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How Do Exporters Adjust to Exchange-Rate Fluctuations? New Evidence from the East African Community

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EAC pursuing two-pronged regional integration strategy

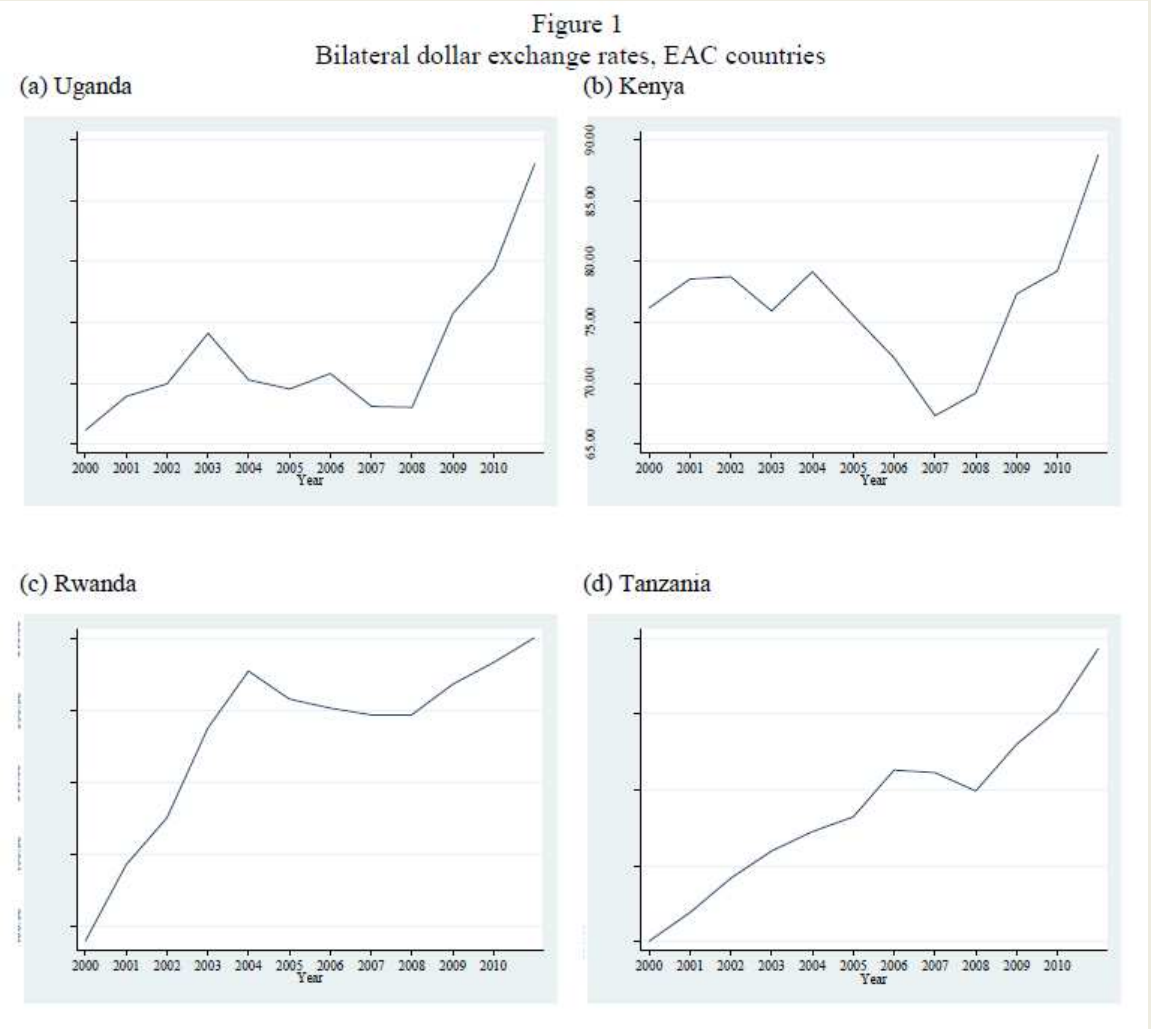
- Trade integration
  - Customs union
  - Attempts at cooperating on building a common market through reduction in NTBs
  - MRAs for some types of services
- Monetary integration

Experience suggests that successful monetary integration requires (inter alia)

- Not too many asymmetric shocks
- Macro convergence
- Integrated regional markets

So far, exchange-rate movements among EAC countries show little convergence

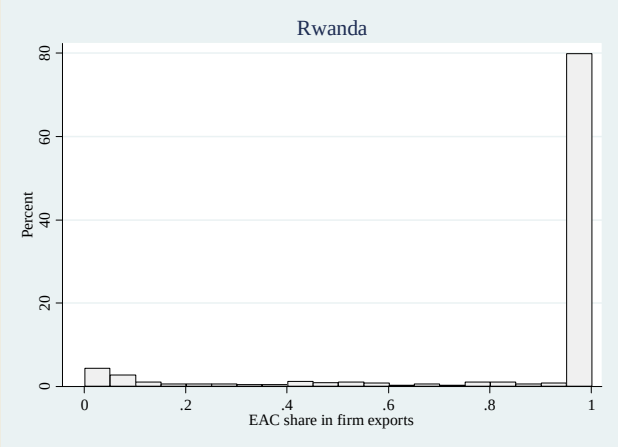
Figure 1
Bilateral dollar exchange rates, EAC countries



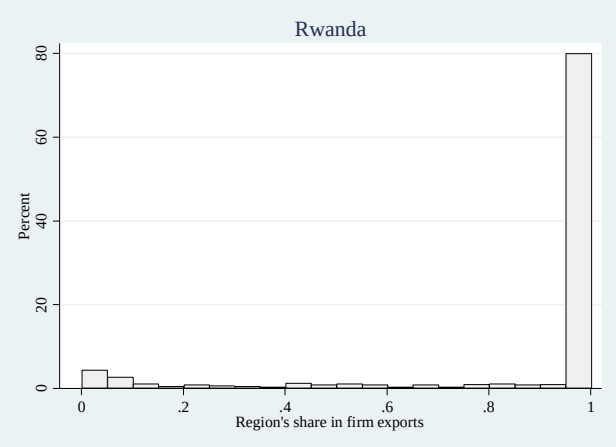
HOWEVER A REGIONAL EAC MARKET SEEEMS TO EMERGE, BREEDING A SPECIAL TYPE OF FIRMS – SMALL MANUFACTURERS

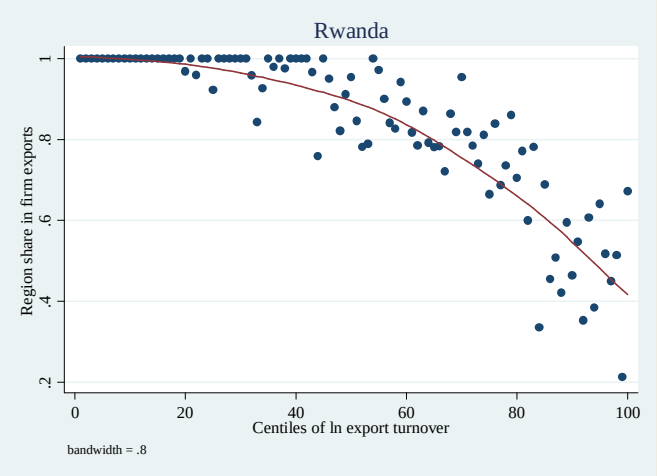
Close to 80% of Rwanda's exporters realize over 95% of their export turnover on regional markets

(a) EAC share in firm exports



(b) Region share (including S-Sudan & DRC)





And the most regionally specialized exporters are the smallest

Our empirical strategy: A detour through the monetary to understand the real

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Our objective: Assess EAC market integration through firm pricing behaviour, using exchange-rate variations as a "laboratory"

In the pass-through literature (see e.g. Feenstra 1989; Marston 1990; Gagnon Knetter 1995, and many others), incomplete ERPT, i.e. pricing to market (PTM) is taken as evidence of

- Variable markups (with constant markups, ERPT would be 100%)
- Market segmentation

Our strategy: use PTM at the firm level from a large, multi-contry dataset to infer how competitive EAC markets are: PTM $\Rightarrow$ market power.

At the **firm level**, PTM estimates are surpisingly consistent (around 0.1, implying ERPT around -0.9) across countries (Atkeson and Burstein 2008, Berman Martin Mayer 2012, Tang Zhang 2012, Fosse 2012, Chaterjee, Dix-Carneiro and Vichyanond 2012); but

- More PTM for large firms
- More PTM for core products

THE FUNDAMENTAL PRICING TO MARKET EQUATION

Heterogeneous-firms model with distribution costs implies that PTM coefficient decreases with toughness of competition (as measured by σ, the elasticity of substitution):

Additive distribution cost in the importing country, as in Berman, Martin and Mayer (2012) or Chatterjee, Dix-Carneiro and Vichyanond (2012):

$$p^c = \tau p + \eta$$

Consumer price elasticity to prod. price: $\varepsilon^p = \dfrac{\tau p}{\tau p + \eta}$

$$\tilde{p}(\varphi) = \underbrace{\left(\frac{\sigma}{\sigma - 1}\right)\left(1 + \frac{\varphi \eta e}{\sigma \tau}\right)}_{\text{New markup}} \frac{1}{\varphi}$$

$$\beta^p = \frac{d \ln \tilde{p}}{d \ln e} = \frac{\varphi \eta e}{\sigma \tau + \varphi \eta e}.$$

PTM EQUATION WITH QUASI-LINEAR PREFERENCES

This property not a particular model's artifact: it appears in a different model

Quasi-linear utility function à la Melitz-Ottaviano (2008):

$$U = x_0 + a\int_\Omega x(\varphi)d\varphi - \frac{\sigma}{2}\int_\Omega x(\varphi)^2 - \frac{X^2}{2}$$

Demand:

$$x = \frac{a}{1+\sigma} + \frac{1}{\sigma(1+\sigma)}\bar{p}^c - \frac{1}{\sigma}p^c$$

Suppose that $p^c = \tau p$ (iceberg transportation cost, no additive distribution cost)

$$\tilde{p} = \frac{1}{2}\left[\frac{e\left(\sigma a + \bar{p}^c\right)}{\tau(1+\sigma)} + \frac{1}{\varphi}\right]$$

PTM elasticity

$$\beta^p = \frac{d\ln\tilde{p}}{d\ln e} = \frac{2\varphi\left(\sigma a + \bar{p}^c\right)}{\varphi\left(\sigma a + \bar{p}^c\right) + \tau(1+\sigma)}$$

DATA: THE FIRST MULTI-COUNTRY FIRM-LEVEL DATASET

Export transaction data from customs administrations of 6 countries

Table 1
Cross-country data summary

	Number of years	Number of transactions	Transactions per year	Number of firms	Number of destinations	Number of products a/
Bangladesh	7 (2005-2011)	412'000	58'857	13'503	197	2'784
Kenya	7 (2005-2011)	255'314	36'473	9'373	185	4'660
Morocco	9 (2002-2010)	463'386	51'487	17'470	179	4'391
Tanzania	7 (2005-2010)	44'408	6'344	4'517	178	3'267
Uganda	8 (2004-2011)	36'919	4'615	2'874	164	2'940
Rwanda	7 (2005-2011)	8'186	1'169	1'991	135	1'415

Notes
a/ Products have been aggregated to the common HS6 classification.

- The good: Large sample
- The bad: No firm-level covariates except constructed from the database
- The ugly: very, very noisy data, especially when it comes to unit values

IDENTIFICATION STRATEGY

Baseline estimation equation

PTM coefficient β^p

$$\ln(p_{fpdt}) = \underbrace{\alpha_0 \ln(e_{odt})}_{\text{pricing to market}} + \underbrace{\alpha_1 \mathbf{x}^1_{odt} + \alpha_3 \mathbf{x}^2_{dt} + \alpha_4 \mathbf{x}^3_{ft} + \alpha_5 \mathbf{x}^4_{p}}_{\text{control variables}}$$

Cross-firm heterogeneity in PTM →

$$+ \underbrace{\sum_k \beta_k \left[\ln(e_{odt}) \times \mathbf{x}^k_{\cdot} \right]}_{\text{interaction with firm characteristics}}$$

$$\underbrace{+\delta_{ot} + \delta_{fpd}}_{\text{fixed effects}} + u_{fpdt}$$

Estimation issues

1. Endogeneity (omitted variable) from macro shocks controlled with origin-year and firm-product–destination fixed effects
2. Firm size approximated by number of export products

STRONG PTM IN EAC BILATERAL TRADE SUGGESTS MARKET POWER

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Dependent var.: ln (Unit Value) Estimator: OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log bilateral RER	0.108*** (0.0316)	0.0853** (0.0332)	1.622*** (0.369)	-0.0812 (0.127)	-0.0908 (0.212)	-0.197*** (0.0692)	0.0873*** (0.0317)	0.137*** (0.0303)	0.0695** (0.0309)	0.0692 (0.390)	-0.559 (0.370)	-0.0225 (0.352)
Interaction terms												
ln (RER) × deval. a/		-0.00217 (0.00143)								0.000232 (0.00136)	0.000670 (0.00136)	0.000608 (0.00136)
ln (RER) × ln (dist.)			-0.182*** (0.0439)							-0.0612 (0.0430)	0.0490 (0.0434)	-0.0385 (0.0397)
ln (RER) × ln (dest. GDP/cap)				0.0223* (0.0128)						-0.0141 (0.0252)	-0.000750 (0.0238)	-0.00824 (0.0237)
ln (RER) × ln (dest. GDP)					0.00987 (0.00779)					0.0167 (0.0144)	0.0145 (0.0133)	0.0249* (0.0131)
ln (RER) × manuf. Prod.						0.396*** (0.0777)				0.301*** (0.0707)	-0.122** (0.0572)	-0.106* (0.0568)
ln (RER) × ln (1+number prod.) b/							0.00848*** (0.00211)			0.00588*** (0.00203)		
ln (RER) × ln (lag number prod.) b								0.00570*** (0.00194)			0.00413** (0.00192)	0.00449** (0.00192)
ln (RER) × EAC bilateral trade c/									0.692*** (0.153)	0.341** (0.164)	0.525*** (0.179)	
Devaluation (Real)		0.0155*** (0.00495)								0.0104** (0.00491)	0.00671 (0.00477)	0.00691 (0.00477)
ln (dest. GDP/cap)				-0.190*** (0.0480)						0.546*** (0.0999)	0.476*** (0.104)	0.515*** (0.103)
ln (dest. GDP)					-0.323*** (0.0476)					-0.648*** (0.0897)	-0.505*** (0.0921)	-0.539*** (0.0912)
ln (1+number prod.)							0.00230 (0.00677)			0.00749 (0.00672)		
ln (lag number prod.)								-0.0103 (0.00646)			-0.00688 (0.00644)	-0.00746 (0.00644)
Observations	568,275	568,275	568,275	567,172	567,114	568,240	568,275	431,635	568,275	566,990	430,556	430,556
R-squared	0.967	0.967	0.967	0.967	0.967	0.967	0.967	0.969	0.967	0.967	0.969	0.969
Firm-product-destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin--year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

…ALTHOUGH EAC EXPORTERS DON'T SEEM TO ENJOY MARKET POWER OUTSIDE OF THEIR REGIONAL MARKET

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Dependent var.: ln (Unit Value) Estimator: OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log bilateral RER	-0.103	-0.127	2.865***	0.134	0.662	-0.568***	-0.131	0.125	-0.314***	-0.749	-1.534	0.0102
	(0.106)	(0.110)	(0.670)	(0.334)	(0.596)	(0.142)	(0.107)	(0.0926)	(0.115)	(1.340)	(1.087)	(0.929)
Interaction terms												
ln (RER) × deval. a/		-0.00571*								-0.000875	-0.000164	-0.00106
		(0.00327)								(0.00323)	(0.00322)	(0.00320)
ln (RER) × ln (dist.)			-0.378***							0.197	0.281**	-0.0155
			(0.0851)							(0.161)	(0.140)	(0.0910)
ln (RER) × ln (dest. GDP/cap)				-0.01000						0.0412	0.105	0.102
				(0.0358)						(0.0815)	(0.0676)	(0.0676)
ln (RER) × ln (dest. GDP)					-0.0205					-0.0624	-0.0621	-0.0242
					(0.0227)					(0.0505)	(0.0420)	(0.0401)
ln (RER) × manuf. Prod.						0.925***				0.645***	0.124	0.0743
						(0.178)				(0.177)	(0.162)	(0.161)
ln (RER) × ln (1+number prod.) b/							0.0114**			0.00531		
							(0.00466)			(0.00443)		
ln (RER) × ln (lag number prod.) b								0.00532			0.00287	0.00263
								(0.00361)			(0.00364)	(0.00365)
ln (RER) × EAC bilateral trade c/									0.862***	0.725**	0.888***	
									(0.188)	(0.327)	(0.312)	
Devaluation (Real)		0.0170								0.00322	-0.000842	-0.000687
		(0.0127)								(0.0127)	(0.0121)	(0.0121)
ln (dest. GDP/cap)				-0.705***						0.624*	0.0328	0.0517
				(0.166)						(0.361)	(0.290)	(0.290)
ln (dest. GDP)					-0.874***					-1.116***	-0.574**	-0.589**
					(0.148)					(0.295)	(0.248)	(0.248)
ln (1+number prod.)							0.0181			0.0223		
							(0.0161)			(0.0161)		
ln (lag number prod.)								-0.0134			-0.0103	-0.0106
								(0.0132)			(0.0133)	(0.0133)
Observations	145,181	145,181	145,181	144,872	144,873	145,181	145,181	112,501	145,181	144,801	112,189	112,189
R-squared	0.957	0.957	0.957	0.957	0.957	0.957	0.957	0.962	0.957	0.957	0.962	0.962
Firm-product-destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin--year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Weaker volume elasticities in EAC suggest supply constraints

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Dependent var.: ln (Volume)												
Estimator: OLS												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log bilateral RER	0.403***	0.514***	0.380	2.220***	3.094***	-0.0612	0.402***	0.469***	0.438***	3.629***	3.035***	2.324***
	(0.0655)	(0.0710)	(0.589)	(0.276)	(0.441)	(0.123)	(0.0658)	(0.0749)	(0.0666)	(0.811)	(0.866)	(0.789)
Interaction terms												
ln (RER) × deval. a/		-0.00247								-0.00286	0.000885	0.000966
		(0.00282)								(0.00285)	(0.00294)	(0.00294)
ln (RER) × ln (dist.)			0.00270							-0.193**	-0.0344	0.0816
			(0.0699)							(0.0917)	(0.102)	(0.0840)
ln (RER) × ln (dest. GDP/cap)				-0.202***						0.0192	0.0317	0.0416
				(0.0274)						(0.0530)	(0.0550)	(0.0549)
ln (RER) × ln (dest. GDP)					-0.109***					-0.0897***	-0.122***	-0.136***
					(0.0163)					(0.0316)	(0.0327)	(0.0320)
ln (RER) × manuf. Prod.						0.601***				0.682***	0.674***	0.652***
						(0.133)				(0.134)	(0.142)	(0.141)
ln (RER) × ln (1+number prod.) b/							0.00142			0.00415		
							(0.00385)			(0.00383)		
ln (RER) × ln (lag number prod.) b								-0.0120***			-0.00529	-0.00578
								(0.00359)			(0.00362)	(0.00361)
ln (RER) × EAC bilateral trade c/									-0.633***	-0.813***	-0.696*	
									(0.227)	(0.291)	(0.360)	
Devaluation (Real)		-0.0470***								-0.0514***	-0.0540***	-0.0543***
		(0.0106)								(0.0107)	(0.0108)	(0.0108)
ln (dest. GDP/cap)				1.015***						-0.615***	-0.644**	-0.697***
				(0.113)						(0.230)	(0.250)	(0.250)
ln (dest. GDP)					1.024***					1.544***	1.687***	1.733***
					(0.100)					(0.199)	(0.216)	(0.215)
ln (1+number prod.)							0.250***			0.244***		
							(0.0129)			(0.0128)		
ln (lag number prod.)								0.0587***			0.0427***	0.0435***
								(0.0122)			(0.0122)	(0.0122)
Observations	568,278	568,278	568,278	567,175	567,117	568,243	568,278	431,637	568,278	566,993	430,558	430,558
R-squared	0.931	0.931	0.931	0.931	0.931	0.932	0.932	0.934	0.931	0.932	0.934	0.934
Firm-product-destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin--year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Whole sample

- PTM coefficient around 0.1 without all the interaction terms
  - Like in the rest of the literature—no difference between industrial and developing countries?
  - More ERPT at the firm level (0.9) than aggregate/sector-level ERPT (0.3 on average)
- Volume elasticities very high for the whole sample, although plausible—when doing the algebra, assuming 20% transportation (τ) cost and 100% retail margin (η), estimates imply elasticity of substitution (σ) between 4 and 8

EAC exporters

- In general, no PTM for EAC exporters, implying no market power
- But very strong PTM ($0.7 < \beta^p < 0.9$) on EAC markets (bilateral trade), suggesting substantial market power
- Weak supply response, suggesting binding capacity constraints

EFFECT OF EXCHANGE-RATE VOLATILITY ON ENTRY AND EXIT

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Dependent var.:	Entry		Exit	
Sample	EAC bilateral	All Sample	EAC bilateral	All Sample
Estimator: RE Probit	(1)	(2)	(3)	(4)
RER volatility a/	4.088***	5.199***	-0.619	-0.511**
	(1.320)	(0.536)	(0.522)	(0.211)
Financial dependence b/	-0.186*	-0.191***	-0.0482	0.0240
	(0.0984)	(0.0551)	(0.0370)	(0.0195)
Volatility × Financial dependence	-1.710	1.618*	1.096	-0.543
	(1.831)	(0.858)	(0.813)	(0.372)
ln (distance)	-2.147***	-0.436***	-0.0784**	0.0981***
	(0.174)	(0.0215)	(0.0357)	(0.00493)
ln (dest. GDP/cap)	0.194	-0.360***	0.201*	0.0402***
	(0.469)	(0.0198)	(0.112)	(0.00472)
ln (dest. GDP)	0.289***	0.301***	-0.0316*	-0.0185***
	(0.0784)	(0.0131)	(0.0179)	(0.00295)
Firm scope c/	-0.530***	-0.401***	-0.00408	0.00231
	(0.0215)	(0.0117)	(0.00377)	(0.00218)
Fixed effects				
Firm-product-destination	Yes	Yes	Yes	Yes
Origin-year	Yes	Yes	Yes	Yes
Observations	42,751	122,735	89,217	243,155
Number of Firm-Destination-Product cells	29,072	81,699	47,101	138,453

CONCLUSIONS

Pricing to market behavior of exporters suggests strong evidence of market power on EAC markets:

- Markets still segmented, protected by tariffs (25% band), NTBs
- Difficult arbitrage between infant-industry protection and need to discipline abuses of market power

Entry and exit behaviour does not provide strong evidence of damage from exchange-rate volatility:

- Exit rates go *down* with exchange rate volatility
- Not higher for credit-constrained firms

Policy implications

- Focus on pursuing regional trade integration (good compromise between infant-industry protection and liberalization
- Still looking for a compelling case to launch process of monetary integration (given tremendous costs in terms of macro constraints)