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# Climate Risk and IMF Surveillance Policy

## A Baseline Analysis

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### ABSTRACT

The International Monetary Fund (IMF) has been tasked with quickly devising a climate change strategy that helps its members meet collective climate change and development goals while maintaining financial stability. This article uses textual analysis algorithms to perform a baseline analysis of the extent to which the IMF's main bilateral surveillance activities—Article IV reports and Financial Sector Assessment Programs (FSAPs)—have focused on climate risks between 2017 and 2021. We find that IMF surveillance activity has paid little and uneven attention to climate risks in Article IV reports, and even less so in FSAPs. However, recent Article IV and FSAP assessments have piloted climate risk analyses that present an opportunity to be expanded and incorporated systematically.

**Keywords**: International Monetary Fund, Surveillance, Climate Change, Physical Risk, Transition Risk, Content Analysis

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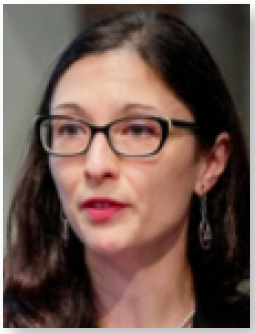

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## Introduction

The International Monetary Fund (IMF) needs to rapidly but carefully devise a climate change strategy that helps countries meet their collective climate change goals in a manner that enhances stability, equity, growth, and sustainable development. A top priority for IMF reform is to align the IMF's core surveillance functions with mitigating climate change. To this end, the IMF recently pledged to incorporate climate change in its current reviews of the Article IV and Financial Sector Assessment Programs (FSAP).

There is a growing consensus that climate change poses serious macro-critical risks to financial systems at both a national and global level. A growing network of central banks and supervisors have organized as the Network for Greening the Financial System (NGFS) to incorporate climate change into their risk assessment toolkits. More recently, the IMF has recognized the need to introduce climate considerations into its operations (Adrian et al. 2020). As the premier multilateral institution charged with ensuring the stability of the international monetary system, the IMF stands to play a key role in supporting these national efforts from a global perspective. Earlier this year, IMF managing director Kristalina Georgieva pledged to put climate change at the heart of its work:

> *As we aim to exit the COVID-19 pandemic and the economic crisis it has triggered we must face a greater threat – that of a changing climate. It is a fundamental risk to economic and financial stability. It is also an opportunity to reinvigorate growth and create new green jobs. Our research shows that combining steadily rising carbon prices with a green infrastructure push can boost global GDP over the next 15 years by about 0.7 percent and generate work for millions of people. This is why at the IMF we embrace the transition to the new climate economy — one that is low carbon and climate resilient, that helps fight the causes of climate change and adapt to its consequences (Georgieva 2021).*

In addition to providing emergency liquidity and policy advice, surveillance is a key pillar of the IMF's mission that is conducted at the global, regional, and country levels: "the IMF identifies potential risks to stability and recommends appropriate policy adjustments needed to sustain economic growth and promote financial and economic stability" (IMF 2021b). The two key tools of bilateral surveillance efforts are Article IV consultations and Financial Sector Assessment Programs (FSAPs).

Recently, the Managing Director charged the IMF to incorporate climate change in the Comprehensive Surveillance Review (CSR) and the FSAPs (Georgieva 2021). According to its 2020 IMF Annual Report, "The IMF has contributed to global efforts by delivering analysis and enhancing country engagement on climate change" (IMF 2020). The IMF reports that it is working to "adapt and build resilience to climate change, provided overarching assessments of preparedness, macroeconomic impact, mitigation, adaptation, and financing strategies for small, vulnerable, and capacity constrained countries" (IMF 2020). In this paper, we provide a baseline assessment of the extent to which the IMF has begun to incorporate climate risk into surveillance activities for countries with the most acute climate risks.

Key to mitigating macro-critical implications of climate change is incorporating physical and transition risks into fiscal and financial systems. Physical risks occur when the material effects of climate change, such as increased incidence of hurricanes damage physical assets, subsequently increasing credit risk and financial losses for investors. Transition risks emerge from a late and uncoordinated introduction of climate policies whose impacts cannot be fully anticipated by investors, leading to sudden adjustments of asset prices (Battiston et al. 2017).

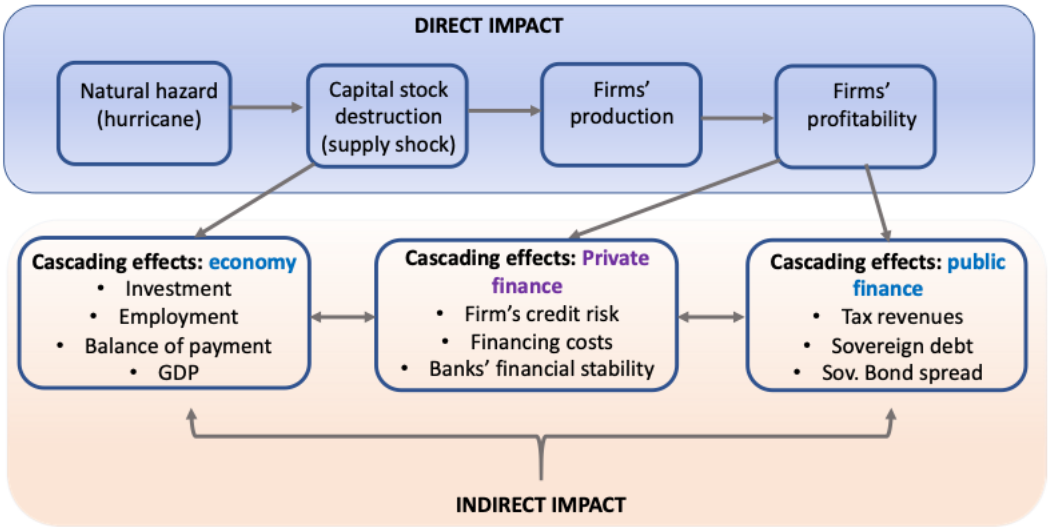
This paper is structured as follows. Section 2 outlines the macro-critical aspects of physical and transition risks. Section 3 discusses the methodology of the paper. Section 4 presents the results that culminate in an 'IMF Climate Surveillance Index' and examines the extent to which the index correlates with climate vulnerabilities in member countries. Section 5 performs a similar analysis for FSAPs. Section 6 summarizes the main findings and outlines suggestions for further research and policy.

## Macro-Critical Aspects of Climate Risks

Over the past half-decade, research on the climate risks posed to financial sectors has made significant developments and is now gaining traction at the IMF. This section outlines three key aspects of climate risk that are of critical importance for the IMF to incorporate into its surveillance activity.

Climate-related financial risks include both 'physical risks' and 'transition risks.' Physical risks arise from immediate weather events as well as long-term changes in the climate. These risks are characterized by increasing severity, volatility, and frequency. They are financial risks because they impact the value of financial assets such as property, infrastructure, and beyond. Banks in turn face higher credit and underwriting risks (Batten et al. 2016; Campiglio et al. 2018; Dikau and Volz 2019; Monasterolo 2020a).

**Figure 1: Macro-Critical Aspects of 'Physical Risk'**




**Source:** Adapted from Dunz et al, 2021.

Figure 1 illustrates the mechanisms by which physical risk can have significant macro-financial impacts on countries. Consider the case of Small Island Developing States (SIDS) in the Caribbean that are highly dependent on tourism for foreign exchange, growth, and employment. Climate vulnerable countries, such as SIDS, pay a higher cost of capital for climate vulnerabilities, which creates problems for fiscal space and debt sustainability (Kling et al. 2021). In this regard, Battiston & Monasterolo (2020) developed the 'climate spread', a climate sovereign risk metric that incorporates countries' exposure to climate phsyical and transition risks in their credit worthiness and financial stability profile. Hence unanticipated increases in the incidence of natural hazards such as

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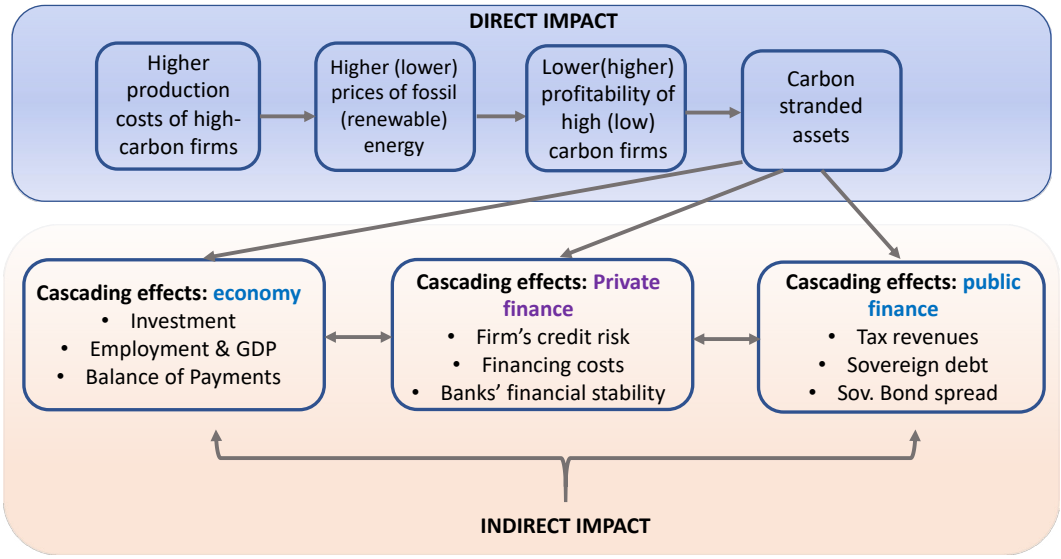
hurricanes translate into acute supply shocks through the destruction of infrastructure that supports tourism such as hotels, roadways, and air transportation. Such destruction of the capital stock can have negative and cascading impacts on countries' growth, employment, and balance of payments. Of course, the level of production and profitability decreases in impacted firms which can have negative impacts on the financial system and of course through losses in tax revenues, bond spreads, and beyond. Recently, the ECB published its first economy-wide climate stress test, covering four million companies worldwide and 2,000 banks in the euro area, over 30 years scenarios. Its stress test finds that in the absence of further climate policies, the costs to companies arising from extreme weather events rise substantially, and greatly increase their probability of default, while early policy action decreases such risk (de Guindos 2021).

Transition risks featured in Figure 2 are those involved with the transition process to a low-carbon economy at the national level. This entails a wide array of quantity and price-based regulations such as bans on coal-fired power plants, carbon taxes, and permitting schemes that increase the production costs and decrease the profitability of carbon-intensive firms, causing some assets to be 'stranded' and others to gain in value. There is an additional liability risk, which refers to the legal risks from parties adversely affected by climate change (Ackerman 2017; Battiston et al. 2017; Dikau and Volz 2019; Monasterolo 2020a).

**Figure 2: Macro-Critical Aspects of National 'Transition Risk'**




**Source:** Adapted from Monasterolo, 2020a.

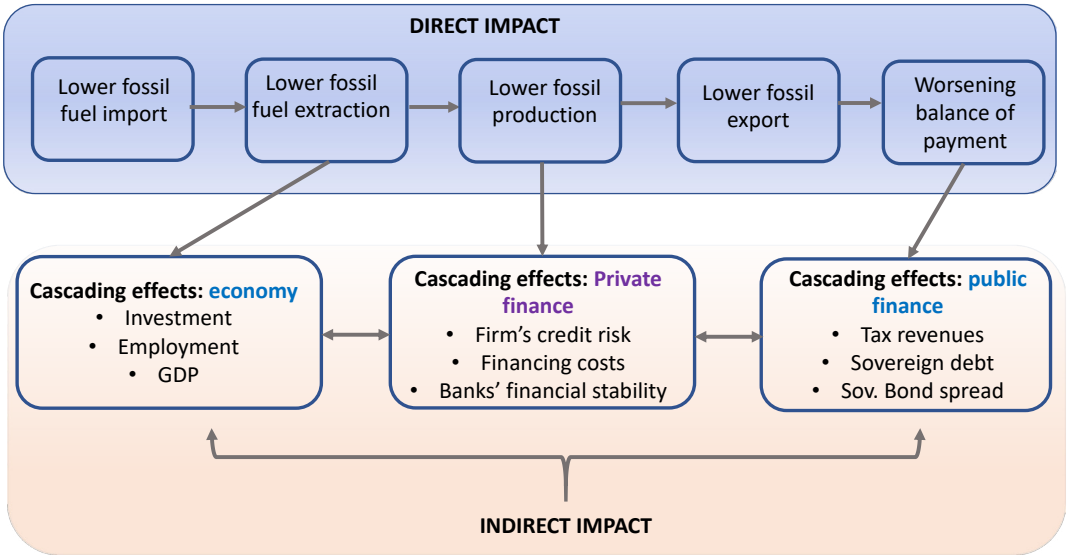
Transitioning away from coal is one of the most important first steps in carbon transitions. The direct and indirect impacts of such transitions are illustrated in Figure 2. Consider a country such as Poland or South Africa – whose share of electricity production from coal is over 60 percent – putting in place a large carbon tax or phasing out coal-fired power plants. Such actions pose risks to the real economy and to fiscal and financial systems. By definition a carbon-tax raises production costs, prices of coal-fired power plants, and lowers their profitability such that they would be deemed carbon stranded assets — a trend that is already underway (Caldecott 2018; Sen and Schickfus 2020).

Transition risks are perhaps the most macro-critical in their potential impacts on the real economy and livelihoods, financial systems, and public finance. Figure 2 outlines some of the cascading

indirect effects such as declines in employment and growth, balance of payments (for countries that export coal), financial stability, tax revenues, and sovereign risk. While exposure to all types of fossil fuels is becoming increasingly risky, a number of central banks see transition risks due to coal extraction and coal-fired power plants closings as the most macro-critical form of climate risk given the depth of such exposure and the consensus that coal should be the first energy source to diversify from (Mercure et al. 2018; Vermuelen et al. 2019; Allen et al. 2020). The Bank of England estimates that a rapid carbon transition could result in equity write-downs from 40 to 65 percent in coal extraction and generation respectively (Bullard 2019).

Transition risks materialize when changes in regulation, taxation, technological innovations, or shifts in consumer preferences and social norms alter the expected future cash flows from productive assets, which can turn the latter into stranded assets (Pointner and Ritzberger-Grünwald 2019). In a widely cited paper, McGlade and Ekins (2015) estimate that by keeping global temperatures within the Paris target range, approximately one-third of the current oil reserves, half the gas reserves, and almost 90% of the coal reserves will become stranded assets.

**Figure 3. Macro-Critical Aspects of '*Spillover* Transition Risk'**




**Source:** Adapted from Monasterolo and Gallagher, 2021.

The early work on climate risk and financial stability was national in nature, given its origins in the central banking community. As a global institution the IMF is charged will monitoring cross-border spillovers as well. To that end, in addition to national-level transition risks, we are developing the concept of 'spillover transition risks' whereby physical or transition risk that happens in one country or region have cross-border macro-critical impacts on financial and fiscal systems (Gallagher et al. 2021; Monasterolo & Gallagher 2021).

Picture the EU putting in place a large carbon tax with a border adjustment mechanism for Figure 3, but in this case through the perspective of a developing country that is highly dependent on oil or gas as a source of exports (either in crude form or indirectly through tourism) such as Angola, Azerbaijan, Congo, Ecuador, Mexico, Timor Leste, and developing states in the Persian Gulf. In those cases, an oil or gas price shock lowers exports and has an immediate impact on the balance of payments. Indeed, it was a shock like this that led to many of the financial crises of the 1980s and continue to

be unexpected and trigger instability (Baumeister et al. 2016). Climate transition spillovers will not only trigger balance of payments shocks but can also cascade to the real economy, private finance, and of course to public finance—especially for fossil fuel dependent economies.

## Methodology and Literature

This paper uses textual analysis techniques to examine the extent to which the IMF has focused on climate risks in its bilateral surveillance activities. First, we create an IMF Climate Surveillance Index that scores the relative attention to climate risks across surveillance reports—both Article IV reports and FSAPs – from January 1, 2017 through March 2, 2021 spanning over 182 countries. Second, we correlate the IMF Climate Surveillance Index with various measures of climate risk for each country to examine whether the IMF has focused on climate risks in the countries that are the most vulnerable.

### Textual Analysis and the IMF

This index is constructed through the coding of IMF documents using a textual analysis methodology that has been widely used in economic and political research, including in studies of the IMF. To streamline the analysis and minimize coding errors, this methodology relies on an open-source software Python. While the creation of our index is novel, textual analysis is a relatively new technique that has provided research opportunities and facilitated the analysis of large corpus' of text across a variety of disciplines (Grimmer & Stewart 2013; Wilkerson & Casas 2017).

New technologies have led to an abundance of digital text that is easily accessible. Combined with advances in computational methods, this has given rise to a greater use of text as a source of data in the social sciences. Text differs from other more traditional data sources, such as aggregate or administrative data, in its degree of dimensionality. The sheer number of documents and word combinations makes text high dimensional. To work with this high dimensionality, the social science literature has adopted techniques from other fields such as natural language processing, machine learning, computational linguistics and biology.

A brief overview of how text is processed and used in the social sciences is as follows. First, restrictions on the data are imposed to make the dimensions manageable. One common approach at this stage is to filter out frequent words, phrases, and punctuation. While these words are important grammatically, they usually carry little meaning and add computational cost. Stemming is also used, and replaces words with only their root.

In the second step, statistical methods to work with high-dimensional data are applied. One common method – and there are several others beyond the scope of this review – is referred to as a dictionary-based method in which a function is applied to the set of words—or 'corpus'. The outcome of interest might be the degree of political slant or its sentiment (positive vs negative). For example, if the researcher is interested in the share of text devoted to a particular topic, then a dictionary-based method might use a textbook on the topic to define prespecified terms. Then the raw count of these terms is divided by the total count of the document to have a measure of the share devoted to the topic.

There are several surveys that describe the methods of text as a form of data in specific disciplines. Gentzkow, Kelly & Taddy (2019) provide an overview of text as data in economics, while Evans and Aceves (2016) do similarly in sociology, Grimmer and Stewart (2013) for political science, and Loughran and McDonald (2016) for accounting.

Within economics, an extensive literature has used text data to study uncertainty and risk. Baker, Bloom & Davis (2016) and Alexopolous & Cohen (2015) draw on newspaper articles to measure economic policy uncertainty. Hassan et al. (2019) use transcripts of conference calls to learn about the risks that firms face. Text as data has been used for other macroeconomic questions such as estimating unemployment and retail sales (Scott & Varian 2014), how transparency impacts on monetary policy (Hansen et al. 2018), measuring competition based on firm's disclosure of 10-K reports (Li et al. 2013), and the degree of innovation from patent applications (Kelly et al. 2021).

Text data has also been used in the political economy. Gentzkow & Shapiro (2010) construct an index of media slant by comparing language from news outlets to speeches by Democratic and Republican congressmen. Digitized versions of the Congressional Record have been used to measure political polarization since 1873 (Jensen et al. 2013, Gentzkow et al. 2019). In labor economics, text in the form of daily work diaries show which features of CEOs make companies more productive than others (Bandiera et al. 2020). Lastly, text in job ads has been used to measure how the content and requirements of occupations have changed over time (Atalay et al. 2020).

Closer to the focus of this paper is work looking at central bank communications to predict changes in policy rates (Apel & Grimaldi 2012), FOMC statements to predict fluctuations in Treasury securities (Lucca & Trebbi 2009), and identifying home bias by analyzing the tone of the speeches of the members of the Governing Council of the Eurozone (Bennani & Neuenkirch 2017). Finally, IMF staff have used textual analysis methodologies to develop a sentiment index to measure member countries' reception of Article IV Consultations, finding that member country authorities largely concur with Article IV advice (Fayad et al. 2020).

## Creating an IMF Climate Surveillance Index

We build on the literature discussed above to create an IMF Climate Surveillance Index for IMF Article IV documents. Our methodology is as follows. First, we design a corpus of search terms. Second, we examine the frequency of these search terms in Article IV reports in the sample. Finally, we construct the IMF Climate Surveillance Index, which is the number of times climate-related terms in the corpus are mentioned as a ratio of the total pool of words in the document.

Table 1 shows the number of publications analyzed per year. Due to COVID-19 restrictions, an entire cycle of Article IVs was not completed in 2020.

**Table 1: Article IVs Per Year**

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Publications | 123 | 110 | 128 | 32 | 1 |

As aforementioned, the first step entails building a corpus of search terms. To do so, we begin by applying the Natural language Toolkit (NLTK) in Python to remove "stop words" from three documents: the IMF (2020a), Leal Filho (2020), and Volz (2020). Stop words include articles, prepositions, and pronouns. They can safely be removed without sacrificing the meaning of the sentence. We also remove page numbers, webpages, and emails. Then, following the papers mentioned above, we identify climate-related bigrams (two-word combinations) from the remaining text. Table 2 lists the corpus of bigrams.

**Table 2: Climate Search Terms**

| | |
|---|---|
| Climate | 'carbon dioxide','transition risk','physical risk', 'environmentally', 'climatic','climate risk', climate-related', 'coal production', 'coal extraction', 'fuelwood extraction', 'coal harvest', 'coal making', 'coal needs', 'coal burning','coal business','coal-based enterprise','coal burner', 'coal combustion', 'coal power plants', 'coal exports', 'coal producer', 'coal industry','coal sector', 'export of coal', 'coal consumption', 'coal transition', 'alternatives to coal','coal asset', 'demand for coal', 'coal-fired power plant', 'adaptation action','adopting climate-smart','air pollution','brown activities','brown activity','brown industries','brown industry','carbon border','carbon content','carbon intensive','carbon footprints','carbon price','carbon pricing','carbon-price floor',"carbon-intensive firm','carbon-intensive industries','carbon-intensive industry','carbon-intensive investments','carbon tax','clean fuel','climate challenge','climate change','climate commitment','climate consideration','climate crisis','climate goal','climate impact','climate response','climate smart','climate conscious','climate-conscious policies','climate-conscious policy','climate-conscious project','climate-smart infrastructure','climate dimension',climate plan',climate readiness','climate spending',curbing emission,'developing climate-smart','disaster funds','emissions target','emissions reduction','energy efficiency','energy efficient',environmental standard,'environmental dimension','flood protection','fossil fuel','fossil-fuel power','fuel tax','fuel taxes','gas emission','global warming','green activities','green activity','green bond','green budget','green industries','green industry',green investment',"green measure','green policies','green policy','green recovery','green response','greenhouse gas','greening recovery','high emissions','high-emissions vehicles','low carbon','low-carbon economy','mitigation action','reduce emission','renewable energy','resilient buildings','resilient road','supporting adaptation','zero emission','zero-emission vehicle' |

Table A.1 in the Appendix shows the number of times each of these terms appeared during the study period. With these terms in hand, we calculate the bigram frequency per document. The IMF Climate Surveillance Index is the ratio of the number of times the climate-related bigrams are mentioned divided by the total pool of relevant words in a specific document, following the methodology in Mihalyi and Mate (2019). Scaled from 0 to 1, a higher score means more attention to climate change per publication for each member country in the sample.

## IMF Climate Surveillance Index

This section reports the results from the IMF Surveillance Index we construct. We find that the frequency of climate change and climate risk has been increasing over the past few years, but the overall level as measured by the index remains quite low and uneven across the IMF membership.

Table 3 reports the number of publications with and without climate terms per year. There is just one 2021 consultation, Costa Rica 2021's Article IV. To avoid distortions and possible generalizations that could affect the results and analysis, this will be discussed separately (Box 1). We see that in earlier years, IMF surveillance documents paid little attention to climate change, with around 30 percent of all publications not mentioning climate change, except 2020. The set of countries without climate mentions is heterogeneous in terms of income level and geography. Some examples are Portugal, Thailand, Russia, San Marino, and other reports that did not discuss climate issues in the analyzed period.

**Table 3: Climate Change Bigrams in IMF Article IV Consultations**

| | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| Number of publications with Climate Terms | 80 | 69 | 92 | 27 |
| Number of publications without Climate Terms | 43 | 41 | 36 | 5 |
| % Publication without Climate Terms per year | 34.96% | 37.27% | 28.12% | 15.62% |

**Source:** Own elaboration.

**Table 4: Search terms frequency per year, and Article IV publication**

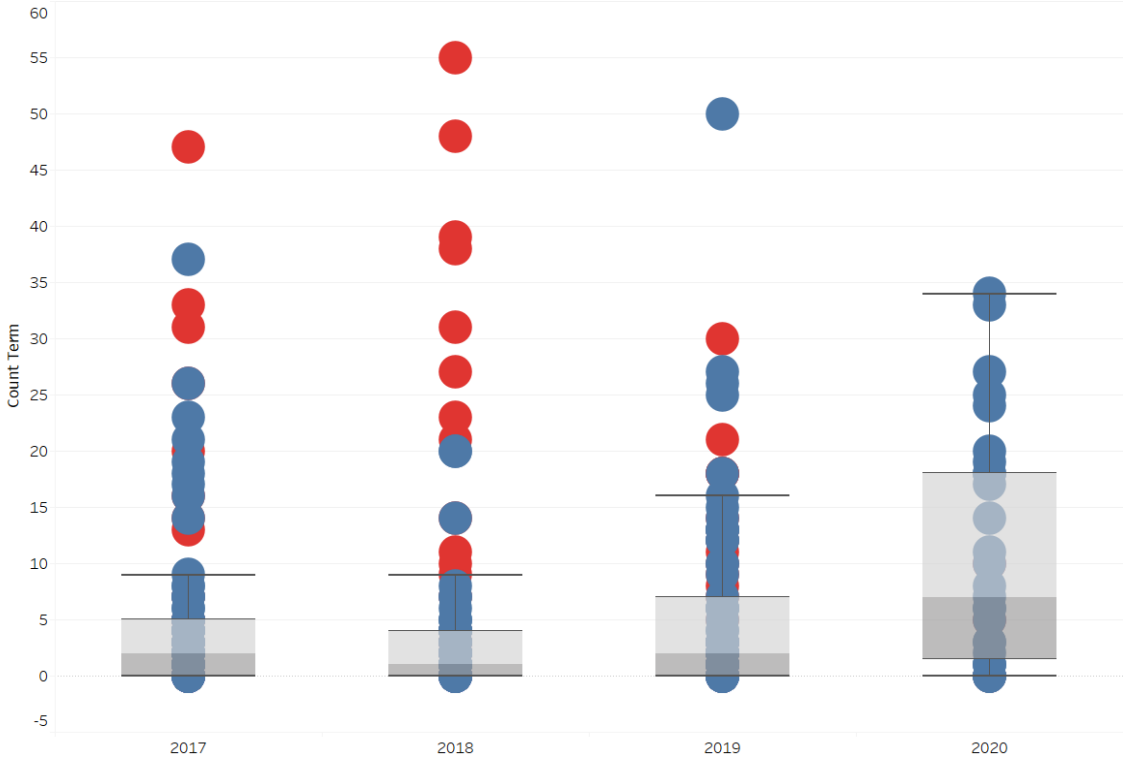
| | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| Total terms | 709 | 597 | 890 | 349 |
| Frequency on average per publication | 5.76 | 5.43 | 6.95 | 10.9 |

**Source:** Own elaboration.

Table 4 summarizes the search term frequency per year and publication (on average). Together, Tables 3 and 4 show an overall increase in attention paid to climate change during the period under study. The share of reports without climate terms decreased, and the average frequency per publication rose. As Figure 2 underscores, there is a jump in the median count of terms from 2 in 2019 to 7 in 2020. However, 2020 represents a restricted sample due to COVID-19 (Table 1).

On the whole, when comparing IMF attention to the terminology adopted by scholars and central banks on climate risks, the IMF has fallen short of analyzing economies through a similar lens. Since 2017, the IMF has published 384 Article IV reports and 66 FSAPs focused on risk assessment. As shown in Table 1, while many of these reports discuss climate change in some detail, they have yet to conduct surveillance through the same lens as the central banking community. The term "climate risk" has gained some traction in Article IV reports but much less so in FSAPS. Starting in 2017, the Fund published six Climate Change Policy Assessments (CCPAs) for different countries: Seychelles (June 2017), St. Lucia (June 2018), Belize (November 2018), Grenada (July 2019), the Federated States of Micronesia (September 2019), and Tonga (June 2020). These CCPAs explain the higher count of terms in the IMF surveillance documents during our period. Thus, these six countries will be removed from the analysis to examine attention to climate risk in general. Figure 2 displays the count terms and data distribution between 2017 and 2020.

**Figure 4: Count of Search Terms, Data Distribution Per Year, without CCPA Countries**

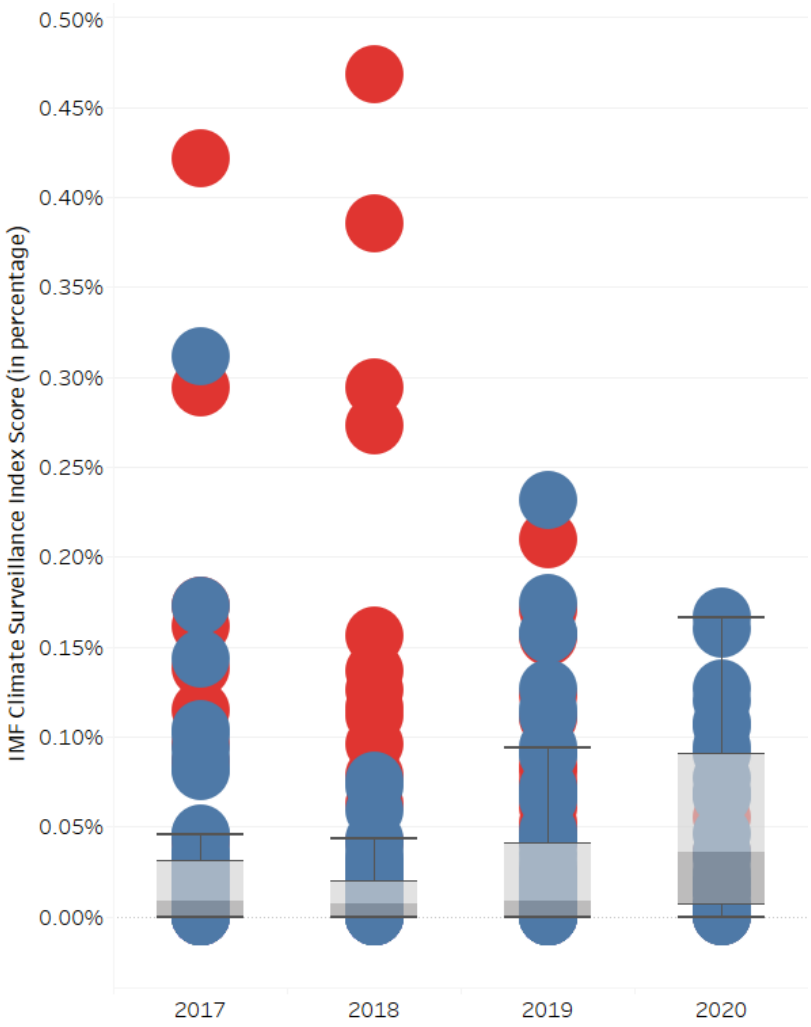



**Source:** Own elaboration. (Red bullets refer to small states).

As shown in Figure 2, small states received the most climate change attention between 2017 and 2019 (red bullets), comprising 55 percent of all count terms in this period. Small states, despite their heterogeneity, have long been recognized as being particularly vulnerable to the impacts of climate change. According to the IMF (2016), one-third of small states are highly exposed to climate change events in the lifetime of the current generation. As the IPCC (2014) points out, the high degree of climate change risk in these countries is determined by the interaction between hazards, exposure, and vulnerability factors: "Due to close connections between human communities and coastal environments, they are particularly exposed to hazards associated with the ocean and cryosphere, including sea-level rise, extreme sea levels, tropical cyclones, marine heatwaves, and ocean acidification" (Thomas et al. 2020).

IMF (2016) recommends a more proactive policy approach: "well-designed domestic policies can reduce the direct human and economic costs of climate change and natural disasters" (IMF 2016). Such a proactive approach entails not only better disaster response but also greater focus on risk reduction and preparedness. These measures should be integrated into core PFM, investment, and debt management frameworks: "risks to the financial sector should similarly be assessed and crisis management frameworks adopted" (IMF 2016). The IMF's work in smaller states is encouraging, as it demonstrates that the IMF has the capabilities to assess physical climate risks.

**Figure 5: IMF Climate Surveillance Index Data Distribution Per Year, without CCPA Countries**




**Source:** Own elaboration. (Red bullets refer to small states).

When we examine the overall performance of IMF surveillance and address climate change through the lens of the IMF Surveillance Index, the results show that IMF attention to this issue has been minimal and uneven. Figure 3 shows the IMF Climate Surveillance Index scores and distribution in the period under study. Table 6 juxtaposes those results with summary statistics from the analysis.

**Table 6: IMF Climate Surveillance Index Scores in Percentage: Statistical Analysis Per Year**

| | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| Average | 0.04% | 0.03% | 0.04% | 0.06% |
| Median | 0.01% | 0.01% | 0.01% | 0.04% |
| St.Deviation | 0.08% | 0.08% | 0.08% | 0.05% |

**Source:** Own elaboration.

The IMF Climate Surveillance Index analysis reveals a high level of concentration of climate change discussion and a large dispersion across Article IV reports. With a 0.08 percent standard deviation over the period, there are few publications with high index scores. As noted earlier, 2020 saw some improvement. Climate change received relatively more attention and was relatively more evenly distributed across Article IV consultations. Member states such as Belgium, France, and the United States had low or no climate discussion in the first three years of analysis, but in 2020 they held among the top index score positions.

Belgium's 2020 Article IV, for example, stated that "[a] comprehensive policy strategy is needed to fulfill the government climate change commitments and take advantage of the opportunities from the transition to a green economy" (IMFb 2020) and pursuing "a comprehensive policy strategy in support of climate targets is also key to enhance the economy's long-term sustainability" (IMF 2020). The Article IV also suggests that Belgium pursue medium and long-term objectives for reducing emissions of greenhouse gases such as regulations to incentivize emissions reductions, introducing carbon taxes (while noting the importance of using the revenues to compensate vulnerable households), and extending the country's emissions-trading system to cover more sectors in the economy.

## IMF Surveillance and Climate Risk

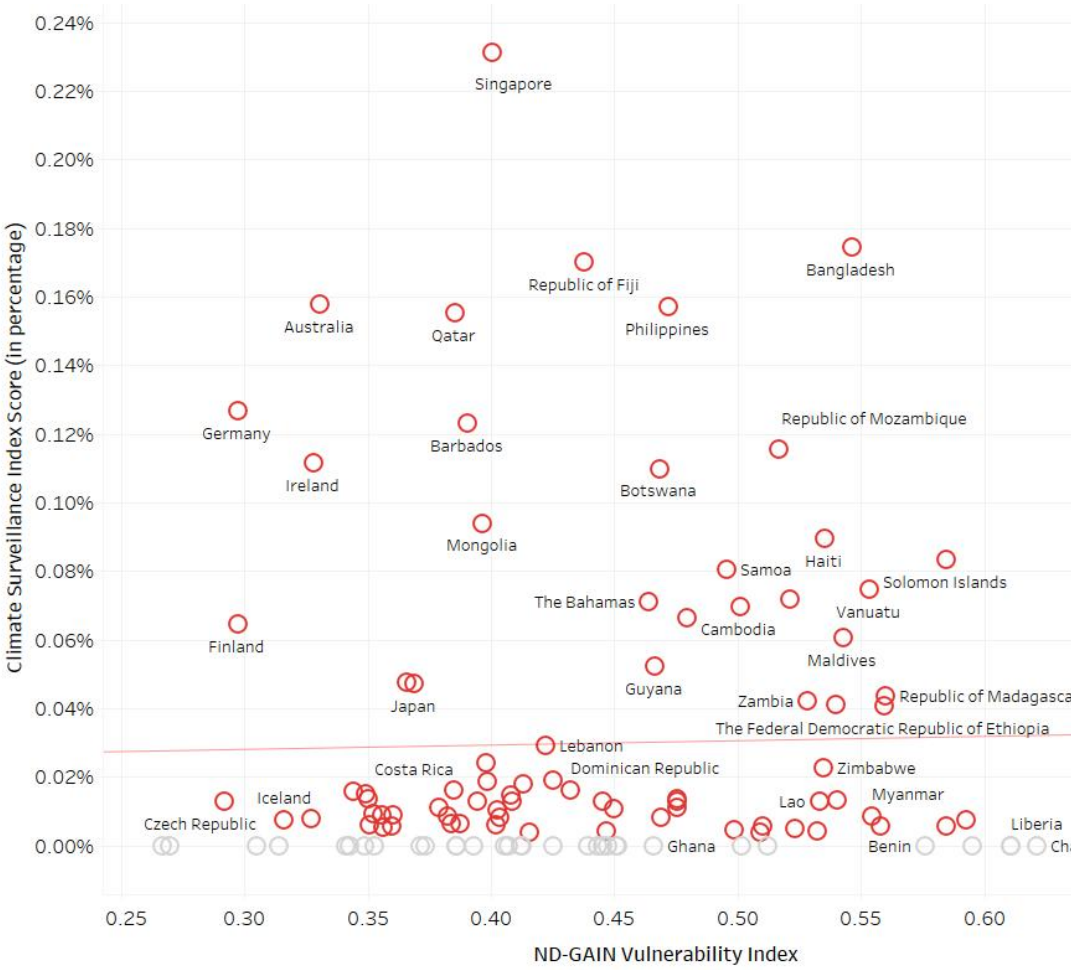
The IMF Surveillance Index helps estimate the extent to which the IMF has focused on climate change across its membership when conducting Article IV surveillance activity from 2017 to 2020. This section of the paper examines the extent to which increases in the level of attention to climate change in Article IV corresponds to the levels of different types of climate risk that member states are experiencing. We first discuss physical risk, followed by examinations of national and spillover transition risks.

### Article IV Reports and Physical Risk

To assess the extent to which IMF Article IV consultations are attentive to physical climate risk in the most vulnerable countries, we correlate the IMF Climate Surveillance Index with different indices of climate vulnerability. To measure whether our IMF surveillance toolkit is suitable for measuring countries' exposure to climate change physical risks, this section contrasts our IMF Climate surveillance index scores with external benchmarks.

In Figure 4 we compare our index with the Notre Dame-Global Adaptation Country Index (ND-GAIN) (Chen et al. 2015). The ND-GAIN Index focuses on country vulnerability to extreme weather combined with its readiness to build resilience. The index looks at two dimensions. The first is vulnerability, which captures a country's exposure, sensitivity, and capacity to adapt to the negative effects of climate change by considering six life-supporting sectors: food, water, health, ecosystem service, human habitat, and infrastructure. The second is readiness, reflecting a country's ability to leverage investments and convert them to adaptation actions. Figure 4 correlates the IMF Climate surveillance index scores in 2019 with the ND-Gain vulnerability index per country.

**Figure 6: IMF Climate Surveillance Index Scores in 2019 and ND-Gain Vulnerability Index, with Trend Line and without CCPA Countries**




**Source:** Own elaboration based on ND-Gain information.

As shown in Figure 4, the ND-Gain measure reveals Niger, Somalia, Chad, Benin, Myanmar, Liberia, Uganda as highly vulnerable to climate physical risk. However, in 2019, according to the IMF Climate surveillance index, their reports gathered low or zero attention in strategies and awareness to these topics. Even though these places were more exposed to climate change and extreme weather impacts, their climate vulnerability garnered little attention from IMF surveillance documents. On the other hand, countries like Singapore, Germany, and Ireland with relatively low physical

risk vulnerability had higher Climate index scores. From this weak correlation we see that at present, IMF surveillance documents are not well-matched in terms of emphasizing climate change for those countries that are most vulnerable.

Another physical risk benchmark is the Germanwatch Global Climate Risk Index (Eckstein et al. 2021). This index relies on extreme weather events and indicates a level of exposure and vulnerability. According to the CRI, in 2019, the countries most affected in fatalities and economic losses due to climate hazards were Mozambique, Zimbabwe, and the Bahamas, followed by Japan, Malawi, and Afghanistan. When analyzed between 2000 and 2019, Puerto Rico, Myanmar and Haiti were most affected, followed by the Philippines, Mozambique, and the Bahamas.

A closer look at the IMF Climate Surveillance Index in these countries shows that only in the Bahamas and Mozambique had scores above the average in the entire period. Like the ND-Gain Vulnerability index, less attention was paid to climate physical risk in most affected and exposed nations.

Another way to assess the fragility of existing infrastructure to climate hazards is by looking at the impacts of extreme weather events (McKinsey 2020). Such events can reduce the capacity and efficiency of infrastructure, leaving infrastructure operating under stress. At worst, assets and systems can be damaged or destroyed, affecting lives and businesses in the manner exhibited in Figure 1.

The ND-GAIN Readiness was applied as a point of reference in this issue. This index measures a country's ability to leverage investments and convert them to adaptation actions. Overall, it considers three components – economic readiness, governance readiness, and social readiness. Lower ND-GAIN Readiness scores mean an inadequate local capacity to face climate change physical risks, or this country is less ready to leverage private and public sector investment for adjusting actions.

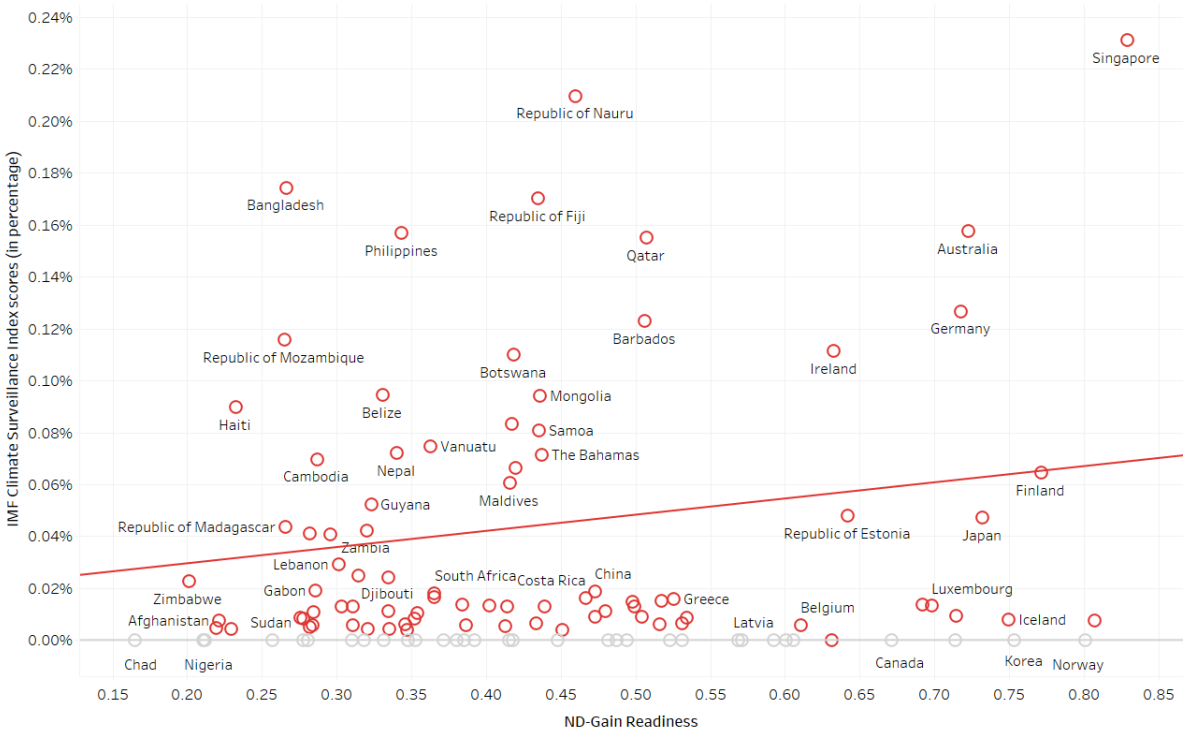
As shown in Figure 5, Afghanistan, Chad, Congo, Somalia have low ND-GAIN Readiness scores, indicating a lack of preparation for extreme weather events, but those countries' Article IV reports did not include a climate risk assessment or green policy strategies. Counterintuitively, the trend line is positive, reflecting a positive association between Climate Surveillance Index scores and ND-Gain Readiness. Countries more able to adapt from infrastructure asset damages are getting more attention from the IMF in these topics.

## Assessing Transition Risk

This section examines the extent to which the IMF Surveillance Index correlates with two indicators of potential transition risk—fossil fuel consumption as a percent of total energy consumption and the share of electricity generated from coal fired power plants. The logic is that the more fossil fuel use as a percentage of production and consumption –especially coal, which is considered the first fossil fuel currently in rapid phase out—the larger the transition that a nation will need to undertake toward a low carbon economy. Figure 6 presents how the IMF Climate Surveillance Index juxtaposes with fossil fuels consumption, Figure 7 with coal electricity as a share of total electricity generation.

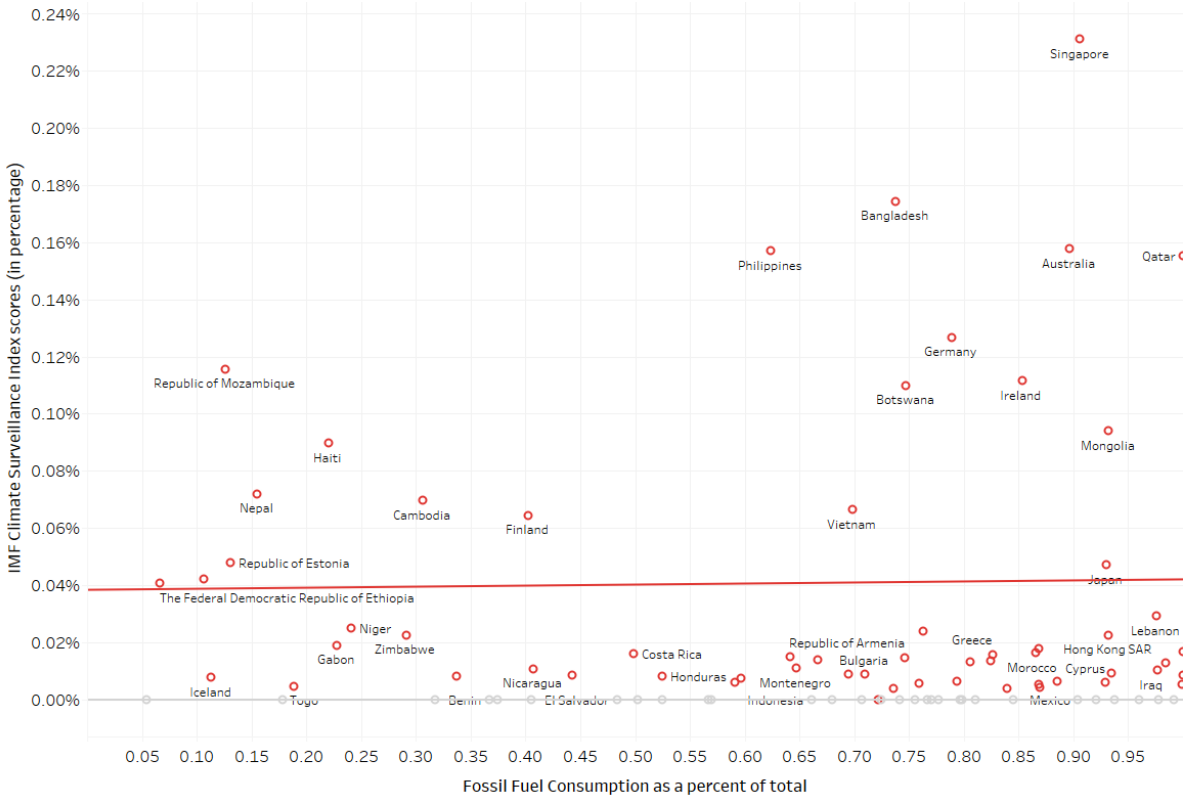
As shown in Figure 6, there is no clear relationship between being a fossil fuel-dependent country and greater IMF attention to climate change. An interesting case is Lebanon. The country has 99 percent of its energy matrix reliant on fossil fuels, all of which is imported (IRENA 2020). This dependence has increased the vulnerability of the Lebanese economy to oil price fluctuations and threatened the country's energy security. However, in Lebanon's 2019 Article IV, the Fund mentioned terms in our corpus just two times throughout the entire document, neither of them concerning transition risk. The term "fuel taxes" was applied in a recommendation to achieve sustained fiscal revenue for the country. This recommendation was paired with a note that the country should increase gas production with "the potential discovery of a natural gas field in Lebanon's territorial

## Figure 7: IMF Climate Surveillance Index Scores in 2019 and ND-Gain Readiness Index, with Trend Line and without CCPA Countries




**Source:** Own elaboration based on ND-Gain information.

## Figure 8: IMF Climate Surveillance Index Scores in 2019 and Fossil Fuel Consumption, with Trend Line and without CCPA Countries




**Source:** Own elaboration, based on World Bank WDI.

waters, where exploration just started, would boost growth and improve the country's external balance" (IMFe 2019).

A similar pattern is seen in South Sudan's in 2019 Article IV consultation. According to the ND-GAIN, South Sudan is the 6th most vulnerable country to climate change, where 72 percent of its energy consumption comes from fossil fuel sources in the oil-dependent economy. This evidence would suggest close attention to climate change by IMF staff. Yet, South Sudan's Article IV centered on measures to restore the economy and does not include transition risk and strategies for adapting. On the contrary, the report concluded that "[the IMF] directors concurred on the need to restore fiscal discipline and strengthen oil revenue" (IMFb 2019) and "the fiscal deficit is projected to average 1–2 percent of GDP in the coming years assuming a robust recovery in oil production and higher capital spending, while annual GDP growth could increase to about 6 percent a year, reflecting a recovery in oil production" (IMFb 2019). These quotes underscore inconsistency in IMF surveillance publications regarding climate change and transition risk.

Coal is the most carbon-intensive fossil fuel, and transitioning away from it is crucial to achieving the desired reductions in emissions. However, as Farbotko et al. (2020) have noted, coal is a core source of energy access and economic growth in some countries that attract significant investment into the sector for the following reasons: "i) the security of supply in regions with abundant coal resources, ii) the desire to protect jobs in the coal sector, and regional areas of coal production, iii) the dependence of public budgets on royalties from coal mining as well as iv) political influence of owners of coal mines and power producers". In such countries phasing out coal faces significant transition risks,

**Figure 9: IMF Climate Surveillance Index Scores in 2019 and Share of Electricity Production from Coal, with Trend Line and without CCPA Countries**


**Source:** Own elaboration, based on BP Statistical Review of World Energy information.

in the short term if such transitions were rapid, and in the intermediate term if such transitions lag. Therefore, greater attention is needed regarding coal fired power.

Poland or South Africa are two examples of countries in which the share of electricity production from coal is over 60 percent. Putting in place a large carbon tax or phase-out of coal-fired power plants would pose significant risks to the real economy and fiscal and financial systems. A carbon tax would raise production costs and prices of coal-fired power plants and lower their profitability such that they would be deemed carbon stranded assets — a trend that is gaining momentum across the world (Caldecott 2018, Sen & Schickfus 2020). Figure 7 compares the IMF surveillance index scores in 2019 with the share of electricity production from coal.

At first glance, Figure 7 shows positive trend line correlation between Article IV attention to climate change compared with the share of coal in the power mix. However, a further look into coal terms reflects a different scenario. Coal term references are very limited in the period. They only have 66 mentions in all 394 publications. Two-thirds of the references to coal were concentrated in Mongolia and Mozambique reports in the four years of analysis. Related research on Mongolia shows that the IMF gave conflicting advice in the Mongolia report in that country's Article IV consultations – on the one hand acknowledging the shortcomings of coal dependency for that country, and on the other hand encouraging Mongolia to create better investment incentives for the country's coal deposits (Recourse 2020). By and large, the IMF has yet to focus on the most significant transition risk that nations face in the short term—phasing out coal fired power.

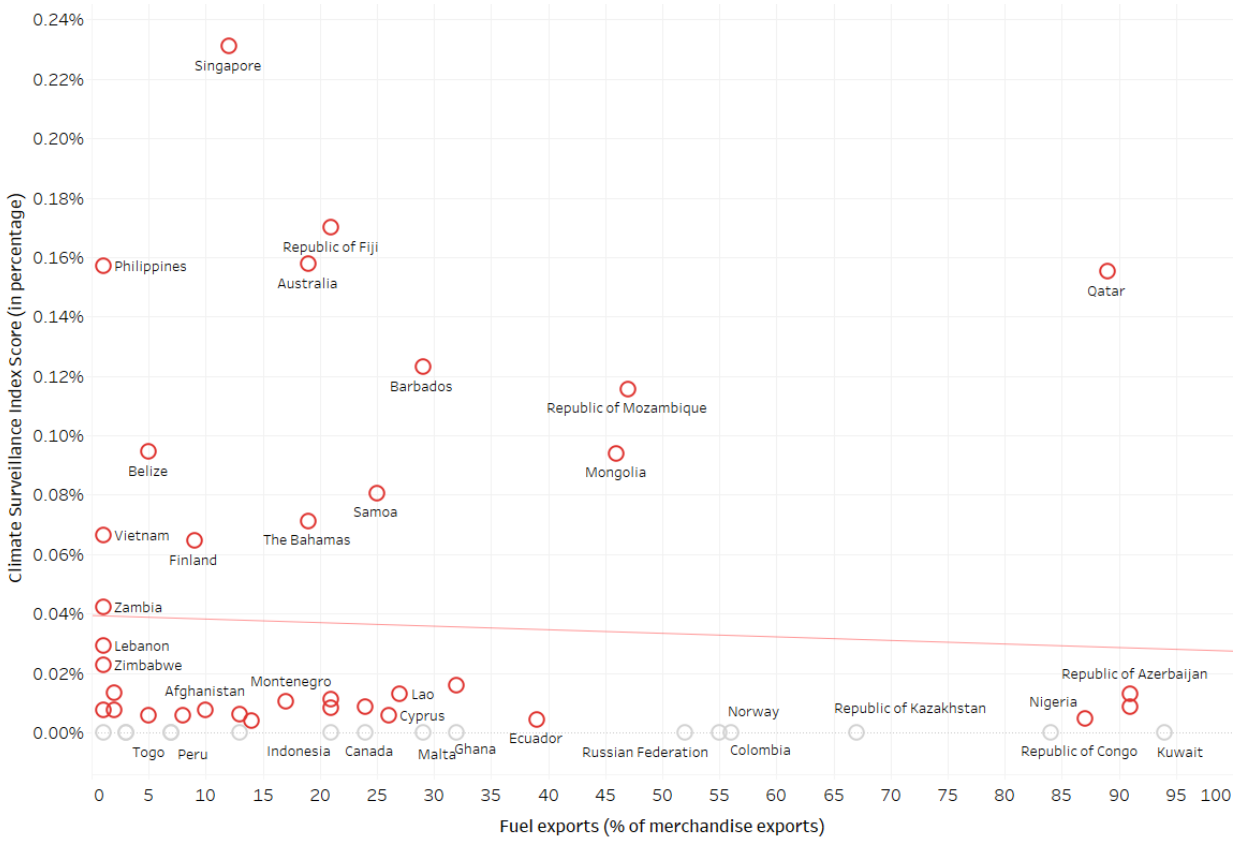
## Assessing Spillover Transition Risk

The IMF is also charged with identifying and discussing the potential spillover risks of member country policies and economic activity (IMF 2021). As the Fund moves to incorporate climate risk into its surveillance activities, assessments of spillover transition risks will be vital to analyze. As discussed earlier and exhibited in Figure 3, both countries that are highly dependent on fossil fuel exports—either directly through fuel or power export or indirectly through the embodied fuel in long distance travel and shipping (services exports) – as well as countries that will be "first movers" in the transition to low carbon economies pose significant spillover transition risks to developing countries. With one exception, such analysis has thus far been a blind spot at the IMF. Figure 8 shows the IMF Climate Surveillance Index for Article IV in 2019 on the vertical axis and fossil fuel exports as a percent of total exports on the horizontal axis.

As displayed in Figure 8, there is no evidence that the IMF is considering transition spillovers in its analyses to date. In this case, the relationship is negative, with the IMF paying less attention to climate change the more a country is exposed to global fossil fuel markets.

Qatar is a case in point. The country is a major producer and exporter of natural gas, oil, and oil products. Its infrastructure is geared towards producing and exporting large volumes of natural gas, either directly (in a gaseous or liquefied state), or conversion to liquid fuels (gas-to-liquids) and petrochemicals. Qatar's 2019 Consultation had an IMF Climate score of 0.16 percent, one of the highest in 2019. Yet, the report shows an increased reference to hydrocarbon price related to oil price volatility in past years. There is only one footnote mentioning climate change. This publication centers on the existing power mix and how oil price shocks affect fiscal and international positions. Such as, 'lower-than-envisaged hydrocarbon prices constitute the main risk to the macrofinancial outlook' (IMFd 2019), and '[IMF Directors] agreed with staff that hydrocarbon price volatility is the primary source of risk to the macroeconomic outlook' (IMFd 2019).

**Figure 10: IMF Climate Surveillance Index scores in 2019 and Fuel Exports (% of Merchandise Exports), with Trend Line and without CCPA Countries**




**Source:** Own elaboration, based on World Bank information.

## Financial Sector Assessment Programs

Established following the financial crises of the late 1990s, the Financial Sector Assessment Program (FSAP) has become a central component of IMF surveillance work. The FSAP is a detailed analysis of a country's financial sector. Although climate change is fast-becoming mainstreamed in FSAP-like tools across the central banking community they are absent in all but one of the IMF's FSAPs in our study period.

FSAPs have two-pronged objectives. According to IMF (2005), FSAPs' goals are: "(i) the identification and resolution of financial sector vulnerabilities and their macroeconomic stability implications, which would then lead to a reduction in the likelihood of crisis and improved global financial stability, and (ii) fostering financial sector development and its contribution to economic growth". These include many components: stress tests and evaluating systemic risks; assessing the resilience and oversight of the banking and non-banking financial sector; evaluating micro and macroprudential frameworks; reviewing the response of policymakers, central banks, and other key actors to systemic stress (IMFa 2019).

In 2009, after the global financial crisis, the FSAPs were restructured. The changes included improving stress testing tools and adding Risk Assessment Matrices to capture risks and their sources more

accurately. They also entailed focusing on crisis preparedness and management and infrastructures in place to respond to crises. The FSAP was also streamlined to be more comparable across countries. These modifications broadened the scope of the FSAP to cover more risks and their spillovers (IMF 2019).

As a result of the review, FSAPs became an integral part of the IMF's surveillance work. They are now carried out every five years for 29 countries with large and interconnected financial sectors that are systemically important in the global economy. Outside of this set of countries and timeframe, countries can request FSAPs to be carried out. Table 6 shows the textual analysis results in FSAPs.

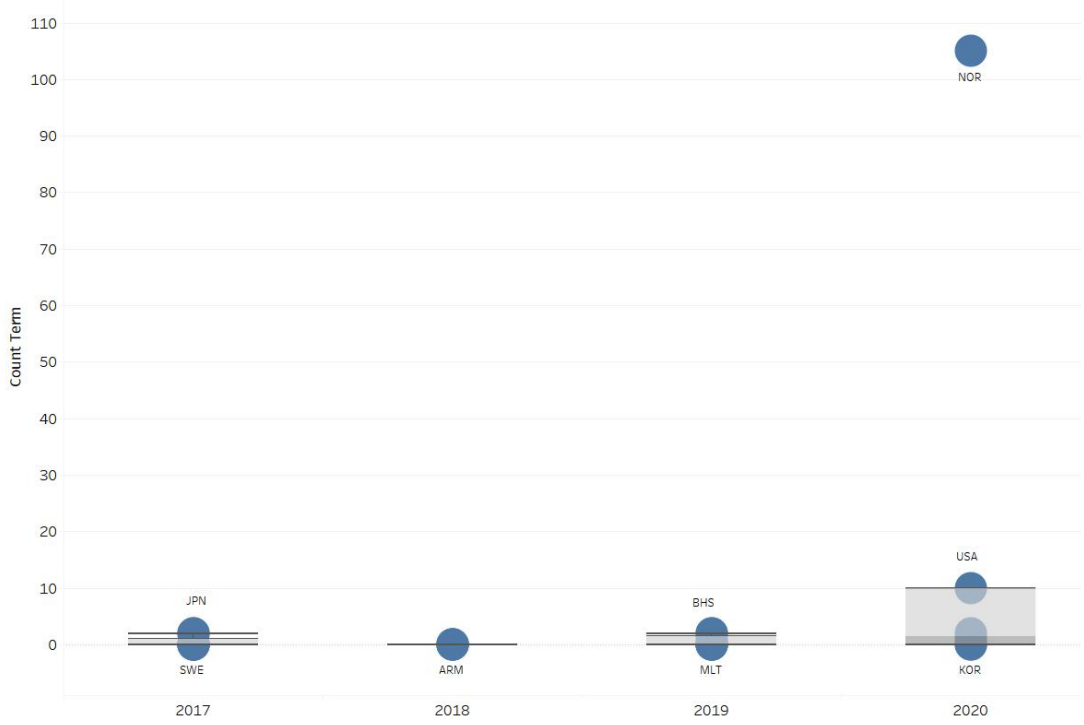
**Table 6: Search Terms Frequency per Year, and FSAP publication**

| | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| Number of publications | 19 | 11 | 19 | 17 |
| Total terms | 4 | 0 | 5 | 118 |
| Frequency | 0.21 | 0 | 0.26 | 6.95 |

**Source:** Own elaboration.

Between 2017 and 2021, 66 relevant FSAPs only mentioned climate change 127 times—with 105 of those mentions were in a pioneering FSAP in Norway. This evidence denotes how limited climate risk has been in FSAPs to date. Figure 9 displays how climate terms have been allocated between reports per year.

**Figure 11: FSAPs Count of Terms, Per Year**




**Source:** Own elaboration.

As shown in Figure 9, Norway's 2020 FSAPs had the most number of climate change references in the period. A deeper analysis reveals a sophisticated exercise of domestic transition risk impacts on Norwegian firms and the financial system. The IMF also models spillover propagation channels due to a significant increase in global carbon prices that impact the Norwegian oil sector (Grippa & Mann 2020). The publication evaluated and assessed the channels for climate-related transition risk to the financial system. This exercise is justified by "the transition to a low carbon economy can be a source of new business opportunities for banks, but also of risks. This is especially so in a country that is highly reliant on fossil fuel production and exports, such as Norway" IMF (2020b), and "the impact of an abrupt transition to a low-carbon economy (so called transition risk) could be high given Norway's reliance on the production and export of oil" IMF (2020b).

The investigation relied on the impact of a fall in oil sector revenues caused by a higher global carbon price and other measures to curb fossil fuel supply and demand globally. The sensitivity tests were conducted in partial equilibrium. They explored two channels: i) domestic cost of emissions, the impact on firms' earnings following a higher domestic carbon price and the implications for their lenders; and ii) external demand, the impact on the Norwegian economy and banks. They also tried to measure how these events could affect the valuations of oil-related companies and the financial wealth of households and other economic sectors.

The IMF found, within the limits of a static, single-factor, and partial equilibrium analysis, that the impacts on the banks and the financial system are relatively contained, but non-negligible. "The overall results underline the importance for financial institutions and their micro and macro-prudential supervisory authorities, of adequately identifying, measuring, and managing this emerging source of risk"( IMF 2020c). The Norway example is an encouraging sign of IMF potential on national and spillover transition risk analysis.

## Summary and Conclusions

It is now widely recognized that climate change poses macro-critical risks to national economies and the world economy alike through physical and transition risk channels. This study assesses the extent to which the IMF has incorporated physical and transition risks into Article IV and FSAP surveillance activities since 2017. We do so by using textual analysis techniques to create an IMF Climate Surveillance Index that gauges the level of attention that the IMF has paid to climate risks over the study period. We then juxtaposed the index with various climate risk indicators and evaluated that the IMF has paid minimal and uneven attention to climate risks thus far. That said, we also discovered cases where the IMF has paid significant attention to physical risks in small states in a handful of Article IV reports, and one case of attention to transition risk in an FSAP for Norway.

In Costa Rica's 2021 Article IV, we begin to see discussion of both types of risk. Costa Rica's 2021 Article IV report had the largest climate count of terms, 84 mentions, and the highest IMF Climate Surveillance Index scores in the analyzed period, at 0.28 percent. A closer look at this reveals the Fund staff welcoming The National Adaptation Policy 2018-2030 and the Institutional Strategic Plan 2018-2022. According to the IMF (2021), "[the Fund's] Directors applauded the authorities for their pioneering efforts to further improve resilience to climate change and fully decarbonize their economy present tremendous opportunities for new jobs and sustainable growth".

This paper provides a baseline to gauge future efforts as the IMF works to scale and align its surveillance activities with climate change goals. Moving forward, it is paramount that the IMF rapidly scale this experience to align its functions with ambitious climate goals. Given the time lag between surveillance reviews and the urgency of addressing climate change, the next reviews of Article IV

Consultations and FSAPs should incorporate the following. First, the assessment of physical and transition risks for all countries in a systematic manner. Second, the assessment of transition spillover risks as part of multinational surveillance efforts and spillover reports. Third, devising guidance notes and training to assist surveillance staff in identifying macro-critical channels for both physical and transition risks and perform necessary analysis to help member states identify and mitigate such risks. The index created for this paper will allow analysts both inside and outside the IMF monitor progress over time.

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**Table A.1: Search Terms Per Year and Total**

| Search Term | 2017 | 2018 | 2019 | 2020 | 2021 | Total | Search Term | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| adaptation action | 1 | 0 | 0 | 1 | 0 | 2 | coal needs | 0 | 0 | 0 | 0 | 0 | 0 |
| adopting climate-smart | 0 | 0 | 0 | 0 | 0 | 0 | coal power plants | 0 | 0 | 0 | 0 | 0 | 0 |
| air pollution | 4 | 13 | 11 | 10 | 1 | 39 | coal producer | 0 | 0 | 0 | 0 | 0 | 0 |
| alternatives to coal | 0 | 0 | 0 | 0 | 0 | 0 | coal production | 18 | 0 | 4 | 0 | 0 | 22 |
| brown activities | 0 | 0 | 0 | 0 | 0 | 0 | coal sector | 6 | 0 | 2 | 0 | 0 | 8 |
| brown activity | 0 | 0 | 0 | 0 | 0 | 0 | coal transition | 0 | 0 | 0 | 0 | 0 | 0 |
| brown industries | 0 | 0 | 0 | 0 | 0 | 0 | coal-based enterprise | 0 | 0 | 0 | 0 | 0 | 0 |
| brown industry | 0 | 0 | 0 | 0 | 0 | 0 | coal-fired power plant | 0 | 2 | 2 | 2 | 0 | 6 |
| carbon border | 0 | 0 | 0 | 0 | 0 | 0 | curbing emissions | 0 | 0 | 0 | 0 | 0 | 0 |
| carbon content | 0 | 0 | 1 | 1 | 0 | 2 | demand for coal | 0 | 0 | 0 | 0 | 0 | 0 |
| carbon dioxide | 0 | 0 | 3 | 1 | 2 | 6 | developing climate-smart | 0 | 0 | 0 | 0 | 0 | 0 |
| carbon footprints | 0 | 0 | 0 | 0 | 0 | 0 | disaster funds | 0 | 0 | 1 | 0 | 0 | 1 |
| carbon intensive | 0 | 0 | 0 | 0 | 0 | 0 | emissions reduction | 0 | 0 | 3 | 2 | 0 | 5 |
| carbon price | 7 | 20 | 21 | 10 | 0 | 58 | emissions target | 1 | 2 | 2 | 0 | 0 | 5 |
| carbon pricing | 0 | 0 | 3 | 13 | 0 | 16 | energy efficiency | 66 | 40 | 17 | 16 | 0 | 139 |
| carbon tax | 22 | 21 | 105 | 23 | 0 | 171 | energy efficient | 3 | 3 | 1 | 4 | 0 | 11 |
| carbon-intensive firm | 0 | 0 | 0 | 0 | 0 | 0 | environmental dimension | 0 | 0 | 0 | 0 | 0 | 0 |
| carbon-intensive industries | 0 | 0 | 0 | 0 | 0 | 0 | environmental standard | 2 | 1 | 4 | 0 | 0 | 7 |
| carbon-intensive industry | 0 | 0 | 0 | 0 | 0 | 0 | environmentally | 14 | 9 | 12 | 6 | 2 | 43 |
| carbon-intensive investments | 0 | 0 | 0 | 0 | 0 | 0 | export of coal | 0 | 0 | 0 | 0 | 0 | 0 |
| carbon-price floor | 0 | 0 | 0 | 0 | 0 | 0 | flood protection | 2 | 0 | 0 | 1 | 0 | 3 |
| clean fuel | 1 | 0 | 4 | 0 | 0 | 5 | fossil fuel | 13 | 4 | 21 | 9 | 1 | 48 |
| climate challenge | 0 | 0 | 1 | 1 | 0 | 2 | fossil-fuel power | 0 | 0 | 0 | 0 | 0 | 0 |
| climate change | 361 | 359 | 427 | 102 | 41 | 1290 | fuel tax | 7 | 15 | 24 | 5 | 0 | 51 |
| climate commitment | 0 | 0 | 0 | 2 | 0 | 2 | fuelwood extraction | 0 | 0 | 0 | 0 | 0 | 0 |
| climate conscious | 0 | 0 | 0 | 0 | 0 | 0 | gas emission | 7 | 5 | 19 | 9 | 11 | 51 |

| Search Term | 2017 | 2018 | 2019 | 2020 | 2021 | Total | Search Term | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| climate consideration | 0 | 0 | 0 | 0 | 0 | 0 | global warming | 3 | 4 | 9 | 4 | 2 | 22 |
| climate crisis | 0 | 0 | 3 | 0 | 0 | 3 | green activities | 0 | 0 | 0 | 1 | 0 | 1 |
| climate dimension | 0 | 0 | 0 | 0 | 0 | 0 | green activity | 0 | 0 | 0 | 0 | 0 | 0 |
| climate goal | 0 | 0 | 0 | 7 | 0 | 7 | green bond | 5 | 7 | 8 | 2 | 1 | 23 |
| climate impact | 0 | 0 | 0 | 0 | 0 | 0 | green budget | 0 | 0 | 0 | 4 | 0 | 4 |
| climate plan | 0 | 0 | 5 | 1 | 0 | 6 | green industries | 0 | 0 | 0 | 0 | 0 | 0 |
| climate readiness | 1 | 0 | 0 | 0 | 0 | 1 | green industry | 0 | 0 | 0 | 0 | 0 | 0 |
| climate response | 0 | 0 | 1 | 0 | 0 | 1 | green investment | 1 | 1 | 1 | 25 | 0 | 28 |
| climate risk | 7 | 2 | 15 | 6 | 3 | 33 | green measure | 0 | 0 | 0 | 0 | 0 | 0 |
| climate smart | 2 | 0 | 2 | 0 | 0 | 4 | green policies | 0 | 0 | 1 | 4 | 0 | 5 |
| climate spending | 0 | 0 | 0 | 0 | 0 | 0 | green policy | 0 | 0 | 0 | 0 | 0 | 0 |
| climate-conscious policies | 0 | 0 | 0 | 0 | 0 | 0 | green recovery | 0 | 0 | 0 | 4 | 2 | 6 |
| climate-conscious policy | 0 | 0 | 0 | 0 | 0 | 0 | green response | 0 | 0 | 0 | 0 | 0 | 0 |
| climate-conscious project | 0 | 0 | 0 | 0 | 0 | 0 | greenhouse gas | 8 | 9 | 29 | 15 | 10 | 71 |
| climate-related | 11 | 7 | 27 | 9 | 5 | 59 | greening recovery | 0 | 0 | 0 | 0 | 0 | 0 |
| climate-smart infrastructure | 0 | 0 | 0 | 0 | 0 | 0 | high emissions | 0 | 0 | 0 | 0 | 2 | 2 |
| climatic | 7 | 8 | 8 | 1 | 0 | 24 | high-emissions vehicles | 0 | 0 | 0 | 0 | 0 | 0 |
| coal asset | 0 | 0 | 0 | 0 | 0 | 0 | low carbon | 2 | 2 | 5 | 4 | 0 | 13 |
| coal burner | 0 | 0 | 0 | 0 | 0 | 0 | low-carbon economy | 0 | 1 | 3 | 6 | 0 | 10 |
| coal burning | 0 | 0 | 2 | 0 | 0 | 2 | mitigation action | 1 | 2 | 1 | 0 | 0 | 4 |
| coal business | 0 | 0 | 0 | 0 | 0 | 0 | physical risk | 0 | 0 | 0 | 0 | 0 | 0 |
| coal combustion | 0 | 0 | 0 | 0 | 0 | 0 | reduce emission | 0 | 0 | 5 | 5 | 1 | 11 |
| coal consumption | 0 | 2 | 0 | 0 | 0 | 2 | renewable energy | 106 | 54 | 70 | 27 | 0 | 257 |
| coal exports | 14 | 0 | 4 | 0 | 0 | 18 | resilient buildings | 0 | 0 | 0 | 0 | 0 | 0 |
| coal extraction | 0 | 0 | 0 | 0 | 0 | 0 | resilient road | 1 | 0 | 0 | 0 | 0 | 1 |
| coal harves | 0 | 0 | 0 | 0 | 0 | 0 | supporting adaptation | 0 | 0 | 0 | 0 | 0 | 0 |
| coal harvest | 0 | 0 | 0 | 0 | 0 | 0 | transition risk | 3 | 3 | 2 | 4 | 0 | 12 |
| coal industry | 2 | 0 | 0 | 0 | 0 | 2 | zero emission | 0 | 1 | 1 | 2 | 0 | 4 |
| coal making | 0 | 0 | 0 | 0 | 0 | 0 | zero-emission vehicle | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | **Total** | **709** | **597** | **890** | **349** | **84** | **2629** |

**Source:** Own elaboration.

**Table A.2: FSAPs Count of Search Terms Per Year**

| Search Term | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|
| adaptation action | 0 | 0 | 0 | 0 | 0 |
| adopting climate-smart | 0 | 0 | 0 | 0 | 0 |
| air pollution | 0 | 0 | 0 | 0 | 0 |
| alternatives to coal | 0 | 0 | 0 | 0 | 0 |
| brown activities | 0 | 0 | 0 | 0 | 0 |
| brown activity | 0 | 0 | 0 | 0 | 0 |
| brown industries | 0 | 0 | 0 | 0 | 0 |
| brown industry | 0 | 0 | 0 | 0 | 0 |
| carbon border | 0 | 0 | 0 | 0 | 0 |
| carbon content | 0 | 0 | 0 | 0 | 0 |
| carbon dioxide | 0 | 0 | 0 | 0 | 0 |
| carbon footprints | 0 | 0 | 0 | 0 | 0 |
| carbon intensive | 0 | 0 | 0 | 0 | 0 |
| carbon price | 0 | 0 | 0 | 36 | 36 |
| carbon pricing | 0 | 0 | 0 | 7 | 7 |
| carbon tax | 0 | 0 | 0 | 16 | 16 |
| carbon-intensive firm | 0 | 0 | 0 | 0 | 0 |
| carbon-intensive industries | 0 | 0 | 0 | 0 | 0 |
| carbon-intensive industry | 0 | 0 | 0 | 0 | 0 |
| carbon-intensive investments | 0 | 0 | 0 | 0 | 0 |
| carbon-price floor | 0 | 0 | 0 | 0 | 0 |
| clean fuel | 0 | 0 | 0 | 0 | 0 |
| climate challenge | 0 | 0 | 0 | 0 | 0 |
| climate change | 2 | 0 | 2 | 11 | 15 |
| climate change resilience | 0 | 0 | 0 | 0 | 0 |
| climate commitment | 0 | 0 | 0 | 0 | 0 |
| climate conscious | 0 | 0 | 0 | 0 | 0 |
| climate consideration | 0 | 0 | 0 | 0 | 0 |
| climate crisis | 0 | 0 | 0 | 0 | 0 |
| climate dimension | 0 | 0 | 0 | 0 | 0 |
| climate goal | 0 | 0 | 0 | 0 | 0 |
| climate impact | 0 | 0 | 0 | 0 | 0 |
| climate plan | 0 | 0 | 0 | 0 | 0 |
| climate readiness | 0 | 0 | 0 | 0 | 0 |
| climate response | 0 | 0 | 0 | 0 | 0 |
| climate risk | 0 | 0 | 0 | 5 | 5 |
| climate smart | 0 | 0 | 0 | 0 | 0 |

| Search Term | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|
| climate spending | 0 | 0 | 0 | 0 | 0 |
| climate-conscious policies | 0 | 0 | 0 | 0 | 0 |
| climate-conscious policy | 0 | 0 | 0 | 0 | 0 |
| climate-conscious project | 0 | 0 | 0 | 0 | 0 |
| climate-related | 0 | 0 | 1 | 9 | 10 |
| climate-smart infrastructure | 0 | 0 | 0 | 0 | 0 |
| climatic | 0 | 0 | 1 | 0 | 1 |
| coal asset | 0 | 0 | 0 | 0 | 0 |
| coal burner | 0 | 0 | 0 | 0 | 0 |
| coal burning | 0 | 0 | 0 | 0 | 0 |
| coal business | 0 | 0 | 0 | 0 | 0 |
| coal combustion | 0 | 0 | 0 | 0 | 0 |
| coal consumption | 0 | 0 | 0 | 0 | 0 |
| coal exports | 0 | 0 | 0 | 0 | 0 |
| coal extraction | 0 | 0 | 0 | 0 | 0 |
| coal harves | 0 | 0 | 0 | 0 | 0 |
| coal harvest | 0 | 0 | 0 | 0 | 0 |
| coal industry | 0 | 0 | 0 | 0 | 0 |
| coal making | 0 | 0 | 0 | 0 | 0 |
| coal needs | 0 | 0 | 0 | 0 | 0 |
| coal power plants | 0 | 0 | 0 | 0 | 0 |
| coal producer | 0 | 0 | 0 | 0 | 0 |
| coal production | 0 | 0 | 0 | 0 | 0 |
| coal sector | 0 | 0 | 0 | 0 | 0 |
| coal transition | 0 | 0 | 0 | 0 | 0 |
| coal-based enterprise | 0 | 0 | 0 | 0 | 0 |
| coal-fired power plant | 0 | 0 | 0 | 0 | 0 |
| curbing emissions | 0 | 0 | 0 | 0 | 0 |
| demand for coal | 0 | 0 | 0 | 0 | 0 |
| developing climate-smart | 0 | 0 | 0 | 0 | 0 |
| disaster funds | 0 | 0 | 0 | 0 | 0 |
| emissions reduction | 0 | 0 | 0 | 0 | 0 |
| emissions target | 0 | 0 | 0 | 0 | 0 |
| energy efficiency | 0 | 0 | 0 | 0 | 0 |
| energy efficient | 0 | 0 | 0 | 0 | 0 |
| environmental dimension | 0 | 0 | 0 | 0 | 0 |
| environmental standard | 0 | 0 | 0 | 0 | 0 |
| environmentally | 0 | 0 | 0 | 0 | 0 |

| Search Term | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|
| export of coal | 0 | 0 | 0 | 0 | 0 |
| flood protection | 0 | 0 | 0 | 0 | 0 |
| fossil fuel | 0 | 0 | 0 | 4 | 4 |
| fossil-fuel power | 0 | 0 | 0 | 0 | 0 |
| fuel tax | 0 | 0 | 0 | 0 | 0 |
| fuel taxes | 0 | 0 | 0 | 0 | 0 |
| fuelwood extraction | 0 | 0 | 0 | 0 | 0 |
| gas emission | 0 | 0 | 0 | 2 | 2 |
| global warming | 0 | 0 | 0 | 0 | 0 |
| green activities | 0 | 0 | 0 | 0 | 0 |
| green activity | 0 | 0 | 0 | 0 | 0 |
| green bond | 0 | 0 | 0 | 0 | 0 |
| green budget | 0 | 0 | 0 | 0 | 0 |
| green industries | 0 | 0 | 0 | 0 | 0 |
| green industry | 0 | 0 | 0 | 0 | 0 |
| green investment | 0 | 0 | 0 | 0 | 0 |
| green measure | 0 | 0 | 0 | 0 | 0 |
| green policies | 0 | 0 | 0 | 0 | 0 |
| green policy | 0 | 0 | 0 | 0 | 0 |
| green recovery | 0 | 0 | 0 | 0 | 0 |
| green response | 0 | 0 | 0 | 0 | 0 |
| greenhouse gas | 0 | 0 | 0 | 4 | 4 |
| greening recovery | 0 | 0 | 0 | 0 | 0 |
| high emissions | 0 | 0 | 0 | 1 | 1 |
| high-emissions vehicles | 0 | 0 | 0 | 0 | 0 |
| low carbon | 0 | 0 | 0 | 2 | 2 |
| low-carbon economy | 0 | 0 | 0 | 1 | 1 |
| mitigation action | 0 | 0 | 0 | 1 | 1 |
| physical risk | 0 | 0 | 0 | 4 | 4 |
| reduce emission | 0 | 0 | 0 | 0 | 0 |
| renewable energy | 0 | 0 | 0 | 0 | 0 |
| resilient buildings | 0 | 0 | 0 | 0 | 0 |
| resilient road | 0 | 0 | 0 | 0 | 0 |
| supporting adaptation | 0 | 0 | 0 | 0 | 0 |
| transition risk | 2 | 0 | 1 | 15 | 18 |
| zero emission | 0 | 0 | 0 | 0 | 0 |
| zero-emission vehicle | 0 | 0 | 0 | 0 | 0 |
| **Grand Total** | **4** | **0** | **5** | **118** | **127** |

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*The views expressed in this Working Paper are strictly those of the author(s) and do not represent the position of Boston University, or the Global Development Policy Center or UNCTAD.*

**Table A.3: FSAPs Count of Terms Per Year and Per Country, and Total**

| Country | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|
| Armenia | | 0 | | | 0 |
| Australia | | | 0 | | 0 |
| Austria | | | | 0 | 0 |
| Brazil | | 0 | | | 0 |
| Bulgaria | 0 | | | | 0 |
| Canada | | | 1 | | 1 |
| Denmark | | | | 2 | 2 |
| Euro Area Policies | | 0 | | | 0 |
| France | | | 0 | | 0 |
| Italy | | | | 1 | 1 |
| Japan | 2 | | | | 2 |
| Luxembourg | 0 | | | | 0 |
| Malta | | | 0 | | 0 |
| Netherlands | 2 | | | | 2 |
| New Zealand | 0 | | | | 0 |
| Norway | | | | 105 | 105 |
| Republic of Korea | | | | 0 | 0 |
| Romania | | 0 | | | 0 |
| Singapore | | | 2 | | 2 |
| Spain | 0 | | | | 0 |
| Sweden | 0 | | | | 0 |
| Switzerland | | | 0 | | 0 |
| Thailand | | | 0 | | 0 |
| The Bahamas | | | 2 | | 2 |
| United States | | | | 10 | 10 |
| Zambia | 0 | | | | 0 |
| Total | 4 | 0 | 5 | 118 | 127 |

**Source:** Own elaboration.