



WP/18/35


IMF Working Paper

Welfare Gains from Market Insurance: The Case of Mexican Oil Price Risk

by Chang Ma and Fabian Valencia

IMF Working Papers describe research in progress by the author(s) and are published to elicit comments and to encourage debate. The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

I N T E R N A T I O N A L M O N E T A R Y F U N D



WP/18/35

IMF Working Paper

Welfare Gains from Market Insurance: The Case of Mexican Oil Price Risk

by Chang Ma and Fabian Valencia

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

I N T E R N A T I O N A L M O N E T A R Y F U N D

IMF Working Paper

Western Hemisphere Department

Welfare Gains from Market Insurance: The Case of Mexican Oil Price Risk

Prepared by Chang Ma and Fabian Valencia¹

Authorized for distribution by Costas Christou

March 2018

IMF Working Papers describe research in progress by the author(s) and are published to elicit comments and to encourage debate. The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Abstract

Over the past two decades, Mexico has hedged oil price risk through the purchase of put options. We examine the resulting welfare gains using a standard sovereign default model calibrated to Mexican data. We show that hedging increases welfare by reducing income volatility and reducing risk spreads on sovereign debt. We find welfare gains equivalent to a permanent increase in consumption of 0.44 percent with 90 percent of these gains stemming from lower risk spreads.

JEL Classification Numbers: F3; F4; G1

Keywords: Hedging, Commodity exporters, Sovereign debt, Default

Author's E-Mail Address: cma18@jhu.edu, fvalencia@imf.org

¹ Johns Hopkins University and International Monetary Fund, respectively. The authors thank Paolo Cavallino, Costas Christou, Daniel Hardy, Dora Iakova, Olivier Jeanne, Laura Kodres, Anton Korinek, Leonardo Martinez, Hui Miao, Eugenio Rojas (discussant), Damiano Sandri, Alejandro Werner, Woo Jin Choi, and seminar participants at the IMF, the Bank of Mexico, George Washington University Student Research Conference, Spring 2017 Mid-west Macro Conference, 2017 Georgetown Center for Economic Research Biennial Conference, 2017 Asian Meeting of the Econometric Society, and China Meetings of the Econometric Society for valuable comments.

Contents

	Page
I Introduction	4
II Mexico's Oil Hedging Program	5
III Benefits/Costs of Hedging in a Two-period Model	8
IV Model Economy	10
A Benchmark Model with Defaultable Debt and Put Options	12
B An Economy without Put Options	14
C Recursive Equilibrium	15
V Quantitative Analysis	15
A Calibration	15
B Welfare Gains from Hedging	17
C Robustness Check	22
VI Extensions	24
A Selling Oil Forward	24
B Risk Averse Investors	27
VII Conclusion	28
References	30
Appendices	32
I Normalized Economy	32
II Proofs	33
A Proof of Proposition 1	33
B Proof of Proposition 2	33
C Proof of Proposition 3	34
D Proof of Proposition 4	35
III Algorithm	35
IV Estimation of Oil Price Process	37
V Option Pricing	37

Tables

1	Actual Strike Prices from Options	17
2	Parameters	18
3	Stochastic Steady State in the Hedging and No-hedging Economies	21
4	Sensitivity Analysis	25
5	Welfare Gains from Selling Oil Forward	27
6	Risk Averse Investors: Hedging and No-hedging Economies	28

Figures

1	Oil Production, Oil Prices, and Sovereign Spreads	6
2	Mexico's Oil Hedging Program	7
3	Two-period Model	11
4	Welfare Gains, Borrowing, and Probability of Default	20
5	Bond Price and Sovereign Spreads	21
6	Event Windows	22
7	Welfare Gains under Different Cost Premiums	23
8	Two-period Model with Forwards	36