(Average 2002-2007)
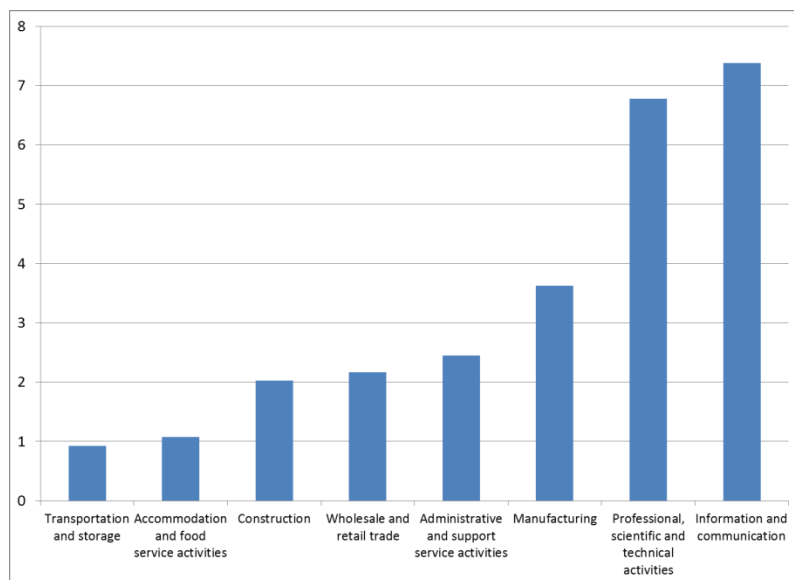
Establishment entry rate
(Average 2002-2007)
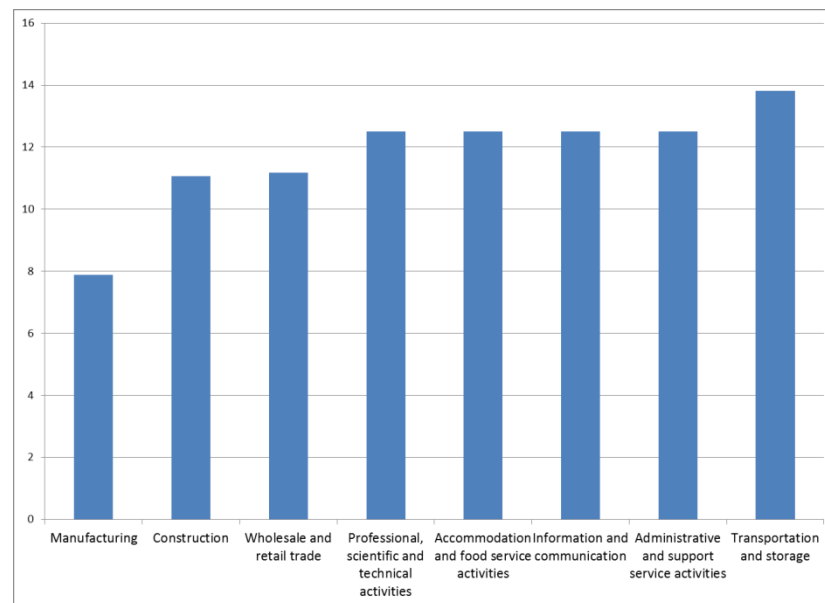
Source: Authors' calculations based on S&P IQ Capital data and the U.S. Census Bureau's Longitudinal Business Database

Note: The external financial dependence indicator is built in the spirit of Rajan and Zingales (1998). It is defined as the median of the share of capital expenses not financed by the cash-flow from operations of US large listed firms.

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Yearly growth in input misallocation versus initial level of dispersion

Source: Authors' calculations based on CompNet data

We cannot present this as a fourth sylized fact anymore, since initial level is not significant in the regressions for labour but rather as descriptive evidence in need of empirical testing (which is what we do next) – see our paper
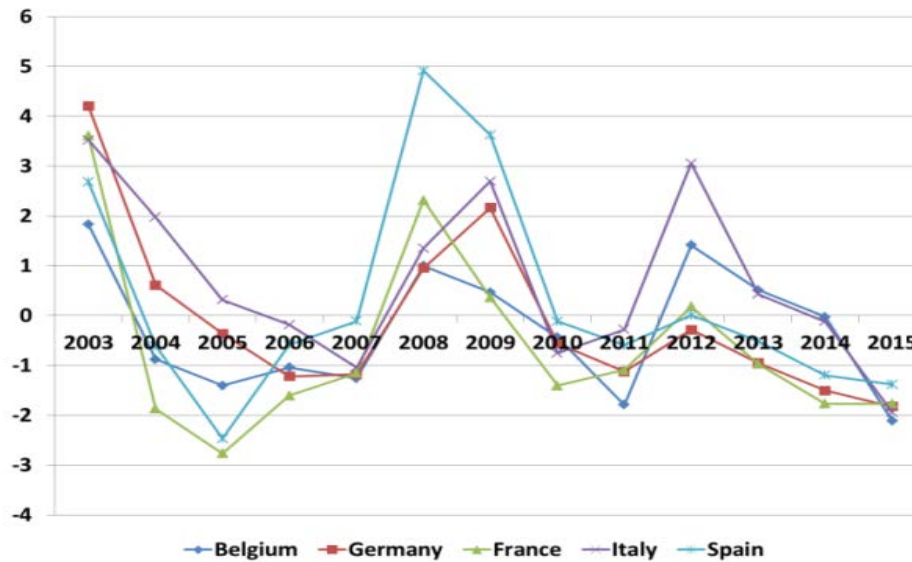
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Evolution of the average interest rate on bank loans to firms by country
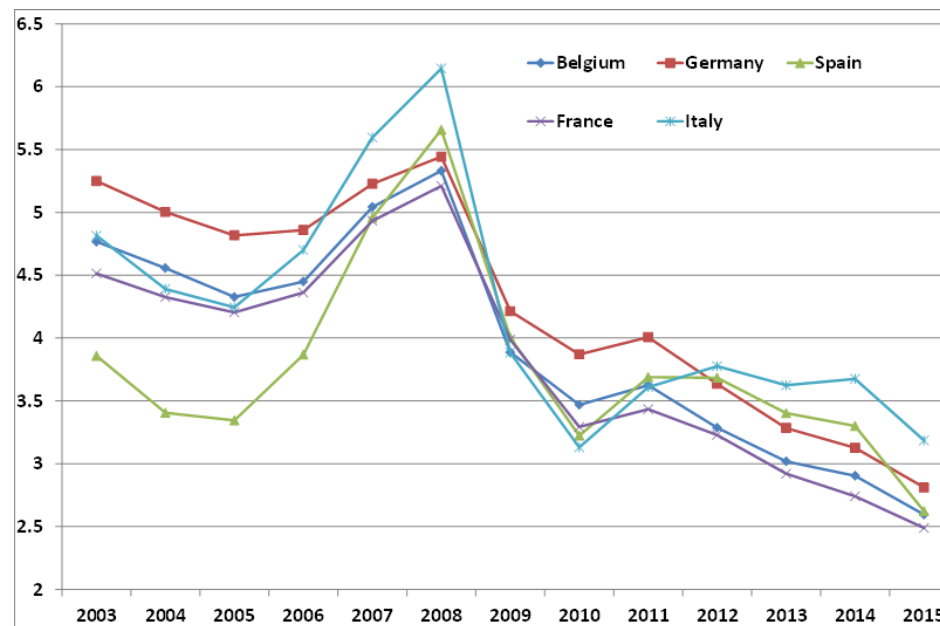
Source: Authors' calculations based on ECB, sourced from the European Central Bank.

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Evolution of credit standards
(principal component of standards related to loan size, non-interest costs,
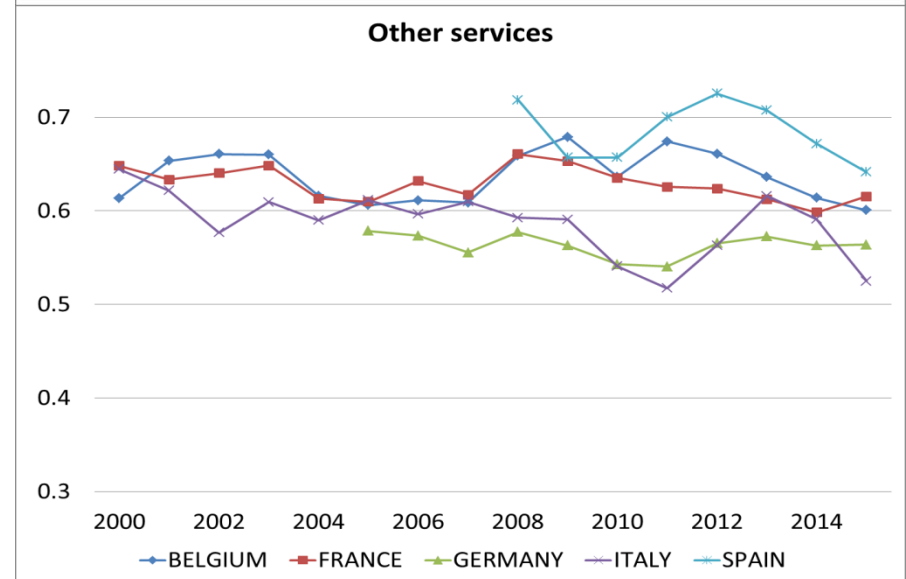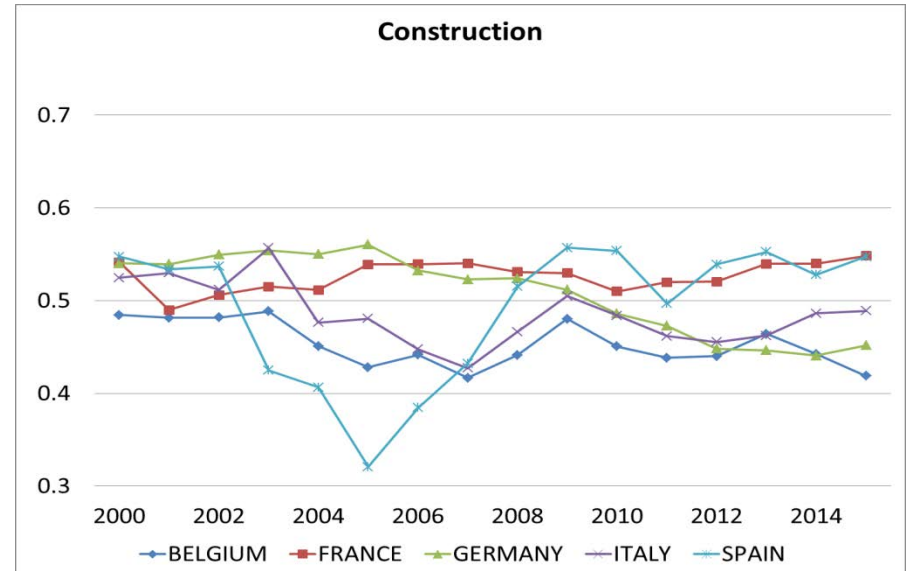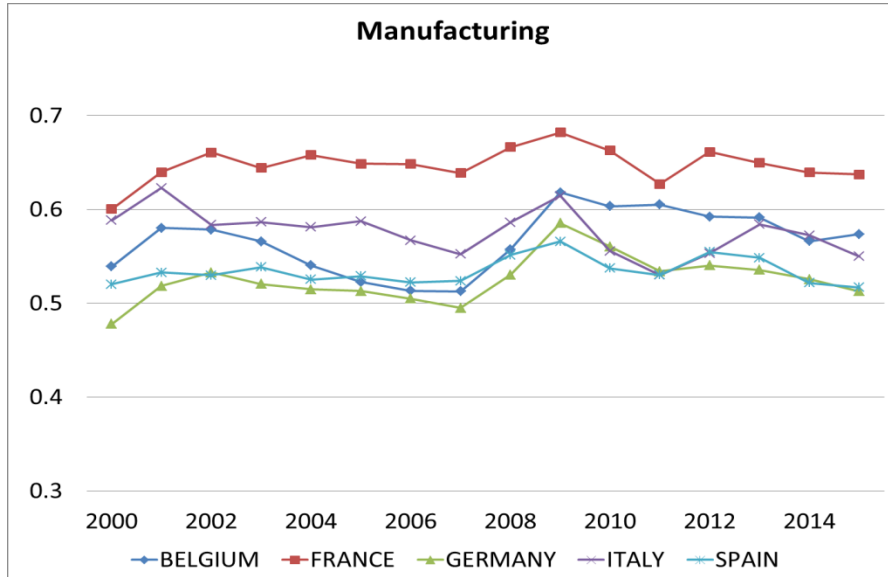collateral and maturity requirements)

Source: Authors' calculations based on ECB Bank Lending Survey data.
Notes: The survey question considered is the following: "Over the past three months, how have your bank's terms and conditions for new loans or credit lines to enterprises changed (in terms of loan size, etc.)?
The replies are aggregated in a **net percentage**, which is defined as the difference between the sum of banks responding "tightened considerably" and "tightened somewhat", and the sum of banks responding "eased somewhat" and "eased considerably". The **diffusion index** is defined as the net percentage weighted according to the intensity of the response, giving lenders who have answered "considerably" a weight twice as high (score of 1) as lenders having answered "somewhat" (score of 0.5). The mean is calculated by attributing the values 1 to 5 to the first possible answer and consequently for the others. A rise in the diffusion index plotted indicates a tightening of the standards related to loan size.

Demand uncertainty by sector

Source: Authors' calculations based on European Commission Business Survey. See next slide for details.
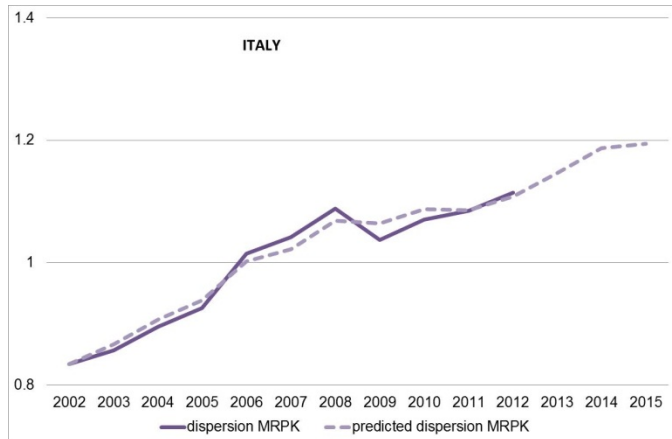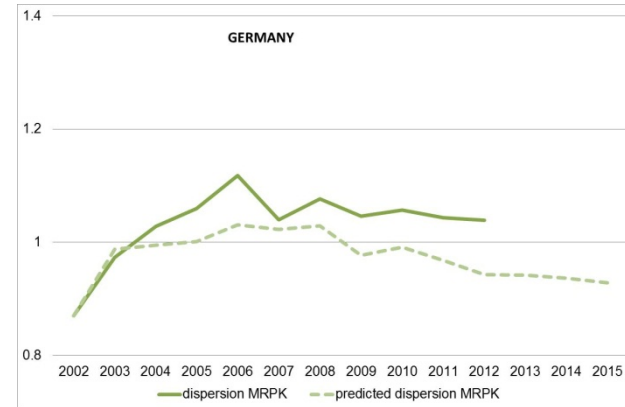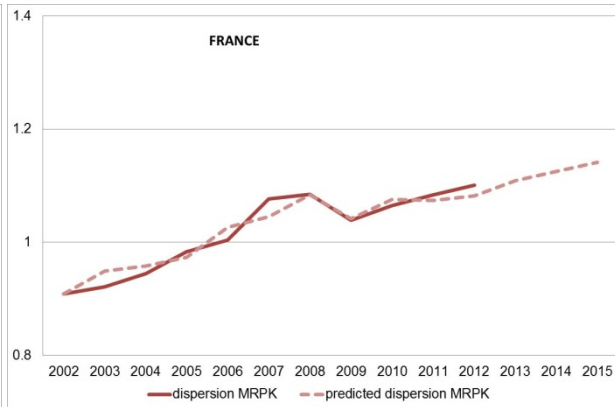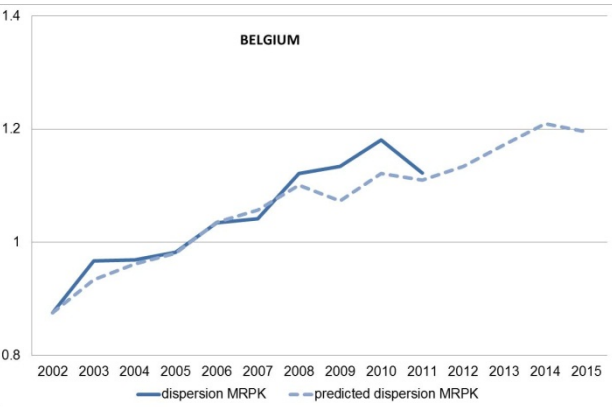
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- Demand uncertainty is measures by a **dispersion statistic** across firms interviewed in the monthly **European Commission Business Survey**: $\sqrt{frac_t^+ + frac_t^- - (frac_t^+ - frac_t^-)^2}$ where $frac_t^+$ and $frac_t^-$ are the shares of firms with "increase" and "decrease" responses at time t to the following questions:

- **Manufacturing**: "production expectations for the months ahead"
- **Construction**: "employment expectations over the next 3 months"
- **Retail trade**: "orders expectations over the next 3 months"
- **Other services**: "expectations of the demand over the next 3 months"

- Demand uncertainty is **minimum** when all firms have the same demand expectations

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Dependent variable: Change in dispersion in MRPK

	1	2	3
Demand uncertainty (t-1)	0.152*	0.158*	0.145
	(-0.09)	(-0.09)	(-0.09)
Dispersion in MRPK in 2002 (ln)	-0.130**	-0.129**	-0.131**
	(-0.06)	(-0.06)	(-0.06)
Change in credit standards (loan size, t/t-1)	0.040***	0.036**	0.037**
	(-0.02)	(-0.01)	(-0.02)
Change in PMR (t/t-1)		0.221**	0.246**
		(-0.1)	(-0.1)
Change in EPL (t/t-1)			0.880*
			(-0.46)
Change in PMR (t/t/-1) * Change in EPL (t/t-1)			21.042*
			(-12.49)
Crisis	-0.030***	-0.032***	-0.033***
	(-0.01)	(-0.01)	(-0.01)
Constant	-0.071	-0.068	-0.062
	(-0.05)	(-0.05)	(-0.05)
Country dummies	YES	YES	YES
Sector dummies	YES	YES	YES
Observations	318	318	318
R-squared	0.145	0.157	0.166

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
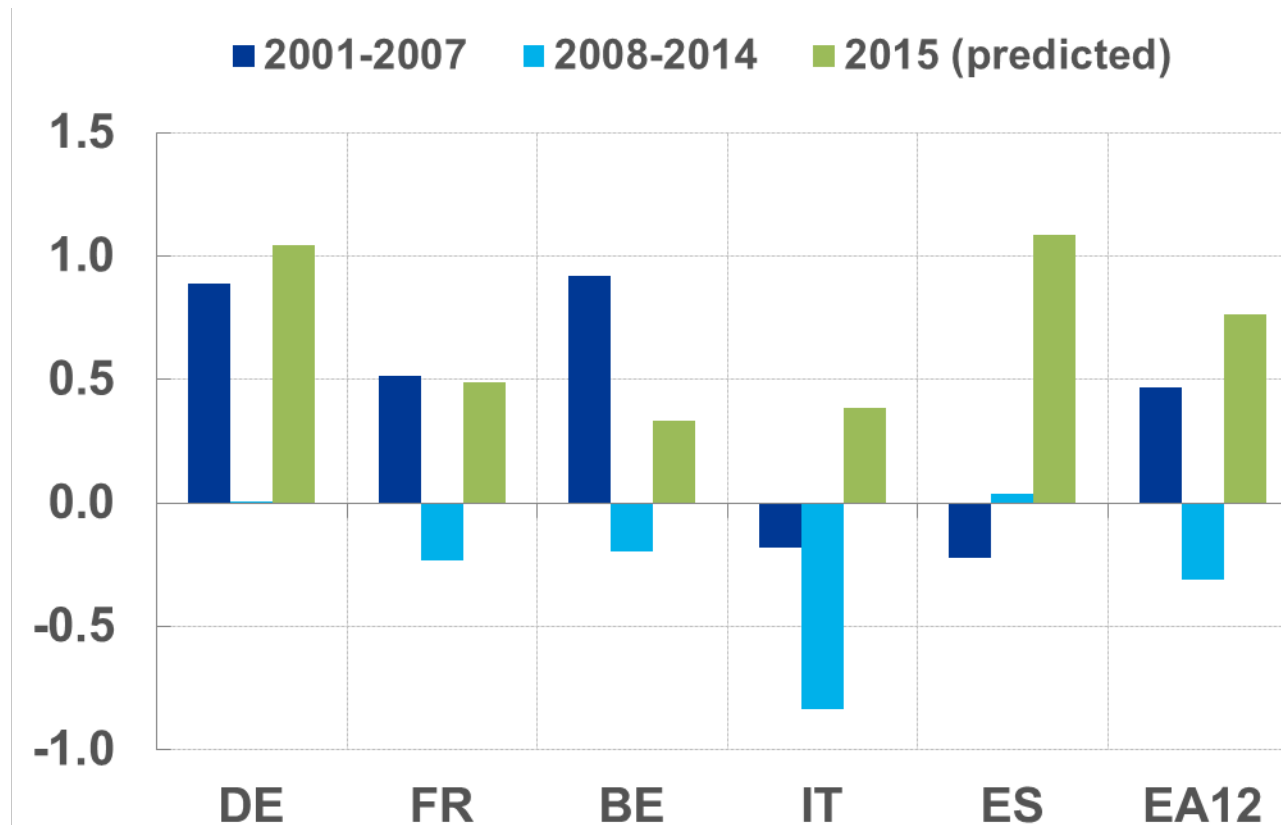
Source: Authors' calculations based on regression analysis
Note: Unweighted averages across sectors. Demand uncertainty for 2015 is computed as the average of January 2015-November 2015 estimates.

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TFP growth
(percentage changes)

Source: European Commission

- Relative to K misallocation L misallocation is expected to have remained flat in 2013-2015, in particular in Italy
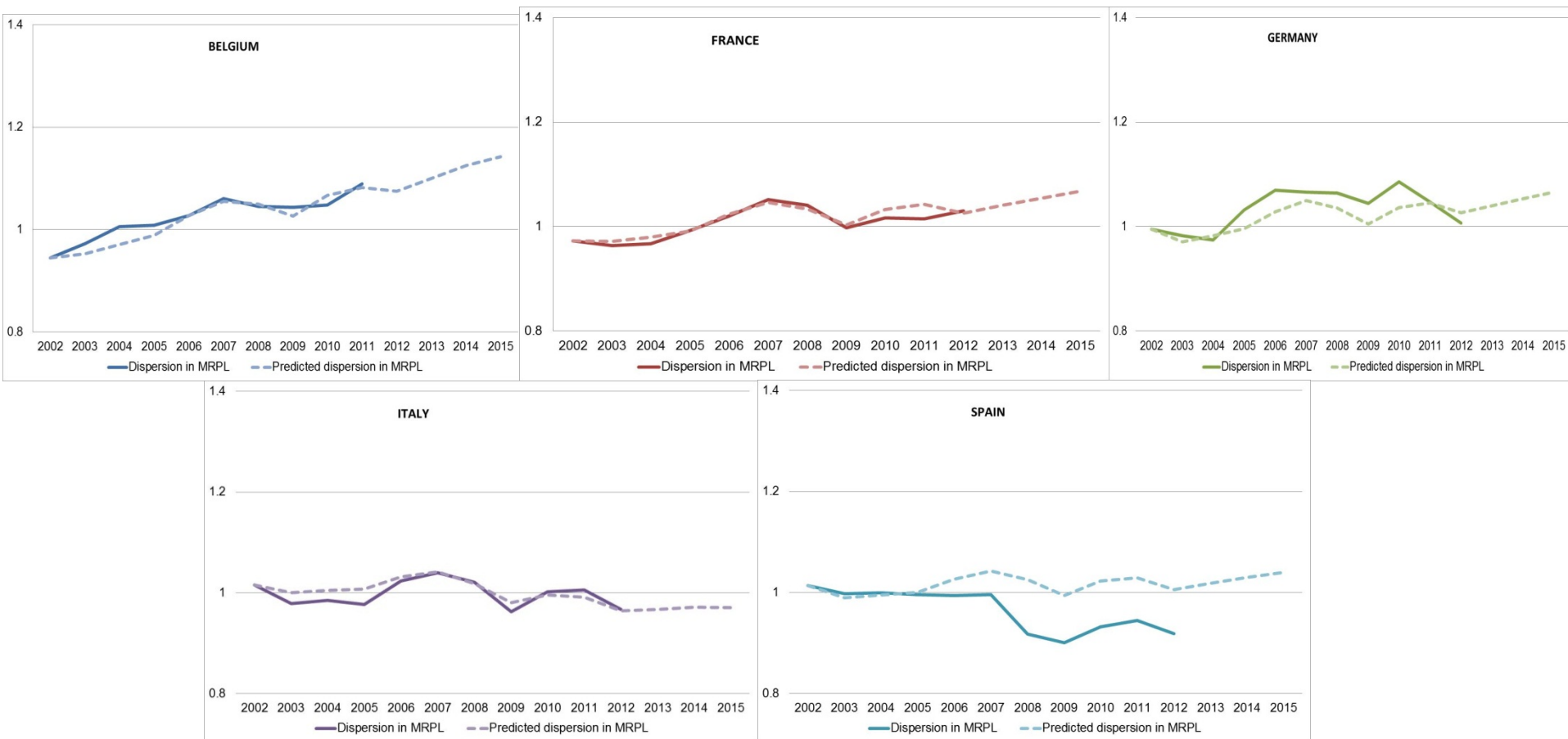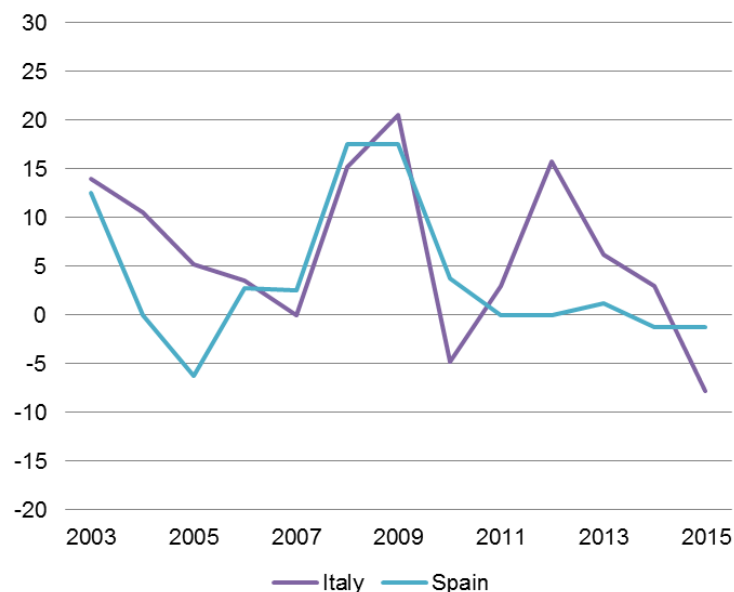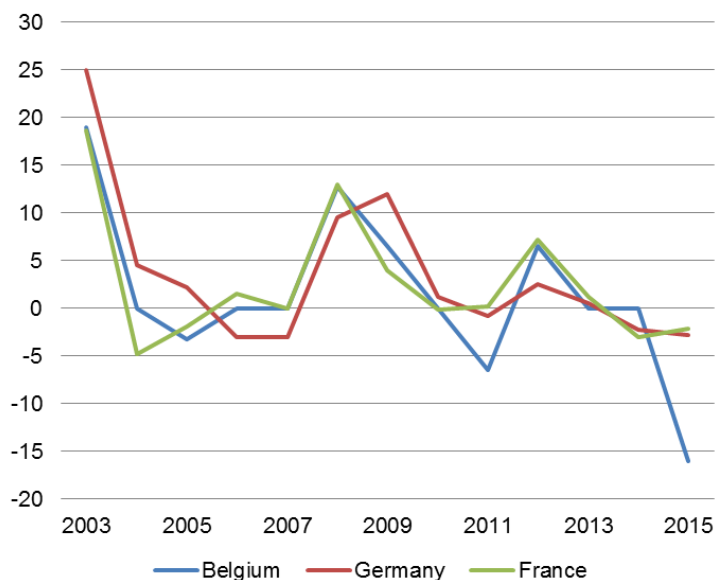

Source: Authors' calculations based on regression analysis

Note: Unweighted averages across sectors. Demand uncertainty for 2015 is computed as the average of January 2015-November 2015 estimates.

Evolution of loan size standards
(diffusion index)

Source: Authors' calculations based on Bank Lending Survey data.

Notes: The survey question considered is the following: "Over the past three months, how have your bank's terms and conditions for new loans or credit lines to enterprises changed (in terms of loan size)?

The replies are aggregated in a **net percentage**, which is defined as the difference between the sum of banks responding "tightened considerably" and "tightened somewhat", and the sum of banks responding "eased somewhat" and "eased considerably". The **diffusion index** is defined as the net percentage weighted according to the intensity of the response, giving lenders who have answered "considerably" a weight twice as high (score of 1) as lenders having answered "somewhat" (score of 0.5). The mean is calculated by attributing the values 1 to 5 to the first possible answer and consequently for the others.

A rise in the diffusion index plotted indicates a tightening of the standards related to loan size.

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