Is Military Spending Converging Across Countries? An Examination of Trends and Key Determinants

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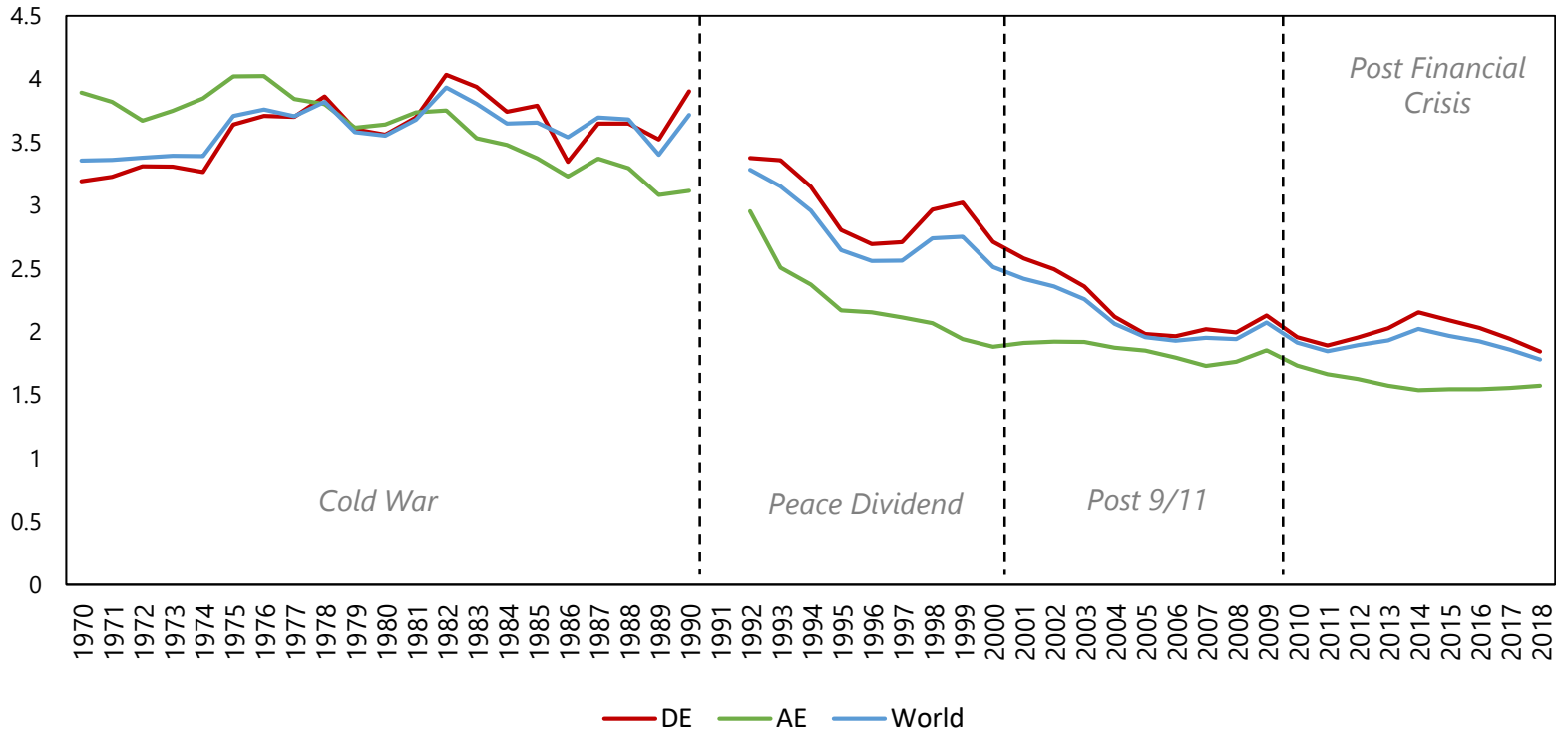
Outline

- Motivation and Contribution
- Convergence in military spending
- Determinants of military expenditure
- Conclusions

- This paper based on an IMF Working Paper with the same title issued on September 20, 2019, coauthored with Benedict Clements and Saida Khamidova

1. Motivation

- Significant drop in global military spending over the last 50 years



Sources: Stockholm International Peace Research Institute (SIPRI) and IMF World Economic Outlook.

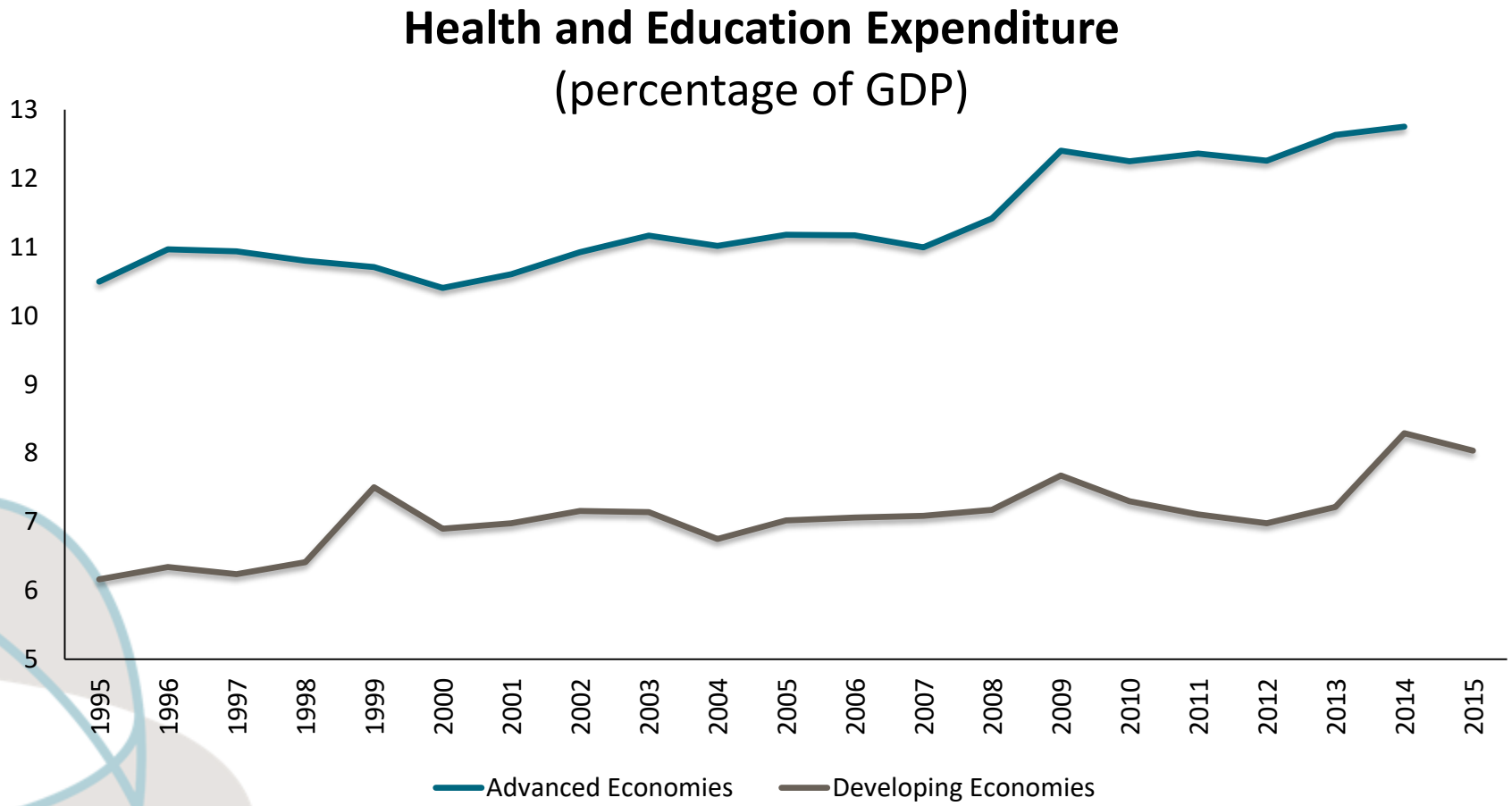
Note: Military expenditure as percentage of GDP calculated as the unweighted country averages within each country group. DE and AE denote the developing economies and the advanced economies, respectively. Data for 1991 on a global basis are not available due to the breakup of the former Soviet Union.

1. Motivation (continued)

Many factors could be behind this fall:

- Improved global security environment
- Fiscal adjustment, particularly in advanced economies following the financial crisis
- Developing countries allocating more to social sectors for MDGs and the SDGs more recently (see next slide)
- Advanced economies faced with rising age-related spending, reflecting changing demographics—the case of social dominance where social expenditures dominate fiscal policy

Social Spending



Sources: World Bank World Development Indicators (WDI).

1. Motivation (continued)

- But military expenditure remain substantial in many countries (see the following three slides)

- The paper assesses the key drivers of military spending and their contribution to the observed convergence in spending

Military Expenditure (Millions of Current USD, 2018)

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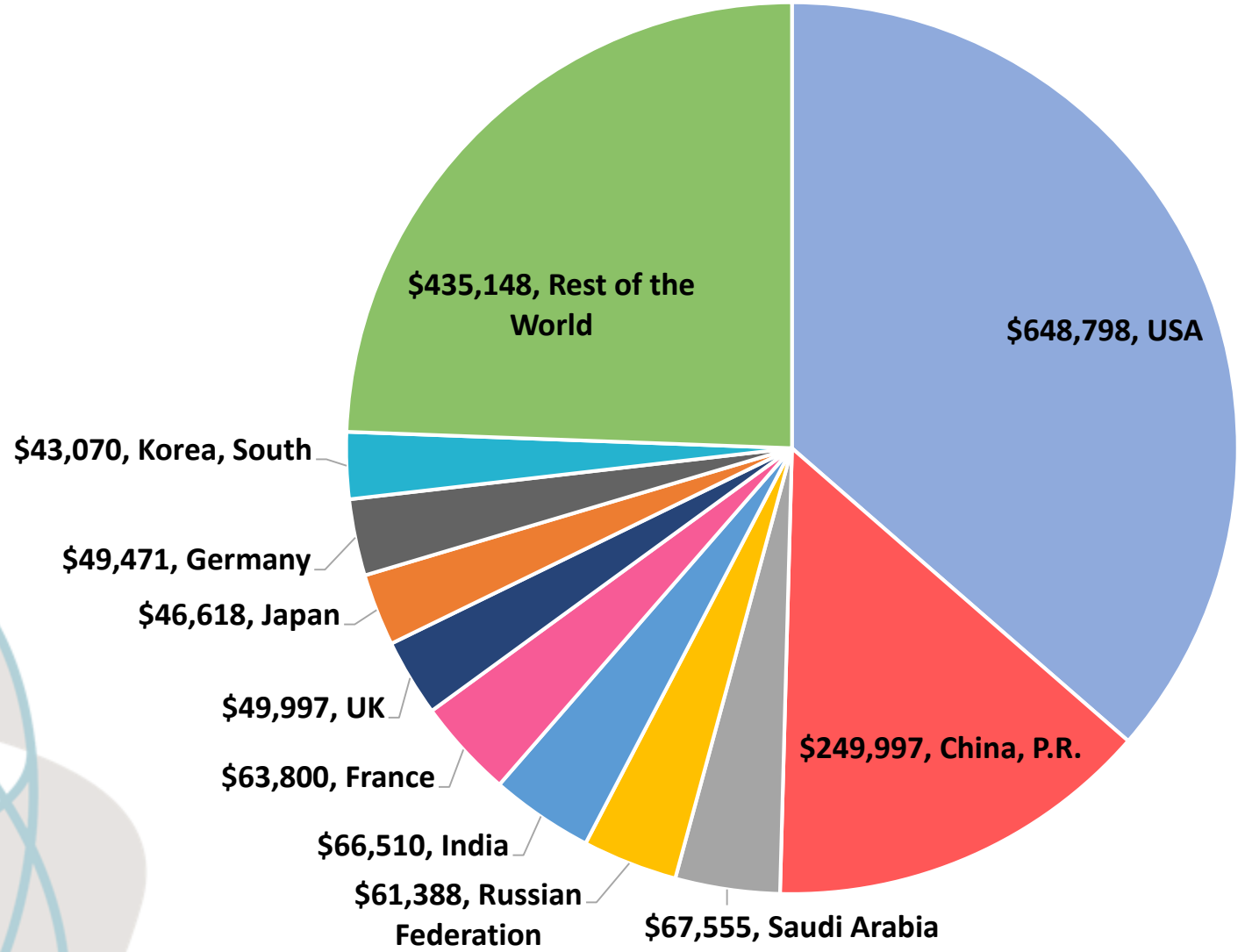

Military Expenditure, 1970-2018 (Percentage of GDP)

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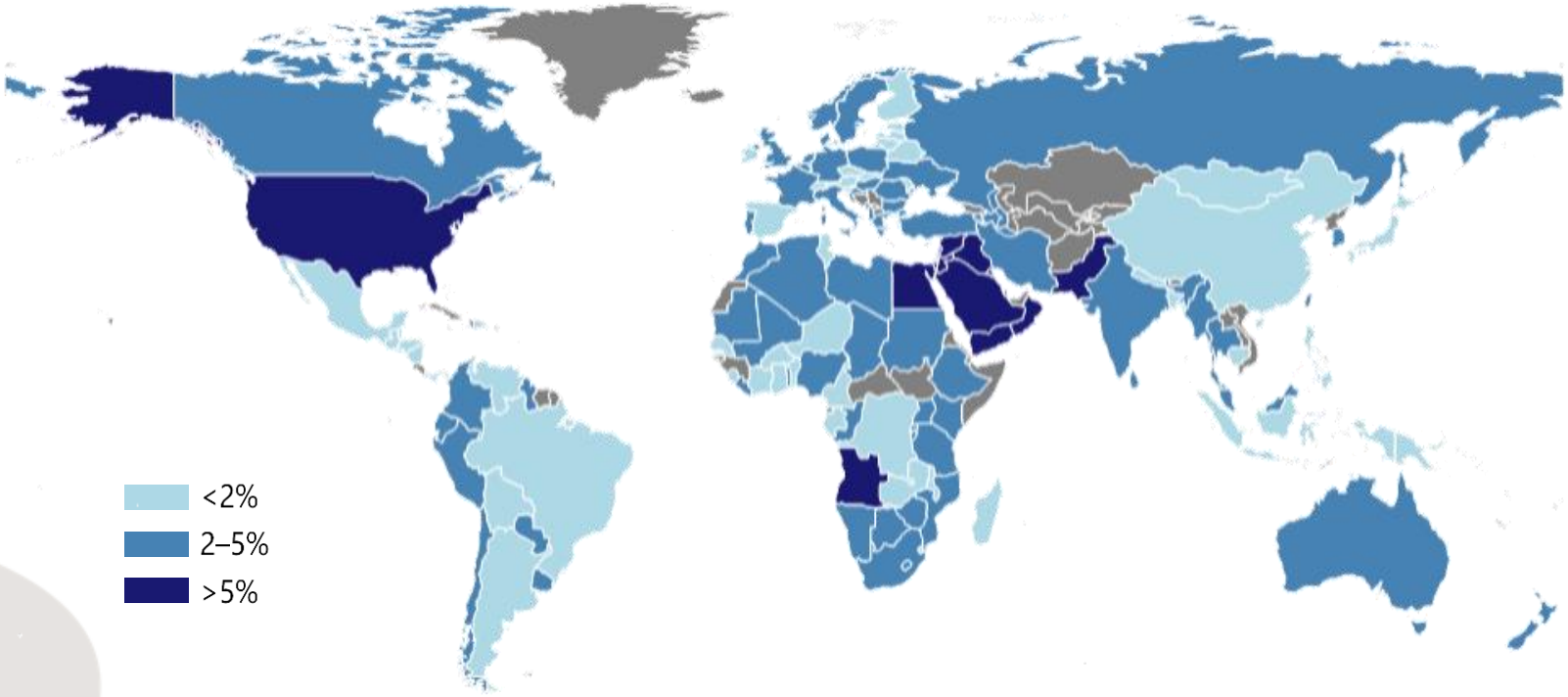
<2%	2 - 5%	>5%
57	68	13



Military Expenditure, 1970-2018 (Percentage of Total Expenditure)

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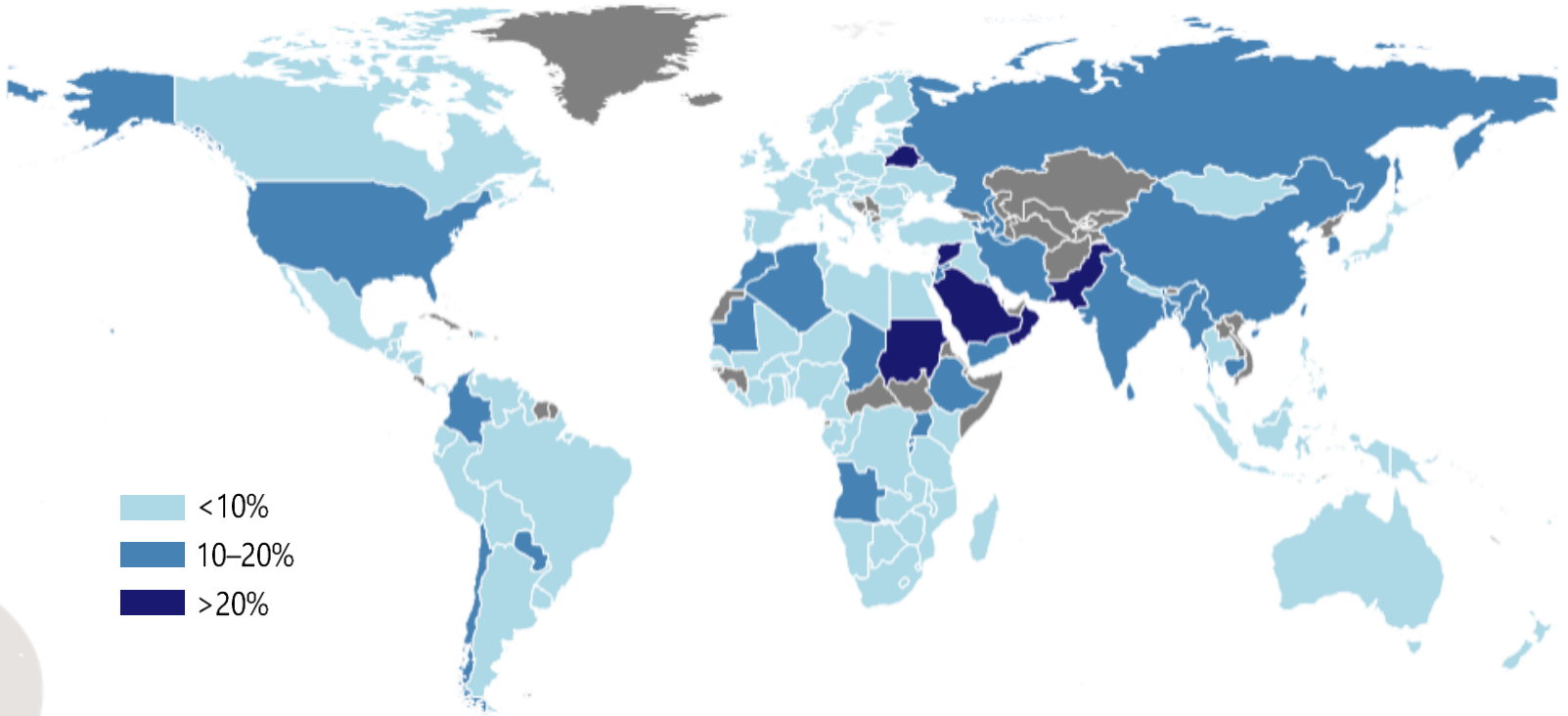
<10%	10 - 20%	>20%
100	31	7



2. Convergence in Military Spending

The big question: Is military spending really converging? Are all countries converging to the same level?

- Ample literature on the convergence in growth rates and other economic variables across countries (Baumol (1986) and Barro and Sala-i-Martin (1992 and 1995)
- Beta, Sigma and nonlinear unit root tests

2. Convergence in Military Spending (continued)

- These tests have limitations
  - In the case of Sigma Convergence, it is not possible to assess whether an observed convergence is statistically significant
  - A Beta test can only test for convergence for a given country group, but a division of countries into subgroups can bias the results
  - Nonlinear unit root test can only be applied to country pairs

- We propose to use an alternative test
  - Suggested by Philipps and Sul (2007)— it does not suffer from the limitations mentioned above
  - It has been used for studying price level convergence in Euro area (Fritsche and Kuzin, 2011) and to income convergence in EU (Monfort, Cuestas, Ordonez, 2013)

Beta Test of Convergence

Underlying model:

$$\frac{y_{iT} - y_{i0}}{T} = a + \beta y_{i0} + \varepsilon_i$$

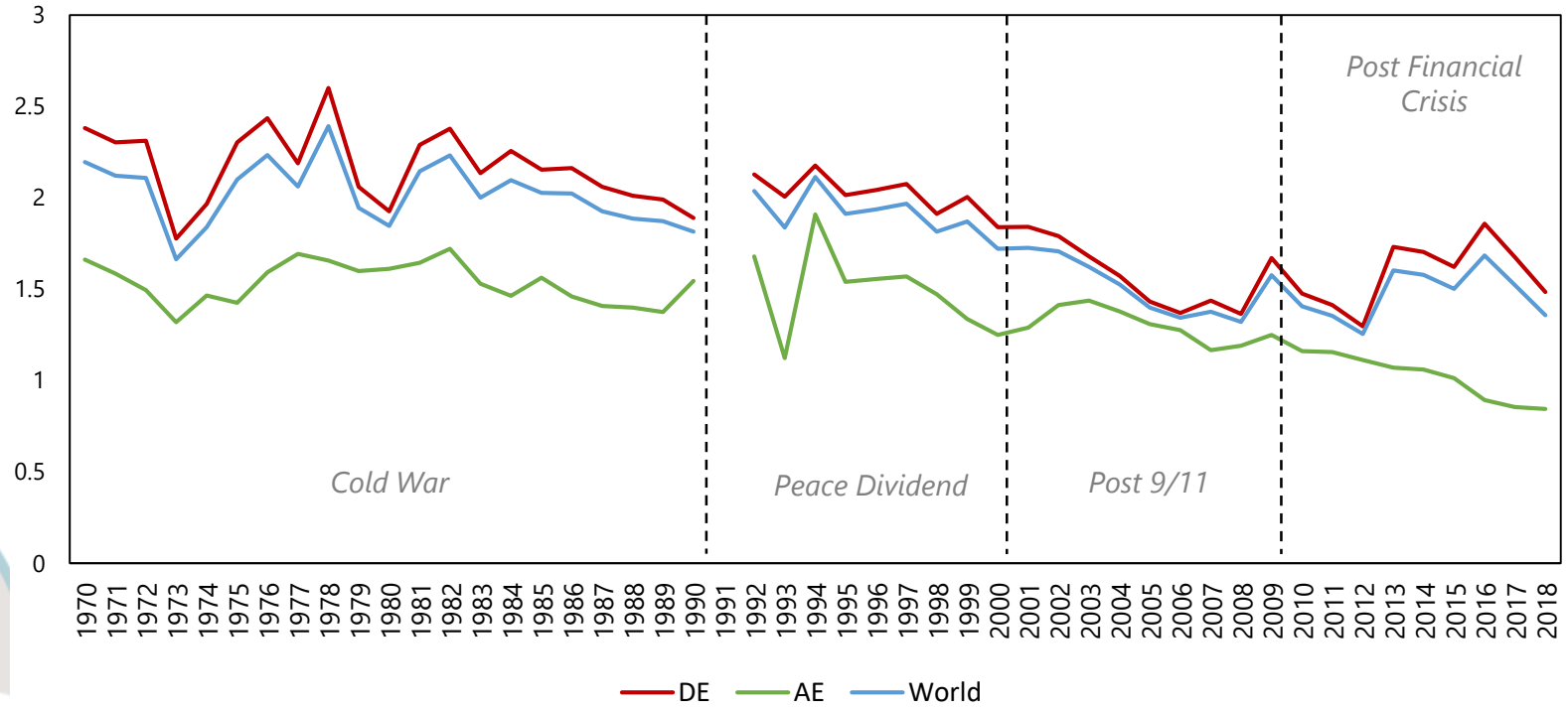
Results:

- For the whole sample, the point estimate of "Beta" coefficient is -0.02 and it is statistically significant. A one-percentage increase in the initial value is associated with a 0.2 percentage faster decrease in the military expenditure, as a share of GDP. Similar results are found in advanced and emerging economies.

Cross-sectional Beta convergence test

	All	Advanced	Developing
y_0	**-0.0237*** **	**-0.0250*** **	**-0.0236*** **
	[0.0018]	[0.0012]	[0.0023]
Cons	**0.0364*** **	**0.0277*** **	**0.0400*** **
	[0.0082]	[0.0051]	[0.0106]
Obs.	140	34	106
R-Sq	0.56	0.93	0.51

Sigma Convergence



2. Convergence in Military Spending (continued)

What does the underlying model look like:

$$\log(V_1) - \log(V_t) - 2\log L(t) = a + b\log t + \varepsilon_t,$$

- Where V is the cross-sectional variance of relative transition path of military expenditure; L(t) is a slowly varying function, such that L(t)→∞ as t→∞; α is the rate of convergence
- Based on the above model and using b=2α, we can test the null hypothesis $\alpha \geq 0$ via a one-sided t-test

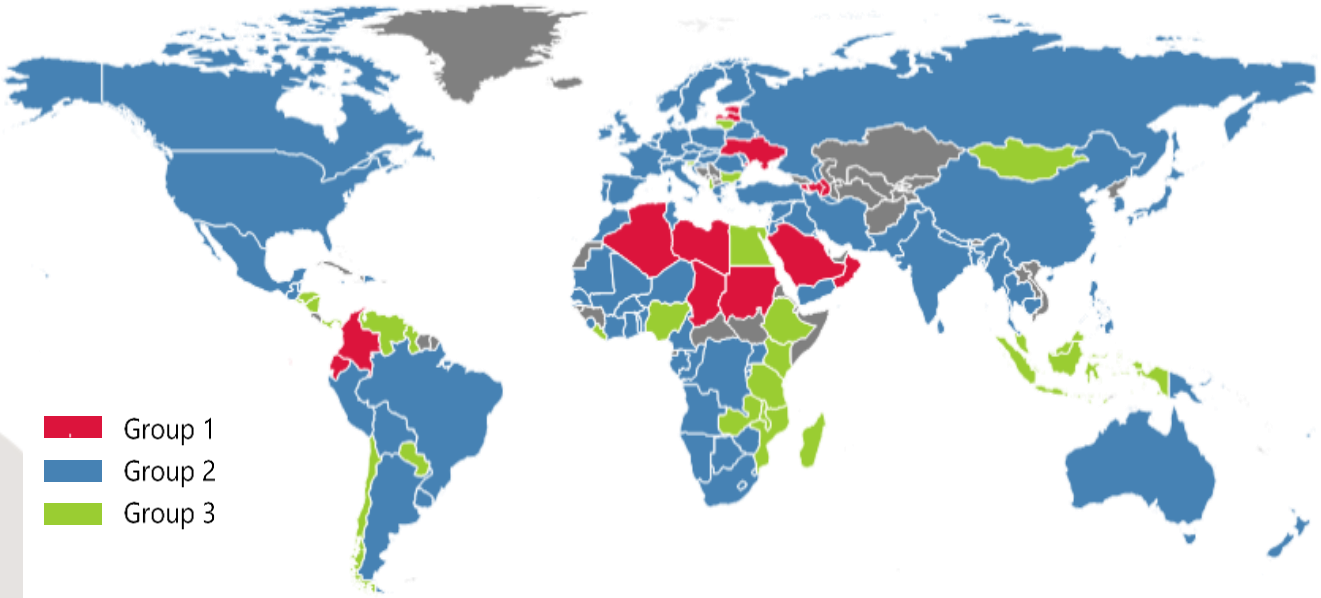
Data

- Annual data from SIPRI, covering 140 countries, of which 34 are advanced 106 developing
- The test yields three country groups; group 2 is the largest with 98 countries and converges faster than the other two groups

2. Convergence in Military Spending (continued)

Group	Countries	Time periods	Coefficient	S.E.	t-stat.
1	13	49	0.55**	0.35	1.58
2	98	49	-0.02**	0.01	-1.60
3	27	49	-0.19**	0.23	-0.82

Note: The null hypothesis is that all countries within each group converge to the same level. This test is a one-sided t-test and the critical value of 5% level is -1.65.



3. Determinants of Military Expenditure

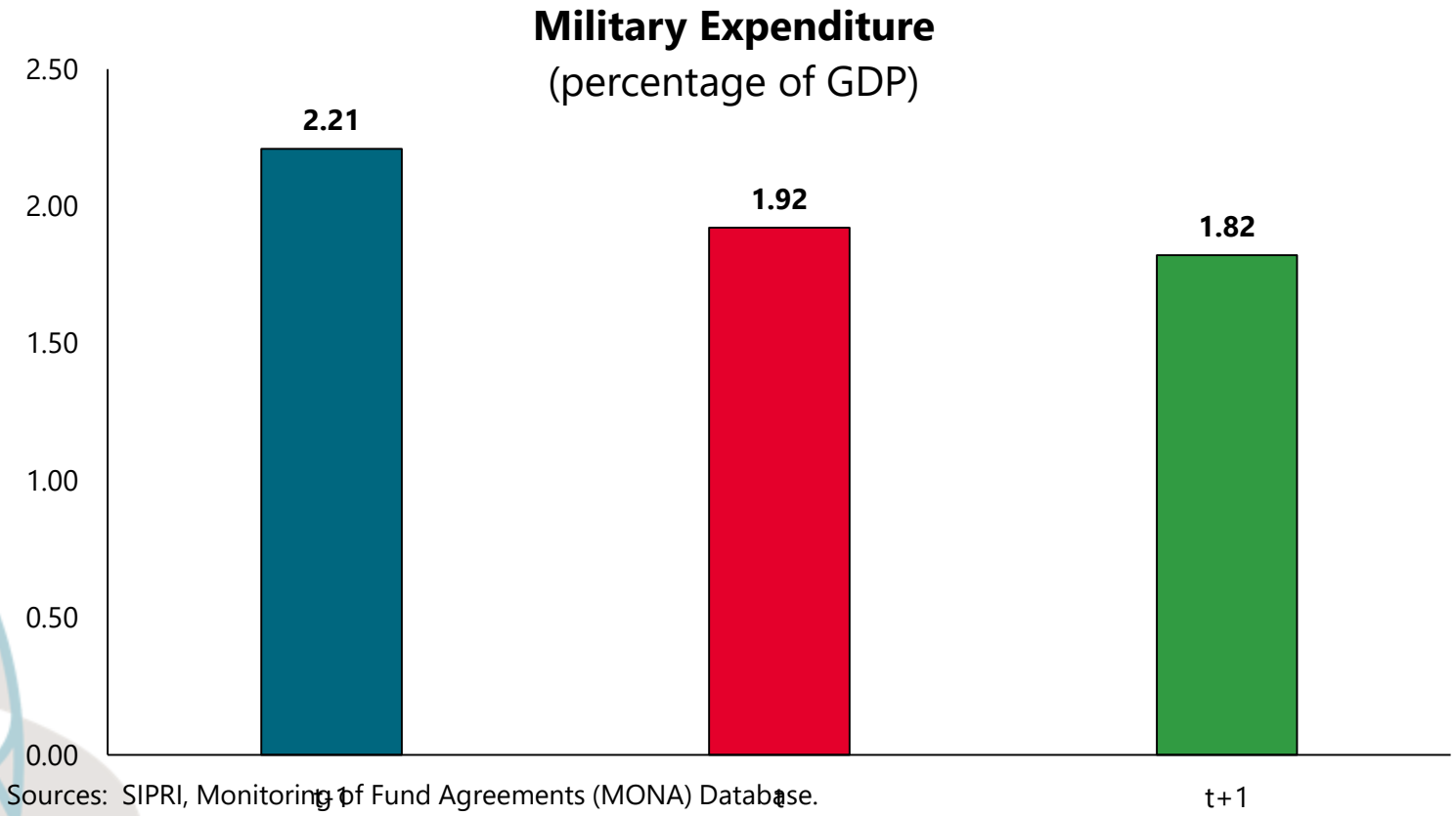
- What has driven changes in military spending in the past 50 years?
- Our baseline specification:

$$M_{it} = \beta_1 IMF_{it} + \beta_2 Social + \boldsymbol{\gamma X_{it}} + \mu_i + \varepsilon_{it}$$

  - Where M_{it} is the military expenditure of country *i* in year *t,* measured as percentage of GDP

- Key variables of interest are:
  - the presence of an IMF–supported program (IMF_{it})
  - the level of social spending in relation to GDP $(Social)$
  - Control variables denoted by vector $\boldsymbol{X_{it}}$ (lagged real per capita GDP, polity score, indicators of violence/terrorism and average neighbors' military spending (as a share of GDP)

Determinants of Military Expenditure – IMF Program Variable



Sources: SIPRI, Monitoring of Fund Agreements (MONA) Database.

Note: t represents the period during an IMF Program, t-1 represents the period one year before the implementation of the program and t+1 one year after.

Error Correction Model of Military Spending

	All	AEs	DEs
L. Military Expenditure (as percentage of GDP)	-0.3364***	-0.1997***	-0.3450***
	[0.0427]	[0.0322]	[0.0455]
L. IMF Program	0.0087	-0.0567	0.023
	[0.0396]	[0.0477]	[0.0434]
D. IMF Program	-0.0076	0.0229	-0.0089
	[0.0331]	[0.0300]	[0.0369]
L. GDP per Capita	0.1756	-0.0361	0.1642
	[0.2082]	[0.1722]	[0.2465]
D. GDP per Capita	-0.2553	0.5977	-0.3902
	[0.5297]	[0.4227]	[0.6073]
L. Polity Score	0.0027	0.0046	0.0005
	[0.0071]	[0.0161]	[0.0077]
D. Polity Score	0.0043	-0.0428**	0.0055
	[0.0057]	[0.0185]	[0.0061]
L. High Political Stability and Absence of Violence/Terrorism	-0.0735	-0.1637**	-0.0774
	[0.0587]	[0.0664]	[0.0638]
D. High Political Stability and Absence of Violence/Terrorism	-0.1937	-0.2284***	-0.186
	[0.1331]	[0.0470]	[0.1356]
L. Low Political Stability and Absence of Violence/Terrorism	-0.1264	-0.0227	-0.1505*
	[0.0787]	[0.0684]	[0.0900]
D. Low Political Stability and Absence of Violence/Terrorism	0.0162	-0.0147	0.0235
	[0.0588]	[0.0369]	[0.0708]
L. Average Neighbors' Spending (as percentage of GDP)	0.0859***	0.0553	0.0855***
	[0.0242]	[0.0624]	[0.0241]
D. Average Neighbors' Spending (as percentage of GDP)	-0.0977*	0.0512	-0.1074**
	[0.0512]	[0.2034]	[0.0518]
L. Health and Education Spending (as percentage of GDP)	-0.0379***	-0.0054	-0.0405***
	[0.0143]	[0.0094]	[0.0146]
D. Health and Education Spending (as percentage of GDP)	0.0092	0.0162	0.0061
	[0.0195]	[0.0104]	[0.0217]
Obs.	1357	317	1040
R-Squared	0.31	0.42	0.32

Note: The dependent variable is military expenditure as percentage of GDP. Country fixed effects are included in all specifications. Robust standard errors are clustered at country level in parentheses. Significant at *10%, **5%, and ***1%.

Sources: SIPRI, IMF World Economic Outlook, World Bank World Development Indicators, World Bank World Governance Indicators, and authors' estimates.

Key results

- Internal security concerns are important in both advanced and developing countries (in the latter there is significant long-term relationship) in influencing defense outlays
- In developing countries, there is a positive relationship between the level of spending in neighbors and country's own spending.
- Policy score (measuring the qualities of governing institutions) is important for advanced economies rather than developing ones
- Social spending does not crowd out defense outlays in advanced economies, but does so in the developing world
- No impact of Fund programs on military spending

4. Conclusions

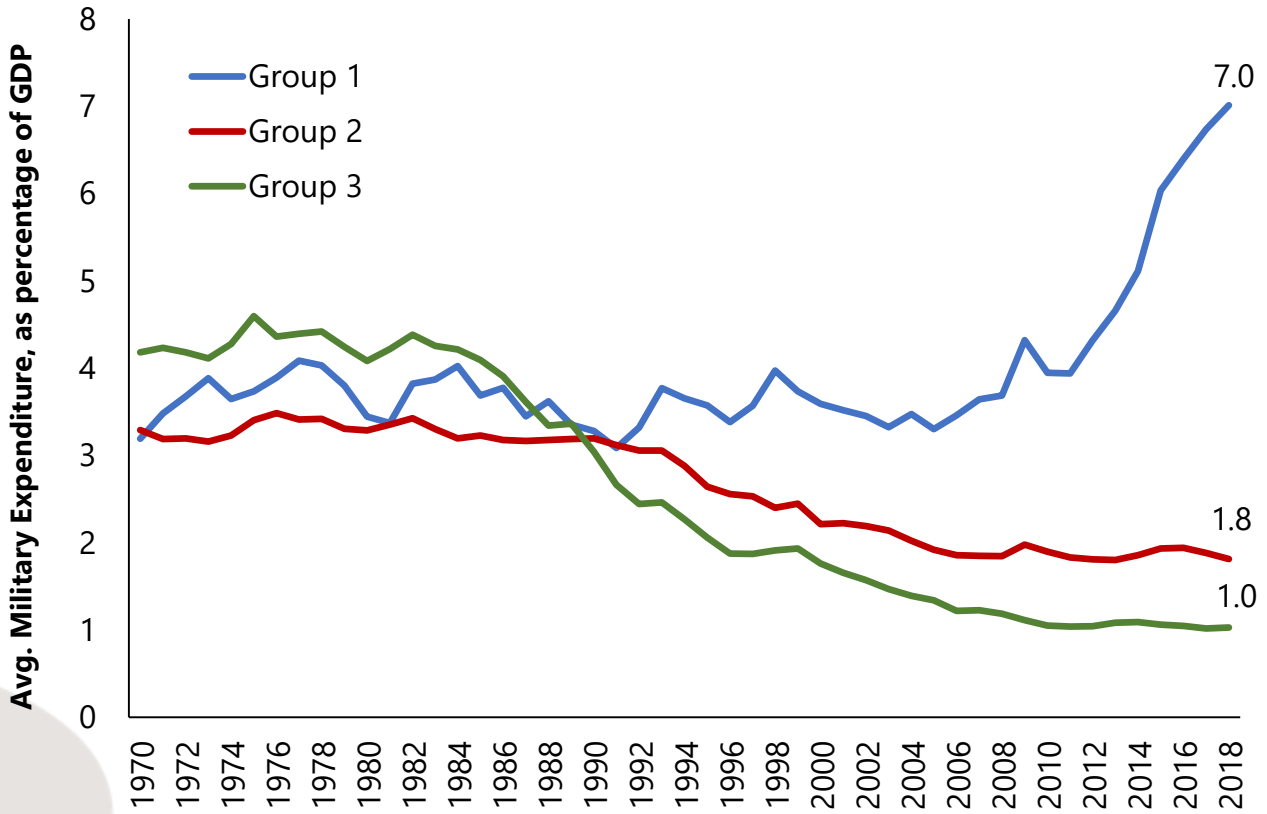
- Our results show that military spending in relation to GDP is indeed converging to a lower level
- Rising GDP per capita, and better governance, could lead to further reductions in military spending
- The spending by neighbors plays a powerful role, especially in developing economies, suggesting positive spillovers from countries reducing military spending

Appendix: Convergence Groups (1970-2018)

Group	Countries
Group 1	Algeria, Armenia, Azerbaijan, Chad, Colombia, Ecuador, Estonia, Latvia, Libya, Oman, Saudi Arabia, Sudan, Ukraine.
Group 2	Angola, Argentina, Australia, Austria, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei Darussalam, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, China, Democratic Republic of the Congo, Republic of Congo, Croatia, Cyprus, Czech Republic, Côte d'Ivoire, Denmark, Dominican Republic, Fiji, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Hungary, India, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Korea, Kuwait, Lebanon, Lesotho, Luxembourg, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Morocco, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Niger, Norway, Pakistan, Papua New Guinea, Peru, Philippines, Poland, Portugal, Romania, Russia, Rwanda, Senegal, Sierra Leone, Singapore, Slovak Republic, South Africa, Spain, Sri Lanka, Swaziland, Sweden, Switzerland, Syria, Taiwan, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, United States, Uruguay, Yemen, Zimbabwe.
Group 3	Albania, Bulgaria, Cabo Verde, Chile, Egypt, El Salvador, Ethiopia, Guyana, Honduras, Indonesia, Kenya, Liberia, Lithuania, Madagascar, Malawi, Malaysia, Mongolia, Mozambique, Nicaragua, Nigeria, Panama, Paraguay, Seychelles, Slovenia, Tanzania, Venezuela, Zambia.

Appendix: Convergence Groups (1970-2018)

Average military expenditure as a percentage of GDP in each group (1970-2018)



Previous Work on Military Expenditure

- Convergence in Military Spending
  - Arvanitidis, Kollias, and Anastasopoulos (2014)
  - Lau, Demir, and Bilgin (2016)
- Military Spending and Fiscal Adjustment
  - Davoodi, Clements, Schiff, and Debaere (2001)
- Military Spending and Economic Growth
  - Alptekin and Levine (2012)
  - Chen, Lee, and Chiu (2014)
  - Zielinski, Fordham, and Schilde (2017)
- Peace Dividend and Arms Race
  - Clements, Gupta, and Schiff (1997)
  - Collier, and Hoeffler (2002)