

# NRP73: Financing Investments in Clean Technologies

A new environmental policy uncertainty index<sup>1</sup>

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# Outline

- 1 Motivation
- 2 Methodology
- 3 Preliminary results
- 4 Discussion

# Why a new indicator?

- We would like to assess the impact of environmental policy uncertainty on investments in clean technologies.
- This matters because their level is vital to how fast and whether climate change can be averted.
- But there is a lack of a proper measure of environmental policy uncertainty and thus existing quantitative studies are limited by data quality.

# How to measure environmental policy uncertainty?

## Environmental Policy Uncertainty (EPU)

- Ambiguity about implementation or discontinuation of an environmental policy
  - Economically relevant
  - Publicly available
  - Credible

- Natural place to search for this information is newspapers.

→ Challenge: need to find a way to extract this information from the text.

# Using machine learning for our EPU Index

- An influential study by Baker, Bloom and Davis (QJE, 2016) has developed an index of *economic* policy uncertainty based on the number of articles containing a specific combination of defined keywords in a range of US newspapers.
- However, Baker et al. capture uncertainty only using the "uncertain\*" keyword.
- We also aim to capture articles where uncertainty is implied but not explicitly mentioned.

# What is the Baker et al. method good at?

Mr Mangini said that with the high level of **uncertainty** in Australian energy **policy**, the focus for IFM was on installing industrial scale **solar** at its non-energy investments.

"We are really focused more on behind the meter solar, which makes more economic sense and is a strong environmental story," he said.

The fund installed a 4MW solar power station at its 77 per cent-owned Darwin Airport at a cost of \$13m in 2016.

"It's virtually 100 per cent renewable," Mr Mangini said.

Figure 1: Example of a correct positive.

# What is the Baker et al. method less good at?

"As always there are risks to the outlook, not least Brexit uncertainty," Dr O'Sullivan said. "This is the big issue for the UK and is also a cloud on the horizon for Ireland, along with **uncertainties** related to the external **policy environment** and exchange rates.

Figure 2: Example of a false positive.

# What is the Baker et al. method less good at?

Australia news

**Feed-in tariffs** could be cut back due to high take-up of solar power

Michael McGowan

520 words

7 March 2018

04:36

The Guardian

GRDN

English

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Experts warn the grid could be over-supplied during low demand periods

Governments should change the way **feed-in tariffs** are paid to homeowners or the high take-up of solar power might force them to be drastically cut back, one of Australia's top energy experts says.

On Tuesday the Clean Energy Regulator released [new data which showed a record 3.5m solar panels were installed on Australia rooftops last year](#).

The record 1,057 megawatts of capacity in small-scale systems installed across the country smashed the previous record set in 2012, and had the capacity to produce the equivalent output of a medium-sized coal-fired power station.

It prompted a warning that the increase in supply to the grid could lead governments to cut **feed-in tariffs** because the power is "essentially worthless".

Figure 3: Example of a false negative.



# The procedure

**We use a hybrid method relying both on Baker et al.'s method as well as machine learning.**

- *First*, we use a broad set of keywords to narrow down our universe of potential *environmental policy* newspaper articles à la Baker et al. (2016).

# The procedure cont'd

## Overview of our query

Environment	Policy
Renewable Energy Generation	Regulation
Energy Storage	Standards & Certification
Energy Infrastructure & Efficiency	Feed-in tariffs & premiums
Transportation	Taxes & Subsidies
Water & Wastewater	Emissions trading schemes
Air & Environment	International agreements
Recycling & Waste	Loan guarantees
Clean Manufacturing	Green & Climate bonds

▶ [Full query](#)

## The procedure cont'd

- *Second*, we use machine learning to define and capture what articles actually qualify as *environmental policy*.
  - 1 Draw a representative sample of articles from the narrowed universe.
  - 2 Manually label them as relevant or irrelevant for *environmental policy*.
  - 3 Input this as a training set to a "classifier" who then learns and develops a rule on what is a relevant/irrelevant article
  
- *Third*, use the same steps to capture *uncertainty* in environmental policy.

# The classifier - how does it work?

- Think of each article as a "bag of words" or a vector containing the number of occurrences of each word present in the article.
- We tell the classifier which "bag of words" is or is not relevant.
- Based on this training, the classifier constructs a rule that determines whether it considers that an article is relevant or not.
- The classifier then applies this rule to our whole universe of newspaper articles.

# Support Vector Machines (SVM)

SVM maximizes the distance between the two closest articles on both sides of the decision boundary:

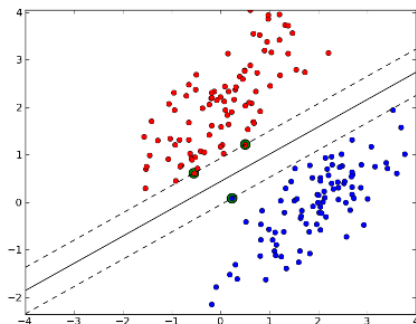
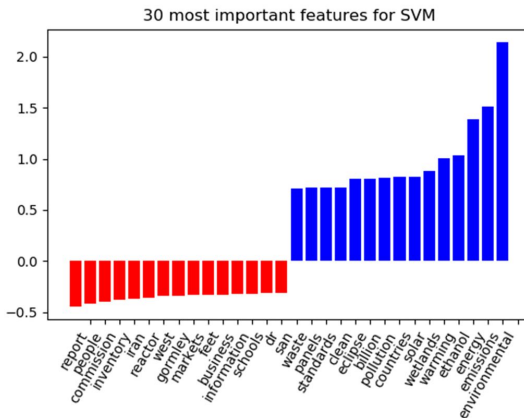


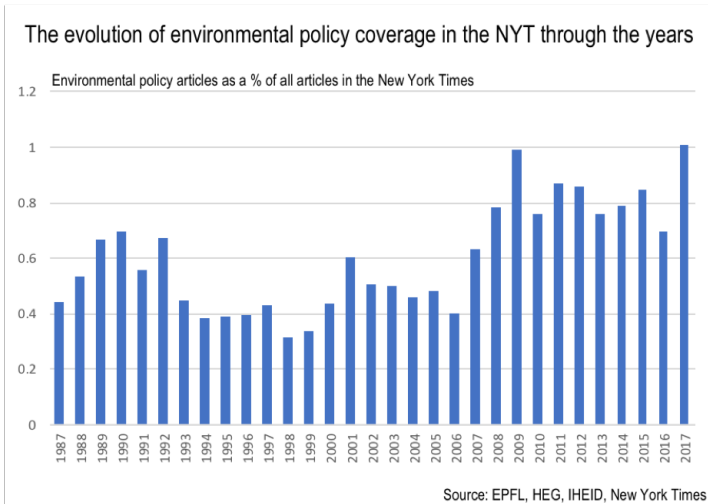
Figure 4: Support Vector Machines

# Preliminary Results

To give you an intuition of how the classifier works, we can look at the words it marked as "most decisive".



# Preliminary Results cont'd



## Next steps

- First, focus on the US for practical reasons.
  - Availability of good investment data.
  - Ability to crawl the NYT's archives for free.
- Newspapers under consideration so far:
  - The New York Times
  - The Wall Street Journal
  - Washington Post
  - ...
- Later, we would like to cover other countries like the UK, Germany, France or Switzerland.



# For discussion

- What do you think about using newspapers to capture uncertainty in environmental policy?
- What newspapers do you draw relevant information from?

# For discussion

- Questions, comments?

# The end

*Thanks for your attention.*

# Query

**Environment:** (Climate OR Carbon OR CO2 OR SO2 OR NO<sub>x</sub> OR Methane OR Environment\* OR Global warming OR Pollut\* OR Air quality OR Smog OR Ozone layer OR GHG OR Greenhouse gas\* OR Emission\* OR Energy efficien\* OR Energy saving OR Energy transition OR Renewable\* OR Solar OR Photovoltaic OR Hydropower OR (Wind NEAR1 (energy OR energies OR turbine\* OR power\*)) OR Fuel cell\* OR ((Storage OR battery) NEAR5 (energy OR electricity)) OR Fossil fuel\* OR ((Wave OR marine OR ocean OR tidal) NEAR3 (energy OR energies)) OR Biomass OR Bioenergy OR Biogas OR Biofuel\* OR Biodiesel OR Bioethanol OR (Geothermal NEAR5 (energy OR energies OR technolog\* OR power\*)) OR ((Electric OR green OR hybrid OR hydrogen) NEAR5 (car OR cars OR vehicle OR vehicles OR engine OR engines OR transport\* OR infrastructure\*)) OR ((Green\* OR clean\*) NEAR5 (energy OR energies OR technology OR technologies OR economy OR economies OR growth OR innovation\* OR finance OR industry OR industries OR job OR jobs)) OR Cleantech OR Clean tech OR waste OR wastewater OR Recycl\* OR Landfill OR Landfills OR Circular Economy)

# Query

**Policy:** Policy OR policies OR strategy OR strategies OR Regulat\* OR Legislat\* OR agenda OR plan OR plans OR guideline\* OR Subsidy OR Subsidies OR Subsidis\* OR Subsidiz\* OR tax OR taxes OR taxation OR Tariff OR Tariffs OR quota OR quotas OR ((Loan OR Loans OR government\*) NEAR5 guarantee\*) OR Regime OR Regimes OR Certificat\* OR Standard\* OR Mandate\* OR Labeling OR labelling OR Phase out OR phasing out OR phaseout OR Allowance\* OR summit\* OR protocol\* OR agreement\* OR negotiation\* OR treaty OR law OR laws OR bill OR bills

# Query

**Alone-standing environmental policy block:** OR “Cap and trade”  
OR “cap and tax” OR Emission\* trading system\* OR Emission\* trading  
scheme\* OR Tradeable permit\* OR emission\* permit\* OR Carbon credit\* OR  
Clean development mechanism OR Carbon price\* OR carbon fee\* OR feed-in  
tariff\* OR UNFCCC OR United Nations Framework Convention on Climate  
Change OR feed-in premium\* OR Green bond\* OR Climate bond\*

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