Growth Effects of the Exchange-Rate Regime and the Capital-Account Openness in A Crises-Prone World Market: A Nuanced View

Assaf Razin

Tel-Aviv University, Cornell University, CEPR, NBER and CESifo.

Yona Rubinstein

Tel-Aviv University and CEPR

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What is this section about:

This paper studies the direct and indirect effects of Macro policies pointing out the role of the indirect channels in evaluating the local

effects.

Motivation:

Exchange rate regimes and capital account openness, influence output growth through two channels:

1. Directly, through their effect on the trade and financial sectors.

2. Indirectly, through their impact on the probability of a balance-of-payments crisis.

Usually, in offsetting directions. For instance, switching from float to peg:

1. Direct effect: positive effect on growth.

2. Indirect effect: negative by increasing the probability of a real exchange rate crisis.

Implications:

1. The empirical analysis demonstrates that the balance-of-payments policies significantly affect the probability of crises; and that the crisis probability, in turn, negatively affects output growth. Namely, the indirect effects of balance-of-payments policy on growth are substantial.

2. By controlling for the crisis probability in the growth equation, the paper uncovers also the direct channel. The direct effects of balance-of-payments policies are also demonstrated to be substantial. Indeed, in benchmark OLS regressions, which abstract from the effect on growth of crisis probabilities, effects of the balance-of-payments policy on output growth turn out to be negligible.

3. The indirect channel is intrisincally non linear: there exists a range for the exogenous variables for which the effect of policy on the likelihood of a crisis is large; and another range, where the effect is rather small.

4. As a consequence of the non linearity of the crisis probability

function, overall growth effects of balance-of-payments policies depend crucially on the level of the crisis probability.

5. Thus, the cost-benefit evaluation of balance-of-payments policies depends on the special characteristics of the economy.
6. We propose a re-examination of discrete high inflation crises. Traditionally the analysis focuses on periods when inflation is above some threshold. Growth falls sharply during discrete high inflation crises.
7. By introducing a probability of internal (high inflation) crises, along with the probability of external (balance-of-payment) crisis that depends on the exchange rate system, we can further discern the non linear affect of the exchange rate system on growth.

A simple statistical model

Let $Y_{1,j,t}$ denote the growth rate of country j in time t as measured in terms of GDP per capita (growth rates).

Let $Y_{2,j,t}^*$ denote a latent variable indicating a threshold state of the economy: If $Y_{2,j,t}^* > 0$ a currency crises occurs; if $Y_{2,j,t}^* \leq 0$ a currency crises does not occurs. That is:

(1)

$$Y_{2,j,t} = \begin{cases} 1 & if\ Y_{2,j,t}^* \geq 0 \\ 0 & else \end{cases}$$

whereas $Y_{2,j,t}$ is a binary variable which equals 1 if currency crises occurs in country j at time t.

We assume that two policies: (i) a float-peg policy and (ii) a liberalization-controls policy. To simplify assume that policy decision is binary. Denote by D_1 the float-peg policy and by D_2 the liberalization-controls policy:

$(2.a)$

$$D_{1j,t} = \begin{cases} 1 & \text{if peg} \\ 0 & \text{if float} \end{cases}$$

and:

$(2.b)$

$$D_{2j,t} = \begin{cases} 1 & \text{if capital controls} \\ 0 & \text{if liberalization} \end{cases}$$

Therefore we could write the system as follows:

$(3.a)$

$$Y_{1,j,t} = \beta_1 X_{j,t} + \gamma_1 D_{1,j,t} + \delta_1 D_{1,j,t} + \phi_1 Y_{2,j,t} + \theta_1 Z_{1,j,t} + \varepsilon_{1,j,t}$$

and

$(3.b)$

$$Y^*_{2,j,t} = \beta_2 X_{j,t} + \gamma_2 D_{1,j,t} + \delta_2 D_{1,j,t} + \phi_2 Y_{1,j,t} + \theta_2 Z_{2,j,t} + \varepsilon_{2,j,t}$$

Whereas $X_{j,t}$ is a vector of country specific exogenous variables and $\varepsilon_{i,j,t}$ is a country specific $i.i.d.$ random shock.

Let $P_{j,t}$ be the conditional probability that country j will face currency crisis in period t. Given our assumption,

(4)

$$P_{j,t} = \Pr(Y_{2,j,t} = 1 \mid \cdot) = \Phi(\beta_2 X_{j,t} + \gamma_2 D_{1,j,t} + \delta_2 D_{1,j,t} + \phi_2 Y_{1,j,t} + \theta_2 Z_{2,j,t} + \varepsilon_{2,j,t})$$

where Φ is the cdf of the unit normal distribution (above).

Note that we can identify the parameters of the "crisis-selection" equation by estimating the following Probit equation:

(5)

$$Y_{2,j,t} = \Phi(\beta_2 X_{j,t} + \gamma_2 D_{1,j,t} + \delta_2 D_{1,j,t} + \phi_2 Y_{1,j,t} + \theta_2 Z_{2,j,t} + \varepsilon_{2,j,t})$$

Where the projected likelihood for:

(6)

$$\hat{Y}_{2,j,t} = \Phi\left(\hat{\beta}_2 X_{j,t} + \hat{\gamma}_2 D_{1,j,t} + \hat{\delta}_2 D_{1,j,t} + \hat{\phi}_2 Y_{1,j,t} + \hat{\theta}_2 Z_{2,j,t}\right)$$

Incorporating the probability of balance-of-payments crises

The estimated growth effect of D_1 and D_2 when the likelihood of a currency crisis is ignored are:

$(7.a)$

$$E(\hat{\gamma}_1^{IV}) = \frac{\partial E\left(Y_{1,j,t} \mid X_{j,t},\ D_{1,j,t}^{IV},\ D_{1,j,t}^{IV},\ Z_{1,j,t}\right)}{\partial D_{1,j,t}} = \gamma_1 + \phi_1 \frac{\partial \hat{Y}_{2,j,t}}{\partial D_{1,j,t}}$$

and:

$(7.b)$

$$E\left(\hat{\delta}_1^{IV}\right) = \frac{\partial E\left(Y_{1,j,t} \mid X_{j,t},\ D_{1,j,t}^{IV},\ D_{1,j,t}^{IV},\ Z_{1,j,t}\right)}{\partial D_{2,j,t}} = \delta_1 + \phi_1 \frac{\partial \hat{Y}_{2,j,t}}{\partial D_{2,j,t}}$$

where $D_{1,j,t}^{IV},\ D_{1,j,t}^{IV}$ are the instrumented policy actions.

It is common wisdom that the likelihood of currency crisis has a negative effect on growth:

$(8.a)$

$$\phi_1 < 0$$

It is also common to assume that a peg exchange rate increases the likelihood of a currency crisis (all other things equal), and that capital controls reduce the probability of such a crisis:

$(8.b)$

$$\frac{\partial \hat{Y}_{2,j,t}}{\partial D_{1,j,t}} > 0$$

$$\frac{\partial \hat{Y}_{2,j,t}}{\partial D_{1,j,t}} < 0$$

Implications:

$(9.a)$

$$E(\hat{\gamma}_1^{IV}) = \gamma_1 + \phi_1 \frac{\partial \hat{Y}_{2,j,t}}{\partial D_{1,j,t}} < \gamma_1 > 0$$

and:

$(9.b)$

$$E\left(\hat{\delta}_1^{IV}\right) = \delta_1 + \phi_1 \frac{\partial \hat{Y}_{2,j,t}}{\partial D_{2,j,t}} > \delta_1 < 0$$

Table 1:
The Frequency of Crises, Switches Between Float and Peg and
Switches between Capital Controls and Liberalizations (%)

Variable	Frequency
Crsises	22.61
Switches to peg	1.71
Switches to float	3.91
Switches to controls	1.03
Switches to liberalizations	0.9

Table 2:
List of Countries

(1)	Algeria	(51)	Malawi
(2)	Argentina	(52)	Malaysia
(3)	Bangladesh	(53)	Maldives
(4)	Barbados	(54)	Mali
(5)	Belize	(55)	Malta
(6)	Benin	(56)	Mauritania
(7)	Bhutan	(57)	Mauritius
(8)	Bolivia	(58)	Mexico
(9)	Botswana	(59)	Morocco
(10)	Brazil	(60)	Myanmar
(11)	Burkina Faso	(61)	Nepal
(12)	Burundi	(62)	Nicaragua
(13)	Cameroon	(63)	Niger
(14)	Cape Verde	(64)	Nigeria
(15)	Central African	(65)	Oman
(16)	Chad	(66)	Pakistan
(17)	Chile	(67)	Panama
(18)	China	(68)	Papua New Guinea
(19)	Colombia	(69)	Paraguay
(20)	Comoros	(70)	Peru
(21)	Congo	(71)	Philippines
(22)	Cote d'Ivoire	(72)	Portugal
(23)	Dominican Rep.	(73)	Romania
(24)	Ecuador	(74)	Rwanda
(25)	Egypt, Arab Rep	(75)	Sao Tome and Pr
(26)	El Salvador	(76)	Senegal
(27)	Equatorial Guin	(77)	Seychelles
(28)	Ethiopia	(78)	Sierra Leone
(29)	Fiji	(79)	Solomon Islands
(30)	Gabon	(80)	Somalia
(31)	Gambia, The	(81)	South Africa
(32)	Ghana	(82)	Sri Lanka
(33)	Grenada	(83)	St. Vincent
(34)	Guatemala	(84)	Sudan
(35)	Guinea	(85)	Swaziland
(36)	Guinea-Bissau	(86)	Syrian Arab Rep
(37)	Guyana	(87)	Tanzania
(38)	Haiti	(88)	Thailand
(39)	Honduras	(89)	Togo
(40)	Hungary	(90)	Trinidad and To
(41)	India	(91)	Tunisia
(42)	Indonesia	(92)	Turkey
(43)	Iran, Islamic R	(93)	Uganda
(44)	Jamaica	(94)	Uruguay
(45)	Jordan	(95)	Vanuatu
(46)	Kenya	(96)	Venezuela
(47)	Lao PDR	(97)	Western Samoa
(48)	Lesotho	(98)	Zaire
(49)	Liberia	(99)	Zambia
(50)	Madagascar	(100)	Zimbabwe

Table 3:
Exchange Regime and Capital Controls: Cyclical Effects

Panel A: Dependent Variable: Growth Rates

Variables	OLS (i)	OLS (ii)	FE (iii)	FE (iv)
Switching to peg between t-2 to t-1	**1.6423 (0.7503)***	**4.6209 (1.4795)****	**1.2041 (0.9958)**	**5.0215 (1.7630)****
Switching to float between t-2 to t-1	0.1761 (0.6483)	0.6383 (0.6692)	-0.0539 (0.7039)	0.2005 (0.7401)
Switching to Capital Controls between t-2 to t-1	**-1.8832 (0.8616)***	**-4.7173 (1.5363)****	**-1.9592 (1.0495)**	**-6.3843 (2.0713)****
The probability of having currency crisis this year ^		**-9.6164 (5.0663)**		**-12.7791 (4.9934)***

Controllers

Variables	OLS (i)	OLS (ii)	FE (iii)	FE (iv)
1970 GDP per capita	**-0.0012 (0.0005)***	**-0.0011 (0.0005)***	--	--
Currency crisis at time t-1	0.5612 (0.5949)	2.7602 (1.2740)*	0.7579 (0.4506)	2.5482 (0.8331)**
Currency crisis at time t-2	-2.1345 (0.6375)**	-1.5347 (0.7221)*	-1.6442 (0.4525)**	-2.2155 (0.4852)**
Growth rate at time t-1	0.2540 (0.0464)**	0.2552 (0.0469)**	0.1802 (0.0275)**	0.2267 (0.0312)**
Growth rate at time t-2	0.1093 (0.0366)**	0.1048 (0.0372)**	0.0069 (0.0274)	-0.0224 (0.0313)

Panel B: Dependent Variable: Currency Crisis (0,1). 1 if REE(t)-REE(t-1)>15% - Probit (dF/dX) estimators

Variables		OLS (ii)		FE (iv)
1970's GDP per capita		0.0000 (0.0000)		--
Switching to peg between t-2 to t-1		**0.3125 (0.0991)****		**0.2893 (0.1028)****
Switching to float t-2 to t-1		**0.0557 (0.0510)**		0.0325 (0.0516)
Switching to Capital Controls between t-2 to t-1		**-0.2656 (0.0470)****		**-0.3313 (0.0524)****
Currency crisis at time t-1		0.2299 (0.0377)**		0.1314 (0.0349)**
Currency crisis at time t-2		0.0563 (0.0296)		-0.0307 (0.0256)
Government def t-1 ^^		0.0000 (0.0000)		0.0000 (0.0000)
Country fixed-effects		**No**		**Yes**

Note:
Data includes 106 countries in the years 1970 to 1997
^ Currency crisis =1 if the real exchange rate increased by 15% between t-1 to t (1 STD)
All specifications include linear time trend
( ) Standard errors in parenthesis
* significant at 5%; ** significant at 1%

Table 4:
Exchange Regime and Capital Controls: Cyclical and Persistent Effects

Panel A: Dependent Variable: Growth Rates

Variables	OLS (i)	FE (ii)
Peg at time t-1	-0.6088 (0.2899)*	-0.1813 (0.4787)
Switching to peg between t-2 to t-1	3.9786 (1.2935)**	4.9046 (1.4604)**
Switching to float between t-2 to t-1	0.4657 (0.7124)	0.8090 (0.8382)
Capital Controls at t-1	-1.2843 (0.4539)**	-1.1997 (0.9385)
Switching to Capital Controls between t-2 to t-1	-1.2843 (0.4539)**	-5.9101 (1.7511)**
The probability of having currency crisis this year ^	-7.9131 (6.0140)	-13.7764 (4.4409)**
Controllers		
1970 GDP per capita	-0.0013 (0.0006)*	--
Currency crisis at time t-1	2.3069 (1.4183)	2.6221 (0.7543)**
Currency crisis at time t-2	-1.7389 (0.7269)*	-2.3438 (0.4911)**
Growth rate at time t-1	0.2481 (0.0456)**	0.2247 (0.0312)**

Panel B: Dependent Variable: Currency Crisis (0,1). 1 if REE(t)-REE(t-1)>15% - Probit (dF/dX) estimato

1970's GDP per capita	0.0000 (0.0000)	--
Peg at time t-1	-0.0192 (0.0221)	0.0368 (0.0361)
Switching to peg between t-2 to t-1	0.2798 (0.1029)**	0.2106 (0.1070)*
Switching to float t-2 to t-1	0.0801 (0.0567)	0.1085 (0.0674)
Capital Controls at t-1	-0.0383 (0.0283)	-0.1021 (0.0639)
Switching to Capital Controls between t-2 to t-1	-0.2491 (0.0513)**	-0.2820 (0.0646)**
Currency crisis at time t-1	0.2264 (0.0373)**	0.1255 (0.0345)**
Country fixed-effects	**No**	**Yes**

Note:
Data includes 106 countries in the years 1970 to 1997
^ Currency crisis =1 if the real exchange rate increased by 15% between t-1 to t (1 STD)
All specifications include linear time trend
( ) Standard errors in parenthesis
* significant at 5%; ** significant at 1%

Table 5.a:
The Frequency of Sudden Stop and Domestic Prices Crises
Using Reinhart-Rogoff (2004) Classification*,**

		Domestic Price Crises		
		0	1	
Sudden Stops Crises	**0**	24.6	9.9	34.5
	1	29.3	36.3	65.5
		53.9	46.1	100.0

Notes:
* Reinhart and Rogoff (2002) classified into 5 categories: (i) peg,
 (ii) limited flexibility, (iii) managed floating , (iv) freely floating and (v) freely falling.
 We aggregate it into 2 main categories: (i) peg_rr, including the first 3 and (ii)
 float_rr, including the other two.
** Data includes 58 countries in the years 1970 to 1997
Domestic prices crisis = 1 if the inflation rate is above 20% per year and 0 otherwise.
Sudden stop crisis = 1 if the real exchange rate depreciation is above 15% per year and 0 otherwise.

Table 5.b:
Switches Between Float and Peg
Using Reinhart-Rogoff (2004) Classification*,**

Variable	Frequency
Switches to peg	10.18
Switches to float	9.97

Notes:
* Reinhart and Rogoff (2002) classified into 5 categories: (i) peg,
 (ii) limited flexibility, (iii) managed floating , (iv) freely floating and (v) freely falling.
 We aggregate it into 2 main categories: (i) peg_rr, including the first 3 and (ii)
 float_rr, including the other two.
** Data includes 58 countries in the years 1970 to 1997

Table 6:
Exchange Regime and Capital Controls
Using Reinhart-Rogoff (2004) Classification*,**
Fixed-Effects Estimators

**Dependent Variable: Growth Rates**

Variables	(i)	(ii)	(iii)
Peg at time t-1	1.656	1.330	1.729
	(0.557)	(0.549)	(0.565)
Capital Controls at t-1	-0.439	-0.587	0.156
	(0.890)	(0.991)	(1.022)
Switching to Capital Controls between t-2 to t-1	-5.852	-3.374	-6.155
	(1.799)	(1.518)	(1.809)
The probability of having currency crisis this year^ excluding the effect of price crisis	-14.843		-22.359
	(4.937)		(7.996)
The probability of having currency crisis this year - real^^ including the effect of price crisis		-6.824	7.632
		(4.084)	(6.578)
**Controllers**			
Growth rate at time t-1	0.176	0.191	0.183
	(0.034)	(0.034)	(0.034)
Growth rate at time t-2	0.008	0.022	0.019
	(0.035)	(0.035)	(0.035)
Currency crisis at time t-1	2.812	0.917	3.340
	(0.978)	(0.629)	(1.069)
Currency crisis at time t-2	-1.904	-1.804	-1.831
	(0.479)	(0.483)	(0.481)
Price (CPI) crisis at time t-1	-0.100	1.078	-1.251
	(0.491)	(0.772)	(1.133)
Price (CPI) crisis at time t-2	0.385	0.374	0.468
	(0.488)	(0.491)	(0.490)

Notes:
* Reinhart and Rogoff (2002) classified into 5 categories: (i) peg, (ii) limited flexibility, (iii) managed floating
, (iv) freely floating and (v) freely falling. We aggregate it into 2 main categories: (i) peg_rr, including the first 3 and (ii) float_rr, including the other two.
** Data includes 58 countries in the years 1970 to 1997
^ The estimated the likelihood for a currency crisis ignoring the effect of price crisis.
^^ The estimated probability for a currency crisis including the effect of past price crisis
All specifications include linear time trend
( ) Standard errors in parenthesis