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FEDERAL RESERVE BANK OF SAN FRANCISCO

# Monetary Policy Challenges in a Changing Global Environment

A stylized globe graphic in the bottom right corner, showing the Americas and Australia, with a grid of latitude and longitude lines.

## Foreign Effects of Higher U.S. Interest Rates

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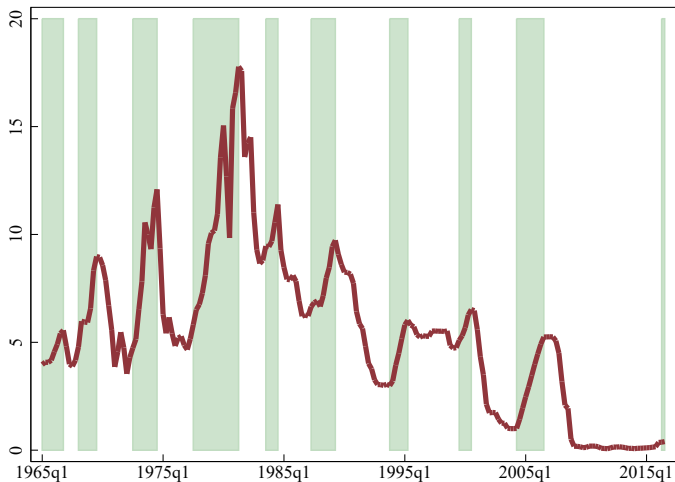
\*Federal Reserve Board

*Asia Economic Policy Conference – SF Fed*

November 17, 2017

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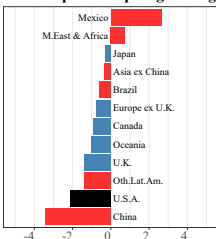
# The Fed Funds Rate from 1965 through 2016



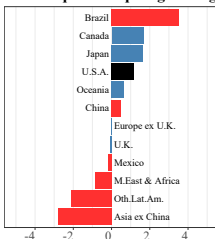
Shaded areas: periods of monetary tightenings

# Last six tightenings: a mixed picture

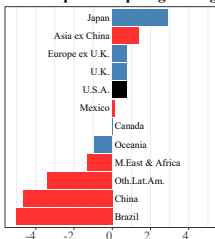
### 1. 1978q1 - 1981q2 Tightening



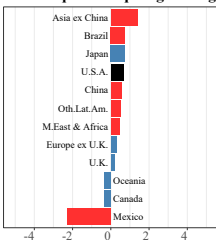
### 2. 1983q3 - 1984q3 Tightening



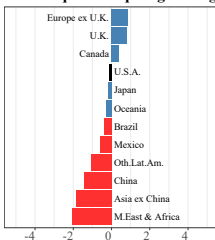
### 3. 1987q2 - 1989q2 Tightening



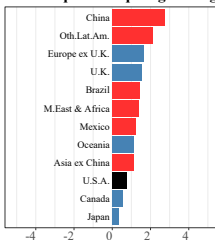
### 4. 1993q4 - 1995q2 Tightening



### 5. 1999q3 - 2000q3 Tightening



### 6. 2004q2 - 2006q3 Tightening



GDP growth relative to ARMA forecast, **Advanced** and **Emerging** regions

# How large are the foreign GDP spillovers from higher U.S. interest rates?

Many authors — Canova (2005), Maćkowiak (2007), Georgiadis (2016), Rey (2015), Dedola, Rivolta, and Stracca (2017) — argue that these spillovers are very large

Few systematic cross-country attempts to tell the channels of transmission apart.

Most studies focus on limited countries, or short time periods.

# This Paper

- Measure foreign GDP spillovers from U.S. interest rate **surprises**
  - 50 countries covering 1965Q1–2016Q4 ( $\approx 10,000$  observations)
  - Effect allowed to depend on country's conditions
- Methodology: panel version of local projections method, amended to allow for the spillovers to depend on country-specific, time-varying characteristics:
  - trade exposure with the U.S.
  - exchange rate regime against the dollar
  - a country's financial position

## Findings: U.S. Foreign Spillovers are substantial

- A 100 bps policy surprise reduces GDP after 3 years by:
  - ▶ 0.7% in the U.S.
  - ▶ 0.5% in Advanced Foreign Economies (AFEs)
  - ▶ 0.8% in Emerging Market Economies (EMEs)
- Effects depend on country's conditions
  - AFE effects magnified by trade and exchange rate regime.
  - EME effects magnified by country's financial conditions.
- The Mundell-Fleming-Dornbusch model appears to work well for AFEs, not so much for EMEs

# Plan for the talk

1. Data
2. Measuring the channels of international interest rate transmission
3. Methodology
4. Results



# Data

- Key ingredients needed:
  1. Measures of U.S. interest rate surprises
  2. Foreign GDP
- To understand transmission:
  1. exchange rate regime vis--vis U.S.
  2. trade with U.S.
  3. other controls (inflation, current account)
- To verify transmission:
  1. foreign exchange rates
  2. foreign interest rates
  3. foreign macro variables

# Three Channels of Transmission...

## 1. Exchange Rate Channel

- GDP of countries anchoring to the dollar should drop more following U.S. monetary shock

## 2. Trade Channel

- GDP of countries trading more with the U.S. should drop more following U.S. monetary shock

## 3. Financial Channel

- Capital market frictions may magnify the impact on a country of U.S. monetary shocks
- These frictions can be exacerbated when fundamentals are weak

# ...and their Data Counterparts

## 1. Exchange Rate Exposure

- We draw on Ilzetzki, Reinhart, and Rogoff (2017) to construct a 0/0.5/1 index that is higher the more a country pegs to the dollar

## 2. Trade Exposure

- We construct an index of trade openness with U.S. by taking the sum of exports to, and imports from the U.S., and dividing by GDP

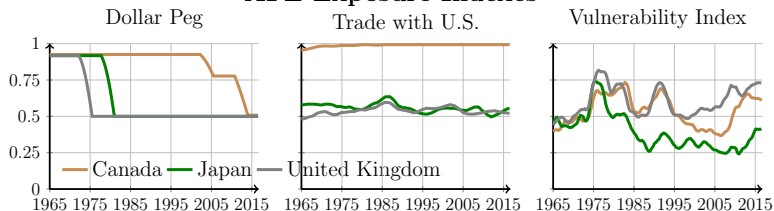
## 3. Financial Exposure

- Construct vulnerability index: first principal component of
  - Year-on-year inflation (+)
  - Current account deficit, expressed as a share of GDP (+)
  - Cyclical GDP (−)

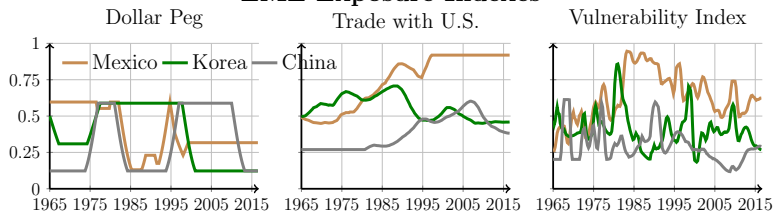
See paper for details on smoothing, trimming, transformations, and so on

# Exposure Measures $e_{i,t}$

## AFE Exposure Indexes



## EME Exposure Indexes



The indexes are logistic transformations of the original variables

## Local Projection Method: Average Effects

Estimate GDP spillovers to foreign economies of U.S. shocks from:

$$y_{i,t+h} = \alpha_{i,h} + \beta_h u_t + A_{h,i} Z_{i,t} + \epsilon_{i,t+h}$$

- $y_{i,t}$  GDP of country  $i$  in quarter  $t$
- $\alpha_{i,h}$  country fixed effect
- $u_t$  is the identified monetary shock, using residuals of VAR-style feedback rule **SHOCK**
- $Z_{i,t}$  controls
- IRF:  $\beta_h$  (average) response to monetary shock

# Local Projection Method: Channels of Transmission

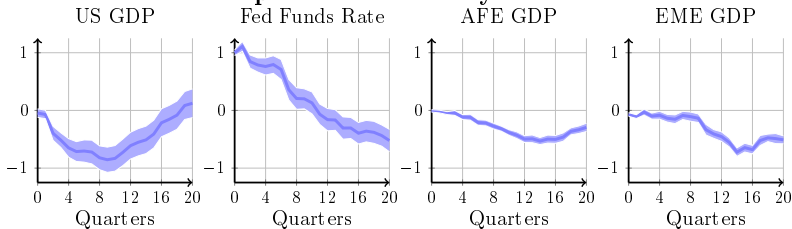
Incorporate country-specific economic conditions:

$$y_{i,t+h} = \alpha_{i,h} + \beta_h u_t + \sum_v \beta_h^v (e_{i,t-1}^v u_t)^\perp + A_{h,i} Z_{i,t} + \epsilon_{i,t+h}$$

- $e_{i,t-1}^v$ : centered transformation of exposure measure
- $(e_{i,t-1}^v u_t)^\perp$ : interaction effect, orthogonal to  $u_t$  and previous interactions
- $\beta_h^v$ : marginal effect of moving from *median* to *high* exposure
- Ordering: exchange rate channel, trade channel, financial channel
- We estimate the local projection separately for AFEs and EMEs. Within group, effects only allowed to differ according to exposure.

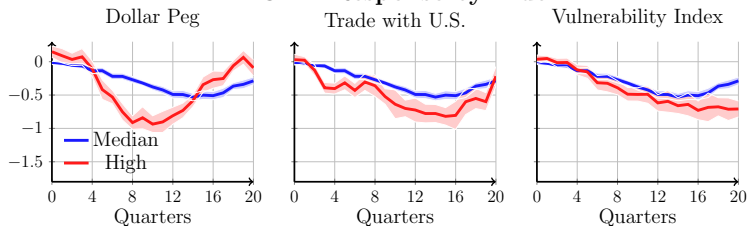
# Results I: Average Effects of U.S. Monetary Shocks

## Response to Monetary Shocks

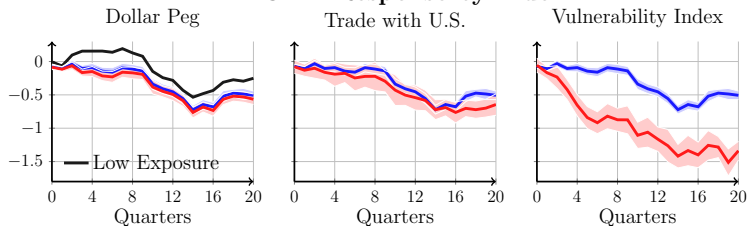


## Results II: Exposure Matters

### AFE GDP Response by Index



### EME GDP Response by Index



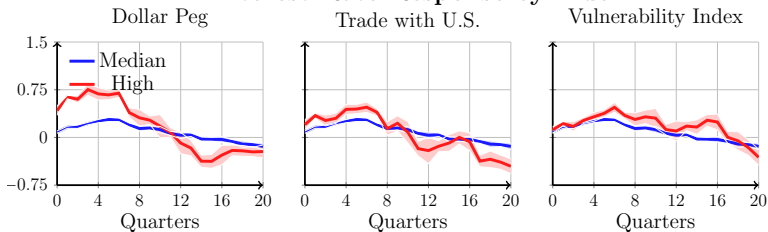


# Summary of Main Results

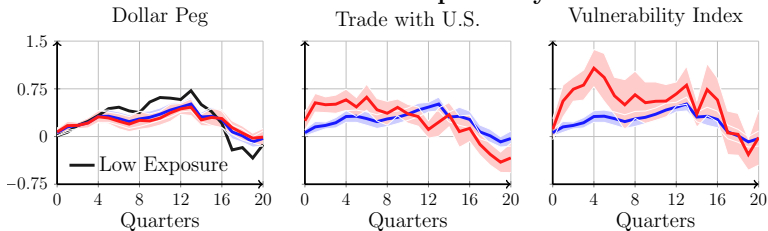
1. Strong foreign effects
2. Larger effects for emerging economies
3. Trade and exchange rate channels explain well the cross-section of responses for AFEs
4. Vulnerability channel explains well the cross-section of responses for EMEs

# Marginal Effects: Foreign Interest Rate Responses

## AFE Interest Rate Response by Index

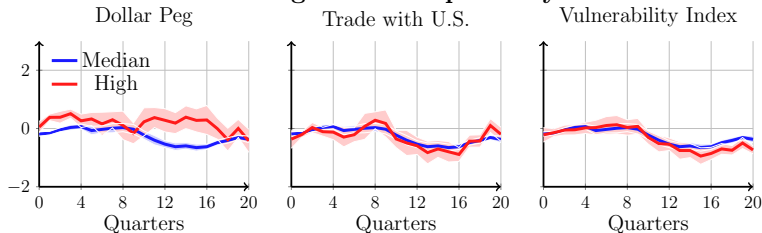


## EME Interest Rate Response by Index

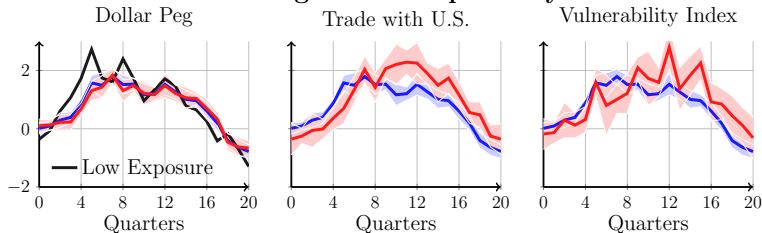


# Marginal Effects: Foreign Exchange Rate Responses

## AFE Exchange Rate Response by Index



## EME Exchange Rate Response by Index

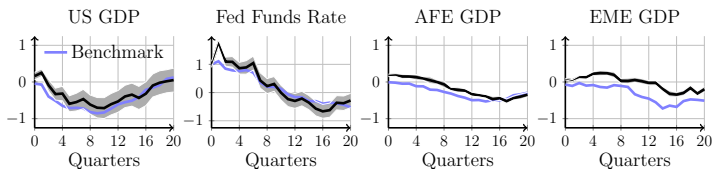


## Summary of Channels

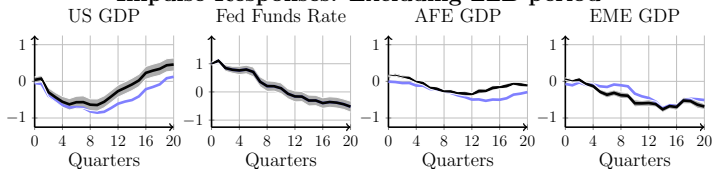
1. Interest rates rise more in AFE peggers, consistent with larger decline in GDP for AFE peggers
2. Slight dollar appreciation for AFE peggers, consistent with larger decline in GDP
3. Interest rates rise a lot in vulnerable EMEs, consistent with larger GDP decline

# Robustness: Alternative Shocks and Periods

## Impulse Responses: Romer & Romer Shocks

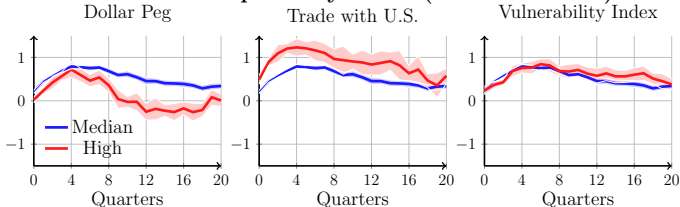


## Impulse Responses: Excluding ZLB period

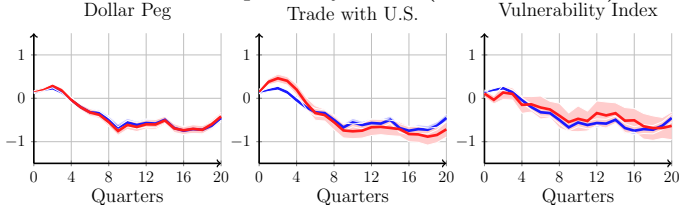


# Robustness: U.S. Demand causes FFR $\uparrow$ 100 bps

## AFE GDP Response by Index (Demand Shock)

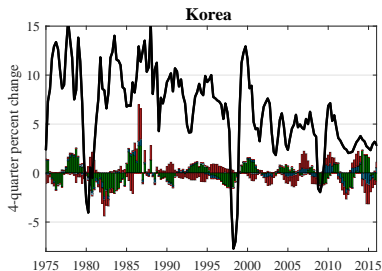
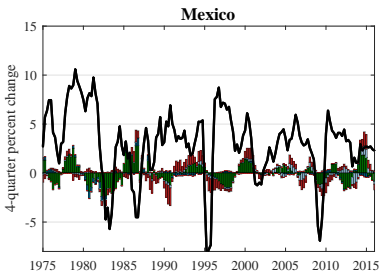
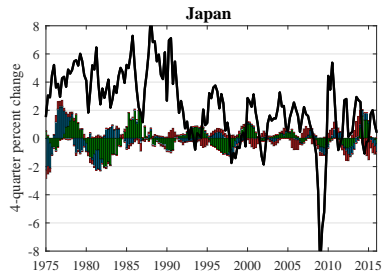
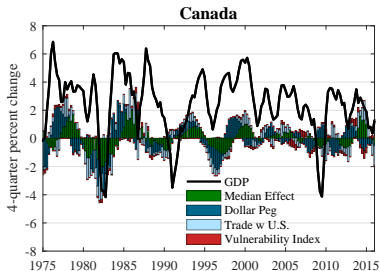


## EME GDP Response by Index (Demand Shock)



Source of higher interest rate matters!

# How Large? Historical Decompositions



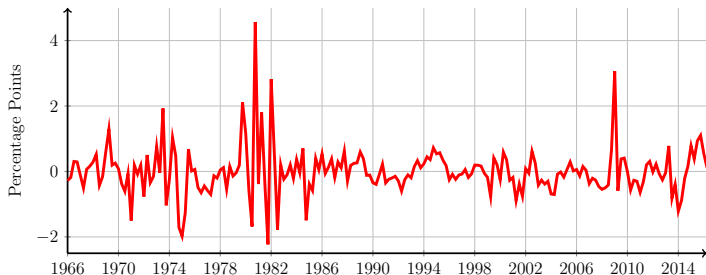
# Conclusions

1. We find large foreign effects of U.S. monetary shocks
2. In advanced economies, effects consistent with Mundell-Fleming-Dornbusch model
3. In emerging economies, importance of financial factors suggests importance of global financial cycle driven by U.S. monetary policy



# U.S. Monetary Shocks

## Identified U.S. Monetary Shocks

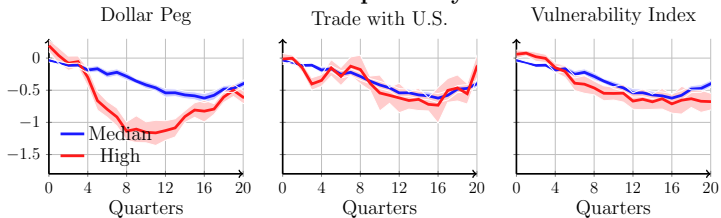


Shock calculated as residual of regression of U.S. interest rate on own lags, current and lagged GDP, inflation, foreign GDP, BAA spread.

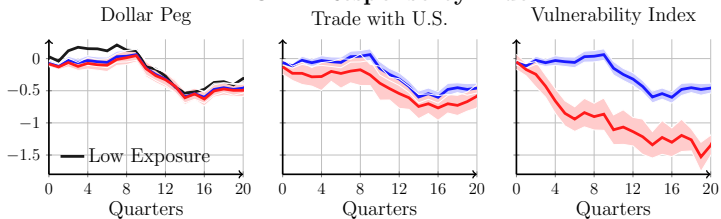
We replace the FFR with the Wu and Xia (2016) shadow rate from 2009 to 2015

# Robustness: No Backfilling

## AFE GDP Response by Index



## EME GDP Response by Index



# Data Coverage

Table 1: Data Availability

Country	GDP			Dollar Peg		Trade with U.S.		Inflation		Current Account	
	first	firstQ	last	first	last	first	last	first	last	first	last
Argentina	1965	(1993)	2016	1965	2016	1971	2016	1965	2016	1970	2016
Australia	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Austria	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Belgium	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1994	2016
Botswana	1965	(1994)	2016	1965	2016	1974	2016	1965	2016	1974	2016
Brazil	1965	(1990)	2016	1965	2016	1982	2016	1965	2016	1970	2016
Canada	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Chile	1965	(1986)	2016	1965	2016	1965	2016	1965	2016	1970	2016
China	1965	(1992)	2016	1965	2016	1972	2016	1965	2016	1981	2016
Colombia	1965	(2000)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Czech Republic	1990	(1996)	2016	1965	2016	1993	2016	1971	2016	1992	2016
Denmark	1965	(1966)	2016	1965	2016	1965	2016	1967	2016	1970	2016
Ecuador	1965	(1990)	2016	1965	2016	1965	2016	1965	2016	1970	2016
El Salvador	1965	(1990)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Finland	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
France	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Germany	1970	(1970)	2016	1965	2016	1970	2016	1965	2016	1970	2016
Greece	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Hong Kong	1965	(1990)	2016	1965	2016	1965	2016	1965	2016	1997	2016
Hungary	1991	(1995)	2016	1965	2016	1991	2016	1967	2016	1991	2016
Iceland	1965	(1997)	2016	1965	2016	1965	2016	1965	2016	1970	2016
India	1965	(1996)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Indonesia	1965	(1983)	2016	1965	2016	1967	2016	1965	2016	1970	2016
Ireland	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Israel	1965	(1995)	2016	1965	2016	1965	2016	1965	2016	1970	2016

# Data Coverage contd.

Italy	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Japan	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Jordan	1975	(1992)	2016	1965	2016	1975	2016	1970	2016	1975	2016
Korea	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Luxembourg	1965	(1965)	2016	1965	2016	1997	2016	1965	2016	1970	2016
Malaysia	1965	(1991)	2016	1965	2016	1966	2016	1965	2016	1970	2016
Mexico	1965	(1980)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Netherlands	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
New Zealand	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1977	2016
Norway	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Peru	1965	(1980)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Philippines	1965	(1981)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Poland	1990	(1995)	2016	1965	2016	1990	2016	1971	2016	1990	2016
Portugal	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1971	2016
Singapore	1965	(1975)	2016	1965	2016	1965	2016	1965	2016	1970	2016
South Africa	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Spain	1965	(1970)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Sweden	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Switzerland	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1980	2016
Taiwan	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Thailand	1965	(1993)	2016	1965	2016	1965	2016	1965	2016	1970	2016
Turkey	1965	(1998)	2016	1965	2016	1965	2016	1965	2016	1970	2016
United Kingdom	1965	(1965)	2016	1965	2016	1965	2016	1965	2016	1970	2016
United States	1965	(1965)	2016	1965	2016	.	.	1965	2016	1970	2016
Venezuela	1965	(1997)	2015	1965	2016	1965	2016	1965	2016	1970	2016

Data coverage for each of the variables included in the panel.

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