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Modeling Energy Price Reform Outcomes and Their Determinants Using a Newly Constructed Dataset

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An Overview:
Energy Price Reform, Challenges, and Outcomes

Many countries regulate domestic energy prices, setting them below international market levels.

- As energy provides households with essential services such as lighting, heating, and cooling, **low energy prices** are used to support lower-income households.
  - Studies have shown that low energy prices are **inefficient** at supporting lower-income households.

- Depending on the country's circumstances, different drivers can move **energy price reform up the policy agenda**:
  - **In energy-exporters**, the fall in international oil prices in late 2014 and the subsequent decrease in government revenue
  - **In energy-importers**, high international oil prices and their impact on the government budget

- The drivers of energy price reform have historically been fiscal. However, energy price reform is now seen as a tool to tackle climate change.

Energy price reform can deliver significant fiscal and economic benefits. But the barriers to reform can be huge.

- Energy price reform can be **challenging** to implement.
  - **Political economy challenges** appear among the top barriers to energy price reform (Rentscher and Bazilian, 2017).
- Nevertheless, many countries have attempted to reform energy prices over the last 70 years.
  - Some of these countries have been **successful** at doing so, unlocking fiscal and economic benefits.
  - Other countries have **failed** at doing so, reversing the energy price reforms, often in response to social unrest.
- It is crucial to understand the **factors** that contribute to **successful vs. unsuccessful** energy price reform **outcomes**.
  - A better understanding can potentially help policymakers implement energy price reforms successfully or perhaps guide them to alternative policies when the factors or circumstances are not appropriate.

Before diving into the analysis, it is important to clarify the definitions of energy price reform and success.

- **Energy price reform:** An increase in regulated domestic energy prices in a country, generally done to improve the fiscal balance.
- **Success:** In the political economy literature, a successful reform is one that improves social welfare (which energy price reform does) and is not reversed (Hill, 2013; Chelminski, 2018).
- In other words, a successful energy price reform is an increase in regulated energy prices that 'sticks.' An unsuccessful one is an increase that is reversed, generally in response to social unrest.
  - The increase could be reversed partially or fully (i.e., back to the pre-reform prices)
- While most reversals of energy price reform are the result of social unrest, this is not the case 100% of the time.

Literature Review: Determinants and Outcomes of Energy Price Reform

What does the academic and grey literature say about energy price reform and outcomes?

- Surprisingly, there is very little on energy price reforms and outcomes. There are far more studies on **food price reforms** and outcomes.

- To the best of our knowledge, there are three studies that have explored energy price reforms and outcomes:

Study	Type	Overview and key results
IMF (2013)	IMF report	A review of **28 episodes of energy price reform**, with a qualitative analysis of the lessons learned. **Key result:** A reform strategy, a communication strategy, gradual increases, and targeted mitigation measures are key.
Natalini et al (2020)	Peer-reviewed publication	A logistic regression of instances of 'fuel riots' against international crude oil prices and other political economy determinants. **Key result:** increases in international oil prices increase the odds of fuel riots.
McCulloch et al (2021)	Working paper	A regression of instances of 'fuel riots' against domestic gasoline prices and other political economy determinants. **Key result:** increases in domestic gasoline prices increase the odds of fuel riots (but not international oil prices).

Nevertheless, there are large gaps in understanding and modelling energy price reforms and outcomes

- The IMF study focused on specific episodes of energy price reform, but only included 28 episodes. They did not do any modelling work.
  - There is room to expand such an analysis to a much larger number of episodes of energy price reform.
- While Natalini et al (2020) and McCulloch et al (2021) used regression models, they regressed instances of fuel riots against international oil prices or domestic gasoline prices.
  - The international oil price can be tricky. In oil-exporting countries, energy price reforms occur when international oil prices are low, while the opposite is true in oil-importing countries.
  - The domestic gasoline price is not the only driver of fuel riots. Increases in kerosene or LPG (cooking gas) prices could lead to fuel riots while the gasoline price remains fixed.
  - There could be multiple episodes of energy price reform within a country within a year that are obscured when looked at them through an annual gasoline price dataset.

This study aims to fill some of these gaps

- We fill some of these identified gaps in the literature by:
  1. Constructing a **new dataset of global energy price reform episodes**, stretching from the 1960s to the present, capturing (to name a few):
     - The **specific energy price increases** that occurred
     - The **reversals of** those energy price increases, if any
     - The **occurrence of social unrest** due to the energy price increase
     - The **use of compensation measures**
  2. Conducting an **in-depth qualitative** and **visual data analysis** of the newly constructed dataset, extracting the lessons learned and key insights.
  3. Applying various **quantitative modelling tools** (e.g., logistic regression analysis) to the newly constructed dataset.
- Today, we will focus on presenting the results from elements 1 and 2 of this study.

Methodology and Data

Constructing a new dataset on global energy price reform episodes (1/3)

- We conducted a **manual search** of **news databases** to find historical episodes of energy price reform, extracting key details on each episode.
  - Details of these episodes were extracted from articles in **newspapers** and **historical newspapers**, although some details were extracted from articles in **trade journals**, **official government publications**, and **academic journals**.
- One of the key databases used was **ProQuest**, including all source types within. Other databases used include **LexisNexis** and **Factiva**.
- The manual search was done **systematically**, country by country and year by year. Advanced search functions were used to build precise searches by combining operators to maximize precision, as follows:
  - Country AND (gasoline OR petrol OR LPG OR “cooking gas” OR diesel OR kerosene OR electricity OR fuel) AND (((price or tariff) AND (lift* OR increas* OR rais* OR hik* OR reform*)) OR (subsid* AND (cut* OR reduc* OR decreas* OR remov* OR reform))) AND YR(XXYY)

Constructing a new dataset on global energy price reform episodes (2/3)

- Using the **news databases**, we extracted data on the energy products targeted during each reform episode (gasoline, diesel, kerosene, LPG, or electricity), the use of compensation, the occurrence of protests, and the reversals of the reforms.

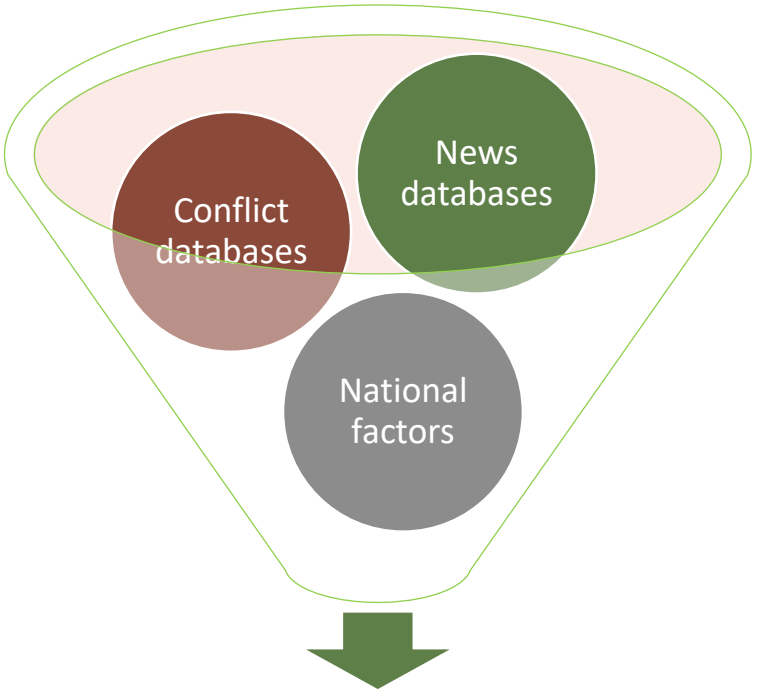
- To add further detail around the occurrence of protests/social unrest, the energy price reform episode data extracted from the **news databases** were combined with data extracted from several **large-scale conflict databases**, including the:
  - GDELT project database
  - Armed Conflict Location & Event Data Project (ACLED)
  - the Urban Social Disorder Database developed by PRIO
  - Mass Mobilization (MM) Database by Binghamton University and University of Notre Dame

- ACLED, PRIO, and MM provide **structured incidents of unrest.** We utilize these databases by filtering the textual entries to export incidents of energy price-related social unrest.

- GDELT is a near-live dataset that provides **semi-strucutred data on events**. We utilize Google's BigQuery to filter and query the data focusing on energy price related social unrest.

Constructing a new dataset on global energy price reform episodes (3/3)

- One drawback of the **news databases** is (sometimes) the lack of detailed information on the protests and unrest that occur as a result of energy price reform in unsuccessful episodes.
- One drawback of the **conflict databases** is that they do not provide detailed information about the energy price reform episodes, such as the extent of the price increases, the products targeted, or the use of compensation. They also say **nothing** about the successful episodes.
- We **combined** all of the manually extracted data into a **single spreadsheet**, *in which each observation is a distinct episode of energy price reform*, containing details on the episode, the social unrest that occurred (if any), plus annual data on **national factors** and circumstances.



Global dataset on energy price reform episodes and outcomes

~150 global episodes captured

Lessons Learned from Energy Price Reform Episodes: Deep-Dive Case Studies

India's energy price reform: Lessons learned

- India has been regulating energy prices for decades, with multiple deregulation attempts. Between 2002 and 2009, India implemented 8 successful energy price reforms, with regulated fuel prices increasing in 2004, 2005, 2006, 2008, and 2009.
  - Gasoline and diesel prices were hiked in all 8 reforms, while kerosene, the "fuel of the poor", was not hiked during any of them.
- In 2010, India raised all petroleum product prices, including kerosene. Over the following years, the Indian government gradually deregulated fuel prices.
- **Lessons Learned:**
  - India successfully reformed energy prices multiple times through a **gradual approach.**
  - Full price deregulation was successfully done on **different fuels** at **different times.**
  - Many of the energy price reform episodes did not touch **kerosene** due to its sensitivity.
  - **Opposition parties** can use energy price reforms as an **opportunity to drive protests.**
  - The one relatively large protest occurred in 2010, when the government increased all fuel prices, including kerosene.
  - Kerosene prices were reformed when the government improved electricity access for the poor and provided them with LPG cooking gas connections as **alternatives.**

Iran's energy price reform: Lessons learned

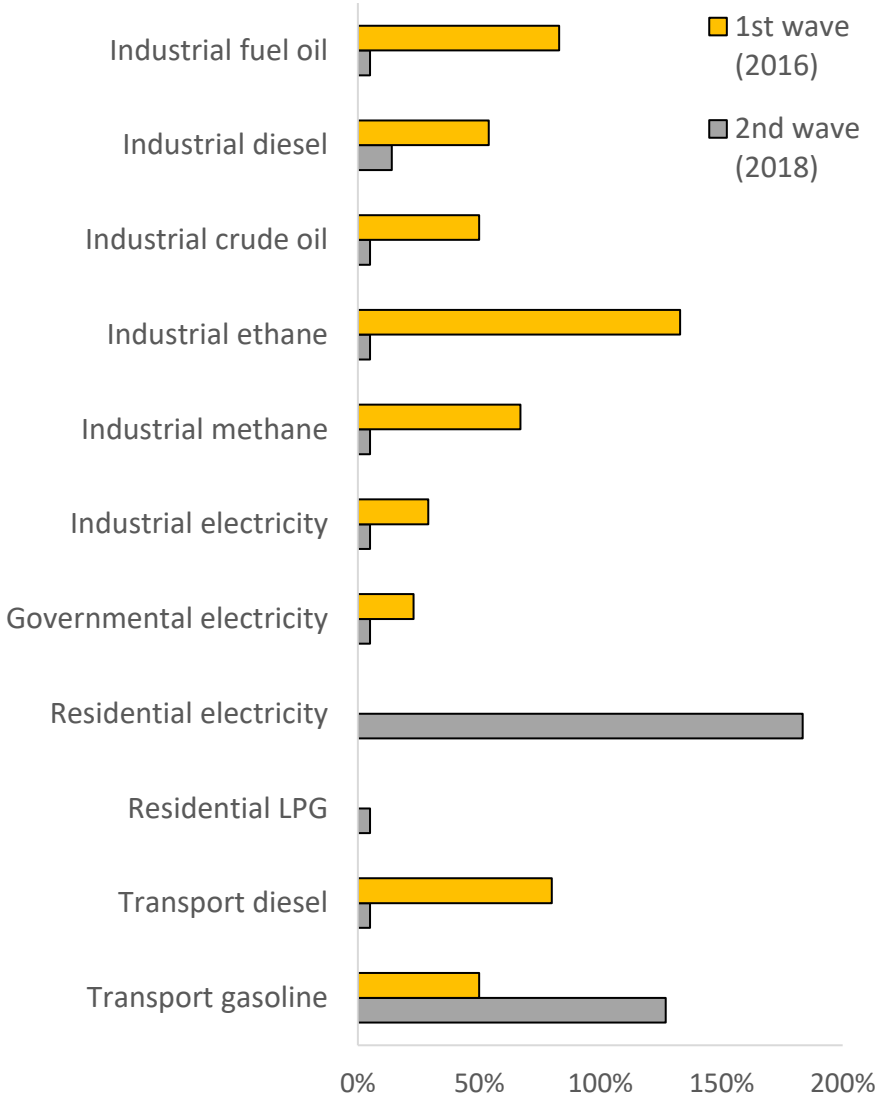
- Iran has been regulating domestic energy prices for decades.
  - One of the earliest recorded episodes in our database occurred in Iran in 1964, in which gasoline prices doubled, leading to strikes by taxis and eventually a partial reversal.
- Iran implemented several major energy price reforms: in 2007 (protests), 2010 (no protests), 2014 (no protests), and 2019 (intense protests)
- **Lessons Learned:**
  - Iran's **past bad experience** with energy price reform in the 1960s appeared to make future Iranian governments wary of implementing energy price increases.
  - A **clear communication strategy** with a **comprehensive compensation scheme** appear to have contributed to the success of the 2010 energy price reform episode, despite its unprecedented scale.
  - Ensuring that **compensation was given before** the sharp energy price increases in 2010 appears to have contributed to the successful outcome.
  - Promises of compensation may not be enough, particularly when energy price increases are large and the **economy is under strain**, as was the case in 2019 with the economic sanctions on Iran.

Malaysia's energy price reform: Lessons learned

- Malaysia has been regulating domestic energy prices for decades. In 2000, they implemented their first energy price increases since 1983.
- Malaysia has implemented numerous energy price increases successfully since then, with no instances of major social unrest or reversal.
- **Lessons Learned:**
  - **Gradual energy price reforms** appear to have contributed to the successful outcomes.
  - Implementing the **same energy price increases**, in absolute term, gives consumers a **sense of familiarity** and **eliminates the surprise factor.**
  - The efforts of the Malaysian government in **communicating the costs of subsidies to citizens** (e.g., distributing informational pamphlets on subsidies) appears to have contributed to the successful outcomes.
  - Most of the domestic media publications supported government efforts by **reporting** the new energy prices after reform and **what the prices would have been without government support,** highlighting the cost on the government budget.

Saudi Arabia's energy price reform: Lessons learned

- Saudi Arabia has been regulating domestic energy prices for decades. Saudi Arabia implemented two major episodes of energy price reform, the first in 2016 and the second in 2018.
- **Lessons Learned:**
  - **Two gradual energy price reforms** appear to have contributed to the successful outcomes.
  - The relatively **higher levels of income in Saudi Arabia** support the successful implementation of energy price reforms.
  - The **comprehensive compensation scheme** (Citizen's Account), which compensated around 50% of Saudi households in 2018, appears to contributed to the successful outcome despite unprecedented energy price increases in that year.



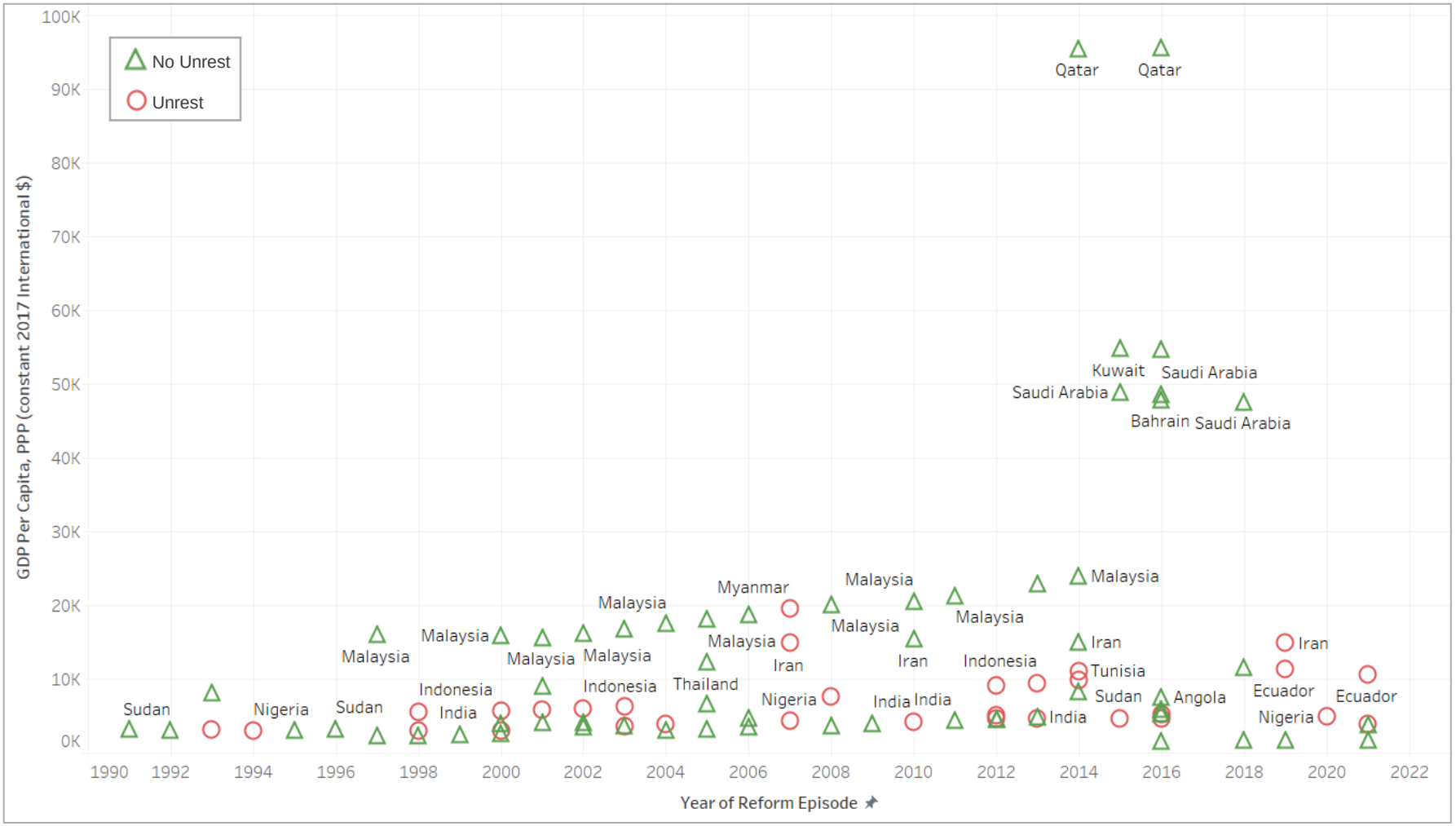
Source: Gasim and Matar (2023)

Indonesia's energy price reform: Lessons learned

- Indonesia has been regulating the prices of energy and food staples for decades.
  - Following the Asian Financial Crisis in 1997, Indonesia implemented large energy price increases in 1998, triggering protests and rioting. Even though the price increases were partially reversed, they led to President Suharto's resignation.
- After Suharto's regime, successive governments made multiple efforts to increase domestic energy prices, with mixed outcomes (usually unrest).
- **Lessons Learned:**
  - **Social unrest** appears to be more likely to occur in a country during future energy price reforms after occurring once before.
  - **Compensation** of lower-income households appears to have contributed to the relatively muted protests that occurred in 2005 (Bantuan Langsun Tunai, or BLT).
  - **Awareness** campaigns were also used in 2005, which may have also contributed to the relatively muted protests in that year.

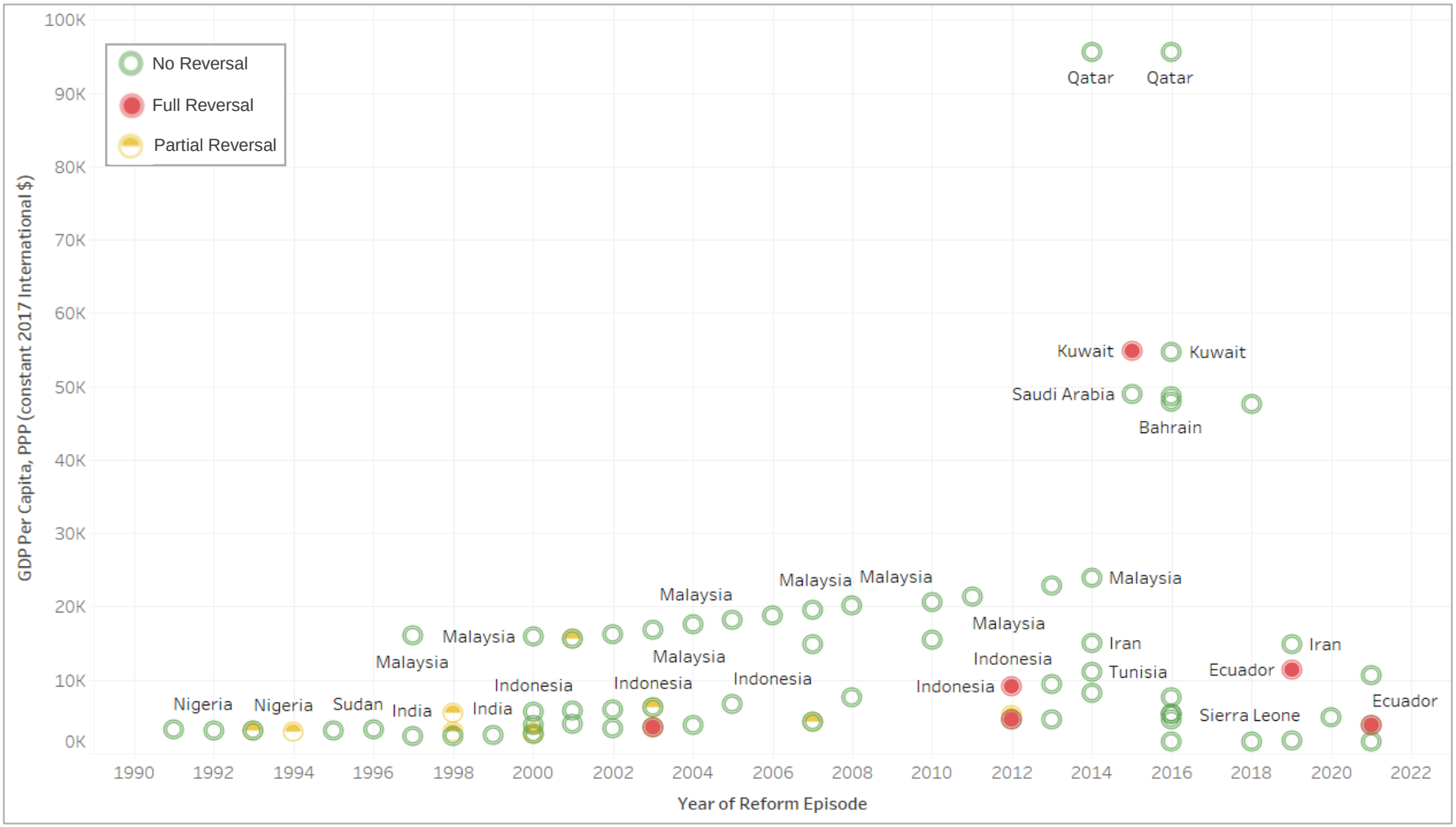
Data Visualization:
Key Insights on Energy Price Reform Outcomes and Their Determinants

GDP per capita VS Social unrest due to energy price reform



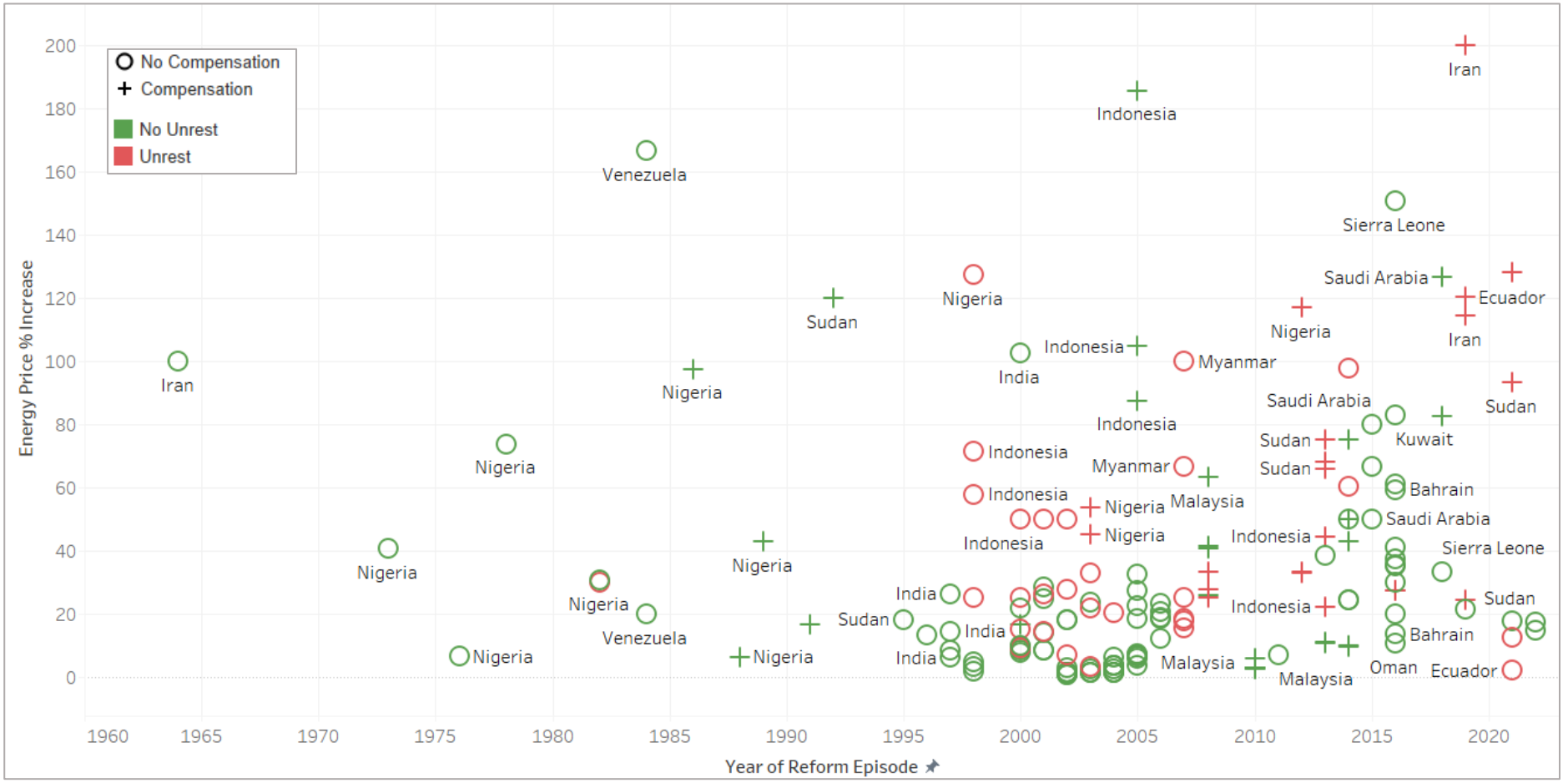
GDP per capita, PPP (constant International $) – World Bank (1990 – 2021)

GDP per capita VS Reversal of energy price reform

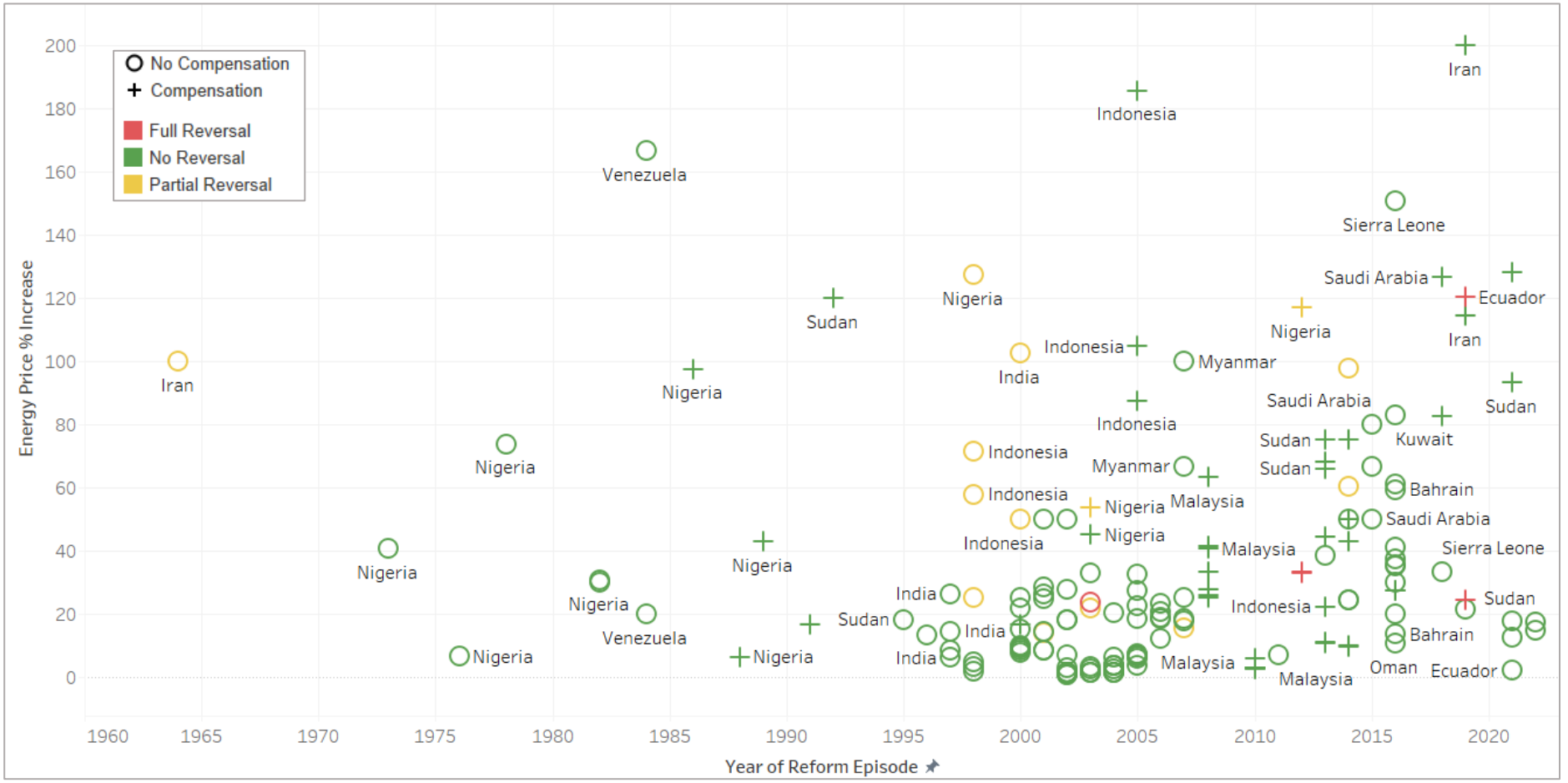


GDP per capita, PPP (constant International $) – World Bank (1990 – 2021)

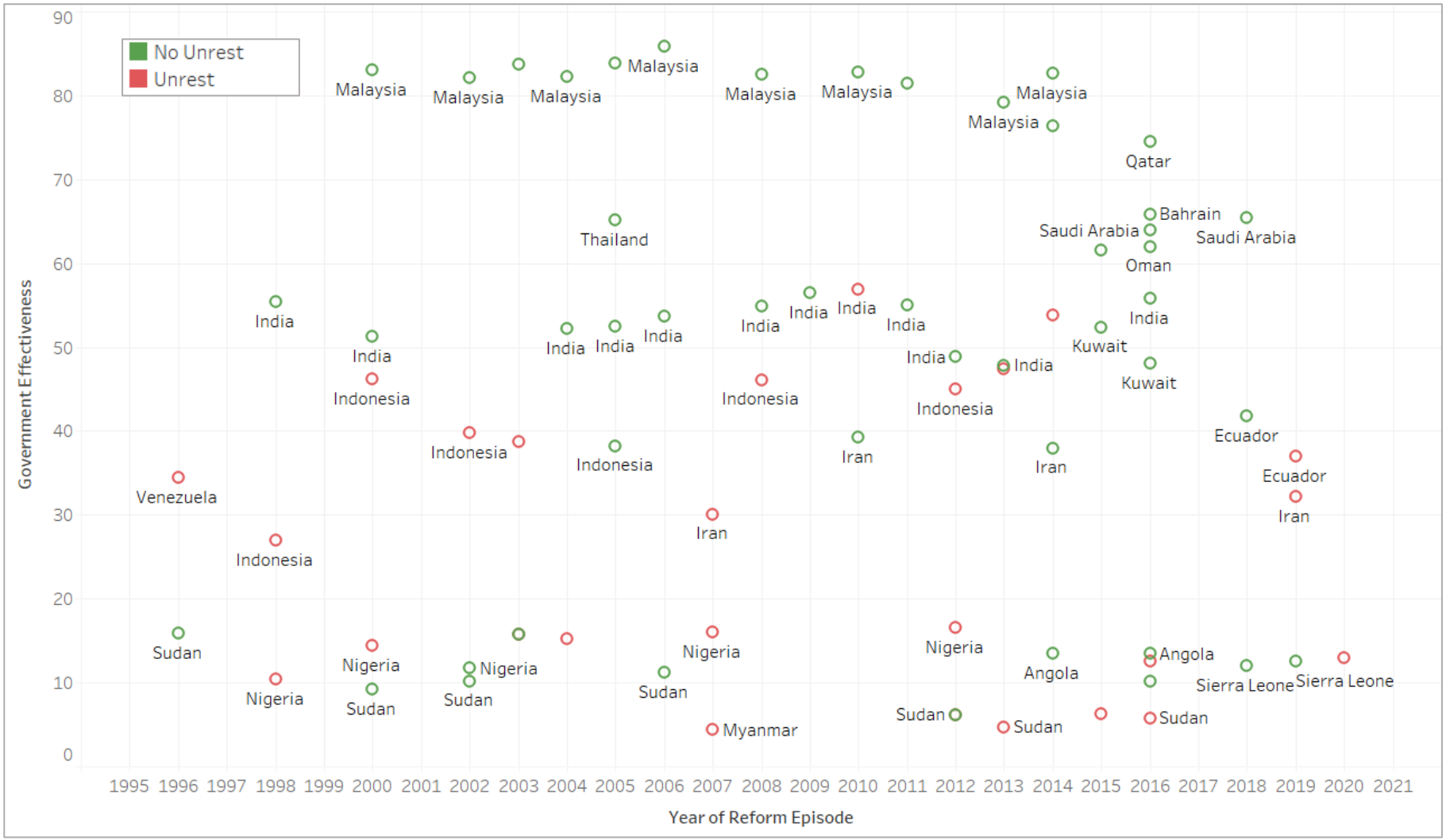
Energy price percentage increase VS Social unrest due to energy price reform



Energy price percentage increase VS Reversal of energy price reform

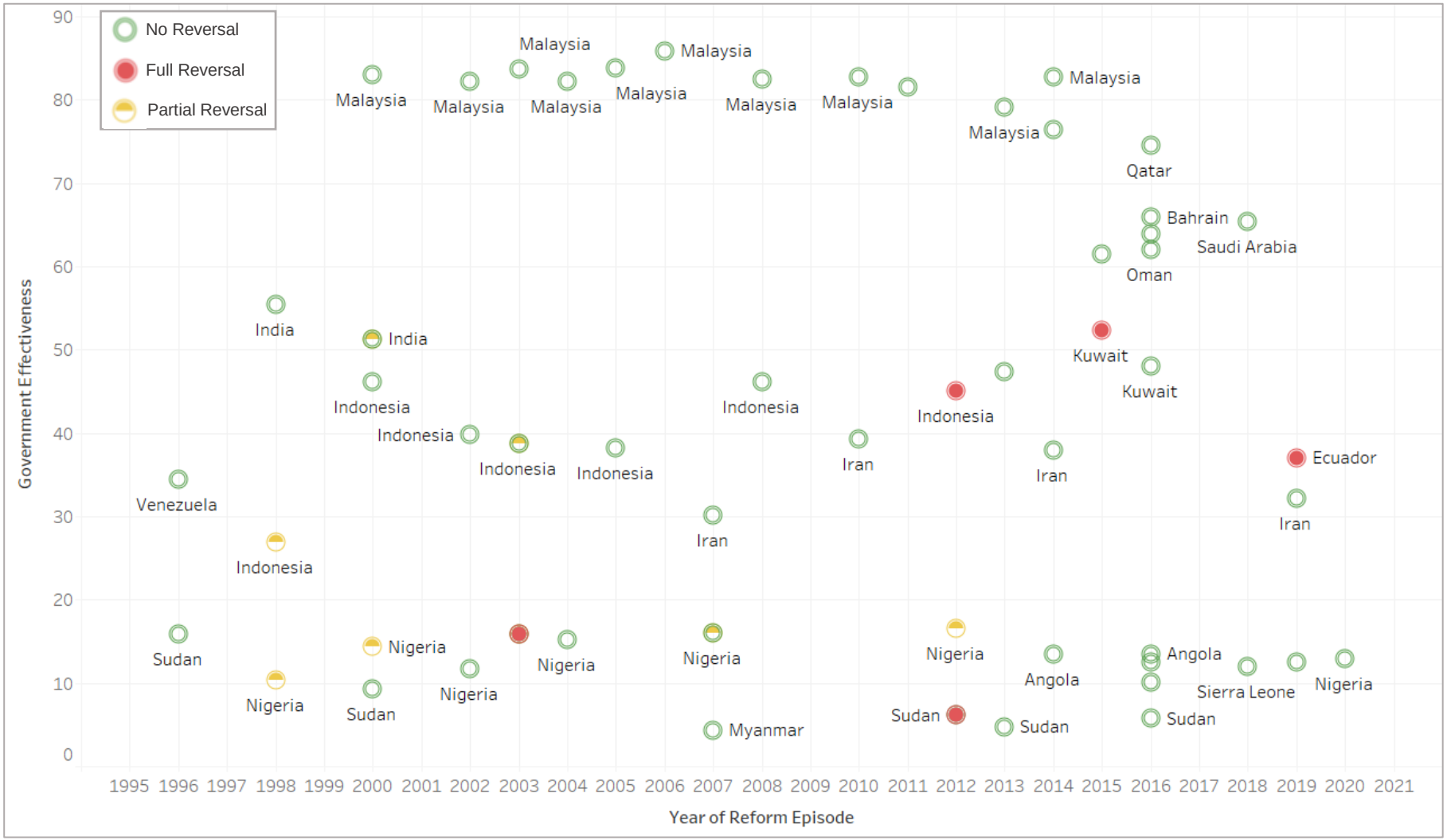


Government effectiveness VS Social unrest due to energy price reform



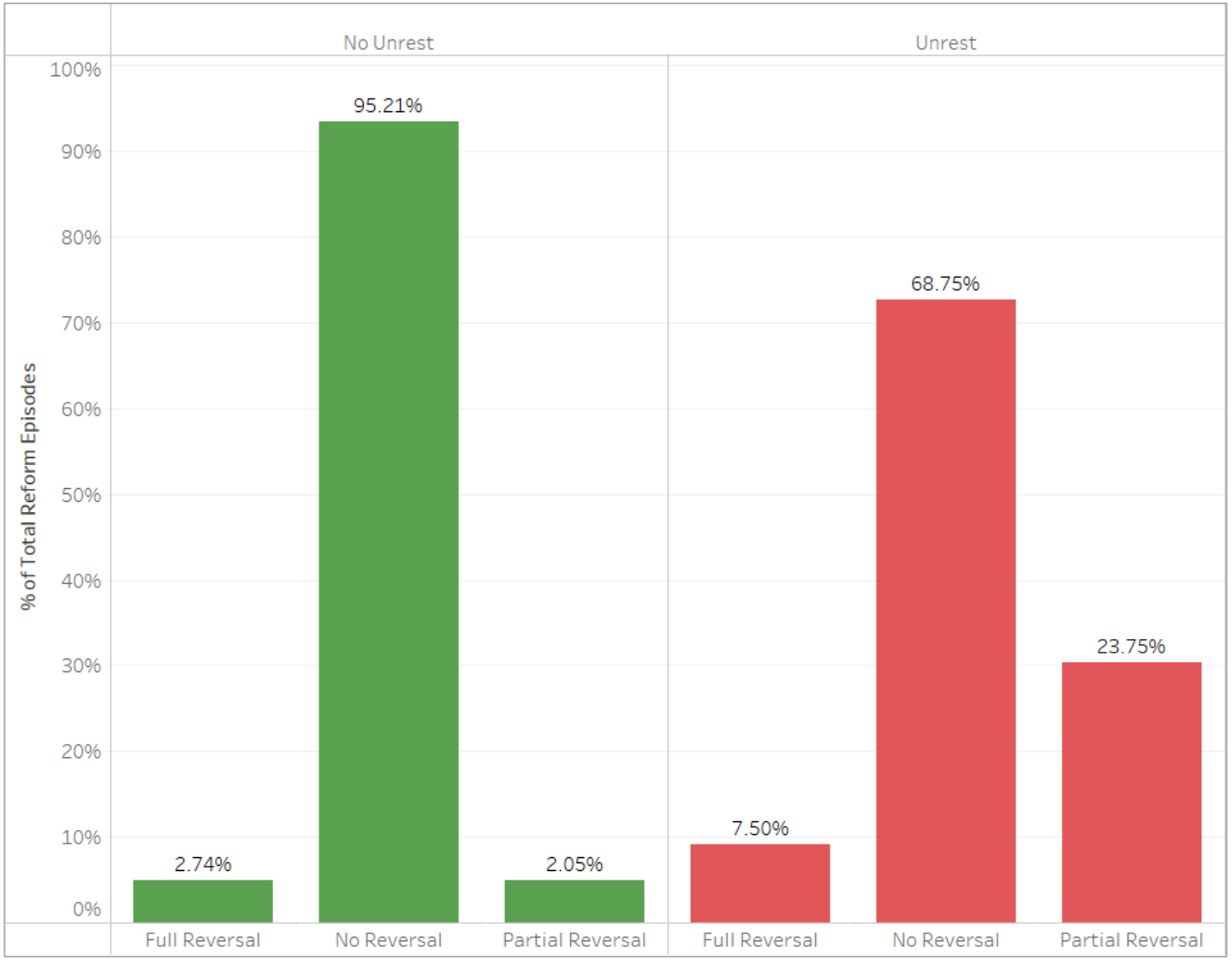
Government Effectiveness – World Bank (1996 – 2020)

Government effectiveness VS Reversal of energy price reform



Government Effectiveness – World Bank (1996 – 2020)

Relationship between social unrest and energy price reform reversal



Conclusion and Next Steps

Conclusion and Next Steps (1/2)

- To better understand energy price reforms and outcomes, we constructed a **new global dataset** of **energy price reform episodes**, capturing details such as the **price increases**, **products targeted**, and **outcomes**, to name a few.
- Case studies of countries reveals some of the common **lessons learned**:
  - Energy price reforms are **likely to stick when they do not lead to social unrest**. When they lead to unrest, the reforms are reversed around a third of the time.
  - Energy price reforms are more likely to succeed in **higher-income** countries.
  - **Gradual** energy price reforms are more likely to succeed.
  - When an **initial attempt** at energy price reform leads to social unrest, future **attempts are likely to do so as well**, even if well-designed. It is therefore important for governments to not rush, and instead take time to implement the reform successfully at the first instance.
  - **Compensation** appears to mitigate negative impacts, contributing to successful outcomes. Compensation schemes vary across countries in terms of the type of compensation, the timing of the compensation, and its effectiveness in reaching vulnerable households.
  - **Awareness** campaigns can also contribute to successful reform outcomes.
- Despite the common lessons learned, the case studies reveal a lot of nuances and unique circumstances each country faces when reforming energy prices.

Conclusion and Next Steps (2/2)

- Future work will involve finalizing and refining the dataset. The plan is to make our global energy price reform episode dataset **publicly available** on KAPSARC's data portal.
  - We will also be sharing online dashboards on global energy price reform episodes.

- Future work will look at applying logistic regressions to the dataset to better understand how the identified drivers influence energy price reform outcomes:
  - $Energy\ price\ related\ social\ unrest_i = \beta_1 + \beta_2 x_{1i} + \beta_3 x_{2i} + \cdots + \beta_n K x_{ni} + \varepsilon_i$
  - $Reversal_i = \beta_1 + \beta_2 x_{1i} + \beta_3 x_{2i} + \cdots + \beta_n K x_{ni} + \varepsilon_i$

Thank you for attending! We look forward to the Q&A!