KNOWLEDGE GENERATION AND ABSORPTION: LESSONS LEARNED FROM REVIEWS OF CIS-5

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An outline

- Structural features of RD activities and innovation processes in CIS-5
- Innovation policy features of CIS-5
- Conclusions

Some lessons from innovation studies of relevance for CIS-5

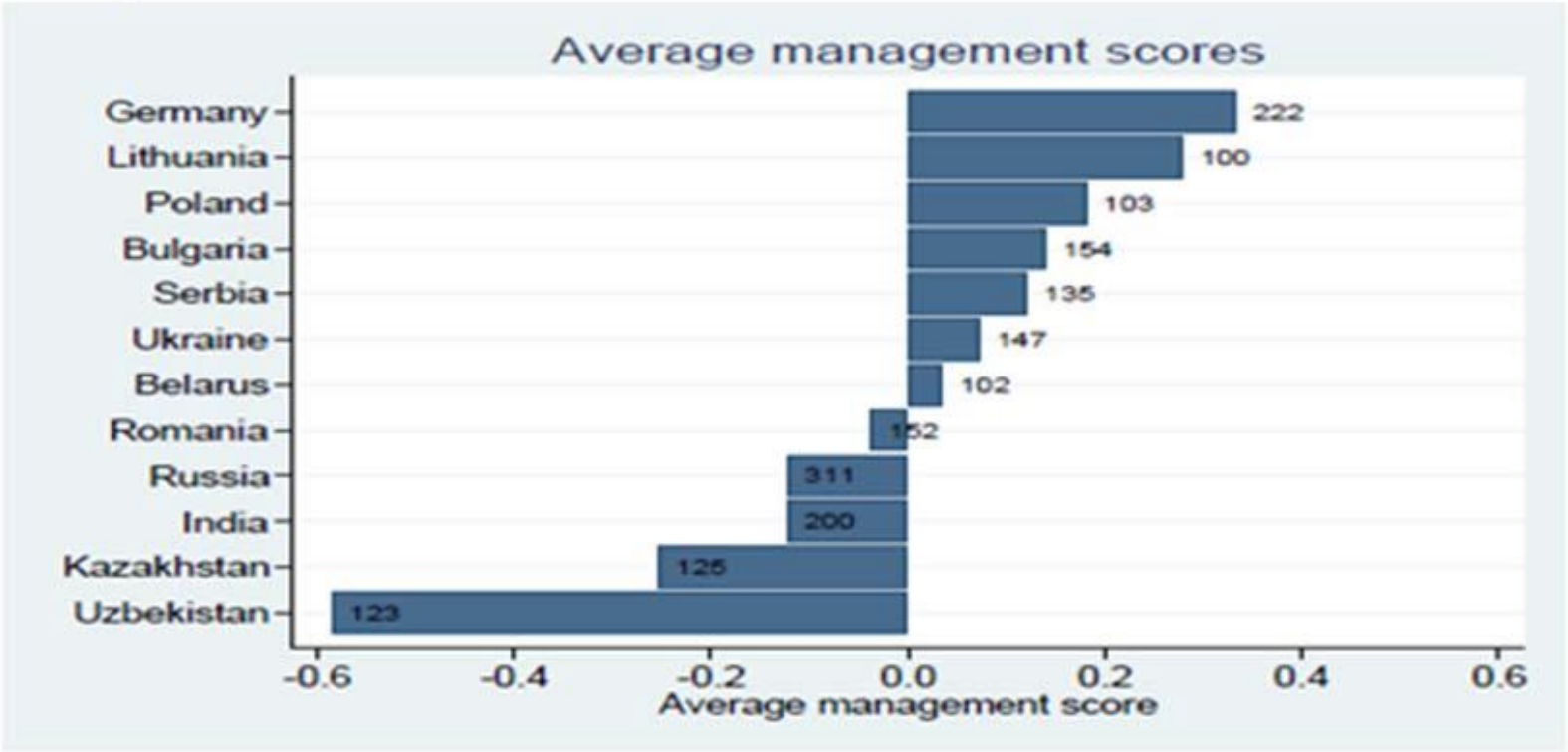
- R&D is rarely sufficient for generating innovation. Non-R&D activities like design and engineering capabilities are very often key to industrial growth of many middle income economies
- Production capability is the capability to produce at world standards of efficiency and quality at a given technology > the major driver of productivity growth in CIS – 5 (see EBRD, 2015)
- Education is essential though learnt knowledge need to be further deepened and extended in ways that can only be done effectively within the organizational context of enterprises
- This requires commitment and investment by enterprises and its management and its employees > social conditions of innovative enterprise (cf. corporate governance et al).

Drivers of growth and determinants of technology upgrading

- CIS-5 drivers are typical of those for (low)(middle) income economies: factor (natural resources; blue collar labour) and efficiency driven economies, not innovation driven economies
- Production capability (ISO9001) as the most significant driver of productivity growth in transition economies + R&D important as driver of 'absorptive capability) (Kravtsova and Radosevic, 2011, Are systems of innovation in Eastern Europe efficient? Economic Systems)
- Low production sophistication and management quality

Weak management practices (Ukr, Bel, Kaz) especially in large enterprises

Management scores across countries

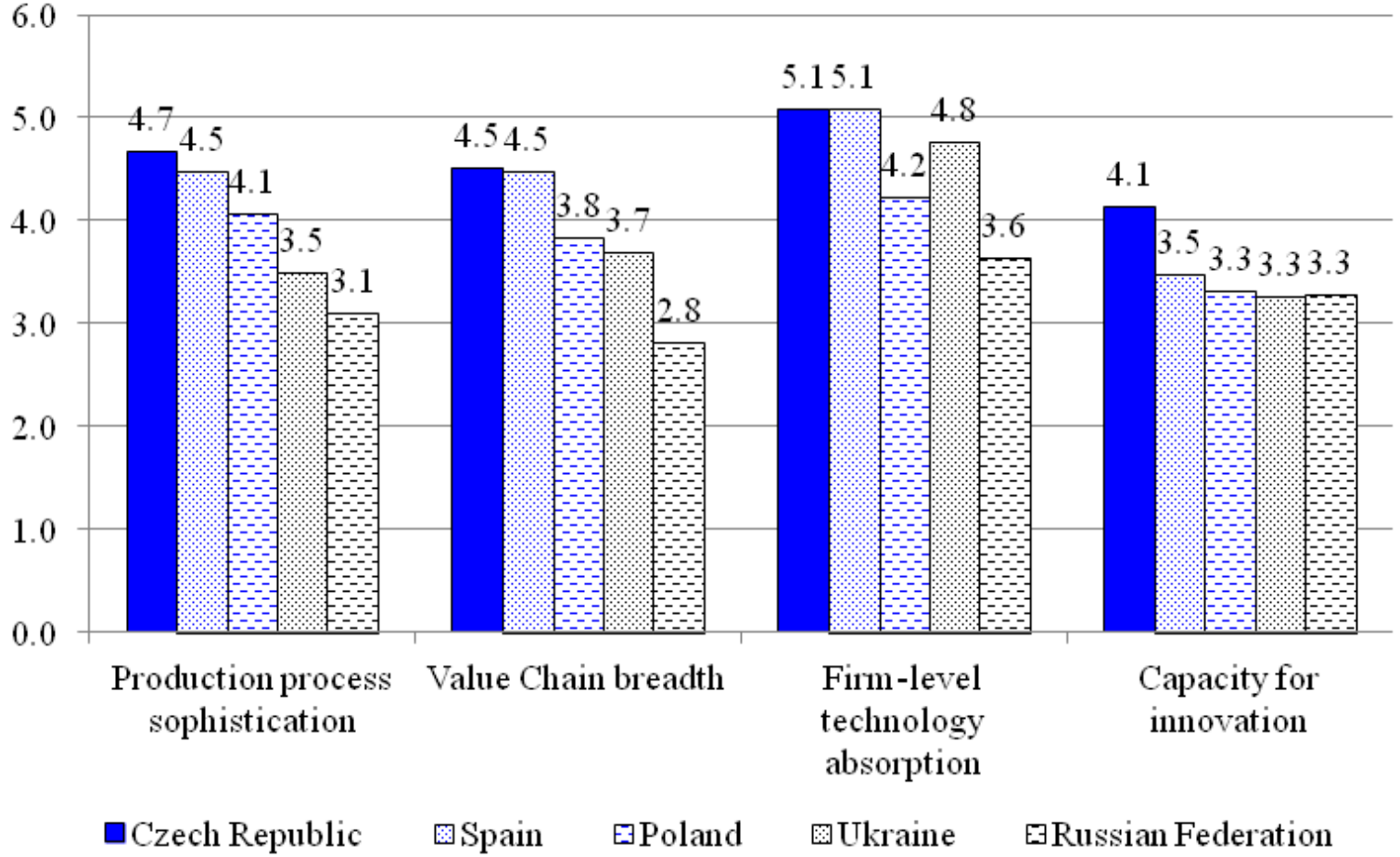


Source: MOI survey.

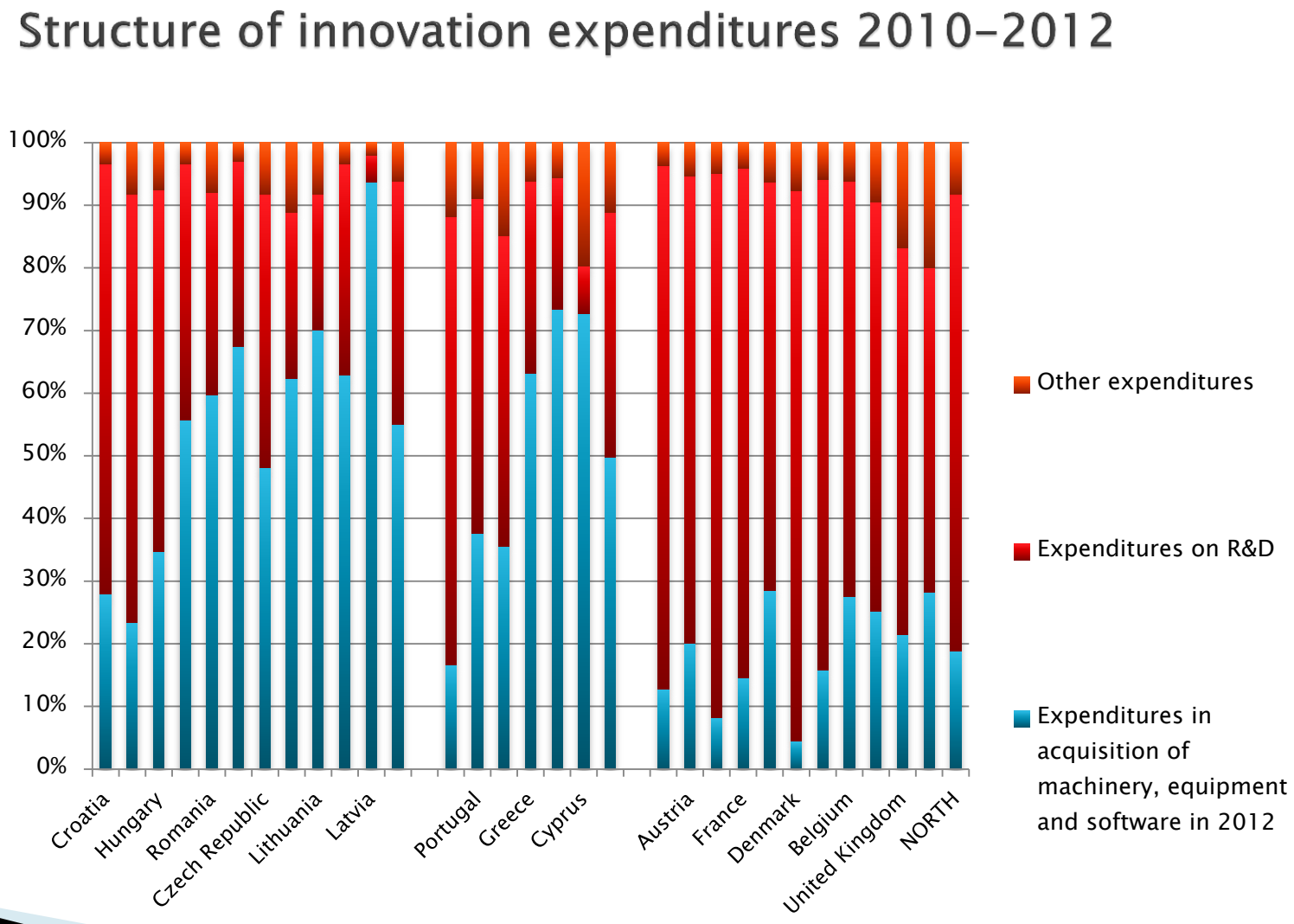
Note: Number of firms included is indicated in the chart. Scores are reported as z-scores, so are in deviations from the sample average of zero.

Lagging behind in terms of the level of sophistication of production processes, and the range of value chain functions while smaller gaps in terms of firm level capacity to absorb technology

Subjective assessment of development of production and technology capabilities in selected countries 2012-13 (scale 1-7)

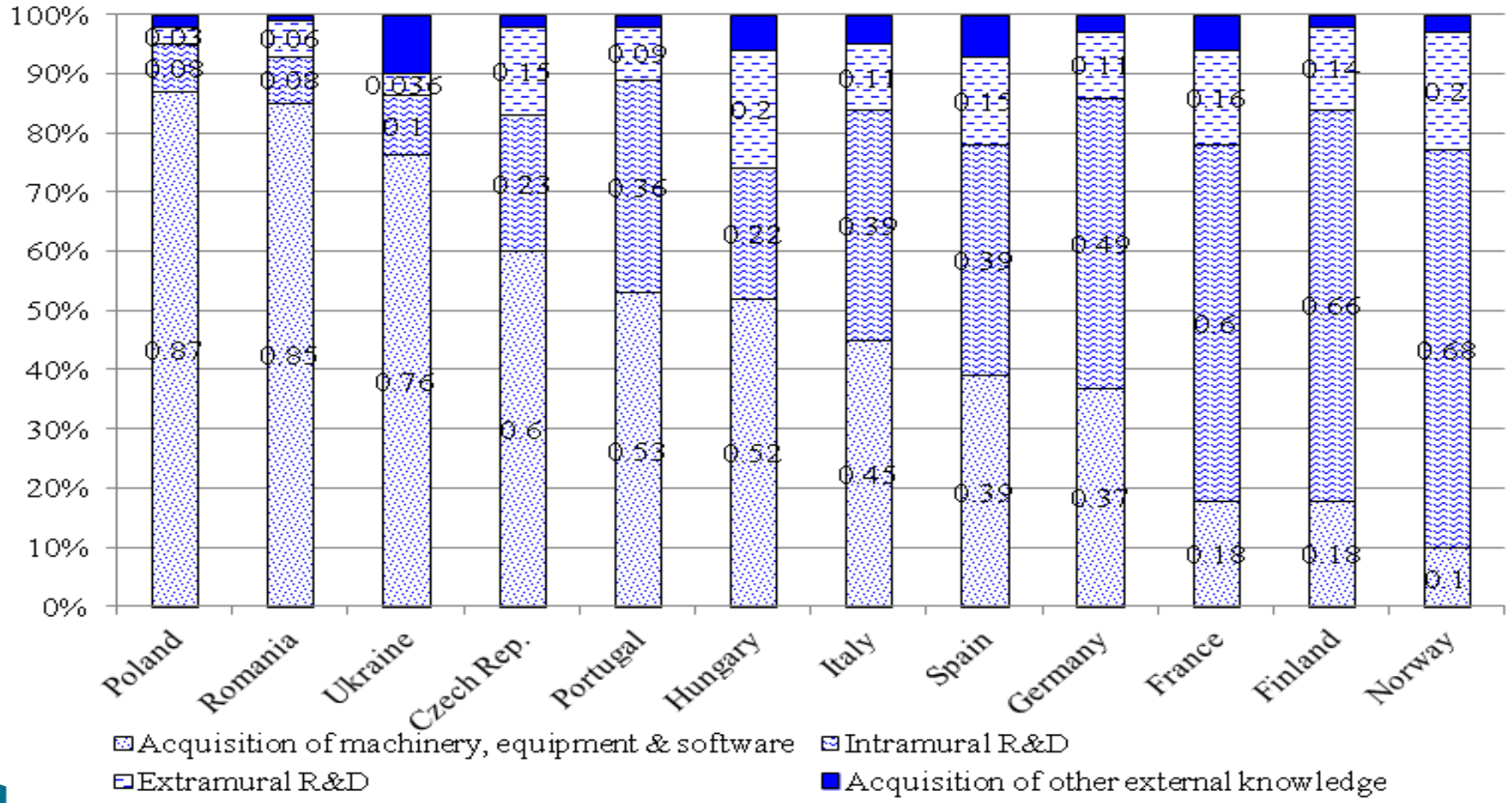


Differences in the role of R&D in innovation process



Innovation activities of Ukrainian firms are focused primarily on the adaptation of machinery, equipment and software

Structure of innovation expenditures in selected countries, 2008 (except Ukraine 2010)



Innovation expenditures are largely based on purchase of machinery

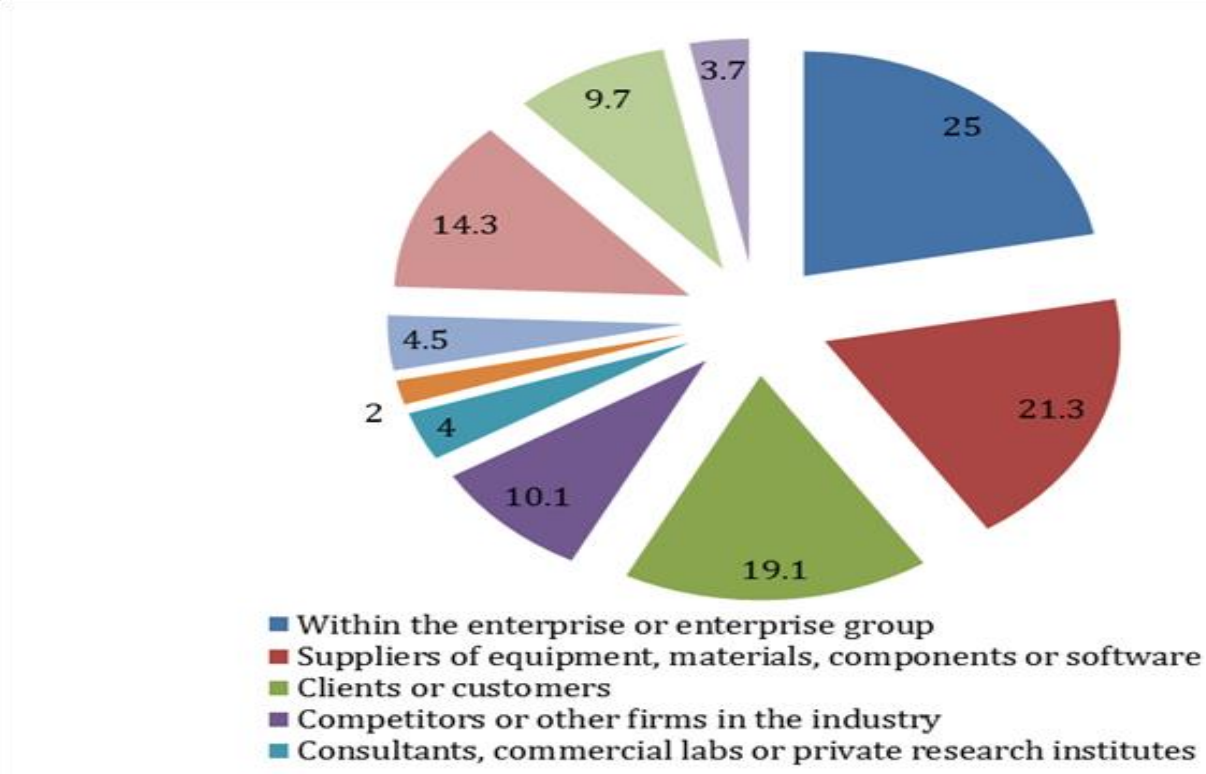
R&D is minor part of innovation activities

Belarus: Share of different types of innovation expenditures 2008

	With ferrous metallurgy	Without ferrous metallurgy
Machinery purchase	**53.3%**	**75.0%**
R&D	**19.1%**	9.8%
Engineering	8.5%	**12.4%**
Licences and patents	0.5%	0.7%
Software purchase	0.5%	0.6%
Training	0.1%	0.2%
Marketing	0.3%	0.3%
Other	**17.8%**	**12.4%**

Innovation is not based on R&D and does not originate from or in close cooperation with R&D organizations

Ukraine: Distribution of innovative enterprises by the most important sources of information for innovation and economic activities, 2008–10

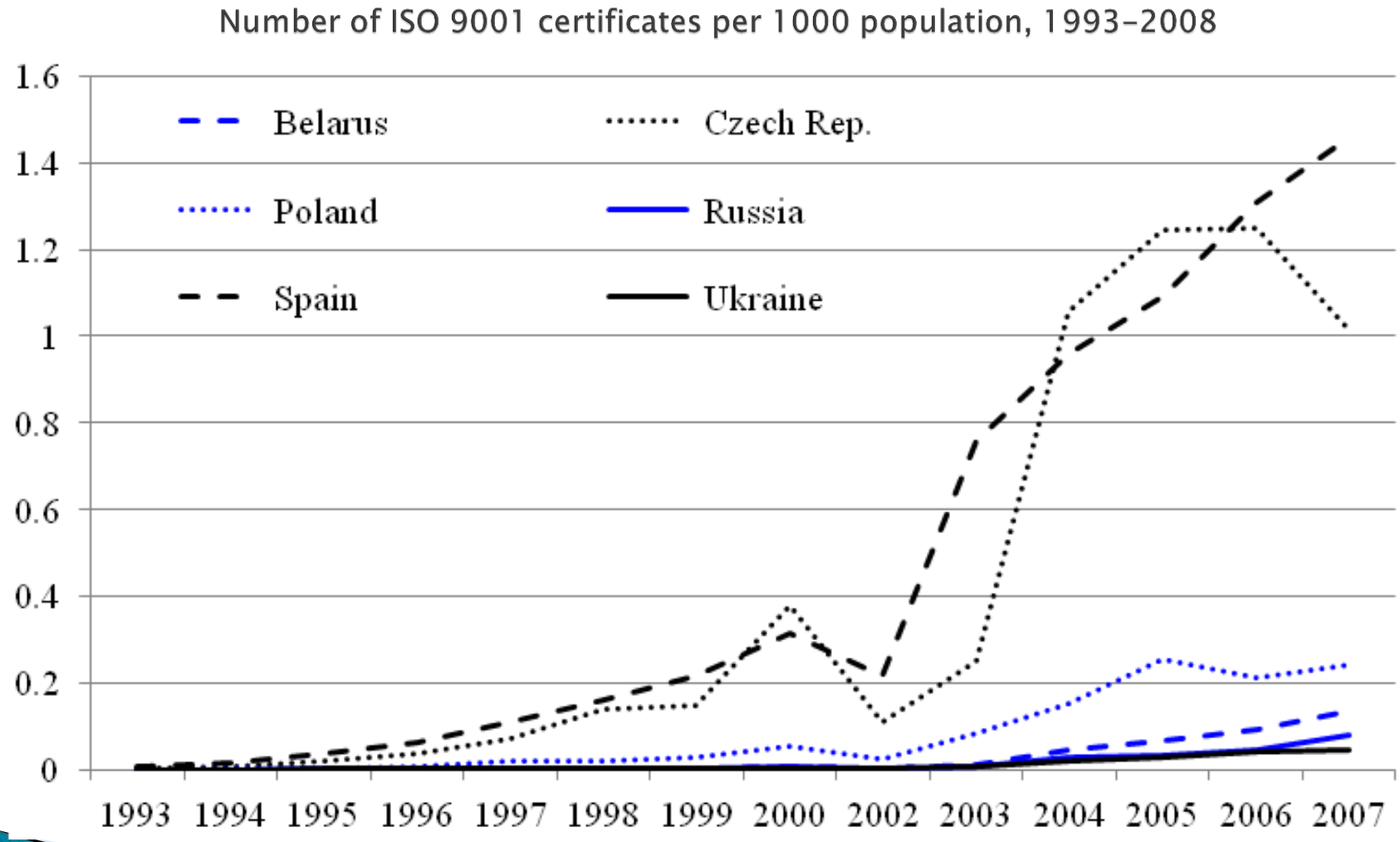


A weak attention to production capability

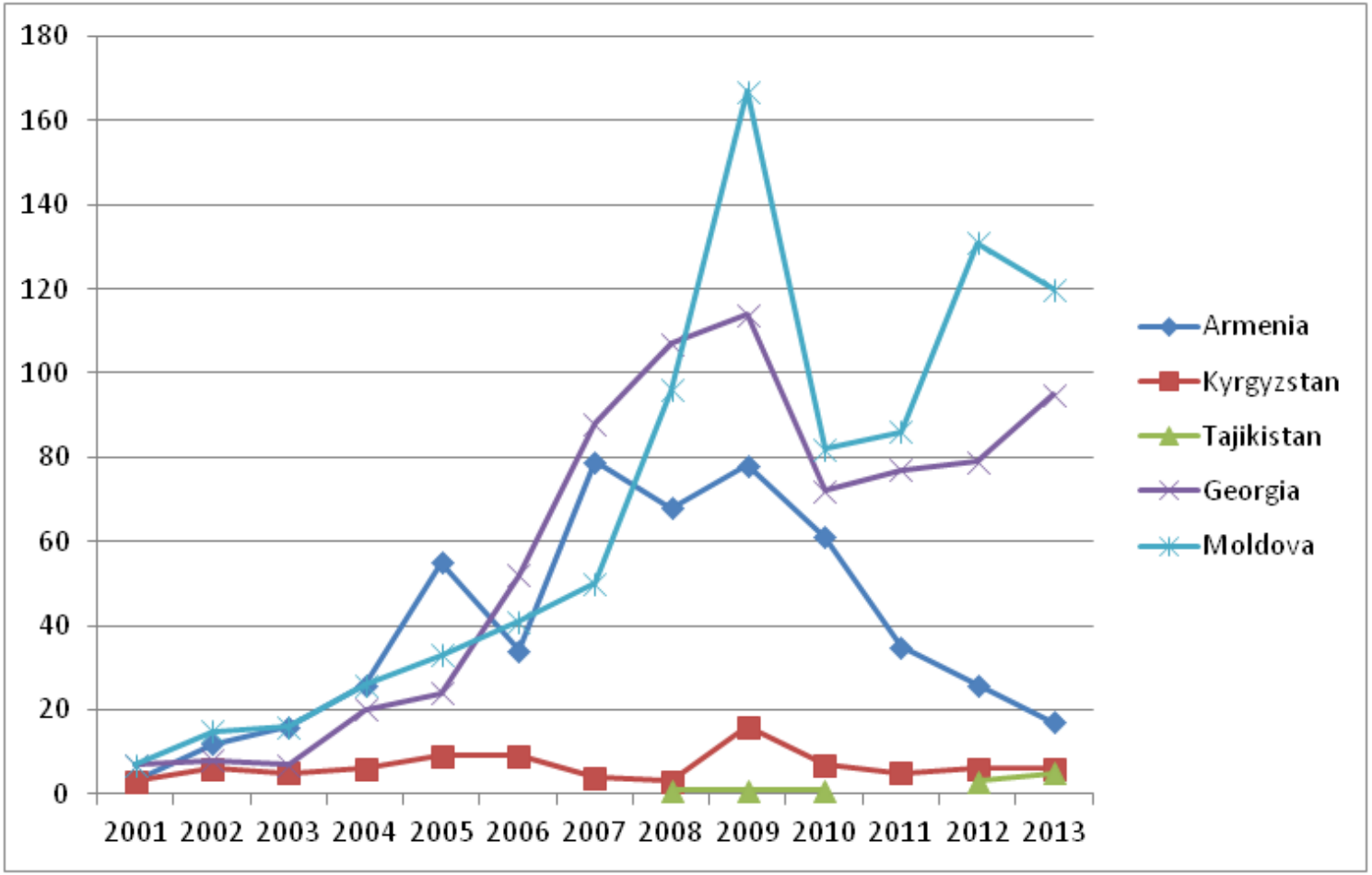
Number of ISO9002 certificates standards, 1999–2011

	1999	2001	2003	2005	2007	2009	2010	2011
Armenia	4	3	16	55	79	78	61	35
Azerbaijan	1	1	2	213	55	148	103	122
Georgia	2	7	7	24	88	114	72	77
Belarus	26	78	102	658	1308	2014	151	171
Russia	541	1517	962	4883	11527	53152	62265	12663
Ukraine	82	66760	308	1375	2150	3252	2592	1207

ISO9001 per capita = a sign of isolation from global value chains as well as an indicator of the huge scope for improvements towards best practice in the management of production capabilities.

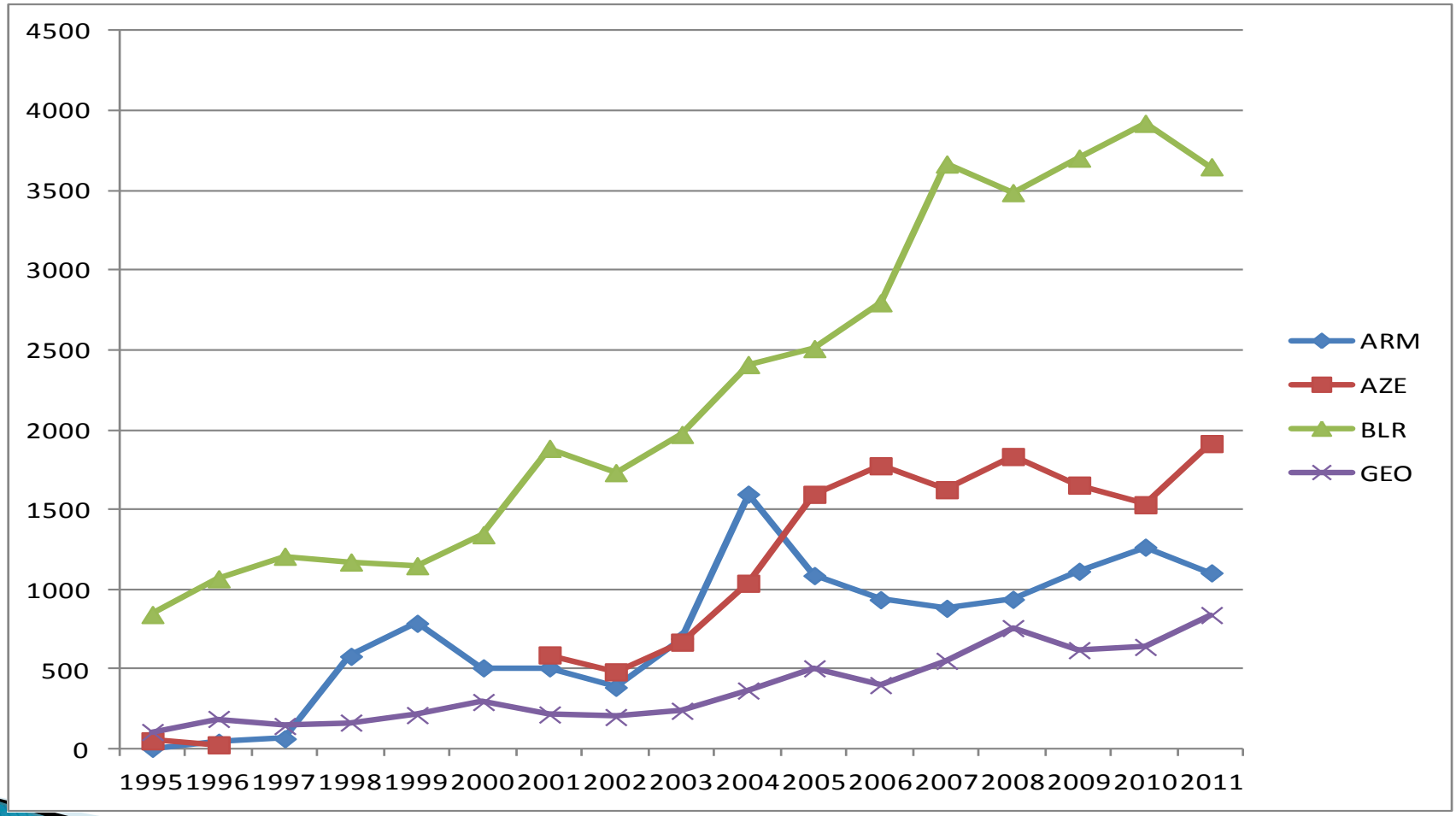


ISO certificates are generic management standard which indicate that there are in place businesses process which should guarantee operational efficiency (production capability)



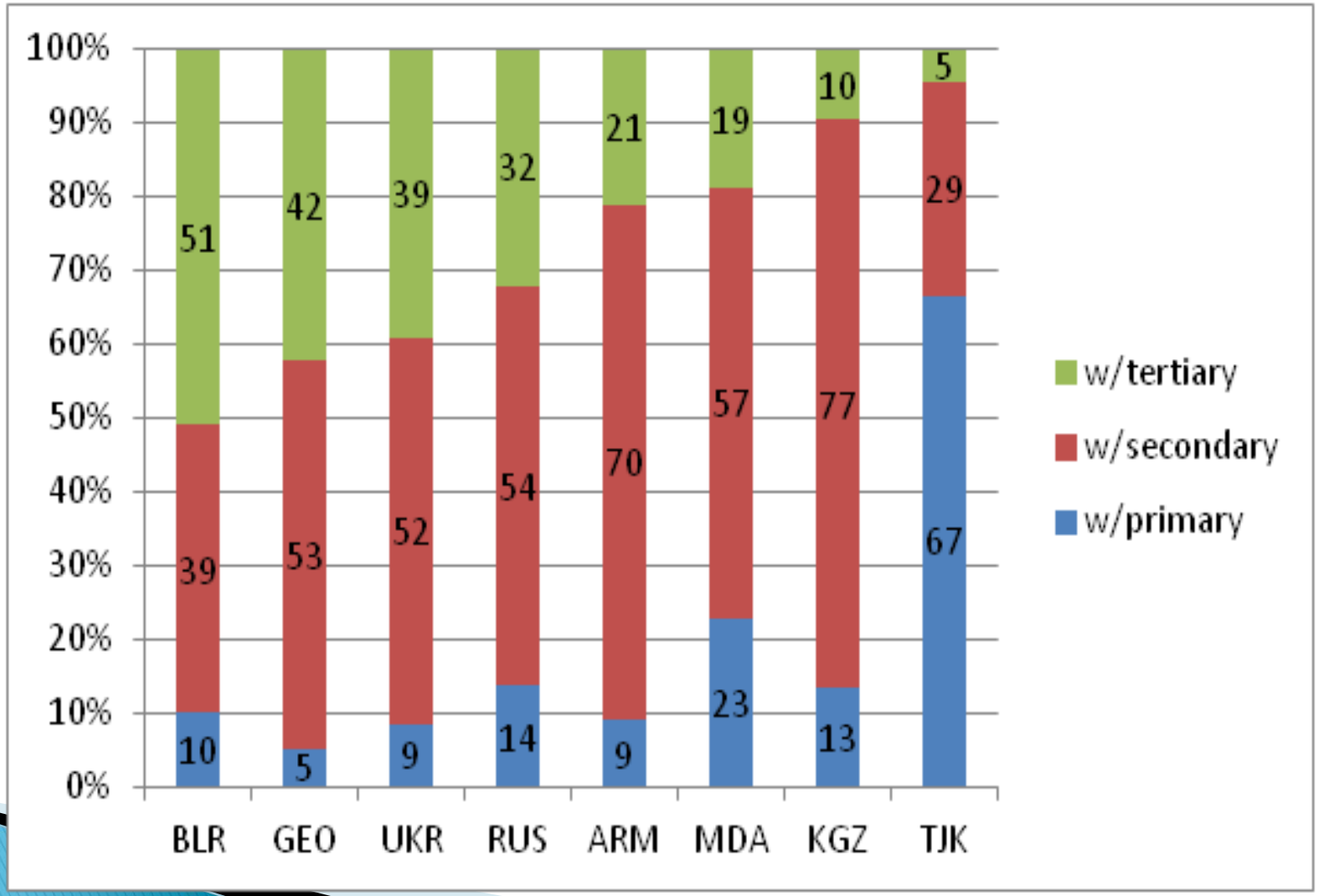
The number of Tajik firms that have adopted ISO9001 standard is almost nil

Very slow improvements in product differentiation:

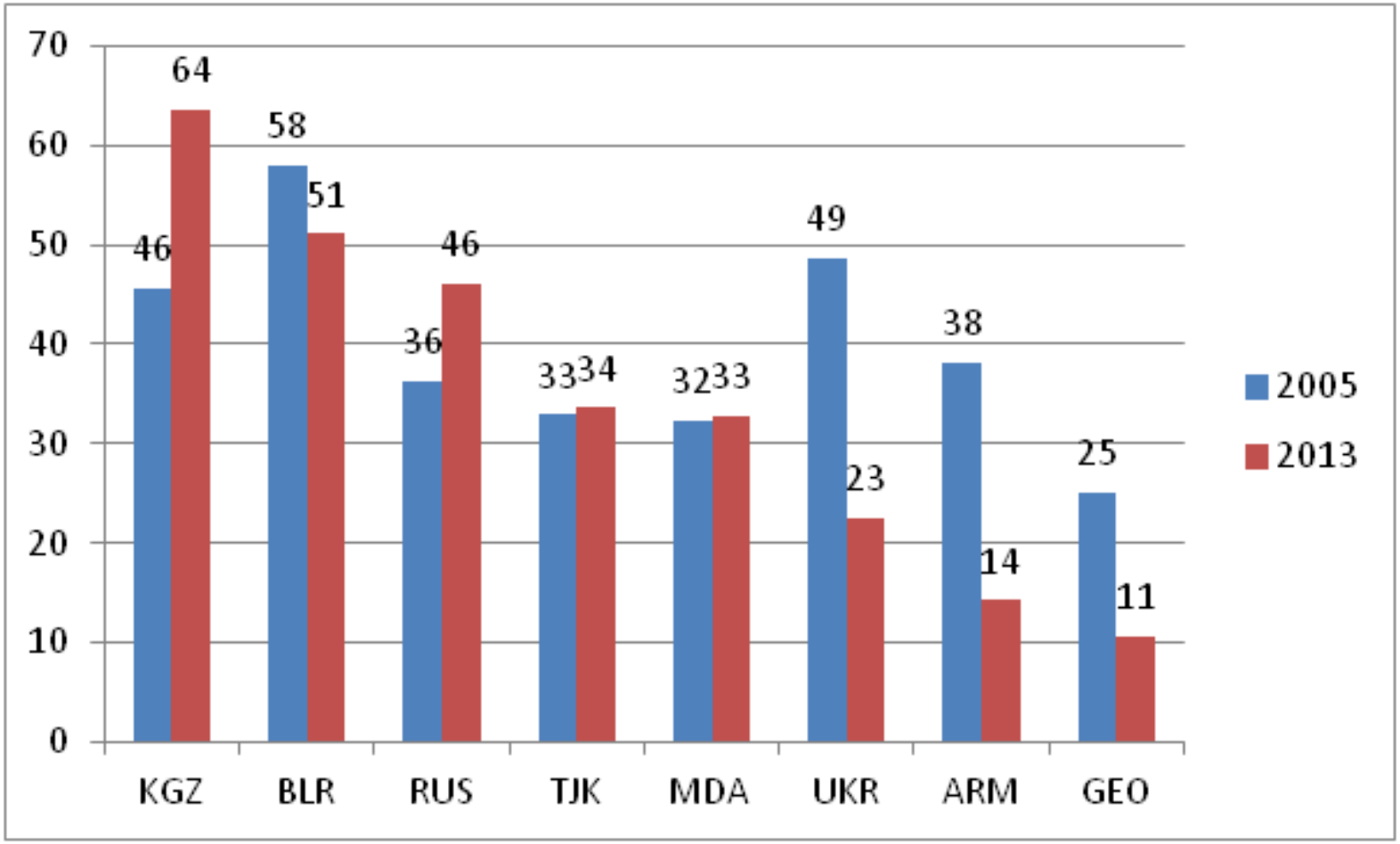


A low demand for highly educated (except Tajikistan)

Unemployment by level of education (% of total unemployment), 2013

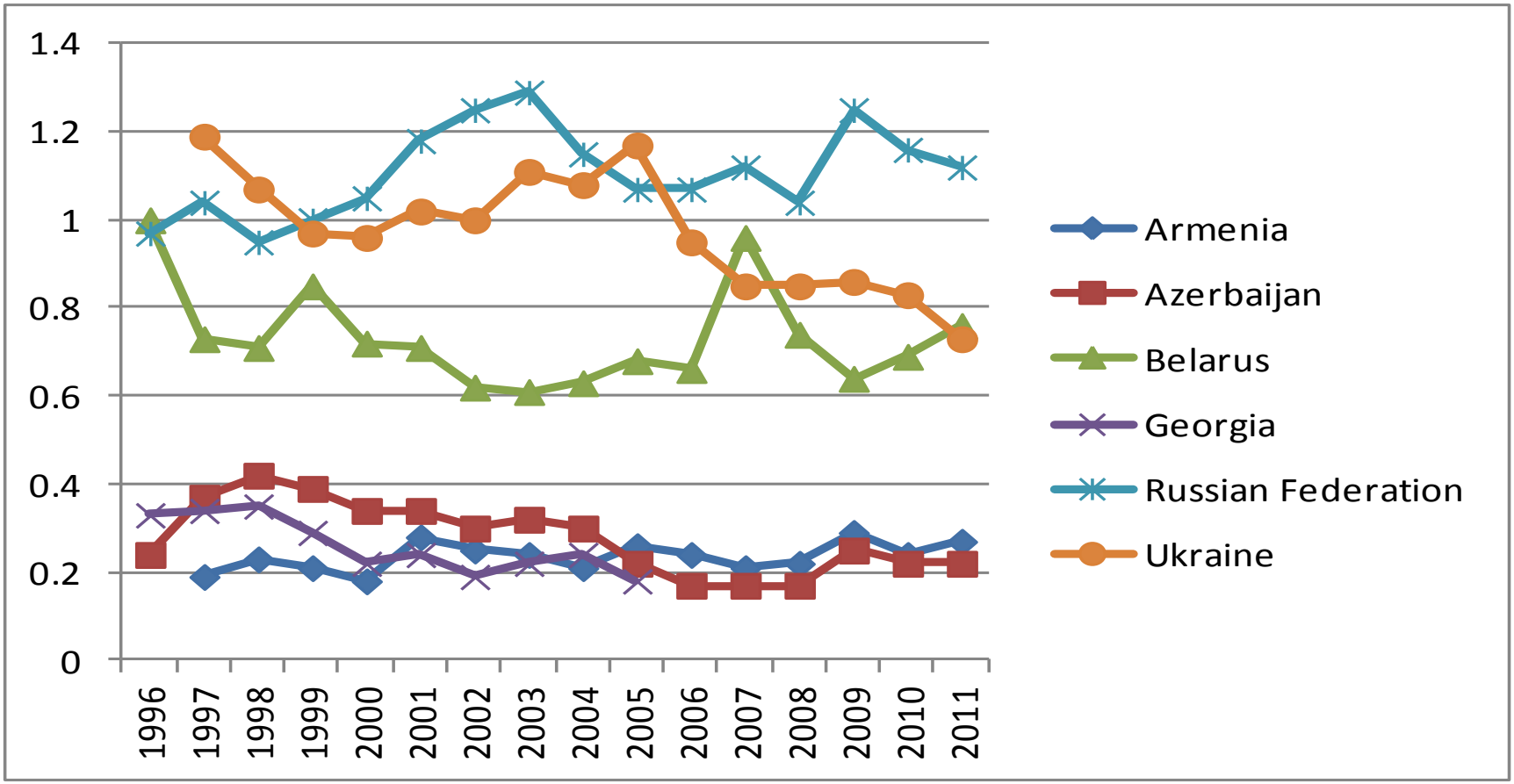


Firms offering formal training (% of firms)



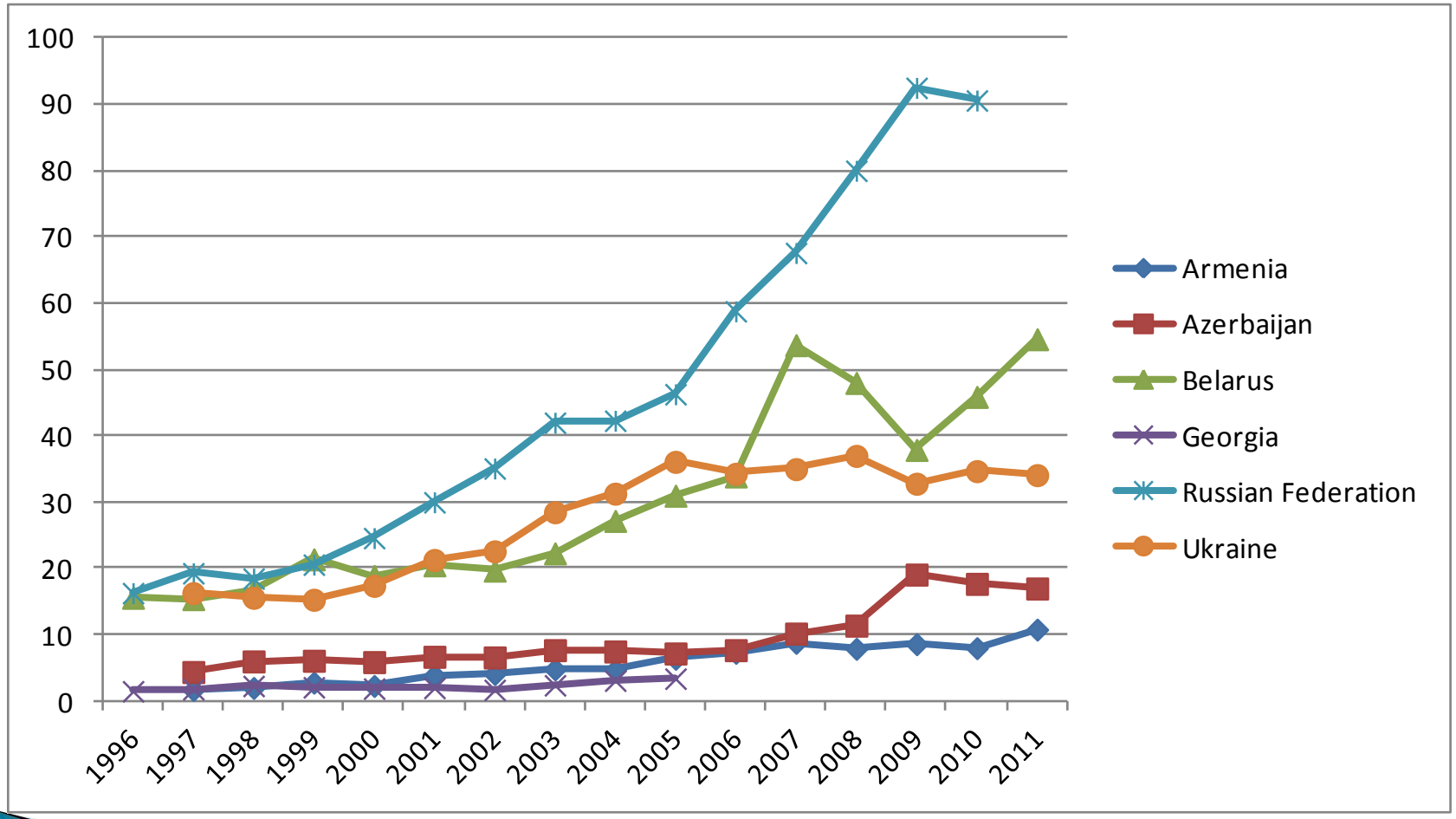
R&D systems are stabilized but are not drivers of innovation processes

Gross expenditures on R&D as percent of GDP, 1996–2011



Differentiation in investments in R&D in CIS-5 partly due to different drivers of growth

GERD per researcher, FTE (in '000 PPP$, constant prices – 2005)



A long-term orientation: The enterprise sector should become the major performer of R&D

All countries above $15Kpc have model 1 (BES dominant performer < BES dominant fundor)

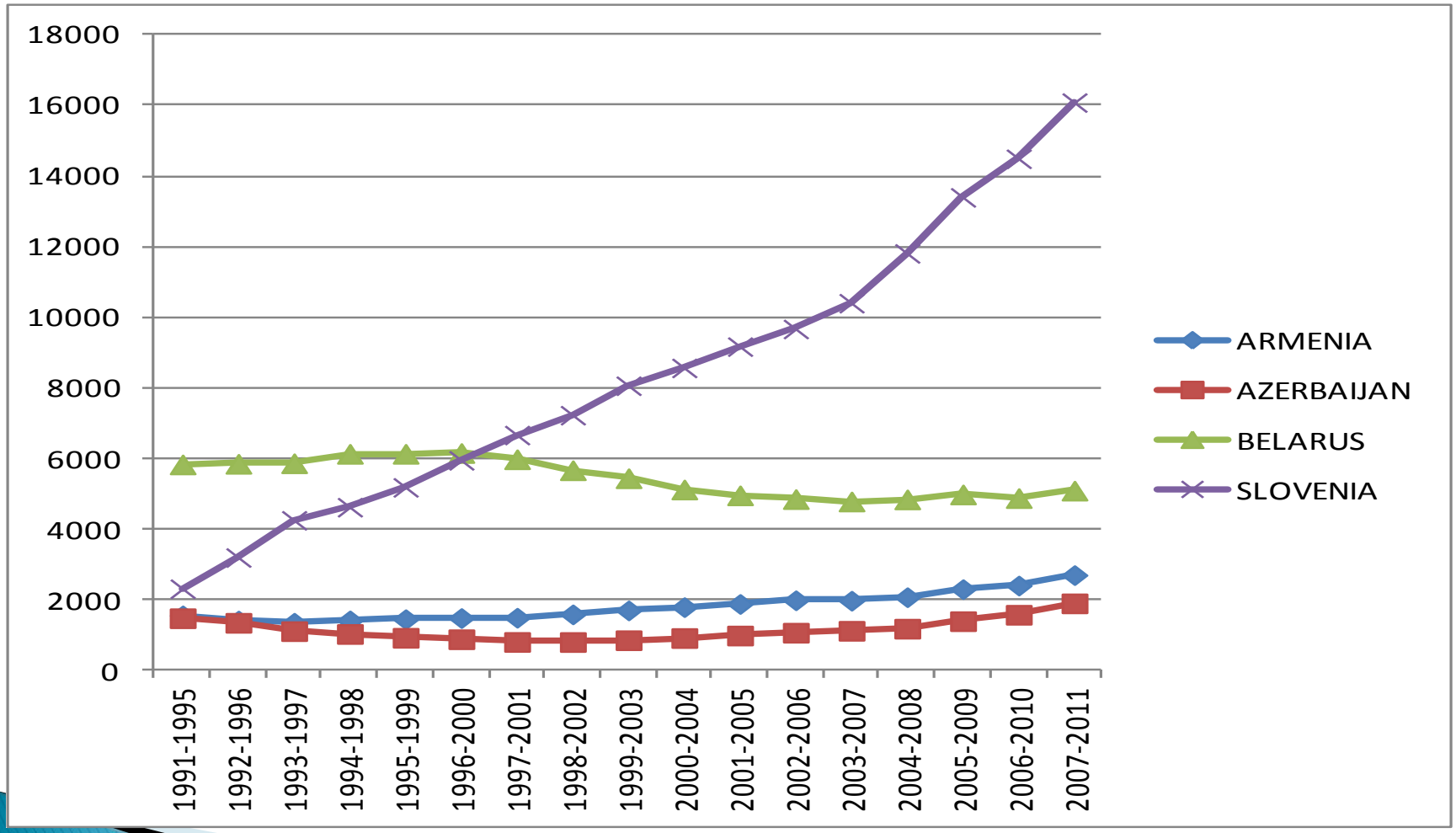
	GDP pc 2003	Model type	Model Dummy
USA	**29,037**	**1**	**1**
Ireland	**24,739**	**1**	**1**
France	**21,861**	**1**	**1**
UK	**21,310**	**1**	**1**
Austria	**21,232**	**1**	**1**
Belgium	**21,205**	**1**	**1**
Finland	**20,511**	**1**	**1**
Germany	**19,144**	**1**	**1**
Spain	**17,021**	**1**	**1**
Korea (Rep)	**15,732**	***1***	**1**
Estonia	*14,340*	*3*	*0*
Slovenia	*13,995*	*1*	*1*
Portugal	*13,807*	*3*	*0*
Czech R	*9,905*	*1*	*1*
Latvia	*9,722*	*1*	*1*
Slovakia	**9,392**	2	**0**
Lithuania	**7,986**	3	**0**
Hungary	**7,947**	2	**0**
Poland	**7,674**	2	**0**
Kazakhstan	**7,655**	5	**0**
Belarus	**7,387**	2	**0**
Croatia	**7,233**	2	**0**
Turkey	**6,731**	3	**0**
Russian Fed	**6,323**	2	**0**
Bulgaria	**6,278**	4	**0**
Romania	**3,510**	2	**0**
Azerbaijan	**3,394**	4	**0**

Model 2: BES < GOV
Model 3: HES < GOV
Model 4: GOV < GOV
Model 5: GOV < BES

Source: Radosevic, 2010

Isolated and unreformed science systems

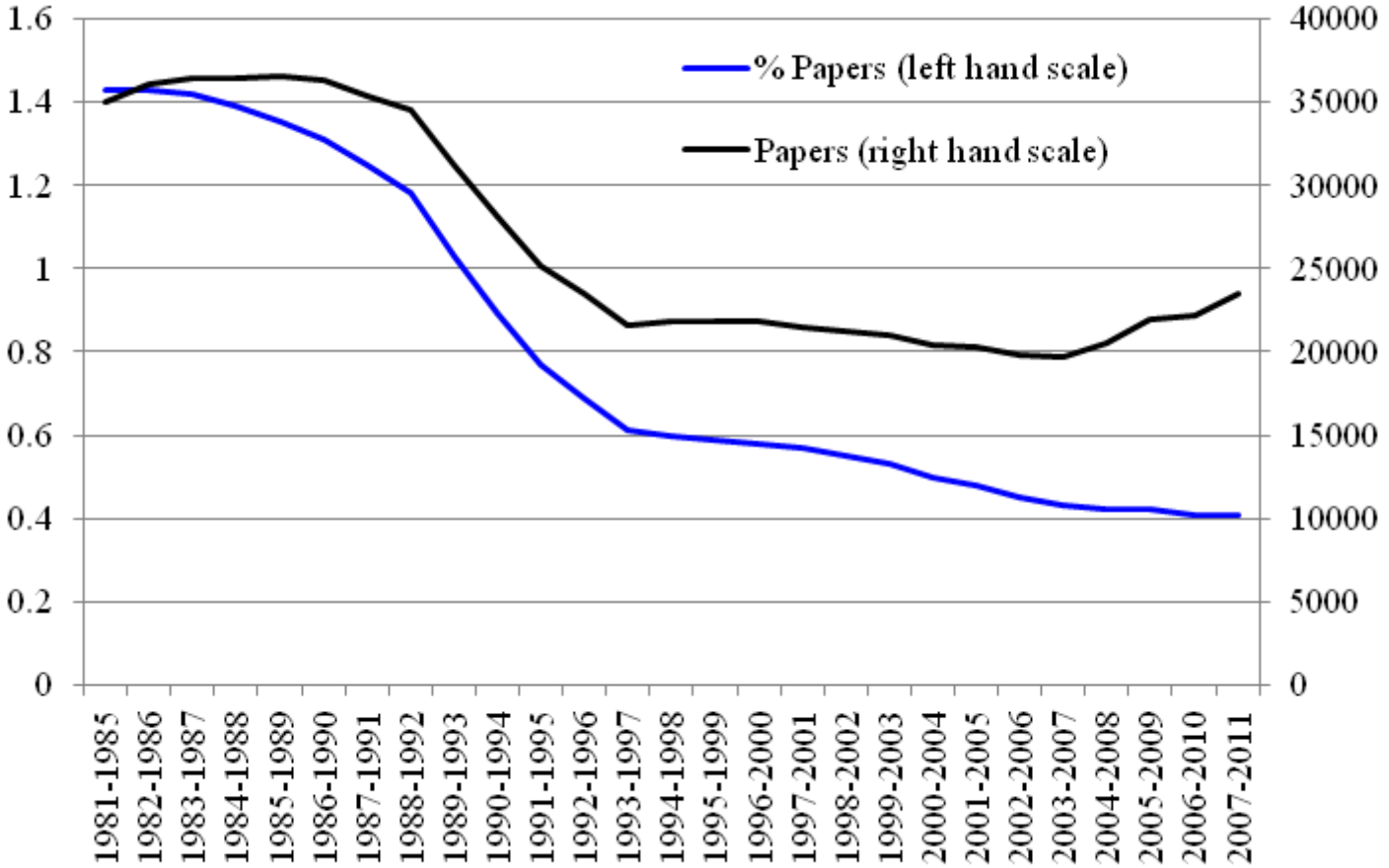
Number of international publications in 1991–2011 period



Source: Thomson NSI database

Ukraine has lost the advantages in science inherited from the Soviet period

Number of scientific papers and world share, 1981–2011

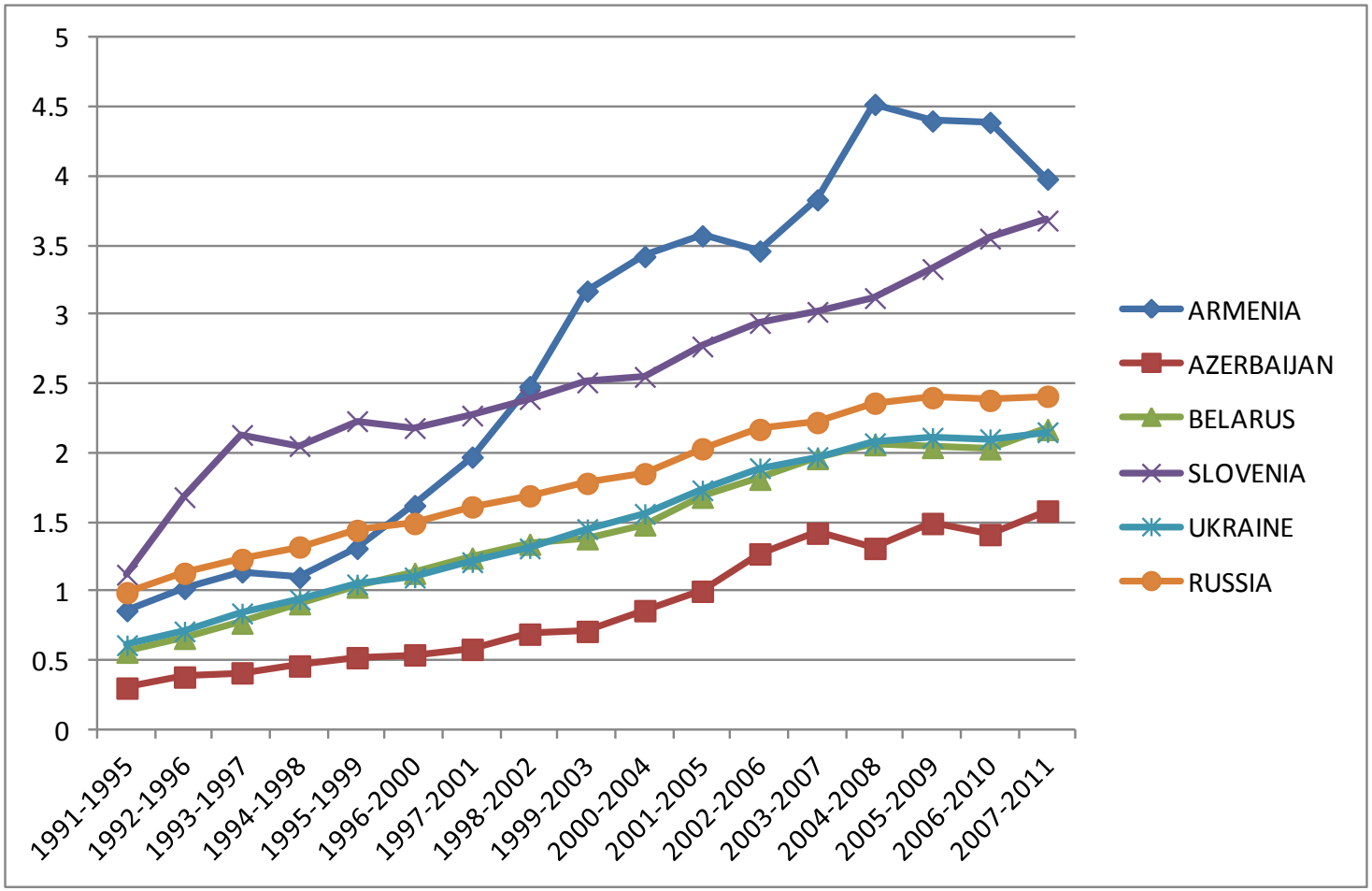


Decline of CIS-5 science systems in comparative context is striking

Annual rate of change of number of S&T publications 1995-2005

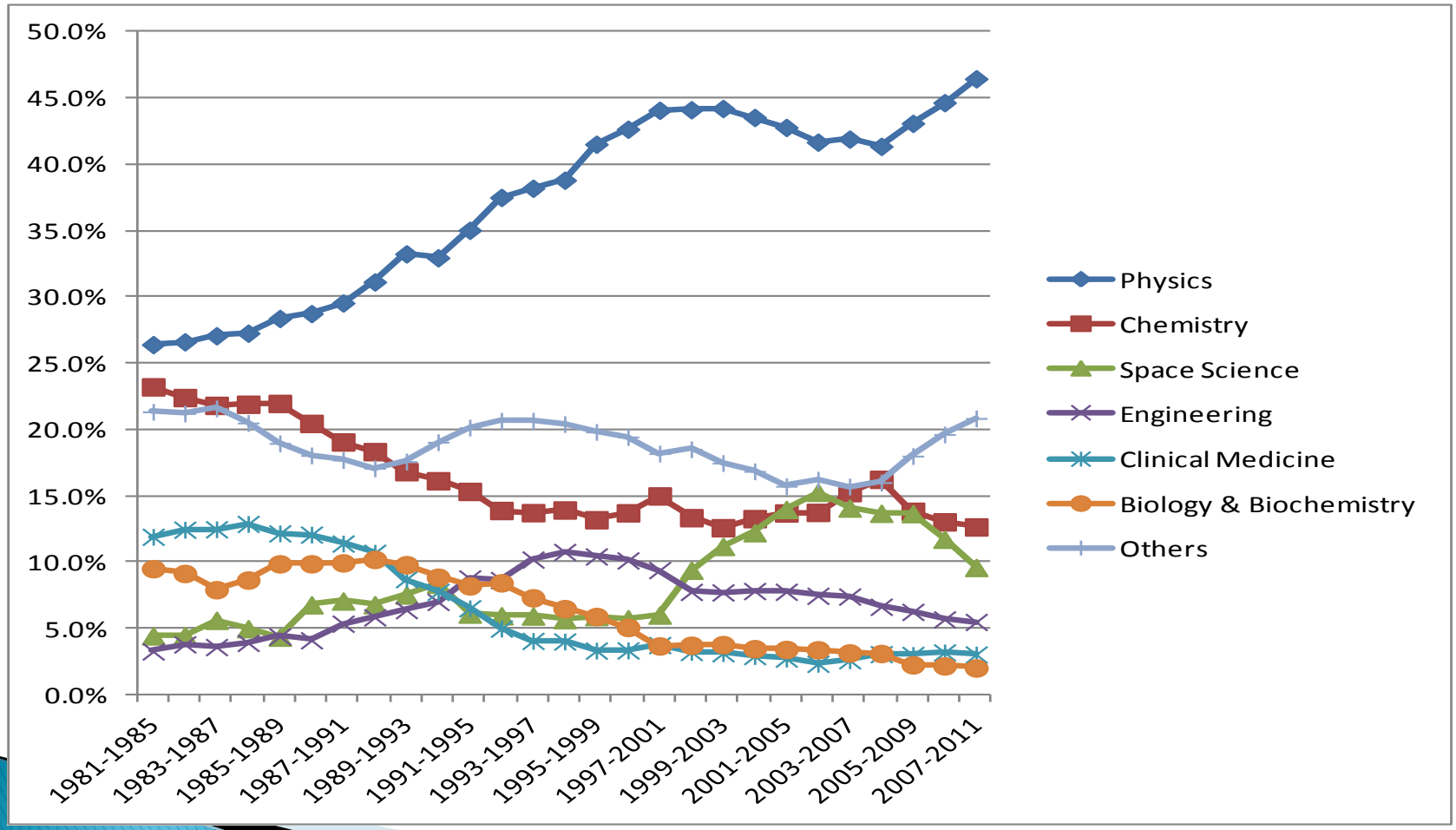
	Annual rate of change 1995-2005
Belarus	-3.1%
Czech Republic	5.5%
Lithuania	9.5%
Slovenia	10.1%
Ukraine	-2.0%
Russia	-2.8%

… though impact (citations/papers) of international scientific publications of CIS-5 has increased



Excessive concentration is not favourable for R&D as factor of absorptive capability

Armenia: Share of scientific publications by major areas of sciences 1981-2011 (overlapping 5 year periods)



Intra-mural expenditures on R&D 2008, in mn Rbl and in % by disciplines

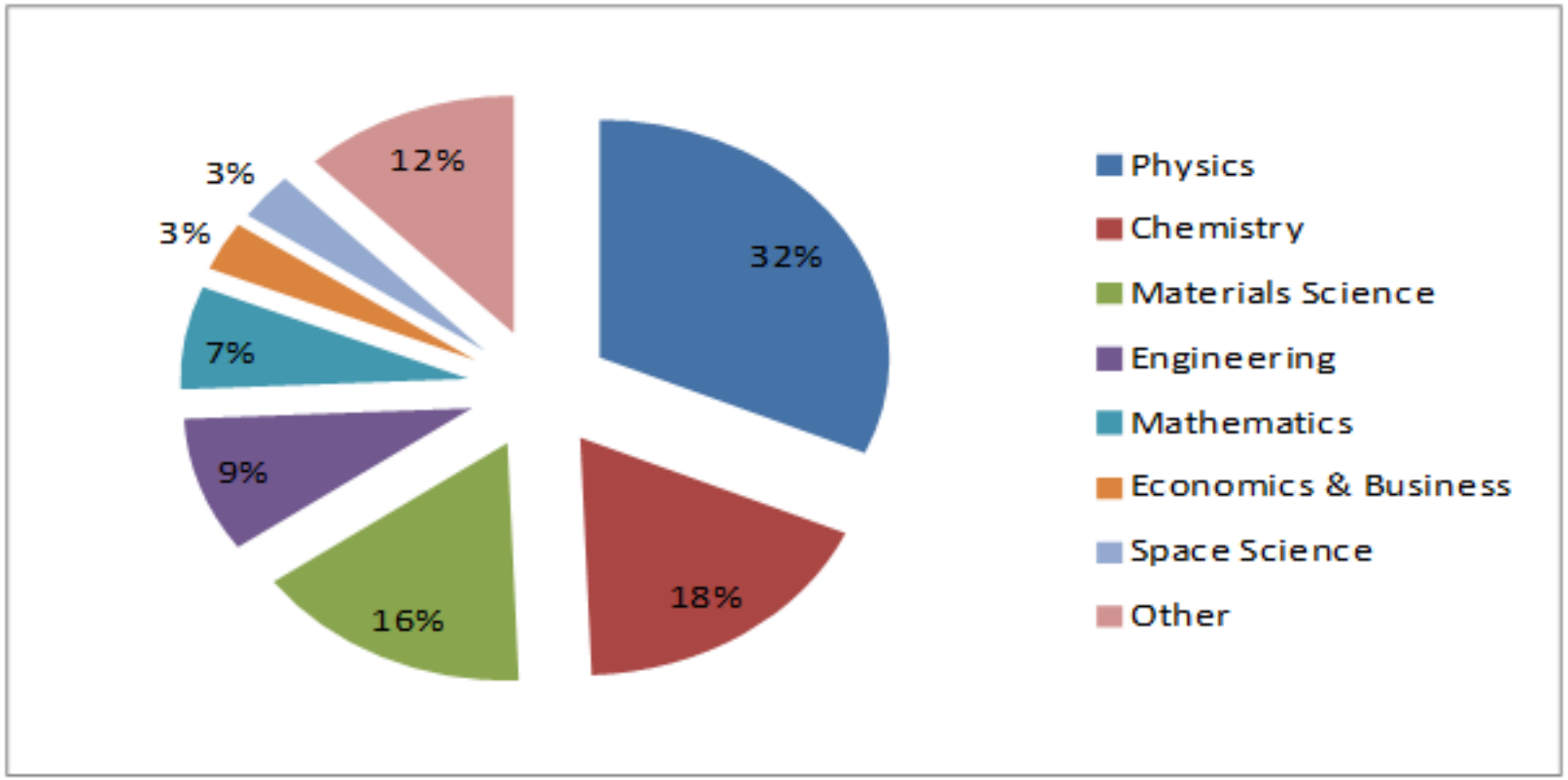
Total	962361	100.00%
Natural sciences	125764	13.07%
Technical sciences	**681115**	**70.78%**
Medicine	45419	4.72%
Agricultural sciences	59826	6.22%
Social sciences	40406	4.20%
Humanities	9831	1.02%

Concentration in R&D on technical sciences and in innovation on machine building and metal mfg ind

Physics, chemistry, materials science and engineering dominate scientific output, while the share of life sciences and environment is negligible

The limited international cooperation on the Ukrainian science system, despite a relatively high share of income which comes from abroad (largely from Russia).

Disciplinary structure of scientific papers of Ukraine 2007–2011



Belarus: a very strong concentration on machine bldg and metal processing

Shares of R&D personnel in industry, 2008

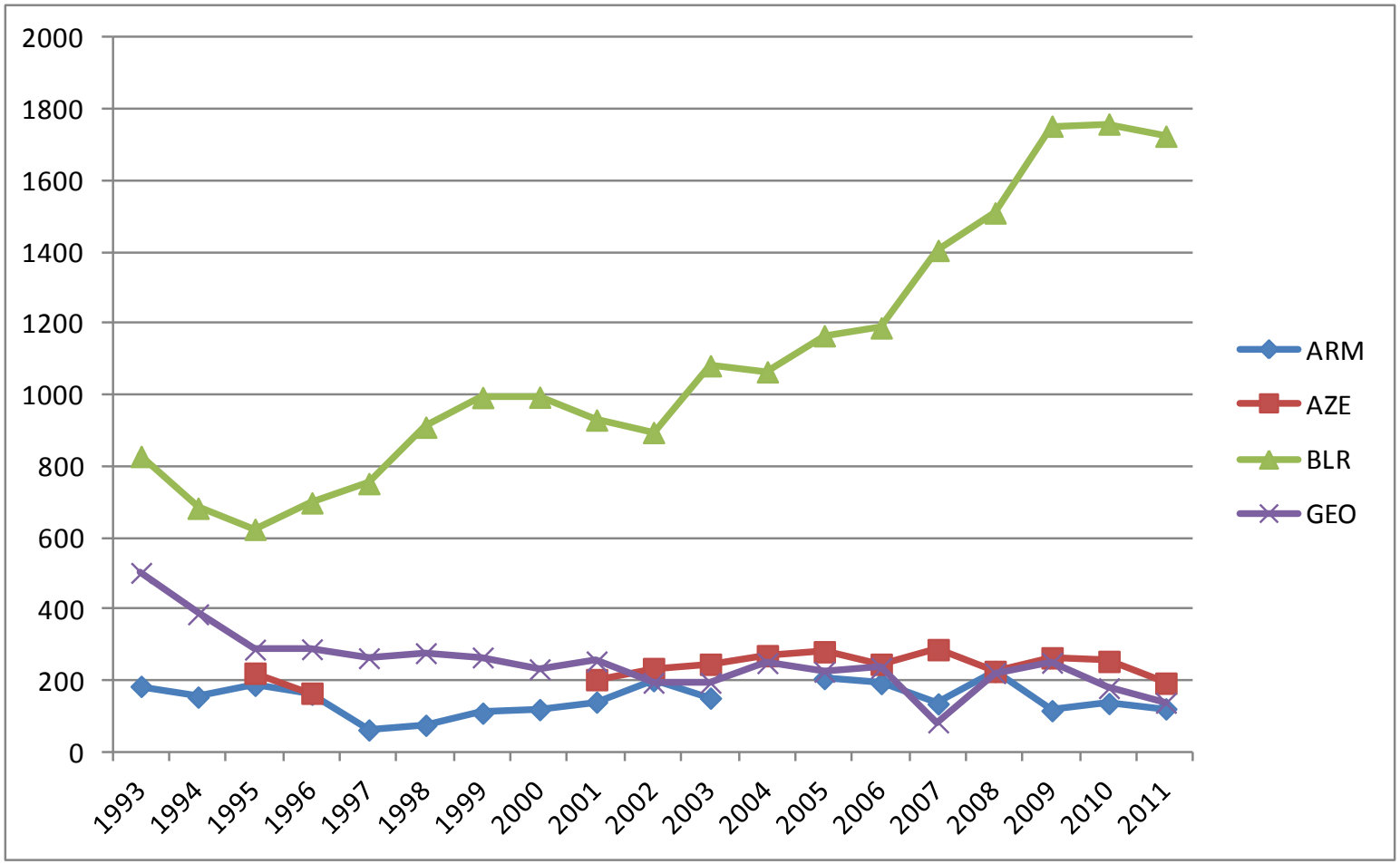
Diverging trends in relation to resident patenting Belarus and Russia vs. rest of CIS

Annual rate of change of number of resident patents 1995-2008

Annual rate of change 1995-2008	
Belarus	5.5%
Czech Republic	1.0%
Lithuania	-1.5%
Poland	-0.3%
Slovenia	-0.3%
Russian Federation	3.6%
Ukraine	-4.0%

Armenia vs Belarus contrast

Number of resident patents 1993-2011



Global value chains

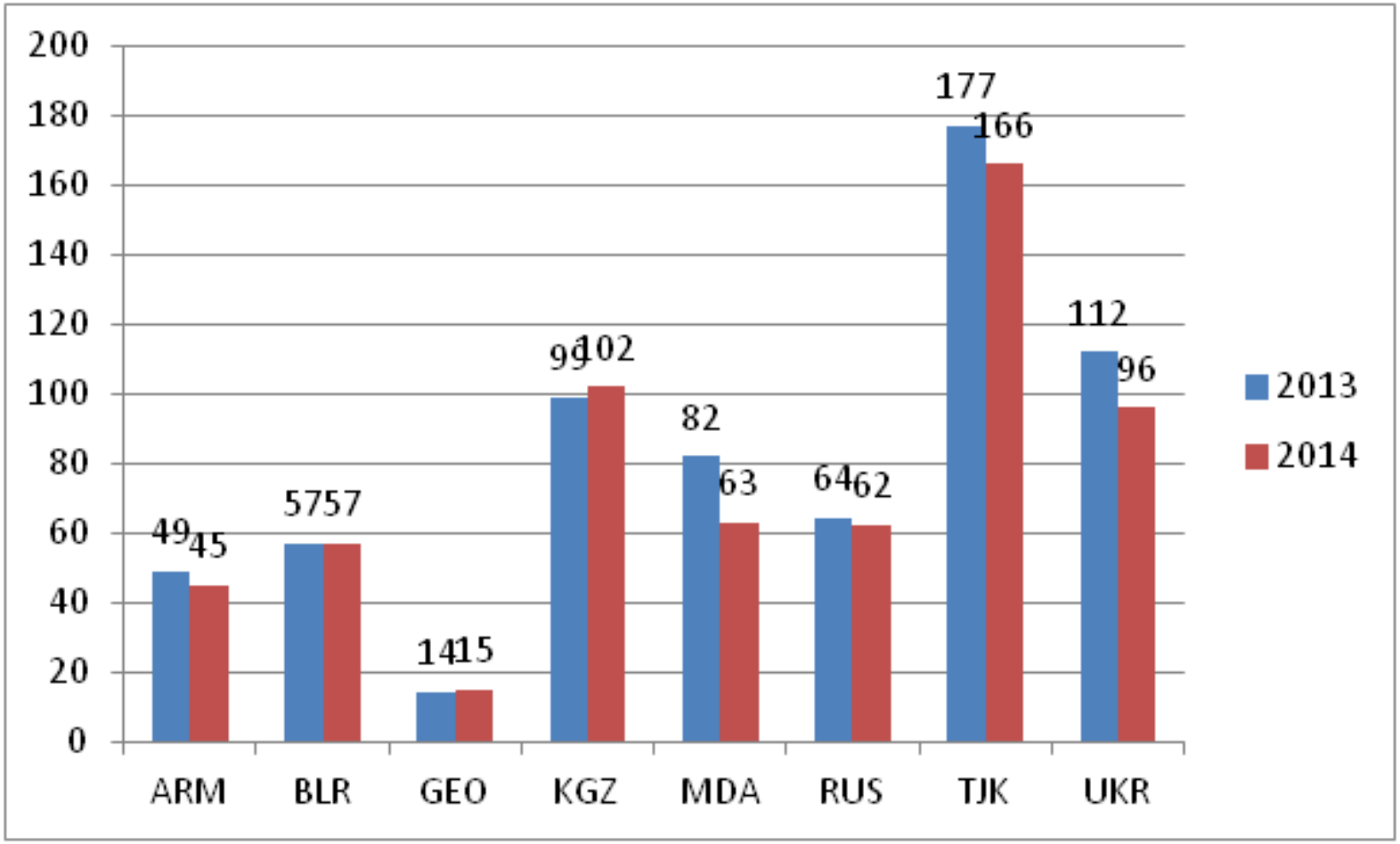
- CIS-5 are largely outside GVCs except in ICT outsourcing services (Ukraine, Armenia, Belarus) and a few country specific sectors
- A striking contrast to central Europe where FDI are dominating export (cf. foregin vs. domestic led modernization)
- No clear understanding of the effects of free economic zones on technology diffusion in the rest of economy

Business environment….

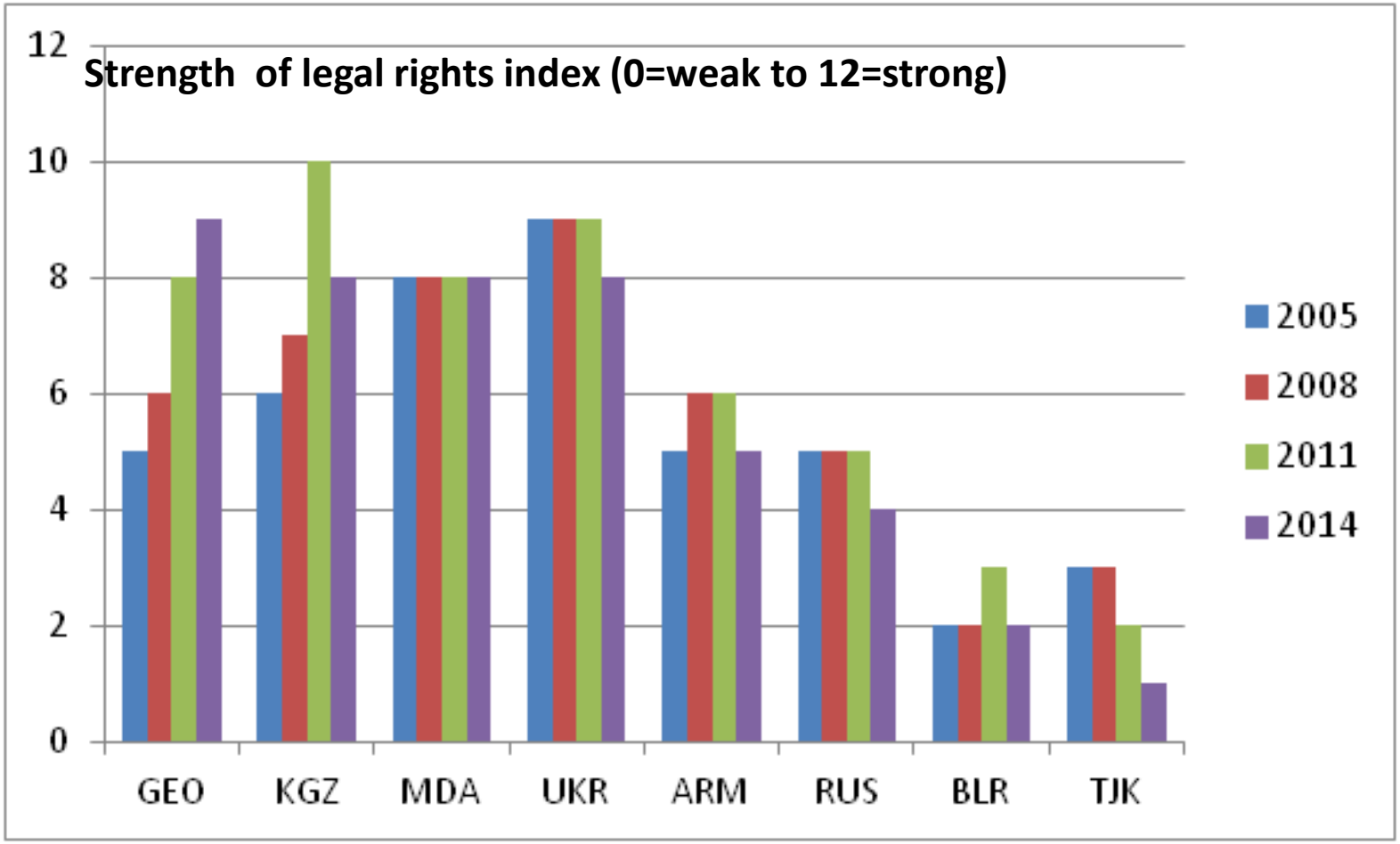
- Slowly improving but ……

Still. ….. unfriendly business regulations

Ease of doing business index (1=most business-friendly regulations

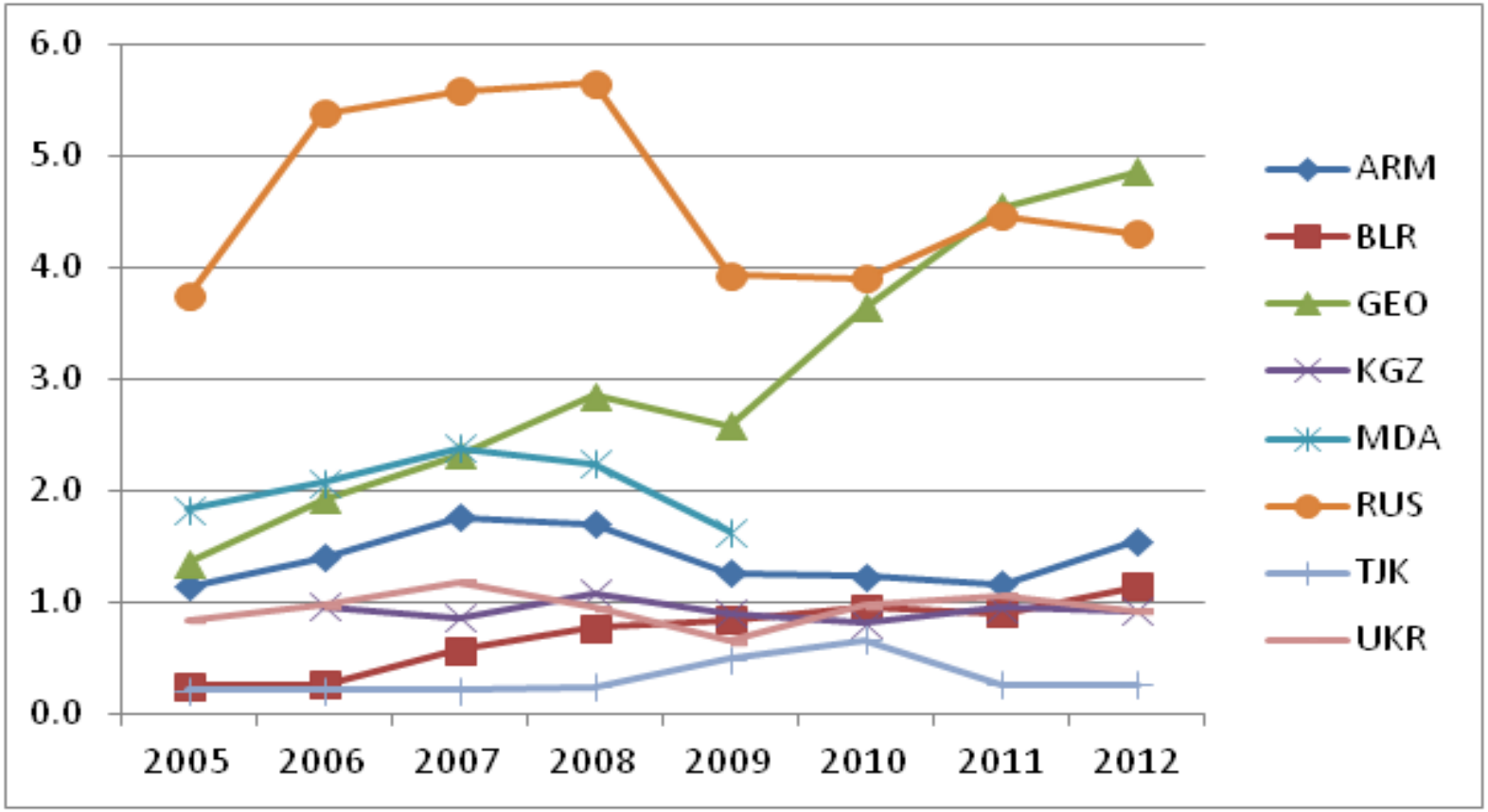


Poor legal rights: the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending



… which results in a very weak entrepreneurial dynamics:

New business density (new registrations per 1,000 people ages 15-64)

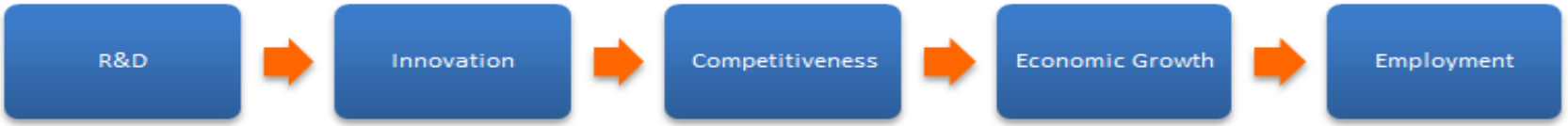


Different innovation policy profiles in CIS-5 ……

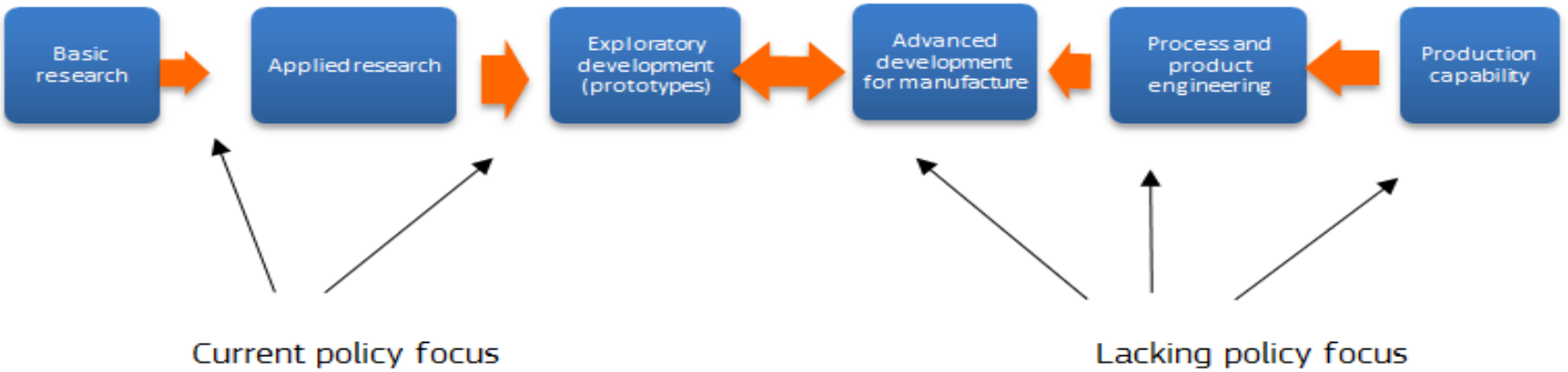
- Belarus: very active and elaborate innovation policy 'pressure to innovate' with developed innovation infrastructure but with limited in house R&D in enterprises
- Ukraine: extensive R&D support but unrelated to technology upgrading of the business enterprise sector
- Kazakhstan: Excessive changes of programs and strategies which aim to achieve diversification unrelated to extractive industries and in new areas with weak domestic demand
- Armenia: innovation policy is entirely post-2008 phenomenon and very limited
- Tajikistan: not yet established innovation policy, need to establish basic industrial support services linked to export

… but by and large all too much R&D focused

Figure 5: Alternative models of technology upgrading R&D based growth



Model of technology upgrading in EU-13



Source: Radosevic et al (2015)

Conclusion 1: CIS-5: Common structural features of RDI

1. Drivers of growth and determinants of technology upgrading in CIS-5 are related to production capability, not RD capabilities
2. Very weak business R&D sector (Arm, Tajik, Kazakh) or dominantly extramural (Ukr, Bel)
3. Public R&D (science) is weak and unbalanced due to historical legacies
4. Weak participation in Global Value Chains

Conclusion 2: Common features of innovation policies in CIS-5

1. Policies are largely focused on R&D driven growth (cf. commercialisation/naïve view)
2. Local sources of productivity improvements (quality, non-R&D innovations, labour skills) are being ignored by policy
3. Non-RDI policies have strong anti-innovation effects (poor innovation climate; corporate governance hampers innovation)

Conclusion 3: CIS-5: Common policy recommendations

1. Introduce policies for quality, non-R&D innovation support and continuous vocational training
2. From passive to active restructuring of RD system including improved evaluation of R&D organisations and programs as part of public management modernization agenda
3. Enhance demand for local RDI via public innovation procurement for New Technology Based Firms
4. Link accession to GVC/FDI with innovation policy
5. Modernisation of curriculum and internationalization of higher education system

Conclusion 4: Reconsider the main structure of the IP Reviews

- To broaden perspective on innovation system beyond public R&D (cf. firm centred innovation ecosystem)
- To be much more focused on enterprise RDI with analyses of a few typical sectors and typical firms
- Reconsider the range of indicators used (cf. to go beyond standard RD indicators and towards technology upgrading indicators))
- Should finance be standalone topic or part of framework conditions analysis?
- FDI and GVC to be given much more prominence
- Industry science linkages to be explored as part of public RD system chapter
- Innovation governance should contain box on institutional capabilities for innovation policy (cf. policy 'best matches' with institutional capabilities)