

University of Groningen

Sovereign debt defaults and currency crises in Latin America

Boonman, Tjeerd Menno

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2015

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Boonman, T. M. (2015). *Sovereign debt defaults and currency crises in Latin America*. University of Groningen, SOM research school.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Sovereign debt defaults and currency crises in Latin America

Tjeerd Menno Boonman

Publisher: University of Groningen, Groningen, The Netherlands

Printed by: Ipskamp Drukkers
P.O. Box 333
7500 AH Enschede
The Netherlands

ISBN: 978-90-367-8373-6 / 978-90-367-8372-9 (ebook)

© 2015 Tjeerd Menno Boonman

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system of any nature, or transmitted in any form or by any means, electronic, mechanical, now known or hereafter invented, including photocopying or recording, without prior written permission of the publisher.



university of
 groningen

Sovereign debt defaults and currency crises in Latin America

PhD Thesis

to obtain the degree of PhD at the
 University of Groningen
 on the authority of the
 Rector Magnificus, Prof. Dr E. Sterken
 and in accordance with
 the decision by the College of Deans.

This thesis will be defended in public on
 Thursday December 10 2015 at 16.15 hrs.

by

Tjeerd Menno Boonman

born on 17 October 1969
 in Amsterdam

Supervisor:

Prof. Dr E. Sterken

Co-supervisor:

Dr J.P.A.M. Jacobs

Dr G.H. Kuper

Assessment committee:

Prof. Dr M. Agosin Trumper

Prof. Dr N. Hermes

Prof. Dr C. Kool

Acknowledgements

The original motivation for my choice for studying financial crises was laid in the department of Emerging Market Country Risk at ING. I arrived there in the mid 1990s, between the Mexico 1995 and the Asian 1997-1998 crisis, a golden era for financial crises in emerging economies. During my PhD period I have visited the department on numerous occasions and every time I was surprised by the profound knowledge of this odd group of intellectuals within a commercial bank. Unfortunately, or ironically, the department did not survive the impact from the last financial crisis, the Global Financial Crisis. In one of the many budget cut rounds that followed it was made redundant only recently. Special thanks to Greetje Frankena, Paul Koenekoop, Anke Mertens, Dirk Jan Pilat and Susan Randall.

I want to thank the members of the reading committee, Prof. Dr Agosin Trumper, Prof. Dr Hermes and Prof. Dr Kool for reading the manuscript and providing valuable comments. I also want to thank Lammertjan Dam, Paul Elhorst, Ben Gales, Ben Heijdra, Pim Heijnen, Herman de Jong, Michael Koetter, Bert Schoonbeek, Gaaitzen de Vries and Doede Wiersma for discussions on methodological, data and human issues. Special thanks to Siep Kroonenberg for all her support in \LaTeX . Although I stayed only for brief periods in Groningen, I did get some feel of the PhD live. It was an eye opener to realize that what I considered typical Mexican problems, life styles and situations were actually similar in many parts of the world. From Indonesia (Kadek Sustrisna) to Turkey (Yeliz Cantimur), from Pakistan (Muhammad Omer) to Belorusia (Anna Samarina), and from Rumania (Irina Stanga) to Iran (Niaz Bashiri): the anecdotes make you realize that emerging economies can indeed be considered a common group. A very special thanks goes out to Javier Arnaut, who received me as a true 'paisa' in the Netherlands. His knowledge of Latin American economic history has helped me past various tricky points. I also want to thank Peter van Santen for his eternal positive and laid-back attitude, Zhongbo, Jochen, Joost and Job, and my former room mates Nicky, Siep and Wim.

Some persons have been important for particular parts of this dissertation. For the theoretical framework in Chapter 2 I want to thank Isai Guizar and Jouko Vilmunen. For the Early Warning System for currency crises (Chapter 3) I want to thank Ningchuan Yang for excellent research assistance, Domenico Giannone for making the Matlab code of Doz, Giannone and Reichlin (2011) available, and participants at the 10th INFINITI conference on international finance, Dublin; the 16th annual international conference on macro economics and international finance, Rethymno, Crete; The economics and econometrics of recurring financial market crises, Waterloo, Ontario; and seminar participants at CIRANO Montréal, and the University of Groningen for comments and suggestions.

Furthermore, I want to thank Xiaoli He for excellent research assistance, Rodrigo Caputo, Ana Maria Chirinos, Luiz Alberto D'Avila, Ali Kutan, Laurie Reijnders, Fernando Rosas, Alan Taylor, Jouko Vilmunen and participants at the LACEA-LAMES 2013 conference in Mexico City, IFABS 2014 conference in Lisboa, Portugal, ICFBR 2014 conference in Brasilia, Brazil and seminars at the University of Groningen and Universidad de Guadalajara for comments and suggestions for the DMPI (Chapter 4).

For the economic impact of sovereign debt defaults (Chapters 5 and 6) I want to thank Javier Arnaut, Arturo Bernal, Gerald Dwyer, Greetje Frankena, Jim Gerber, Ali Kutan, Juan Rivera and participants at the FRESH 2012 London meeting at LSE; the 11th INFINITI Conference on International Finance, Aix en Provence; and seminar participants at Tecnologico de Monterrey campus Guadalajara for comments and suggestions, and Alan Timmermann for data descriptions of the Aiolfi, Catao and Timmermann (2011) dataset.

The practical side of my stay in Groningen was arranged through SOM. I want to thank all that helped me out in my not-so-standard situation: Ellen, Arthur, Rina, Linda and Justin. Also Martine Koolman was a solid pillar for my annual visits: I found my computer every year in a different room with a different room mate and yet all worked well.

I have been very fortunate to get the opportunity to do my PhD. It provided me the chance to discover new paths and to broaden my professional

opportunities. In this respect special thanks go to Miguel Angel Montoya, who brought me in contact with Elmer Sterken, and to Maria Elena Vazquez who supported me since the start. I also want to thank Mauricio Cervantes, Mario Adrian Flores, Victor Gutierrez, Fernando Rosas, Ivan Valdovinos and Xiomara Vazquez from the Tecnologico de Monterrey, campus Guadalajara for their support and fruitful discussions. From the Universidad de Guadalajara I want to thank Leonardo Gatica for his highly intellectual sessions and his down-to-earth advice. I also want to thank Willy Cortez, Seimei Coronado, Margarita Gallegas, Antonio Ruiz Porras, Mauricio Ramirez, Guillermo Sierra and Francisco Venegas for their enthusiasm and professionalism. Special thanks go out to my fellow PhD's Roberto Arias and Johann Gottschalk. Our infrequent reunions have helped me a lot to continue.

In the summer of 2015 I was admitted to the summer investigation program at Banxico, the Central Bank of Mexico. With seminars, access to new data bases, contact with highly experienced policy makers, and under the inspiring supervision of Alberto Romero and Juan Pablo Graf I saw country risk from yet another perspective. I want to thank Fernando Bizuet, Diego Cid, Aldo Heffner, Fabrizio Lopez, Stefano Lord, Gabriel Martinez, Serafin Martinez and Ernesto Sepulveda for their support and fruitful discussions. My stay also gave me the chance to explore one of the most fascinating cities that I know, Mexico City.

The PhD provided me the chance to visit my home country every year for several months. It was good to be back in the Netherlands, where everything works well and in time. And just before getting bored with that, or getting back into hold habits like complaining about the weather or public transport I could return to Mexico. A very special thanks to my parents who have been in Groningen more in the last four years than ever before. Always ready for any practical and non-practical issue. I will miss the fish'n'chips in Den Oever! It also gave me the opportunity to meet up with Anne and Niels, and re-live old times with the old UvA-econometrist-bunch with whom I have not exchanged a single word on methodologies but all the more on the real important things in life: Roald, Catherine, Theun, Louise, Anton, Imre,

Martijn, Evelijn, Merijn, Esther, Justus, Ralph, Karen, Jeroen, Rachel, Johan and Anneke. Unfortunately, it took me one year too long to have Anton witness this special event. The only bad thing of terminating the PhD is that I will miss out on these annual trips to the Netherlands.

Last but not least, I want to dedicate this thesis to my closest family. To Lauris, who can still surprise me every day and has given me guidance and motivation to continue and to take the right decisions. And to our three children Brecht, Axel and Sibel who have lacked my parental time in various occasions. Now that this book is out I can dedicate more time to you. Thanks for your patience!

Contents

1	Introduction	1
1.1	Motivation	1
1.2	Definitions	6
1.2.1	Currency crises	6
1.2.2	Sovereign debt	8
1.2.3	Sovereign debt defaults and sovereign debt crises	8
1.2.4	The definitions that we apply	11
1.3	Research questions and contributions	12
1.4	Outline of the thesis	15
2	Historical and theoretical background	19
2.1	Economic history of Latin America	19
2.1.1	1870–1914: Global trade and financial integration	20
2.1.2	1914–1930: The collapse of the old world order	21
2.1.3	1931–1944: Great Depression and WW II	22
2.1.4	1945–1971: Inward-looking regimes	23
2.1.5	1972–now: Market reforms and return to globalization	24
2.2	History of currency crises and sovereign debt defaults	28
2.2.1	Currency crises	28
2.2.2	Sovereign debt defaults	31
2.2.3	Conclusion	35
2.3	Theoretical framework	35
2.3.1	Currency crises	37
2.3.2	Sovereign debt	38

2.3.3	Sovereign debt defaults	39
2.3.4	Relation between currency and sovereign debt crises	48
2.4	Conclusion	51
3	The Global Financial Crisis and currency crises in Latin America	53
3.1	Introduction	53
3.2	Literature review	57
3.2.1	Early Warning Systems	57
3.2.2	Early Warning Systems: applications for Latin America	58
3.3	Methodology	60
3.3.1	Crisis dating	60
3.3.2	Factor models	61
3.3.3	Ordered logit model	63
3.3.4	Ex ante forecasts	65
3.4	Data description	65
3.5	Empirical results	69
3.5.1	Regressions	69
3.5.2	Forecast performance	74
3.5.3	Robustness checks	81
3.6	Discussion	83
3.7	Conclusion	87
4	Sovereign Debt Crises in Latin America: A Market Pressure Approach	89
4.1	Introduction	89
4.2	Methodology	93
4.2.1	Construction of the DMPI	93
4.2.2	The DMPI as a crisis index	93
4.2.3	The ROC curve	94
4.3	Data description	98
4.4	Empirical results	99
4.5	Sovereign debt crises and business cycles	105
4.6	Conclusion	108

5	The economic impact of sovereign defaults in Latin America	111
5.1	Introduction	111
5.2	Literature review	114
5.3	Methodology	115
5.3.1	Dummy variable approach	116
5.3.2	Output loss approach	117
5.4	Data description	118
5.5	Empirical results	119
5.5.1	Pooled data	120
5.5.2	Zooming in on three historical periods	122
5.5.3	Focusing on individual countries	130
5.6	Conclusion	135
6	Sovereign defaults, business cycles and diversity in impact	137
6.1	Introduction	137
6.2	Literature review	140
6.2.1	The timing of sovereign debt defaults	140
6.2.2	Determinants of impact of debt default on economic growth	142
6.3	Methodology	143
6.3.1	Sovereign debt defaults and business cycles	143
6.3.2	Severity and contraction period	144
6.3.3	Analyzing the severity of the impact	145
6.4	Empirical results	145
6.4.1	Timing of sovereign debt defaults	146
6.4.2	Severity of output losses and contraction period	151
6.4.3	Analyzing the severity of the impact	151
6.5	Discussion	159
6.6	Conclusion	161
7	Conclusion	163
7.1	Main findings	163
7.2	Lessons for Latin America	167

7.3	Directions for future research	168
References		171
Appendices		187
A	Two alternative definitions of the Exchange Market Pressure Index	188
B	Sovereign debt default episodes in Argentina, Brazil, Chile and Mexico, 1870–2012	189
C	Explanatory variables for Argentina, Brazil and Mexico, 1990–2009: definitions and sources	190
D	Interpretations of the static factors of the Early Warning System for currency crises in Argentina, Brazil and Mexico 1990–2009	199
D.1	Argentina: variables with the highest correlations . . .	199
D.2	Argentina: dominant category per static factor	201
D.3	Brazil: variables with the highest correlations	203
D.4	Brazil: dominant category per static factor	204
D.5	Mexico: variables with the highest correlations	206
D.6	Mexico: dominant category per static factor	207
E	Robustness checks of 6 and 24 months run-up periods for Argentina, Brazil and Mexico, 1990–2009	208
E.1	Ordered logit estimation results	208
E.2	Forecasted probabilities of currency crises	216
E.3	Performance of the logit model using the Quadratic Probability Score	224
F	Explanatory variables for Argentina, Brazil, Chile and Mexico, 1870–2012: definitions and sources	226
G	Dummy variable approach: regressions for Argentina, Brazil, Chile and Mexico, 1870–2012	228
	Samenvatting (Summary in Dutch)	231

List of Tables

2.1	Dating of currency crises in Argentina, Brazil, Chile and Mexico, 1870–2012.	30
2.2	Dating of sovereign debt default episodes in Argentina, Brazil, Chile and Mexico, 1870–2012.	34
3.1	Ordered logit estimation results for Argentina 1991M5–2007M12, with a 12 months run-up period.	71
3.2	Ordered logit estimation results for Brazil 1994M8–2007M12, with a 12 months run-up period.	73
3.3	Ordered logit estimation results for Mexico 1990M1–2007M12, with a 12 months run-up period.	75
3.4	Out-of-sample performance of logit models with 12 months run-up, using the Quadratic Probability Score (QPS).	80
4.1	Contingency table of crisis realizations and signals.	94
4.2	Sovereign debt crisis episodes for Argentina, Brazil, Chile and Mexico, 1870–2012.	99
4.3	Benchmark debt crises and the constructed DMPI, with thresholds of 0.1 and 0.5 standard deviation.	104
5.1	Sovereign debt default episodes for Argentina, Brazil, Chile and Mexico, in three historical periods: 1870–1930, 1931–1971 and 1972–2012.	119

5.2	Impact of sovereign debt defaults on economic growth for pooled data (Argentina, Brazil, Chile and Mexico; 1870–2012): dummy variable approach.	120
5.3	Cumulative impact of sovereign debt defaults on economic growth for pooled data (Argentina, Brazil, Chile and Mexico; 1870–2012): Wald tests.	121
5.4	Redundancy test outcomes for fixed effects in Argentina, Brazil, Chile and Mexico; 1870–2012.	124
5.5	Impact of sovereign debt defaults on economic growth, in periods 1870–1930, 1931–1971 and 1972–2012 (pooled data): dummy variable approach.	125
5.6	Cumulative impact of sovereign debt defaults on economic growth, in periods 1870–1930, 1931–1971 and 1972–2012 (pooled data): Wald tests.	126
5.7	Impact of sovereign debt defaults on economic growth per country (Argentina, Brazil, Chile and Mexico), 1870–2012: dummy variable approach.	131
5.8	Cumulative impact of sovereign debt defaults on economic growth, per country (Argentina, Brazil, Chile and Mexico), 1870–2012: Wald tests.	132
6.1	Severity of the output loss and contraction period of sovereign debt defaults in Argentina, Brazil, Chile and Mexico 1870–2012.	152
6.2	Determinants of severity of the impact of sovereign defaults in Argentina, Brazil, Chile and Mexico, 1870–2012.	156
6.3	Determinants of contraction period of the impact of sovereign defaults in Argentina, Brazil, Chile and Mexico, 1870–2012.	157
B.1	Sovereign debt default episodes: alternative sources.	189
E.1	Ordered logit estimation results for Argentina, with a 6 months run-up period.	210

E.2	Ordered logit estimation results for Argentina, with a 24 months run-up period.	211
E.3	Ordered logit estimation results for Brazil, with a 6 months run-up period.	212
E.4	Ordered logit estimation results for Brazil, with a 24 months run-up period.	213
E.5	Ordered logit estimation results for Mexico, with a 6 months run-up period.	214
E.6	Ordered logit estimation results for Mexico, with a 24 months run-up period.	215
E.1	Quadratic Probability Score for forecasting currency crises in Argentina, Brazil and Mexico 1990–2009, with run-up periods of 6, 12 and 24 months.	225
G.1	Impact of sovereign debt defaults on economic growth for pooled data (Argentina, Brazil, Chile and Mexico; 1870–2012): dummy variable approach.	228
G.2	Impact of sovereign debt defaults on economic growth, in periods 1870–1930, 1931–1971 and 1972–2012 (pooled data): dummy variable approach.	229
G.3	Impact of sovereign debt defaults on economic growth per country (Argentina, Brazil, Chile and Mexico), 1870–2012: dummy variable approach.	230

List of Figures

1.1	Map of Latin America.	2
1.2	Countries in default or restructuring: Latin America and the rest of the world, 1811–2010.	5
2.1	Time line of Argentina, Brazil, Chile and Mexico, 1870–2010.	29
2.2	Latin America and the rest of the world: debt-to-GDP ratio and countries in default, 1870–2010.	32
2.3	Currency crises and sovereign debt crises in Argentina, Brazil, Chile and Mexico, 1870–2012.	36
3.1	Nominal exchange rates of the Argentinian peso, Brazilian real and Mexican peso, 2008–2009. Indexed (2008M1 = 100), monthly data.	54
3.2	Currency crisis episodes for Argentina for the period 1991–2009 (monthly data), with a 12 months run-up period for each crisis.	67
3.3	Currency crisis episodes for Brazil for the period 1994–2009 (monthly data), with a 12 months run-up period for each crisis.	68
3.4	Currency crisis episodes for Mexico for the period 1990–2009 (monthly data), with a 12 months run-up period for each crisis.	69
3.5	Argentina: probability of a crisis for the out-of-sample period, 2008–2009.	77
3.6	Brazil: probability of a crisis for the out-of-sample period, 2008–2009.	78

3.7	Mexico: probability of a crisis for the out-of-sample period, 2008–2009.	79
4.1	Illustration of the Receiver Operating Characteristic (ROC) curve.	96
4.2	DMPI and benchmark debt crisis periods for Argentina, Brazil, Chile and Mexico, 1870–2012.	100
4.3	DMPI: utility under different penalty values for missed crises, for varying threshold.	101
4.4	Business cycle indexes for Argentina, Brazil, Chile and Mexico, 1870–2004.	106
4.5	Impulse response functions for the Debt Market Pressure Index (DMPI) and the business cycle index (BCS) with 2 standard error bands about the impulse responses.	107
5.1	Output losses of sovereign debt defaults for Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data).	123
5.2	Output losses of sovereign debt defaults for Argentina, Brazil, Chile and Mexico in three historical periods 1870–1930, 1931–1971, 1972–2012: pooled observations.	128
5.3	Output losses of sovereign debt defaults per country (Argentina, Brazil, Chile and Mexico), 1870–2012.	133
6.1	Pattern of macroeconomic indicators around the time of the first year of a sovereign debt default in Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data).	147
6.2	Pattern of world economic and external trade indicators around the time of the first year of a sovereign debt default in Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data).	149
6.3	Pattern of commodity prices around the time of the first year of a sovereign debt default in Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data).	150

6.4	Pattern of macroeconomic indicators around the time of the first year of a sovereign debt default in Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data): deep versus mild crises.	153
6.5	Pattern of world economic and external trade indicators around the time of the first year of a sovereign debt default in Argentina, Brazil, Chile and Mexico, 1870–2012 (pooled data): deep versus mild crises.	155
E.1	Probability of a currency crisis for Argentina for the out-of-sample period, 2008–2009, with a 6 months run-up period. . .	217
E.2	Probability of a currency crisis for Argentina for the out-of-sample period, 2008–2009, with a 24 months run-up period. . .	218
E.3	Probability of a currency crisis for Brazil for the out-of-sample period, 2008–2009, with a 6 months run-up period.	220
E.4	Probability of a currency crisis for Brazil for the out-of-sample period, 2008–2009, with a 24 months run-up period.	221
E.5	Probability of a currency crisis for Mexico for the out-of-sample period, 2008–2009, with a 6 months run-up period.	222
E.6	Probability of a currency crisis for Mexico for the out-of-sample period, 2008–2009, with a 24 months run-up period.	223

