

A New Environmental Policy Uncertainty Index¹

Second Partner's Meeting

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Why we need an uncertainty index



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Why we need an uncertainty index



- ▶ Germany is in many ways a suboptimal place for Tesla to manufacture cars due to
 - ▶ High wages
 - ▶ Stringent labor laws
 - ▶ Relatively strong unions
 - ▶ One of the highest electricity prices in the world

▶ 0.33 USD/kilowatt hour in 2018

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- ▶ Germany is in many ways a suboptimal place for Tesla to manufacture cars due to
 - ▶ High wages
 - ▶ Stringent labor laws
 - ▶ Relatively strong unions
 - ▶ One of the highest electricity prices in the world
 - ▶ 0.33 USD/kilowatt hour in 2018
- ▶ Yet, the factory is moved there.

Why we need an uncertainty index

- ▶ Elon Musk: *“Brexit [uncertainty] made it too risky to put a Gigafactory in the UK”.*



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Why we need an uncertainty index

Uncertainty about Brexit is hampering business investment in Britain

Companies are still not sure what will happen

Stag-nation

Real business investment, Q1 2007=100



Brexit uncertainty index

Share of British firms who say Brexit is one of their top three sources of uncertainty, %



Sources: Bank of England; "The impact of Brexit on UK firms" by N. Bloom et al, NBER Working Paper No. 26218 (2019)

The Economist

⇒ **Policy uncertainty matters for real investment choices.**

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Environmental groups criticise 'weak' government plan to enforce green laws after Brexit

Proposed watchdog would fail to deliver 'green Brexit,' say campaigners

80% of our environmental laws come from the EU. (Friends of the Earth, UK)

⇒ **Brexit uncertainty encapsulates environmental policy uncertainty (EnvPU) with likely repercussions for clean investments.**

Our Objective

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Environmental Policy Uncertainty (EnvPU)

- ▶ Perceived inability to predict the future state of the regulatory environment. In other words, there is ambiguity about the implementation or discontinuation of an environmental policy that:
 - ▶ is economically relevant,
 - ▶ is publicly available information, and
 - ▶ is credible.

Our objective



⇒ We aim to measure uncertainty pertaining to EnvP as perceived by the general public.

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Reminder: we use machine learning

- ▶ 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.

▶ Details on methodology

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Progress since last meeting

- ▶ Obtained access to Dow Jones for 11 US newspapers² between 1979 (or whenever first online issue appeared) and 2019.
⇒ A total of 496,256 articles.
- ▶ We have repeatedly drawn random samples and labelled 1,500 articles on EnvP.
- ▶ Our project partner has trained an algorithm using this training data;
 - ▶ Precision: 77%
 - ▶ Recall: 65%

²New York Times, Washington Post, Wall Street Journal, Houston Chronicle, Wall Street Journal, The Dallas Morning News, The San Francisco Chronicle, Boston Herald, Tampa Bay Times, San Jose Mercury News, San Diego Union Tribune

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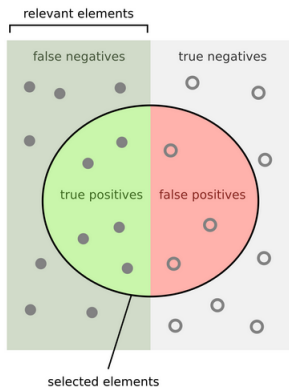
How good is our EnvP classifier so far?

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How many selected
items are relevant?

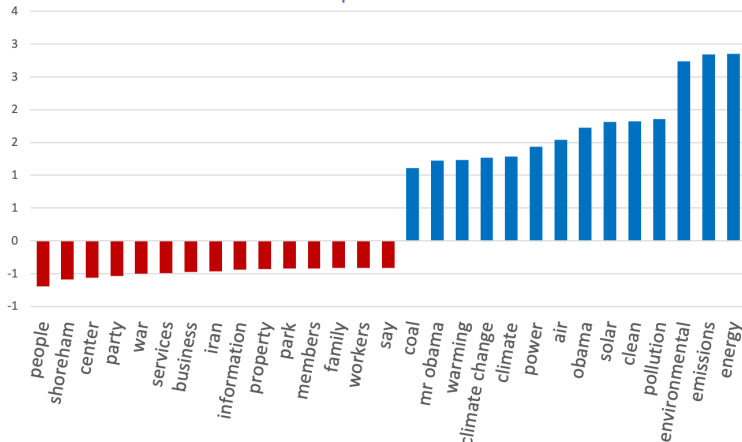
$$\text{Precision} = \frac{\text{true positives}}{\text{true positives} + \text{false positives}}$$

How many relevant
items are selected?

$$\text{Recall} = \frac{\text{true positives}}{\text{true positives} + \text{false negatives}}$$

A look into our classifier's rules

Most important features



Source: Dow Jones, EPFL, IHEID, SIB & HES-SO

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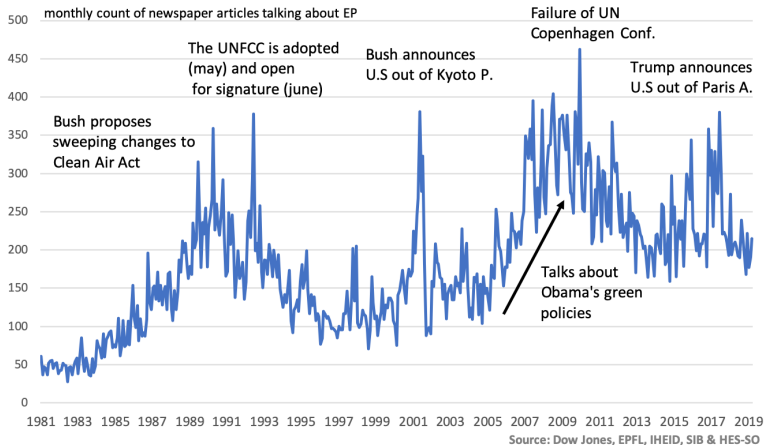
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Our EP index spans 40 years...

The coverage of Environmental Policy in U.S. newspapers over the years



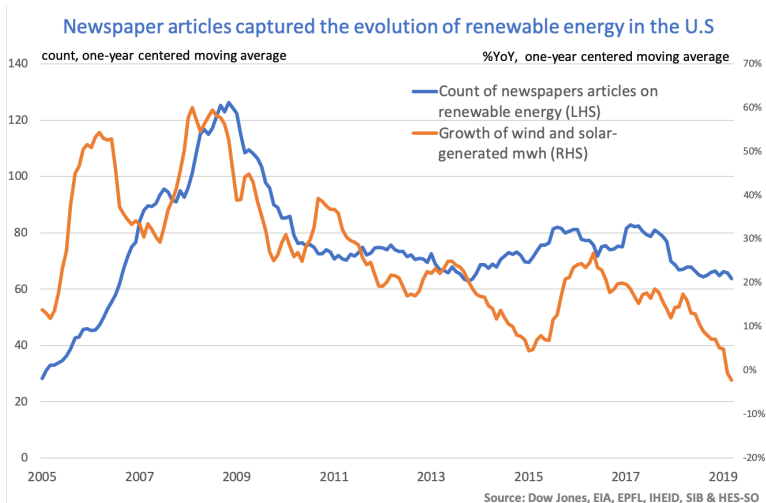
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... and it mirrors real trends



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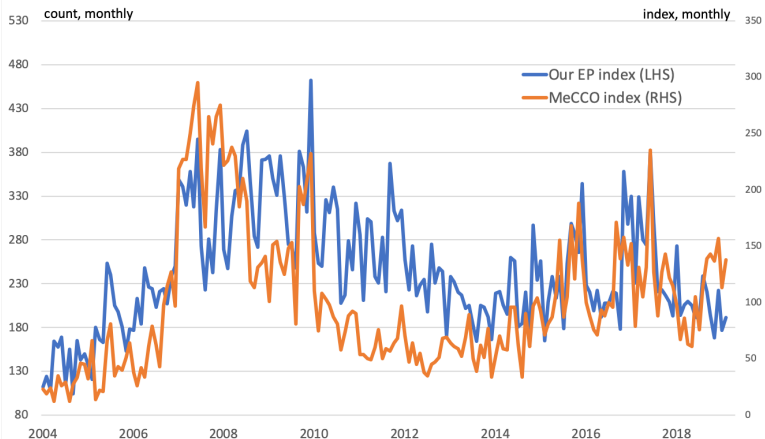
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It covers more years than currently available EP indices

We find similar trends than alternative EP indices



Source: Dow Jones, University of Colorado , EPFL, IHEID, SIB & HES-SO

► Comparison with a "naive" Baker et. al. query

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- ▶ Label hundreds of newspapers articles on uncertainty with the help of two RAs from IHEID.
- ▶ Train and fine-tune the uncertainty algorithm.
- ▶ Obtain our EnvPU index.
- ▶ Working with RAs from IHEID, we would like to cover other countries like the Germany or Switzerland.

The end

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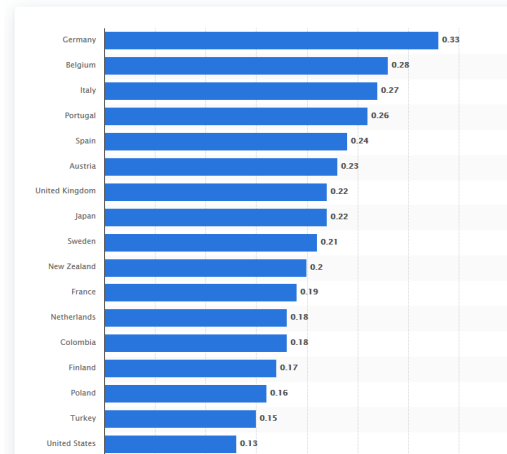
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Thanks for your attention.

Global electricity prices

Global electricity prices in 2018, by select country

(in U.S. dollars per kilowatt hour)



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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.

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

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

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:

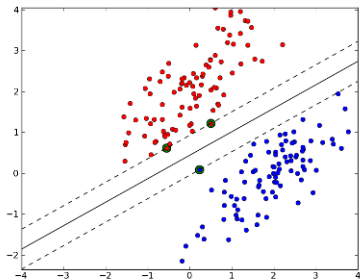
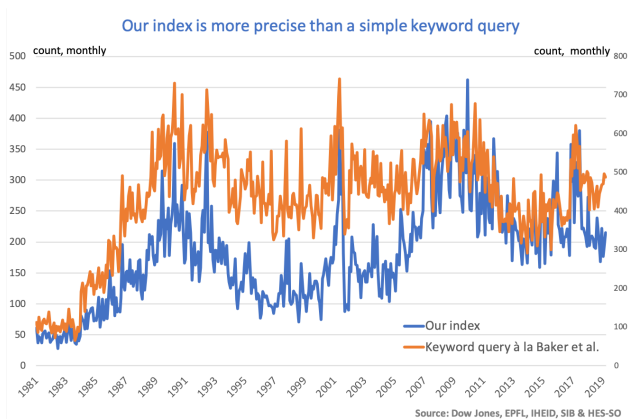


Figure 4: Support Vector Machines

More precise than simple word query



Naive query: (Environmental or Emissions) AND (regulation OR white house OR congress OR legislation)

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