

# Exit from Exchange Rate Regimes and Length of Economic Recovery: Propensity Score Matching Approach

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# Motivation

- **Main objective – analysing the effect of ER regime switch on length of economic recovery;**
  - only handful of papers concern themselves with factors determining the length and amplitude of economic recovery;
  - only a limited set of theoretical or empirical papers focuses on effects of regime switch;
  - seminal paper by Eichengreen and Sachs (1985);
  - more recent experience with active ER regime management in developed and developing countries;

# ER regime switch - evidence

## ER regimes classification

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Fix	1	No separate legal tender or currency union
Fix	2	Pre announced peg or currency board arrangement
Fix	3	Pre announced horizontal band that is narrower than or equal to $\pm 2\%$
Fix	15	Dual market in which parallel market data is missing.
Intermediate	4	De facto peg
Intermediate	5	Pre announced crawling peg; de facto moving band narrower than or equal to $\pm 1\%$
Intermediate	6	Pre announced crawling band that is narrower than or equal to $\pm 2\%$ or de facto horizontal band that is narrower than or equal to $\pm 2\%$
Intermediate	7	De facto crawling peg
Intermediate	8	De facto crawling band that is narrower than or equal to $\pm 2\%$
Intermediate	9	Pre announced crawling band that is wider than or equal to $\pm 2\%$
Intermediate	10	De facto crawling band that is narrower than or equal to $\pm 5\%$
Intermediate	11	Moving band that is narrower than or equal to $\pm 2\%$ (i.e., allows for both appreciation and depreciation over time)
Intermediate	12	De facto moving band $\pm 5\%$ / Managed floating
Floating	13	Freely floating
Floating	14	Freely falling

Source: classification by Cushman and De Vita (2017) on Ilzetzi et al. (2017)

# ER regime switch - evidence

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	4447	35	0	1	0	0	3	1	0	1	1	2	0	20	6
2	6	3578	1	21	2	0	11	34	0	28	7	29	3	27	15
3	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0
4	15	13	0	633	1	1	5	6	1	2	0	3	0	3	0
5	0	1	0	1	52	0	2	0	0	0	0	0	0	2	1
6	0	2	0	0	0	47	1	2	1	0	1	0	0	2	0
7	1	6	0	14	0	2	655	9	0	7	0	2	0	9	0
8	2	17	0	12	1	0	19	1167	3	29	2	14	2	12	1
9	0	0	0	0	0	0	1	2	17	3	0	2	0	1	0
10	0	10	0	7	0	2	8	34	3	730	0	7	0	25	2
11	0	3	0	0	0	0	2	1	0	0	291	4	1	1	0
12	0	7	0	3	0	2	7	10	1	15	6	677	4	48	1
13	1	1	0	0	0	0	0	2	0	0	0	1	173	7	0
14	3	17	0	6	4	4	10	30	0	24	1	46	6	485	10
15	6	19	0	1	0	0	1	5	0	6	0	3	0	17	823

Source: Ilzetzki et al. (2017) for full sample, 194 countries \* 77 years (1940)

# Literature review

- Cushman and De Vita (2017) use PSM in the context of ER regime choice and FDI inflows;
- **ER regime** -> Krugman (1979) and Flood; Garber (1984); Walti (2005) for duration analysis; Fiess and Shankar (2009);
- **determinants of economic recovery** -> Takats and Upper (2013); Tsangarides (2010); Dao (2017);
- **definition of recovery** -> Bijsterbosch and Dahlhaus (2011); Francis et al. (2014); Braun and Larrain (2005); Ambrosius (2016);

# Propensity Score Matching

# Matching design and data

- Ilzetzki (2017)'s sample for 195 countries starting in 1950+ (Penn World Table 9.0.) -> country/year unit; year dummies as covariates (Cushman and de Vita, 2017);
- only country/year observations for crisis events (independent countries);
- change in the exchange rate regime that occurred one year or later after the official outbreak of a crisis (ruling out currency crisis);
- change in the ER regime as a conscious decision of policy makers to use it as a part of the stabilizing policy toolkit;

# Matching design and data (II)

- **The start of the crisis** -> year when there is a YoY drop in a real GDP;
- **The end of the crisis** -> year when the real GDP stops declining and reaches its trough;
- **The length of the recovery** -> the beginning of crisis till the point when the real GDP overpasses the pre-crisis levels for the first time;

‘Depressions’ - initial drop in economic activity is followed by second or even third sub-crisis, hence the overall pattern resembles the W or triple V letter.



# Matching design and data (II)

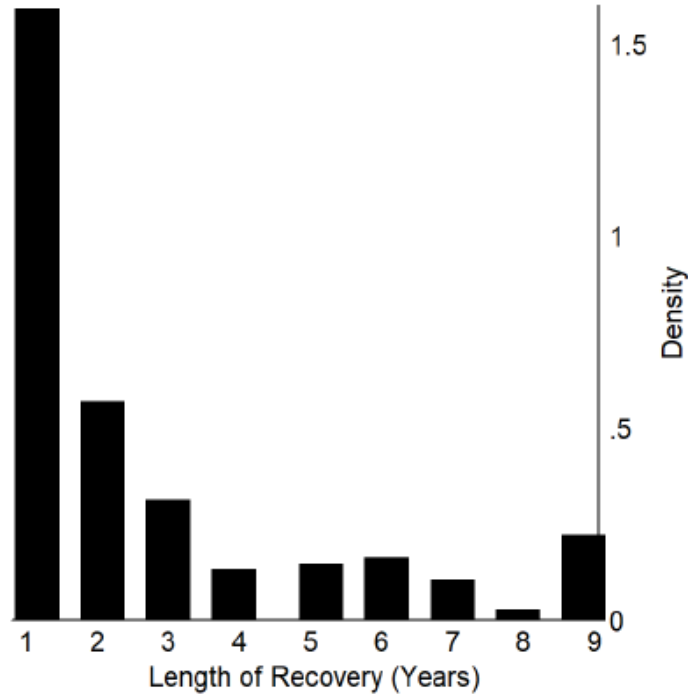


Figure 1: Length of Economic Recovery Distribution

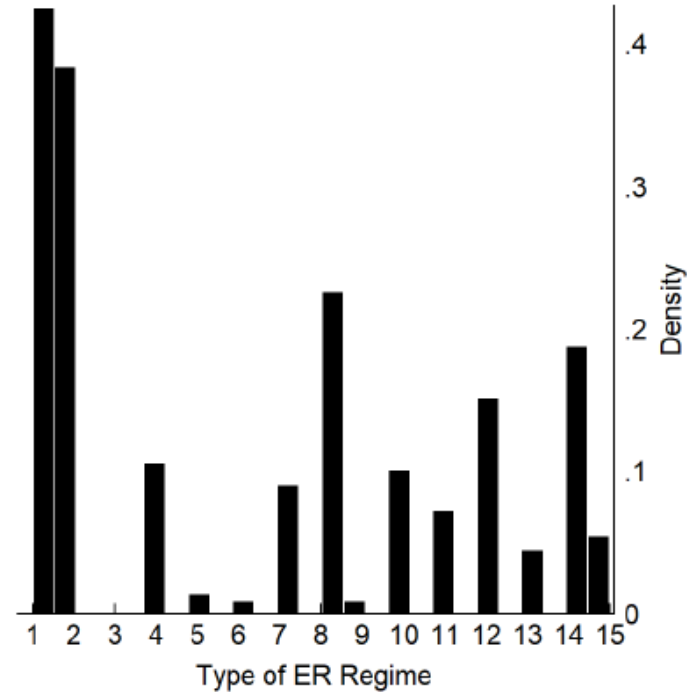
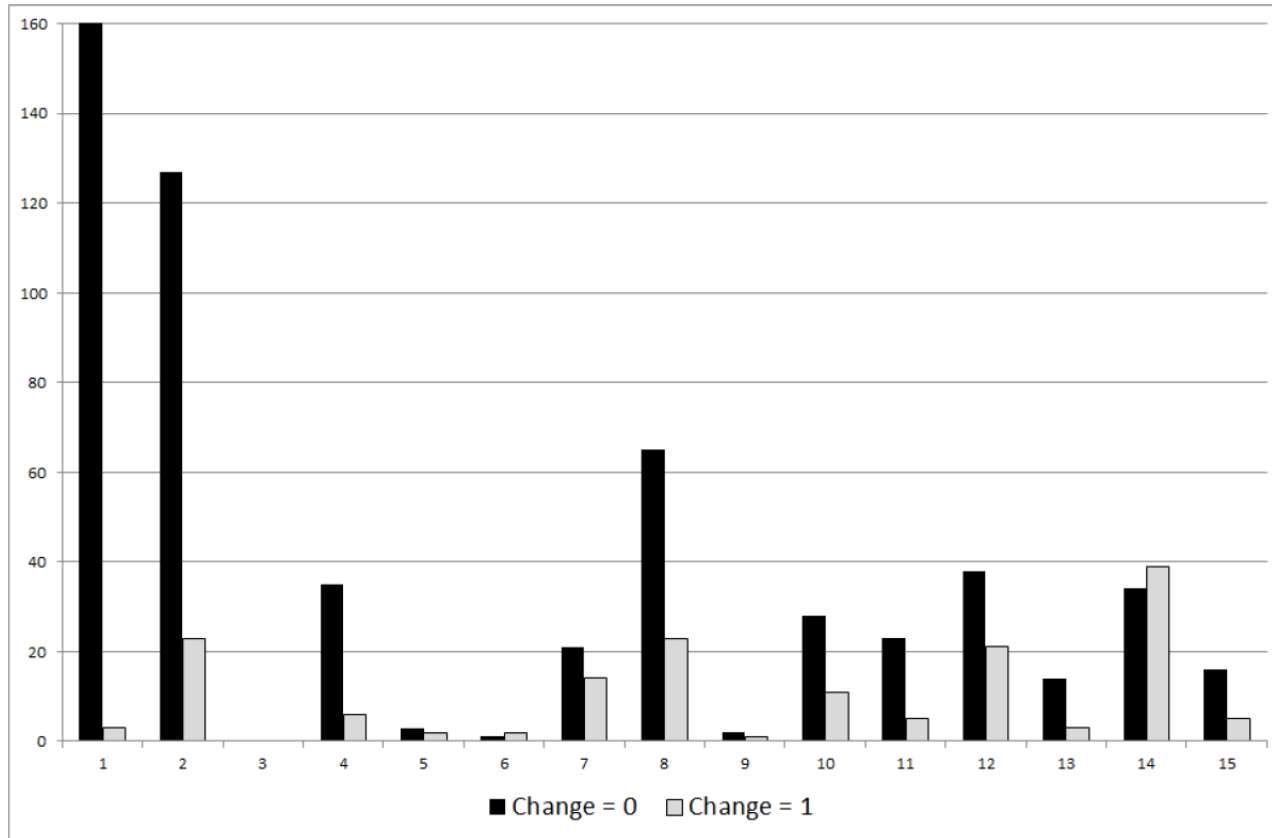


Figure 2: Pre-crisis Exchange Rate Regime Distribution

# Matching design and data (II)



# Matching design and data (III)

1. all covariates that affect either treatment probability or outcome,
2. covariates that affect treatment probability,
- 3. covariates that affect outcome (potential confounders) ->** determinants of length of economic recovery;
- 4. covariates that affect both treatment probability and outcome (true confounders) ->** covariates that simultaneously affect treatment probability (ER regime switch) and length of recovery;

Strict exogeneity -> before-crisis observations; 5 (10) nearest neighbours & 0.01 (0.05) caliper & logit link function;

# Data description

	Description	Source
Fix	Dummy, 1= fixed regime in t-1	Ilzetzki et al. (2017)
Intermediate	Dummy, 1= intermediate regime in t-1	Ilzetzki et al. (2017)
Floating	Dummy, 1= floating regime in t-1	Ilzetzki et al. (2017)
LnGDP	Ln(GDP), constant prices	Penn World Tables
LnGDP_sq	Ln(GDP), constant prices, squared	Penn World Tables
Ln(GDPpc)	Ln(GDP) in PPP per capita, constant prices,	Penn World Tables
Ln(GDPpc)_sq	Ln(GDP) in PPP per capita, constant prices, squared	Penn World Tables
L.growth	YoY real growth rate, t-1	Penn World Tables
Crisis years	Number of years to through	Penn World Tables
Severity	% change from previous peak to through	Penn World Tables
Fiscal	Change in fiscal expenditures, t+1 over t-1, t=crisis beginning	Penn World Tables
M2	M2/GDP, 3-year average, pre-crisis	World Bank
NX	NX/GDP, 3-year average, pre-crisis	World Bank
ER	Change in nominal ER, 3-year average, pre-crisis	World Bank
Debt	External debt/GDP, 3-year average, pre-crisis	World Bank
Inflation	Inflation rate in t-1	World Bank
Reserves	Change in total reserves (including gold), t over t-1, t=crisis beginning	World Bank
Res/GDP	Total reserves (including gold) over GDP, pre-crisis level	World Bank
Openness	Imports and exports of goods and services over GDP, pre-crisis level	World Bank
dNIR	Change in nominal IR, t minus t-1, t=crisis beginning	World Bank

# Results

Table 1: Determinants of the Crisis Recovery Length by OLS

	(1)	(2)	(3)	(4)	(5)	(6)
Change (1= ER regime switch)	0.728*** (0.00)		0.728*** (0.00)		0.728*** (0.00)	
Fixed			0.264 (0.11)	0.337* (0.07)	0.330*** (0.00)	0.329*** (0.00)
Intermediate	-0.330*** (0.00)	-0.329*** (0.00)	-0.066 (0.64)	0.008 (0.96)		
Floating	-0.264 (0.11)	-0.337** (0.07)			0.066 (0.64)	-0.008 (0.96)
Ln(GDP)	0.329*** (0.00)	0.323*** (0.00)	0.329*** (0.00)	0.323*** (0.00)	0.329*** (0.00)	0.323*** (0.00)
Ln(GDP)_sq	-0.017*** (0.00)	-0.016*** (0.00)	-0.017*** (0.00)	-0.016*** (0.00)	-0.017*** (0.00)	-0.016*** (0.00)
Ln(GDPpc)	-0.299 (0.53)	-0.293 (0.54)	-0.299 (0.53)	-0.293 (0.54)	-0.299 (0.53)	-0.293 (0.54)
Ln(GDPpc)_sq	0.019 (0.50)	0.019 (0.51)	0.019 (0.50)	0.019 (0.51)	0.019 (0.50)	0.019 (0.51)
L.growth	-0.004 (0.67)	-0.005 (0.65)	-0.004 (0.67)	-0.005 (0.65)	-0.004 (0.67)	-0.005 (0.65)
Crisis years	1.220*** (0.00)	1.222*** (0.00)	1.220*** (0.00)	1.222*** (0.00)	1.220*** (0.00)	1.222*** (0.00)
Severity	-0.054*** (0.00)	-0.054*** (0.00)	-0.054*** (0.00)	-0.054*** (0.00)	-0.054*** (0.00)	-0.054*** (0.00)
Fiscal	-0.003** (0.03)	-0.003** (0.03)	-0.003** (0.03)	-0.003** (0.03)	-0.003** (0.03)	-0.003** (0.03)
Fixed*Change		0.674** (0.04)		0.674** (0.04)		0.674** (0.04)
Floating*Change		0.857*** (0.00)		0.857*** (0.00)		0.857*** (0.00)
Intermediate*Change		0.700*** (0.00)		0.700*** (0.00)		0.700*** (0.00)
Constant	-0.380 (0.87)	-0.388 (0.86)	-0.644 (0.77)	-0.725 (0.75)	-0.710 (0.75)	-0.717 (0.75)
N	728	728	728	728	728	728
R2	0.841	0.841	0.841	0.841	0.841	0.841
Ln(GDP) turning point	9.759	9.797	9.759	9.797	9.759	9.797

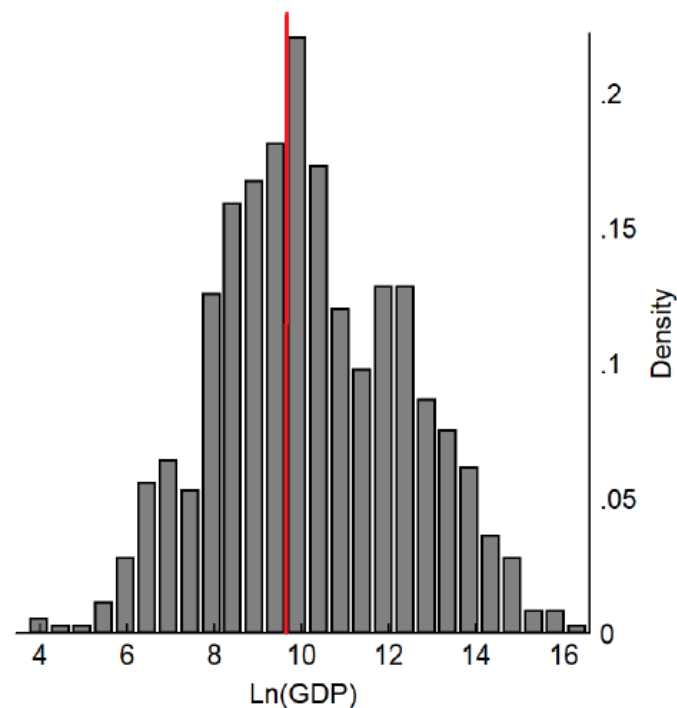


Figure 4: Economic Size Distribution and Turning Point

Table 2: Benchmark regression - 1st stage tobit estimates (1=change in ER regime)

	(1)	(2)	(3)	(4)	(5)	Fix	Inter	Float
Intermediate	1.767*** (0.00)	1.572*** (0.00)	1.971*** (0.00)	1.398*** (0.00)	2.136*** (0.00)			
Floating	2.190*** (0.00)	1.622*** (0.00)	1.852*** (0.00)	1.479*** (0.00)	2.082*** (0.00)			
LnGDP	0.309 (0.52)	0.497 (0.42)	0.291 (0.73)	0.726 (0.26)	1.242 (0.20)	0.093 (0.94)	-0.811 (0.51)	-0.388 (0.80)
LnGDP_sq	-0.014 (0.53)	-0.018 (0.52)	-0.011 (0.78)	-0.029 (0.33)	-0.056 (0.21)	0.017 (0.79)	0.046 (0.42)	0.007 (0.92)
LnGDPpc	3.792** (0.01)	5.883*** (0.00)	5.481** (0.04)	5.460** (0.01)	4.493 (0.16)	2.922 (0.55)	9.386**** (0.00)	8.207 (0.29)
LnGDPpc_sq	-0.246*** (0.00)	-0.373*** (0.00)	-0.363** (0.02)	-0.347** (0.00)	-0.311 (0.10)	-0.200 (0.49)	-0.594*** (0.00)	-0.503 (0.28)
L.growth	-0.038 (0.17)	-0.04 (0.24)	-0.059 (0.23)	-0.052 (0.19)	-0.149* (0.05)	-0.001 (0.99)	-0.102 (0.14)	0.014 (0.89)
Crisis years	0.392*** (0.00)	0.164 (0.18)	0.079 (0.60)	0.048 (0.75)	-0.187 (0.36)	0.267 (0.34)	0.468* (0.07)	-0.637* (0.08)
Severity	-0.040** (0.01)	-0.036** (0.02)	-0.035** (0.04)	-0.033* (0.09)	-0.038 (0.12)	-0.089** (0.03)	-0.003 (0.87)	-0.147** (0.03)
Fiscal (diffG)	0.009** (0.02)	0.007 (0.11)	0.007 (0.16)	0.006 (0.21)	0.007 (0.26)	0.000 (0.98)	0.009 (0.21)	0.008 (0.58)
Constant	-19.72*** (0.00)	-15.27 (0.98)	-11.21 (0.98)	-27.09*** (0.00)	-22.27 (0.11)	-16.97 (0.40)	-35.55** (0.02)	15.830 (0.99)
Untreated	497	220	124	171	84	80	65	39
Treated	158	119	87	88	54	27	50	33
Total	655	339	211	259	138	107	115	72
Length of recovery	all	>1 year	>2 years	>1 year	>2 years	>1 year	>1 year	all
Depressions	yes	yes	yes	no	no	yes	yes	yes

Note: Regression *Fix* with subsample of country-year pairs with pre-crisis fixed ER regime. Regression *Inter* with subsample of country-year pairs with pre-crisis intermediate ER regime. Regression *Float* with subsample of country-year pairs with pre-crisis floating ER regime. *Depressions* include observations with multiple consequent crisis periods.

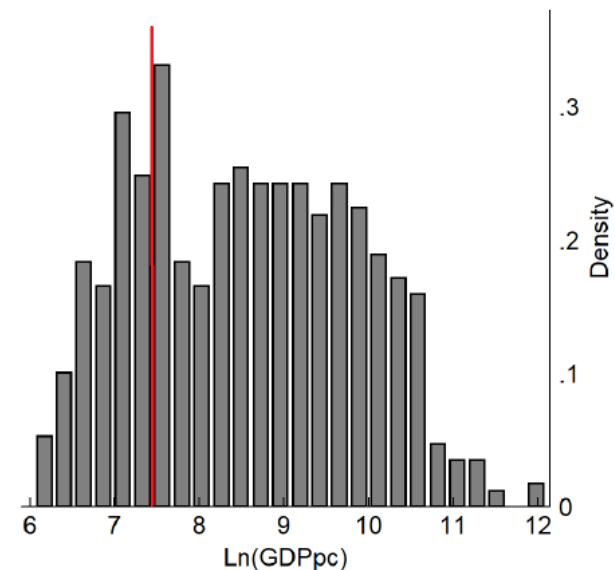


Figure 5: Economic Development Distribution and Turning Point, 1st stage tobit

Table 3: ATT Effects for Benchmark Specification

		Treated	Controls	Diff	S.E.*	t-stats*	p-value*
Model (1)	Unmatched	4.28	2.31	1.97	0.21	9.27	
	ATT	3.97	2.95	<b>1.02**</b>	<b>0.40</b>	<b>2.54</b>	<b>0.011</b>
Model (2)	Unmatched	5.25	3.93	1.32	0.27	4.83	
	ATT	4.90	3.78	<b>1.11**</b>	<b>0.54</b>	<b>2.04</b>	<b>0.041</b>
Model (3)	Unmatched	6.33	5.07	1.26	0.30	4.20	
	ATT	6.34	5.21	<b>1.13</b>	<b>0.87</b>	<b>1.29</b>	<b>0.198</b>
Model (4)	Unmatched	4.34	3.42	0.93	0.26	3.52	
	ATT	4.26	3.26	<b>1.00*</b>	<b>0.52</b>	<b>1.92</b>	<b>0.055</b>
Model (5)	Unmatched	5.33	4.51	0.82	0.33	2.49	
	ATT	5.77	4.29	<b>1.48</b>	<b>1.26</b>	<b>1.18</b>	<b>0.238</b>
Fix	Unmatched	6.70	4.56	2.14	0.51	4.18	
	ATT	6.32	5.61	<b>0.70</b>	<b>1.09</b>	<b>0.65</b>	<b>0.517</b>
Inter	Unmatched	4.48	3.69	0.79	0.43	1.82	
	ATT	4.36	4.49	<b>-0.13</b>	<b>0.69</b>	<b>-0.19</b>	<b>0.849</b>
Float	Unmatched	4.15	2.31	1.84	0.59	3.10	
	ATT	3.83	2.72	<b>1.11</b>	<b>1.24</b>	<b>0.90</b>	<b>0.370</b>

Note: \* bootstrapped (100 reps.)



Table 4: ATT Effects for Other Control Variables

Added conditioning variable	#	Diff (T-C)	S.E.*	t-stats*	p-value*
M2	248	0.72	0.76	0.96	0.338
NX	251	0.58	0.78	0.75	0.750
ER	301	0.84*	0.48	1.74	0.081
Debt	150	1.14	1.47	0.77	0.441
Inflation	168	0.88	1.34	0.65	0.513
Reserves	181	0.79	1.09	0.73	0.465
Res/GDP	173	0.71	1.06	0.67	0.502
Openness	185	0.62	1.11	0.56	0.574
dNIR	75	0.69	0.99	0.69	0.489
Composite I (ER, NX, M2)	198	0.74	1.12	0.66	0.509
Composite II (Debt, Res/GDP, Open)	65	0.78**	0.37	2.08	0.038

Note: \* bootstrapped (100 reps.)

# Results & Discussion

1. the active exchange rate management **may not** necessarily be associated with wider economic benefits, except mitigation of ER volatility, that would lead to a more speedy recovery;
2. empirical evidence also shows that countries often use the change in the ER regime only as the last-resort tool once all the other options, fiscal or monetary policy measures, have been exhausted.
4. the observed differences in length of recovery between countries with active (treated) and passive (control) ER management vary from **half a year up to one year**;
5. differences have a tendency **to be reduced** once controlling for fundamental characteristics of countries related to their trade openness and monetary policy conduct (ER reserves, interest rate policy).

# Robustness & Future Research

1. Ruling out 4 currency unions (EMU, ECCU, WAEMU, CEMAC) → robust;
2. Fiscal expenditures excluded from benchmark regression;
3. Duration analysis (but with IV) → IV Poisson GMM model (GDP p.c. and GDP p.c. squared as good IVs) → so far robust;
4. Sensitivity towards ER classification;
5. Classification by Laeven and Valencia (2012) and others for type of crisis event;
6. More precise calculation of length of recovery (quarterly data), but shortening of the sample likely;
7. Direction of ER regime switch (particular focus on intermediate regimes);

**Thank you for your attention!**

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