Some thoughts on productivity and Greece

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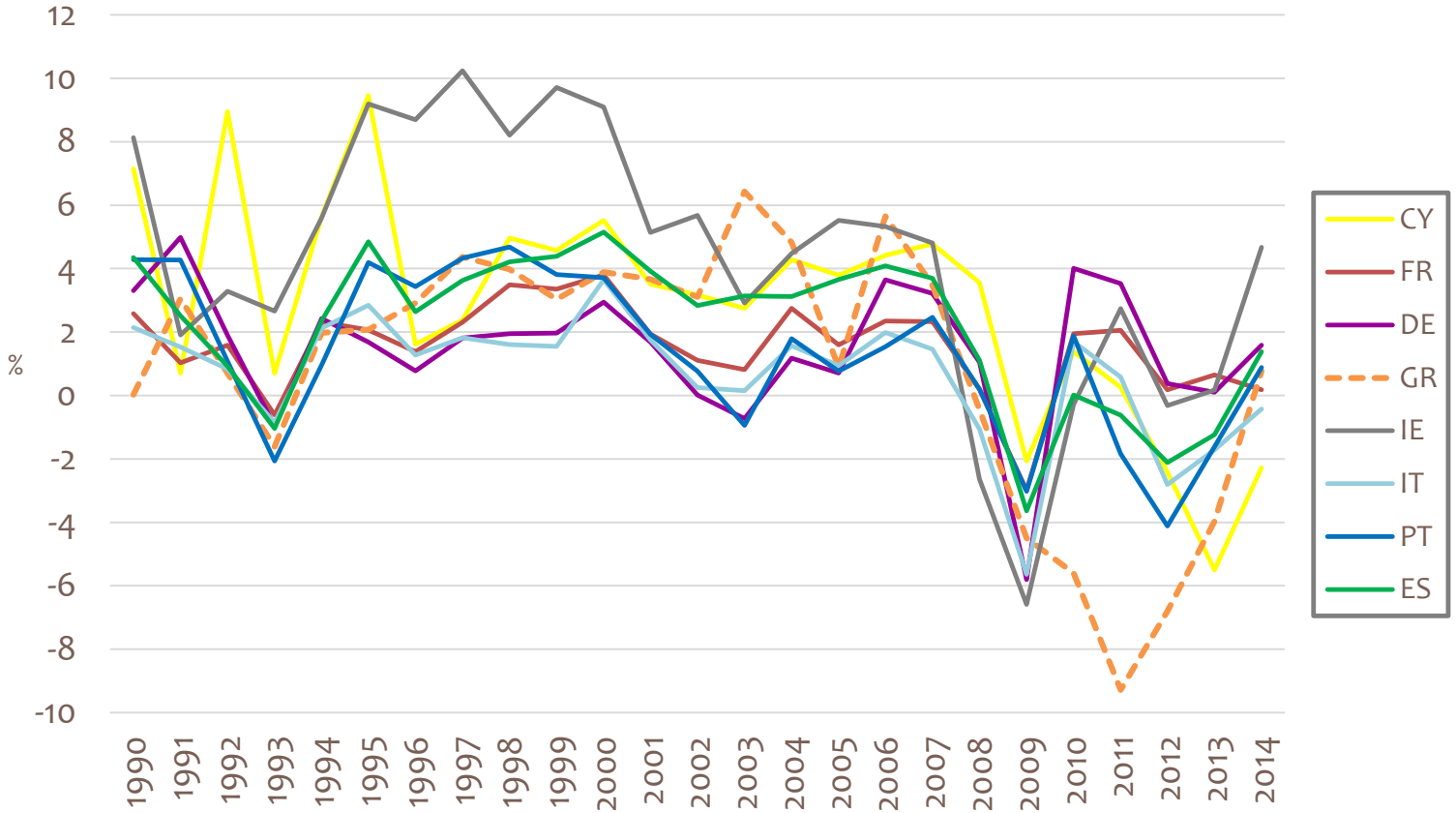
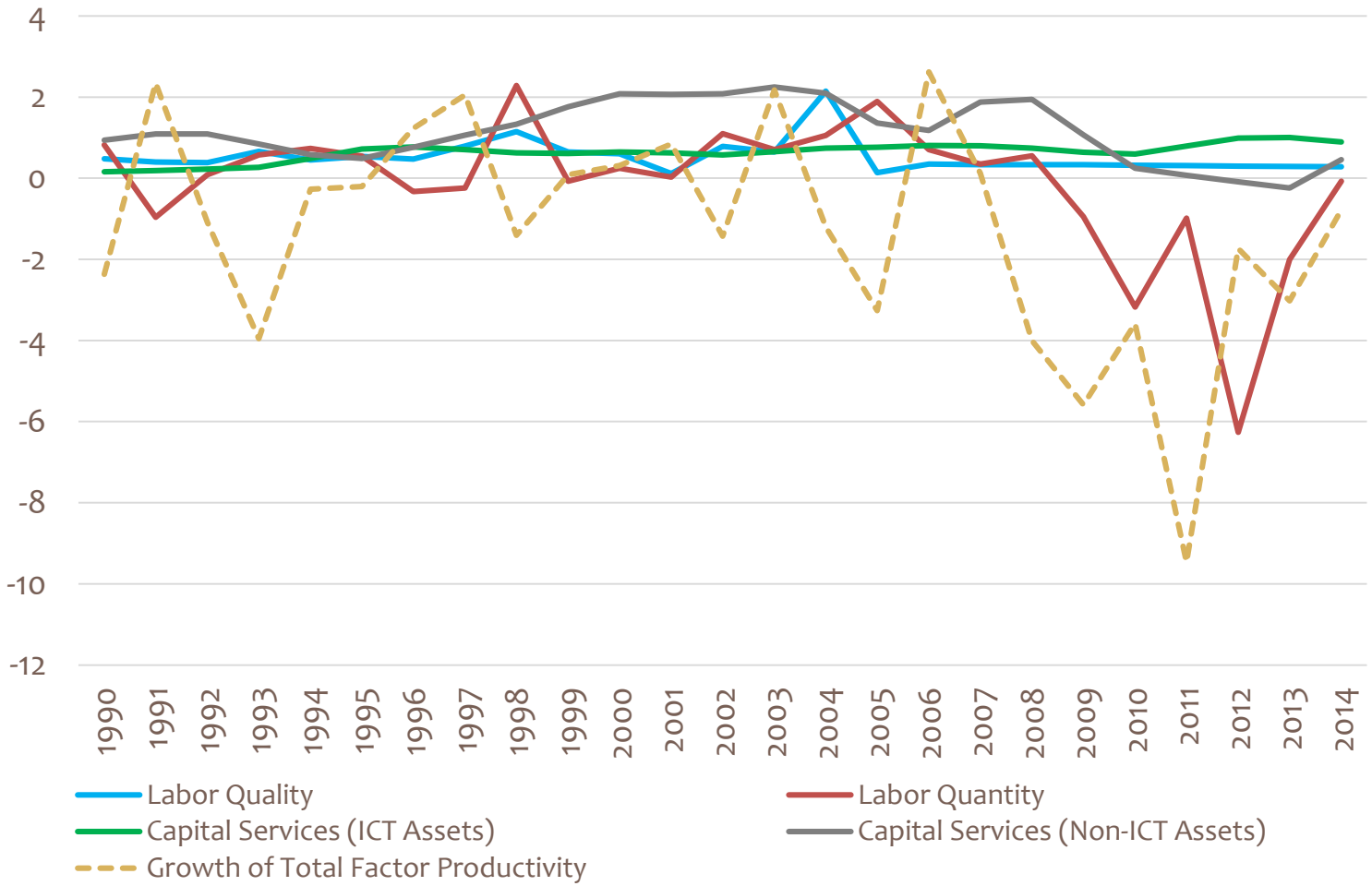
GDP change



Country	Avg. Growth Rate 1994-2007	Country	Avg. Growth Rate 1994-2007
Germany	1.7%	France	2.3%
Ireland	7.4%	Italy	1.7%
Greece	**3.6%**	Cyprus	4.5%
Spain	3.6%	Portugal	2.3%

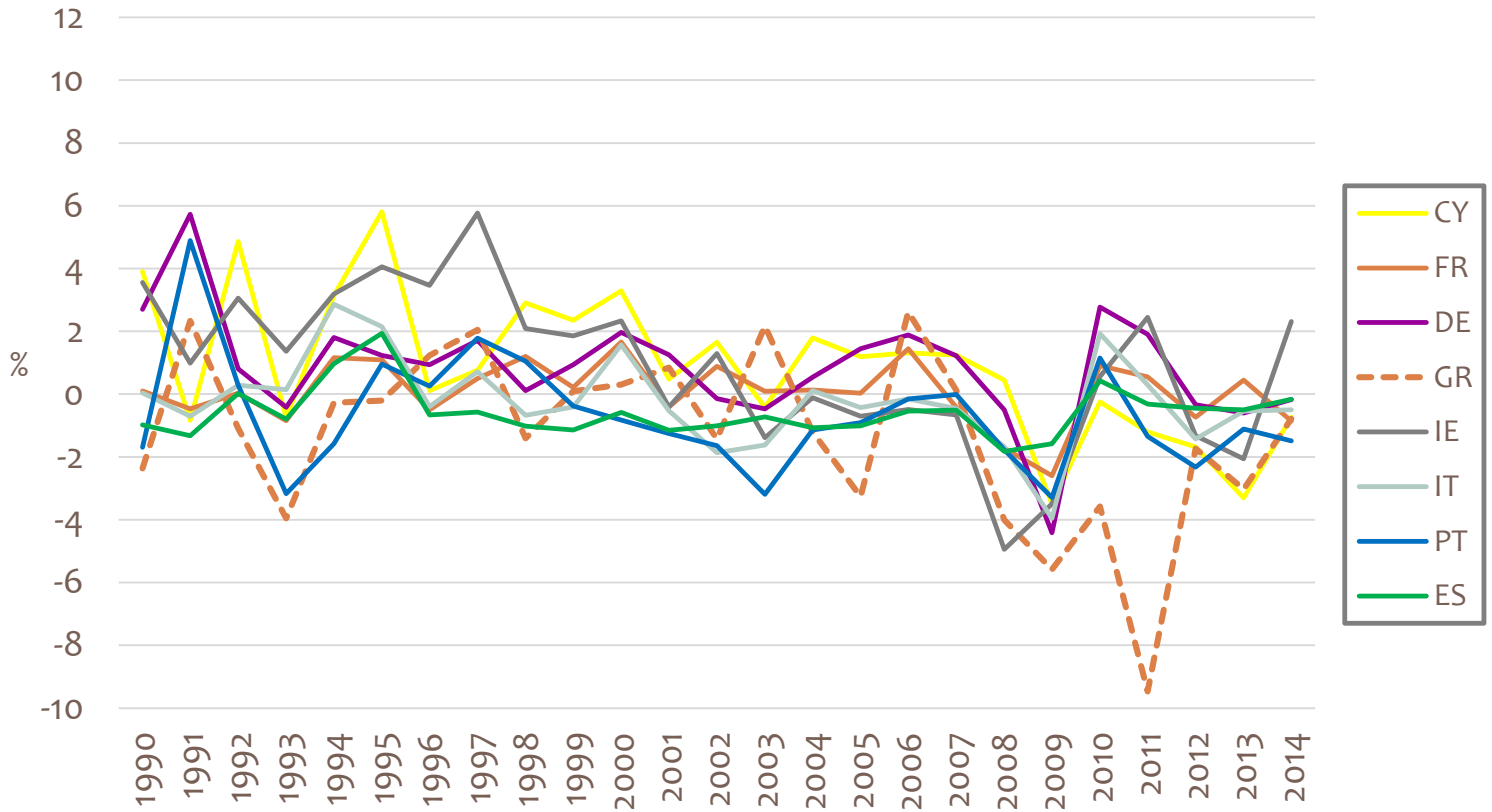
Sources: The Conference Board Growth and Total Factor Productivity database, AMECO database

Determinants of GDP change in Greece



Source: The Conference Board Growth and Total Factor Productivity database

Contribution of Total Factor Productivity to GDP change



Country	Share of TFP to change 1994-2007*	Country	Share of TFP to change 1994-2007*
Cyprus	0.4	Ireland	0.1
France	0.2	Italy	-1.2
Germany	0.7	Portugal	-0.2
Greece	**-0.2**	Spain	-0.1

Source: The Conference Board Growth and Total Factor Productivity database
* TFP contribution to GDP change / GDP change

Analysis of Growth and TFP in Greece, IOBE, 2008

- Sector and country analysis for a period of 35 years (1970 – 2004)
- Cobb – Douglas production function, with a translog multilateral functional form, bottom – up estimation approach
- Three factors of production: labor, capital and intermediate inputs
- Output oriented technical efficiency (inclusion of an asymmetric disturbance term, following a semi-defined distribution)
- No calculations of capacity utilisation and allocative efficiency, due to lack of data about the prices of inputs in some of the sectors
- Maximum likelihood estimation method

Decomposition of Output Growth

- TFP was the **main determinant of product growth** (gross value added) in the overall period. However:
  - This was the result of TFP's dominant role in the 1970s and of its significant contribution to growth during the 1980s
  - The TFP became negative since the 1990s and was not boosted by the widespread use of information technologies, as was the case in more advanced countries (e.g. the U.S.)
- **Significance of factors of production:**
  - Intermediate inputs' growth was of high importance during all the sub-periods
  - Fixed capital's contribution was dominant for growth during the 1990s and in the beginning of the 2000s
  - Labor exhibited the smallest significance for output increase

Determinants of Gross Value Added changes (1970-2004)

Sector	%ΔY*	%ΔM	%ΔC	%ΔL	TFP	Residual
Agriculture and Fishing	0.52	0.49	0.37	-0.20	-0.16	0.01
Mining and Quarrying	3.14	0.32	0.64	-0.12	2.90	-0.59
Food products and Beverages	2.31	0.54	0.38	0.01	1.51	-0.13
Textiles and textile products	0.35	0.06	0.25	-0.26	1.19	-0.88
Leather and Leather products	-0.77	-0.75	0.58	-0.35	1.58	-1.83
Wood and Wood products	0.04	-0.13	0.66	-0.16	0.93	-1.26
Paper products; Publishing; Printing	1.33	0.19	1.28	0.12	1.55	-1.80
Coke; Refined Petroleum products	2.10	0.25	0.39	0.30	2.81	-1.64
Chemical and Chemical products	4.15	1.05	0.63	0.03	2.25	0.18
Rubber and Plastic products	3.17	0.82	1.07	0.06	2.78	-1.57
Other Non-Metallic products	3.40	0.85	0.75	-0.07	1.78	0.09
Basic metals and Fabricated Metals	3.94	1.21	0.64	0.04	1.68	0.36
Machinery and Equipment n.e.c.	4.00	0.75	1.01	0.08	3.08	-0.92
Electrical and Optical Equipment	2.33	0.61	0.60	-0.10	2.22	-1.00
Transport Equipment	2.91	0.56	0.64	0.13	2.24	-0.66
Manufacturing n.e.c.	3.12	0.48	1.27	-0.02	3.41	-2.03
Electricity, Gas and Water supply	3.30	0.50	1.31	0.21	2.25	-0.97
Construction	3.15	2.43	0.50	0.25	-0.34	0.32
Transport; Storage; Communication	4.25	2.50	1.17	0.14	0.30	0.14
Wholesale and Retail Trade	3.57	3.03	0.01	0.47	-0.35	0.40
Financial Intermediation; Real Estate	3.80	2.06	1.19	0.71	-0.76	0.61
Public Administration, Defence	4.11	3.09	1.48	0.18	-0.44	-0.20
Health; Social Work; Education	4.40	1.43	2.53	0.27	-0.31	0.48
Hotels - Restaurants; Other services	5.15	3.87	1.36	0.87	-1.11	0.16
Average (non-weighted)	**2.82**	**1.09**	**0.86**	**0.11**	**1.29**	**-0.53**

Source: IOBE
*Y = Gross Value Added, M = Intermediate Inputs, C = Capital, L = Labour

Decomposition of Total Factor Productivity

Sector TFP trends

- Increasing TFP during the overall period only in Industry (Mining and Quarrying, Manufacturing sectors, Electricity – Gas – Water supply)
- TFP decline in the Primary sector, in Construction and in all the Services sectors excluding Transports, due to falling TFP trends during the 1990s and in 2000 – 2004

Total Factor Productivity determinants

- Not statistically significant role of public capital; TFP was determined by technological progress, technical efficiency and returns to scale
- High and stable positive contribution of technological progress
- Continuously falling technical efficiency during the examined period, with a negative and increasing impact on TFP
- Positive effect of returns to scale only during the 1970s. Their negative impact afterwards did not exceed that of technical inefficiency.

Sector contribution to Total Factor Productivity (%)*

Sector	1970-80	1980-90	1990-00	2000-04	1970-04
Agriculture and Fishing	0.02	0.06	-0.07	-0.13	-0.01
Mining and Quarrying	0.04	0.04	0.03	0.02	0.04
Food products and Beverages	0.13	0.13	0.13	0.06	0.12
Textiles and textile products	0.06	0.08	0.05	0.02	0.06
Leather and Leather products	0.04	0.01	-0.01	0.00	0.01
Wood and Wood products	0.02	0.00	0.00	0.00	0.01
Paper products; Publishing; Printing	0.05	0.01	0.02	0.00	0.02
Coke; Refined Petroleum products	0.11	0.13	0.04	0.13	0.10
Chemical and Chemical products	0.09	0.06	0.03	0.03	0.06
Rubber and Plastic products	0.06	0.02	0.01	0.01	0.03
Other Non-Metallic products	0.06	0.03	0.02	0.02	0.04
Basic metals and Fabricated Metals	0.10	0.09	0.04	0.03	0.07
Machinery and Equipment n.e.c.	0.03	0.01	0.02	0.00	0.02
Electrical and Optical Equipment	0.07	0.03	0.02	0.01	0.03
Transport Equipment	0.06	0.03	-0.01	0.03	0.03
Manufacturing n.e.c.	0.03	0.01	0.01	0.01	0.01
Electricity, Gas and Water supply	0.05	0.08	0.09	0.07	0.07
Construction	0.12	0.15	-0.28	-0.48	-0.06
Transport; Storage; Communication	0.06	0.19	-0.04	-0.35	0.02
Wholesale and Retail Trade	0.12	0.02	-0.25	-0.38	-0.08
Financial Intermediation; Real Estate	-0.17	-0.24	0.00	-0.42	-0.17
Public Administration, Defence	0.10	0.02	-0.32	-0.05	-0.06
Health; Social Work; Education	0.12	-0.12	-0.05	-0.30	-0.05
Hotels - Restaurants; Other services	0.05	-0.12	-0.31	-0.55	-0.18
Average (weighted)	1.430	0.693	-0.818	-2.229	0.122

Source: IOBE
* Sector weighting with Domar weights

Contribution of TFP components (1970 – 2004)

Sector	Technological Progress	Technical Efficiency	Returns to scale	Total Factor Productivity
Agriculture and Fishing	2.29	-1.91	-0.54	-0.16
Mining and Quarrying	2.75	-0.06	0.21	2.90
Food products and Beverages	2.56	-1.02	-0.01	1.51
Textiles and textile products	2.53	-1.33	-0.01	1.19
Leather and Leather products	2.38	-0.47	-0.33	1.58
Wood and Wood products	2.62	-1.92	0.23	0.93
Paper products; Publishing; Printing	2.53	-1.55	0.57	1.55
Coke; Refined Petroleum products	2.91	-0.41	0.31	2.81
Chemical and Chemical products	2.65	-0.83	0.43	2.25
Rubber and Plastic products	2.57	-1.03	1.24	2.78
Other Non-Metallic products	2.67	-1.28	0.39	1.78
Basic metals and Fabricated Metals	2.66	-1.01	0.03	1.68
Machinery and Equipment n.e.c.	2.46	-0.99	1.61	3.08
Electrical and Optical Equipment	2.60	-0.97	0.59	2.22
Transport Equipment	2.46	-1.03	0.81	2.24
Manufacturing n.e.c.	2.41	-0.60	1.60	3.41
Electricity, Gas and Water supply	2.94	-0.10	-0.59	2.25
Construction	2.82	-0.91	-2.25	-0.34
Transport; Storage; Communication	2.69	-0.38	-2.01	0.30
Wholesale and Retail Trade	2.37	-1.52	-1.20	-0.35
Financial Intermediation; Real Estate	2.63	-1.54	-1.85	-0.76
Public Administration, Defence	2.26	-2.31	-0.39	-0.44
Health; Social Work; Education	2.37	-1.58	-1.10	-0.31
Hotels - Restaurants; Other services	2.69	-0.87	-2.93	-1.11
Average (non-weighted)	**2.58**	**-1.07**	**-0.22**	**1.29**

Source: IOBE

Determinants of Labor Productivity

- Increasing labor productivity throughout the examined period (+ 2.2%), though with fluctuations in the rate of growth
- Fastest increase in the 1970s (+2.7%), slowest during 2000-2004 (+1.4%)

Labor Productivity determinants

- Labor productivity growth mainly due to TFP increase
- Similar positive effects from the changes in capital per person employed and intermediate inputs per person employed

Characteristics of new businesses in Greece

Study for the Bank of Greece, completed in 2015

Survival of new businesses before and after the onset of the economic crisis (up to 2012)

- Factors affecting the survival and exit of new businesses (financial, size, etc.)
- Sectors with high concentration of new surviving businesses
- Regions attracting most of new surviving businesses
- Strategies followed by new businesses that managed to survive during the crisis (e.g. export orientation, innovation)

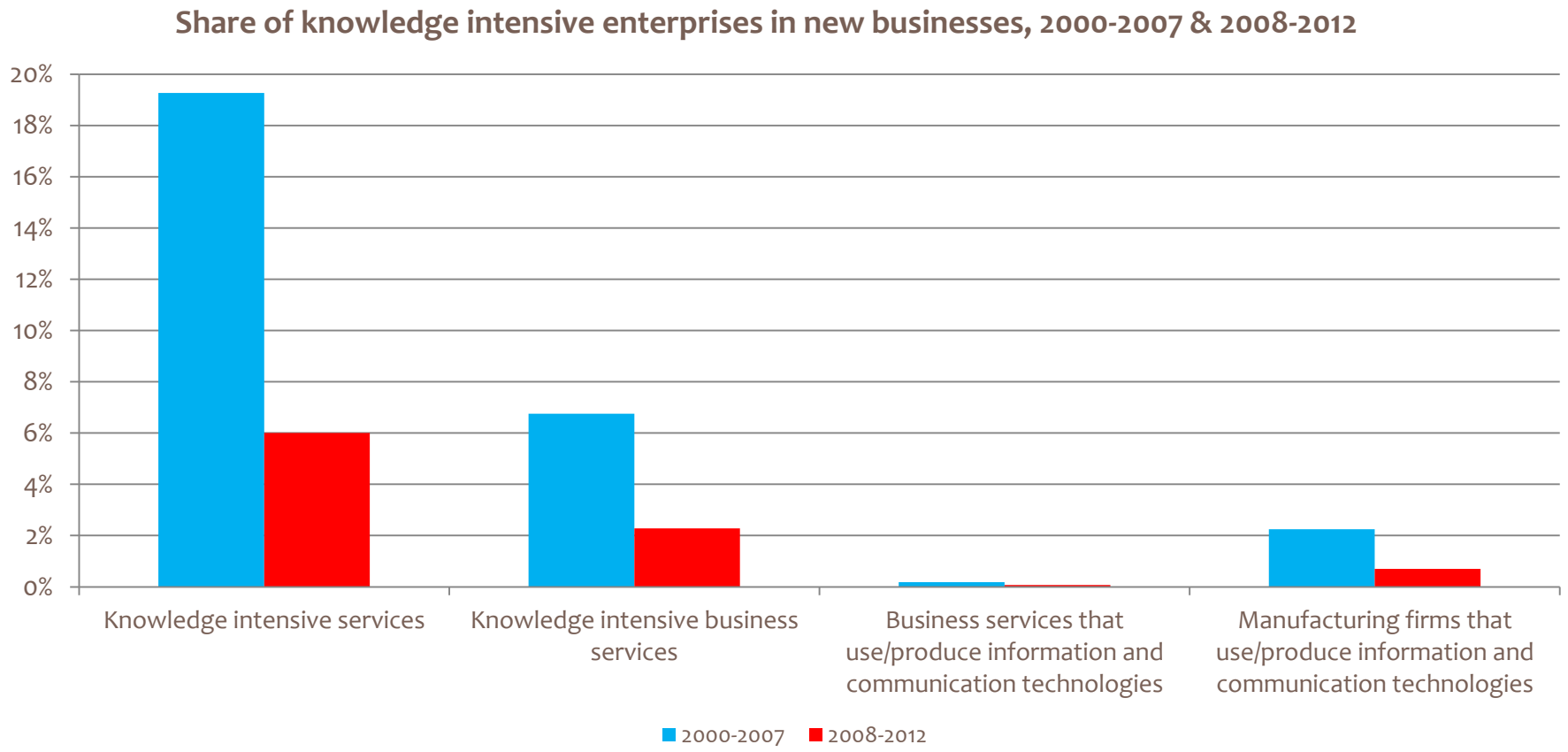
Demographic characteristics of Greek businesses*

	Number of enterprises			Number of persons employed			Value added		
	Greece		EU-28	Greece		EU-28	Greece		EU-28
	Number	Share	Share	Number	Share	Share	Billion €	Share	Share
Micro	669 773	96.7 %	92.7 %	1 225 566	58.7 %	29.2 %	18	37.4 %	21.1 %
Small	20 058	2.9 %	6.1 %	361 207	17.3 %	20.4 %	10	20.9 %	18.2 %
Medium-sized	2 455	0.4 %	1.0 %	228 692	10.9 %	17.3 %	8	16.6 %	18.5 %
SMEs	**692 286**	**99.9 %**	**99.8 %**	**1 815 465**	**86.9 %**	**66.9 %**	**37**	**74.8 %**	**57.8 %**
Large	400	0.1 %	0.2 %	273 587	13.1 %	33.1 %	12	25.2 %	42.2 %
Total	**692 686**	**100.0 %**	**100.0 %**	**2 089 052**	**100.0 %**	**100.0 %**	**49**	**100.0 %**	**100.0 %**

* Figures are estimates for 2014 produced by DIW Econ, based on 2008 – 2012 figures from the Structural Business Statistics Database (Eurostat). The data cover the 'non – financial business economy', which includes industry, construction, trade and services (NACE Rev. 2 sections B to J, L, M and N), but not enterprises in agriculture, forestry and fisheries, as well as the largely non – market service sectors, such as education and health.

Source: Small Business Act, Fact Sheet 2014, European Commission

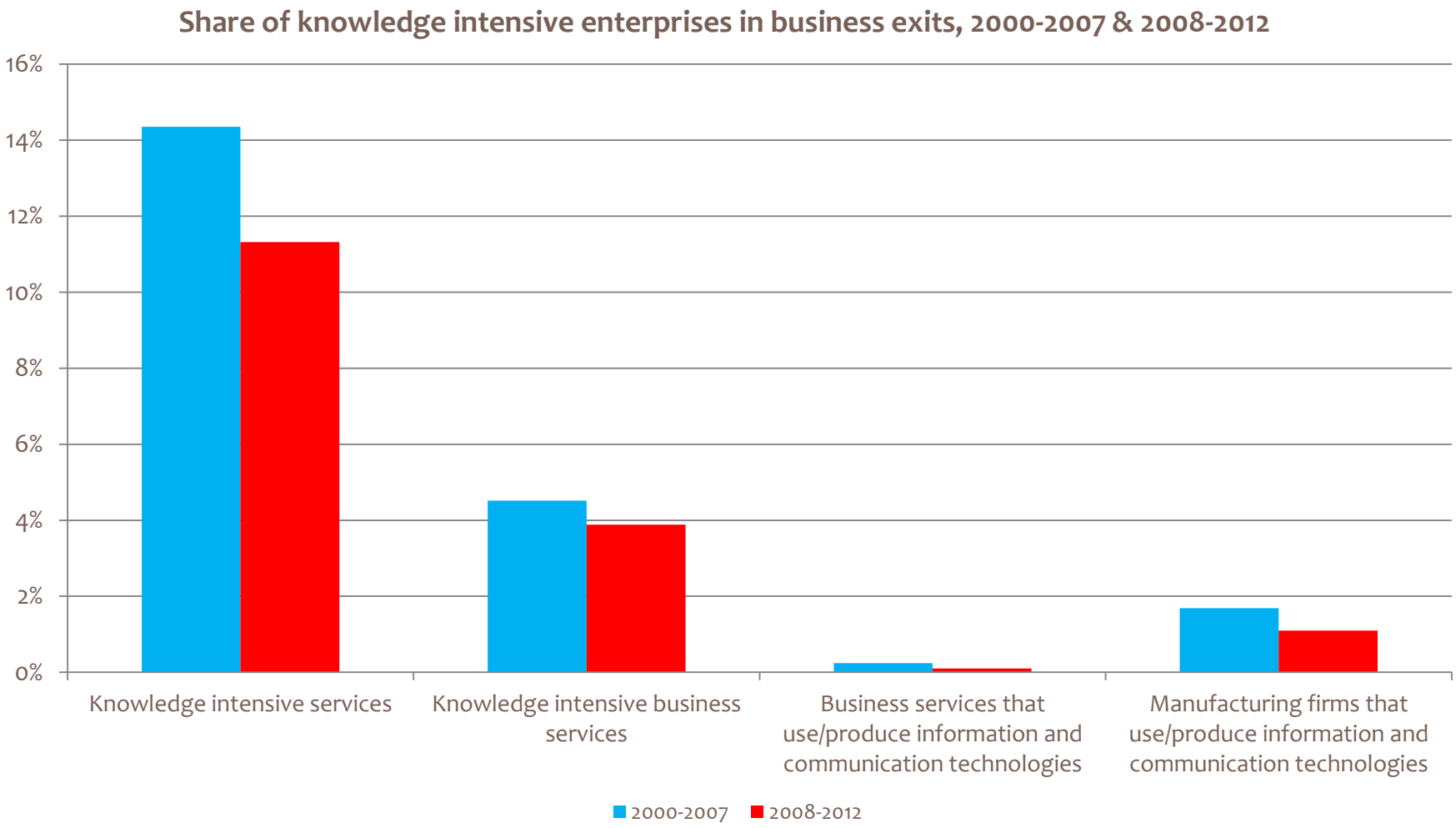
Does knowledge and Information Technologies that boost productivity, encouraged entrepreneurship during crisis?



- Unfavorable macroeconomic conditions discouraged the entry of new firms operating in Knowledge and ICT intensive industries
- Only 6% of those firms that founded during period 2008-2012 belong to knowledge intensive sectors.
- The corresponding percent during period 2000-2007 was nearly 20%

Sources: Hellastat - Financial Statements Database – data processing IOBE

But knowledge and ICT intensive firms exhibit a lower percentage of exit during period 2008-2012



Sources: Hellastat - Financial Statements Database – data processing IOBE

Business classification: Technological Performance & Innovation intensity

- IOBE & Labour of Industrial and Energy Economics field research in 2000 of the largest Greek firms (2011 – 2013), for the Hellenic Federation of Enterprises (SEV)

Typology	**Category A:** the «high innovation-intensive»	**Category B**: the «middle innovation-intensive»	**Category C: the** «low innovation-intensive»
Identification	✓Product innovation **and** process innovation: **443 firms (21.9% of the sample)**	**984 firms (48.6% of the sample)**	No innovation **598 firms (29.5% of the sample)**
Differences	✓61% large firms ✓86% applies vocational education and training ✓30% conducts some R&D in house ✓70% export	✓46% large firms ✓79% applies vocational education and training ✓25% conducts some R&D I ✓44% export	✓33% large firms ✓60% applies vocational education and training ✓14% conducts some R& ✓32% export (tourism)

Effects of structural reforms on the technical efficiency of tradeable sectors

On – going study for the Bank of Greece

- **First Stage:** Analysis of the reforms in the regulatory framework of tradeable sectors, as well as of horizontal reforms. Examination of the degree of their implementation.
- **Second Stage:** Creation of a database with firm and sector level data, in order to examine the effects of structural reforms on the technical efficiency of tradeable sectors; Business demographic analysis (e.g. entry, exit, average size)
- **Third Stage:** Exploration of the effects of reforms and of firm/industry specific characteristics on the technical efficiency by estimation of a translog Production Frontier Model

Some (policy) points

- (1) Capital reallocation
- (2) Labor reallocation
- (3) Size of firms
- (4) Total Factor Productivity
- (5) Competition (e.g. Katsoulacos & Vettas, 2005)
- (6) The Europe perspective
- (7) Capital and investment
- (8) Human capital and innovation