The "Paradox of Innovation" in Conflict Zones
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The Paradox of "Innovation in Conflict Zones"
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Data & Methods
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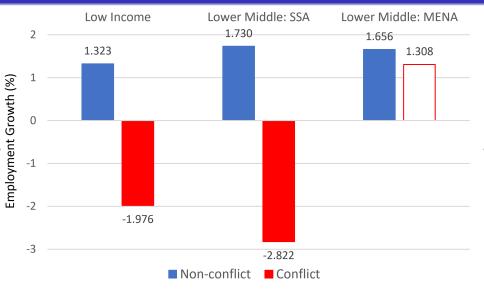# The Paradox of Innovation in Conflict Zones

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15 September 2023
3rd Annual Conference of the Regional Research Network of
the Central Banks of the Middle East and North Africa
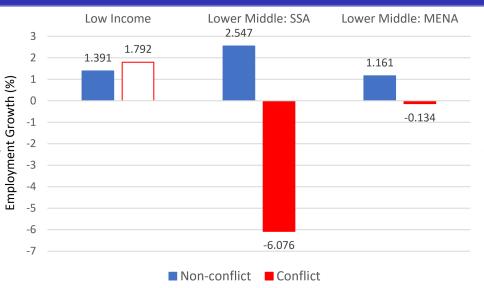Rabat, Morocco

The Paradox of Innovation
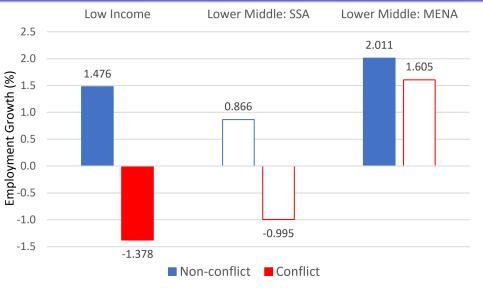
The
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Product Innovation

E-commerce Website

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Formal Training

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Process Innovation

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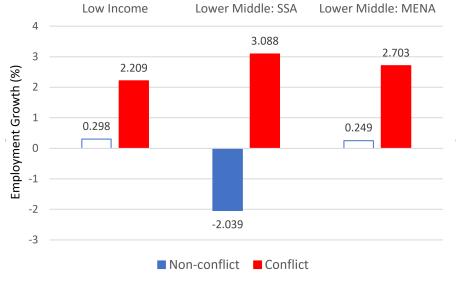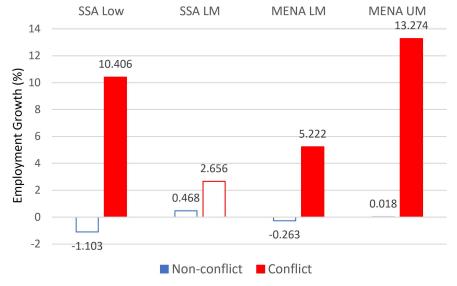o

New Process Logistics

World Bank Enterprise Surveys (WBES)

- Regression sample: 73,281 manufacturers and service providers
- Years 1998 to 2023
- Sub-Saharan Africa (SSA): 101 surveys in 42 countries
- Middle East and North Africa (MENA): 50 surveys in 16 countries (includes Türkiye)
- 6 measures of innovations:
    - Process Innovation
    - Product Innovation
    - ISO Certification
    - E-commerce Website
    - Formal Training
    - R&D Expenditures

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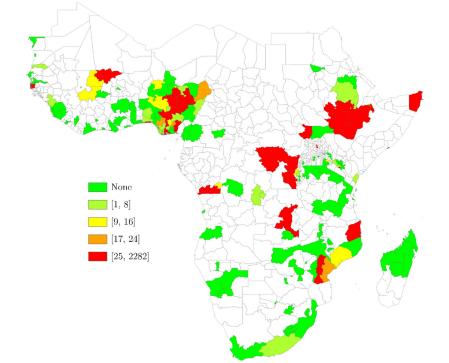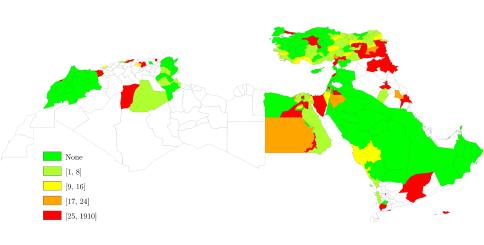Data & Methods
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WBES Innovation Follow-up Survey (IFS)

- Regression sample: 10,040 manufacturers and service providers
- Years 2008 to 2014
- Subset of firms revisited in 21 countries:
  - SSA: 4,791 enterprises in 112 subdivisions in 14 countries
  - MENA: 5,249 enterprises in 65 subdivisions in 7 countries
- 25 innovative activities: more granular measures
- 5 innovation indexes (5 components each) are created:
  - Process Innovation Index
  - Product Innovation Index
  - Organization Innovation Index
  - External Innovation Index
  - Investment in Innovation Index

Uppsala Conflict Data Program (UCDP)

- Dyad-level data: The use of armed force between two parties, of which at least one is the government of a state
- WBES-UCDP merge: UCDP Fatalities are first aggregated for first-order subnational administrative division and then summed over the respective number of WBES growth periods
- Conflict Zone: 25 or more battle-related deaths (Gleditsch et al. 2002; Sundberg and Melander 2013; Högbladh 2022)
- SSA: 28 of 229 subdivisions are conflict zones (12.2 percent)
- MENA: 43 of 199 subdivisions are conflict zones (21.6 percent)

	None
	[1, 8]
	[9, 16]
	[17, 24]
	[25, 2282]

None

[1, 8]

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[25, 1910]

Regression Specification

$$y_i = \alpha + \beta_1 Conflict_r \times Innovation_i + \beta_2 Innovation_i$$

$$+ \sum_j \beta_{3j} x_{ji} + \lambda_h + \lambda_r \times \lambda_s \times \lambda_t + \varepsilon_i$$

- OLS estimation
- Adapts Aterido,Hallward-Driemeier, and Pagés (2011)
- The average annual employment growth rate y for firm i:

$$y_i = \left[\exp \left(\frac{\ln (p_n / p_0)}{n - 1} - 1 \right) \right] \times 100$$

where p_n and p_0 are the last and first observations of **full-time permanent employees** in the period, and $n - 1$ is equal to the number of growth years.

Table 5. 58-Country WBES Sample 1998-2023

Dependent Variable: Average Annual Geometric Growth Rate of Full-time Permanent Employees (%)

| | | | Lower Middle | | Upper |
	Low	Pooled	SSA	MENA	Middle
	(1)	(2)	(3)	(4)	(5)
Conflict × Process Innovation	1.911**	3.376***	5.127**	2.454**	-1.948
	(0.957)	(0.968)	(2.312)	(1.019)	(2.109)
Process Innovation	0.298	-0.675	-2.039**	0.249	0.132
	(0.465)	(0.573)	(0.976)	(0.698)	(0.556)
Conflict × Product Innovation	-3.299***	-1.206	-4.552**	-0.348	0.874
	(1.168)	(0.872)	(2.251)	(0.830)	(0.856)
Product Innovation	1.323***	1.601***	1.730**	1.656***	0.457
	(0.408)	(0.484)	(0.817)	(0.590)	(0.529)
Conflict × ISO Certification	-0.902	0.280	0.543	-0.149	-0.420
	(1.199)	(0.934)	(3.984)	(0.937)	(1.036)
ISO Certification	0.575	1.213***	-0.068	1.361***	1.285***
	(0.501)	(0.429)	(0.764)	(0.514)	(0.435)
Conflict × E-commerce Website	0.401	-2.396***	-8.623***	-1.292**	-0.134
	(1.049)	(0.681)	(2.809)	(0.638)	(1.019)
E-commerce Website	1.391***	1.581***	2.547***	1.161***	1.175**
	(0.464)	(0.395)	(0.804)	(0.435)	(0.414)
Conflict × Formal Training	-2.854***	-0.534	-1.861	-0.406	0.697
	(1.015)	(1.004)	(3.037)	(0.844)	(1.122)
Formal Training	1.476***	1.487***	0.866	2.011***	1.230**
	(0.487)	(0.526)	(0.916)	(0.604)	(0.537)
Conflict × R&D Expenditures	-0.699	1.024	3.558	0.053	1.606
	(1.282)	(1.022)	(2.958)	(0.978)	(1.560)
R&D Expenditures	0.644	0.386	-1.345	1.444**	0.384
	(0.452)	(0.618)	(1.059)	(0.704)	(0.669)
Observations	23,117	30,826	9,252	21,574	19,338
Number of Clusters	541	676	203	473	383
Adjusted R^2	0.124	0.107	0.103	0.105	0.090

Table 6. 21-Country IFS Sample 2008-2014

Dependent Variable: Average Annual Geometric Growth Rate of Full-time Permanent Employees (%)

	Pooled	SSA		MENA	
		Low	LM	LM	UM
	(1)	(2)	(3)	(4)	(5)
Conflict × Process Innovation Index	1.904***	3.256***	3.547**	1.582**	-0.406
	(0.732)	(0.894)	(1.591)	(0.733)	(0.773)
Process Innovation Index	-0.621***	-0.304	-1.005**	-0.401	-0.501
	(0.228)	(0.413)	(0.427)	(0.316)	(0.601)
Conflict × Product Innovation Index	-1.563***	-4.872***	-3.946***	-0.198	-1.018
	(0.544)	(1.843)	(1.099)	(0.529)	(1.040)
Product Innovation Index	0.980***	1.519***	1.670**	0.266	1.266
	(0.328)	(0.562)	(0.790)	(0.236)	(0.887)
Conflict × Organizational Innovation Index	-1.071*	-2.227**	-1.061	-0.813**	0.184
	(0.628)	(1.088)	(1.803)	(0.386)	(0.584)
Organizational Innovation Index	0.451*	1.939***	-0.567	0.527**	0.100
	(0.272)	(0.600)	(0.654)	(0.217)	(0.412)
Conflict × External Innovation Index	-1.015	-2.645***	-2.143	-0.148	-1.757
	(0.897)	(0.981)	(2.666)	(0.492)	(2.020)
External Innovation Index	0.891***	1.031***	1.468**	-0.068	1.335**
	(0.284)	(0.344)	(0.708)	(0.366)	(0.530)
Conflict × Investment in Innovation Index	-0.452	0.224	-1.342	-0.576	0.752
	(1.033)	(0.919)	(2.907)	(0.589)	(0.510)
Investment in Innovation Index	0.314	0.142	-0.539	0.222	1.368**
	(0.352)	(0.554)	(0.855)	(0.366)	(0.495)
	(0.732)	(1.506)	(1.968)	(0.832)	(0.983)
Observations	10,040	2,105	2,686	3,555	1,694
Number of Clusters	226	79	55	66	26
Adjusted R^2	0.126	0.143	0.073	0.200	0.122

Summary & Outlook

- Findings reveal dual paradoxes of innovation in conflict zones.
- Process innovators in conflict zones are resilient job creators.
- New process logistics is key: e.g., internet-based operations for purchasing, accounting, or computing.
- Non-conflict conditions: Innovation via new products, investment, and linkages remain the best channels for structural transformation and the expansion of decent work.
- Conflict-prone countries: Policy recommendations call for the support of technologically-nimble firms capable of pivoting to process innovation when signs of violence-induced uncertainty reemerge.