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## Mandatory corporate carbon disclosures and the path to net zero

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### 1 Introduction

According to the latest Intergovernmental Panel on Climate Change report (IPCC 2021), total global additional carbon emissions as of 2020 should not exceed 300Gt of CO<sub>2</sub> equivalents in order for the world to have at least an 83% chance of limiting global warming to no more than 1.5°C. Since global energy-related emissions last year amounted to 31.5 Gt of CO<sub>2</sub> according to the IEA (2021), the entire carbon budget the world has left would be exhausted in the next eight and a half years if energy-related emissions were to continue at the same rate as last year. The pathway to net zero is narrowing by the day and its success depends on a universal and ambitious drive to eliminate or capture carbon emissions by all players – governments, corporations, financial institutions, and consumers.

The drive to reduce and ultimately eliminate net carbon emissions begins with the mundane tasks of measuring and reporting emissions. Out of 2,993 listed companies for which Trucost estimated yearly carbon emissions in 2005, 217 (or 7.25%) voluntarily disclosed their emissions. By 2018, these numbers had grown to 8,446 companies, with 1,346 (or 15.94%) voluntarily disclosing their carbon emissions (Bolton and Kacperczyk 2021a). Thus, despite the significant progress in measuring and reporting corporate carbon emissions, the overwhelming majority of listed companies around the world still does not disclose their emissions, and even fewer privately held companies do so.

Numerous global corporations from a wide range of industries, including financial institutions and asset managers, have recently issued carbon reduction pledges, frequently culminating in a net zero position by 2050 (Comello et al. 2021, Bolton and Kacperczyk 2021b). However, as pointed out in a recent article in *The Economist*, the current voluntary disclosures and pledges lack a coherent measurement and reporting framework: “Firms disclose reams of irrelevant puffery, while often failing to reveal

<sup>1</sup> The authors of this Policy Insight are all members of CEPR's Sustainable Finance Research and Policy Network, led by Dirk Schoenmaker and steered by Patrick Bolton, Stefan Reichelstein and Alex Edmans.

the few things that matter. Ideally an asset manager would be able to work out the carbon footprint of their portfolio and how it may change over time. But many firms failed to disclose their emissions rigorously and often the measures made public by individual firms overlap, leading to double-counting when you add them all up” (*The Economist*, 2021).

In anticipation of the upcoming COP26, we argue in this Policy Insight that mandatory carbon disclosures can make a critical contribution to the path to net zero by delivering much of what policymakers and asset managers need to manage carbon transition risk, and perhaps more importantly, to accelerate the pace of future carbon emissions reductions. We believe it is important that mandatory carbon disclosures are kept simple and straightforward to interpret, and that such a mandate be enforced.

A common methodology to measure and report greenhouse gas emissions has been established through the International Greenhouse Gas Protocol. This protocol envisions firms measuring their carbon footprints by including all direct (scope 1) and indirect (scope 2 and 3) emissions. The latter comprise the upstream emissions associated with a firm’s operations and the entire supply chain of production inputs, as well as downstream emissions associated with the use of products sold by the firm. For the reasons articulated below, our recommendation focuses on mandates for firms to report their direct emissions.

Several important initiatives to promote the reporting of carbon emissions have already been underway for the past few years. Under the leadership of Mark Carney and Michael Bloomberg, the Financial Stability Board has established the Taskforce on Climate-related Financial Disclosures (TCFD) to consult institutional investors and companies on how to effectively report firm-level climate risk exposures. Another initiative is the Sustainability Accounting Standards Board (SASB), which has a broader aim of defining industry-specific standards to guide the disclosure of environmental, social, and governance (ESG) metrics. The International Financial Reporting Standards Foundation (IFRS) is in the process of creating the International Sustainability Standards Board (ISSB), which will be charged with defining globally consistent and comparable sustainability reporting standards. In a significant step, this effort has received the backing of the International Organization of Securities Commissions (IOSCO).

Setting standards is a time-consuming process, especially when it comes to environmental impact, with its multifaceted complexity. Yet, time is running out and some aspects such as direct carbon emissions are relatively straightforward. Given the expertise that data providers such as the Carbon Disclosure Project (CDP) or Trucost have already developed in collecting and estimating greenhouse gas (GHG) emissions, and given the consensus that has formed around the methods to measure and report direct emissions (Busch et al. 2018), it should be possible to immediately implement systematic corporate reporting of these emissions without having to wait for a global and comprehensive consensus to emerge around the sustainability reporting standards defined by the ISSB or other standard-setting initiatives. To be sure, there appears to be a broad consensus among economists on the usefulness and effects of requiring companies to report their direct carbon emissions according to a recent poll.<sup>2</sup>

2 See <https://www.igmchicago.org/surveys/climate-reporting-mandate/>.

## 2 Recommendation

We recommend that governments represented at COP26 adopt the following corporate carbon disclosure mandate:

- *Publicly listed firms are to report their global greenhouse gas emissions for the past calendar year in their annual reports. Private firms beyond a certain minimum size are to report their global greenhouse gas emissions for the past calendar year to a national registry in the country in which the firm is headquartered.*
  - Corporate GHG emissions are expressed in tonnes of CO<sub>2</sub> equivalent, where the aggregation weights for greenhouse gases other than CO<sub>2</sub> are determined according to current IPCC guidelines.
  - Corporate GHG emissions comprise direct (scope 1) emissions from all installations and operating assets that the company (or its subsidiaries) has a majority interest in.
  - In addition to the above measure of gross direct carbon emissions (GDE), we support the reporting of corporate net direct carbon emissions (NDE), provided that GDE and NDE are reported separately. The NDE metric should only allow the subtraction from GDE of those carbon offsets that the firm, or its subsidiaries, has removed and sequestered *durably* from the atmosphere in the past year. Durability requires a reasonably high degree of confidence that the captured CO<sub>2</sub> will not be released back into the atmosphere for at least 100 years.
  - In future years, firms should be required to report not only their GDE and NDE figures for the most recent calendar year, but also the trajectory of past GHG emissions, beginning with the year in which the reporting mandate went into effect.

## 3 Discussion

### IMPLEMENTATION AND REGULATORY BURDEN

Governments adopting our recommended mandate for corporate carbon reporting are likely to do so within the institutional frameworks of their own countries. Some jurisdictions already have significant parts of our recommendation in place. Notably, publicly listed firms headquartered in the UK have been obligated to report their scope 1 (and scope 2) emissions in their annual reports since 2013. Within the EU, installations in carbon-intensive sectors covered by the European Trading System (EU ETS) must report their annual GHG emissions to the European Union Transaction log. As noted in Downar et al. (2021), these installation-level reports are not readily aggregated to emissions at the firm level. Importantly, the European Union's Monitoring, Reporting, and Verification (MVR) framework is an enforcement mechanism in place to prevent the underreporting of carbon emissions.

Carbon-intensive production facilities in the United States also have an obligation to report their emissions to the US Environmental Protection Agency. A similar reporting requirement applies to carbon-intensive production facilities in California as part of the state's cap-and-trade system. Again, these facility-level emission reports are thus far not readily aggregated to firm-level emissions. Securities and Exchange Commission (SEC) chair Gary Gensler recently indicated that staff at the SEC are considering potential carbon reporting requirements for publicly listed firms in the US (Gensler 2021). In the Appendix to this Policy Insight, we summarise additional, relevant insights from the accounting and finance literature on the implications and challenges of implementing reporting mandates.

## DIRECT VERSUS INDIRECT EMISSIONS

Companies that already voluntarily disclose their carbon emissions frequently report both direct and indirect emissions. But the reporting of indirect emissions (especially scope 3 emissions) varies greatly from company to company. Google, for instance, only includes employee commuting and travel in its scope 3 figures (Google 2019). In contrast, the scope 3 emissions reported by Toyota account for more than 98% of total emissions associated with vehicle production.<sup>3</sup> The company's estimate of indirect emissions includes the upstream emissions associated with the production of the tens of thousands of parts that go into the vehicles as well as the future expected emissions associated with the use of the vehicles, specifically, the combustion of fuel powering the vehicles sold.

The estimation of scope 3 emissions is an inherently complex and also subjective task, in part because there are no comprehensive guidelines for allocating pools of emissions across time periods and/or product lines. Accordingly, some recent studies view the boundaries of scope 3 emissions as inherently fuzzy, at least for certain industries (Rocky Mountain Institute 2020, Comello et al. 2022). From an economy-wide perspective, the inclusion of indirect emissions also creates a double counting problem along the supply chain, with the direct emissions of suppliers being counted again as indirect emissions for downstream firms.

Our recommendation to limit the corporate reporting mandate to direct emissions (and direct removals) is primarily based on considerations of simplicity and transparency. In a regime of global and comprehensive corporate reporting of direct emissions, it will be much easier for third-party carbon data providers to aggregate these reported emissions into assessments of indirect emissions along the supply chain. There are current efforts underway to provide a more comprehensive and standardised format for the accounting of scope 3 emissions (Impact Institute 2021, Rocky Mountain Institute 2020). As these efforts come to fruition in the future, policymakers may well consider extending the reporting mandate to indirect emissions, in particular to scope 2 emissions, which are generally easier to determine and verify.

## ABSOLUTE VALUES VERSUS CARBON INTENSITY MEASURES

The UK mandate of 2013 requires firms to also provide a carbon intensity metric, leaving the reporting entity with discretion in choosing an appropriate denominator variable (e.g. sales, cost of goods sold), or a physical measure of output. Carbon intensity measures can be informative to outside observers in terms of gauging carbon footprint improvements, particularly so for growing firms. Yet, a ratio measure may also mask a lack of progress in terms of absolute emission reductions, the variable that is ultimately of interest for the trajectory to net zero.

Also, the empirical literature on carbon transition risk points to the significance of absolute carbon footprint measures. Bolton and Kacperczyk (2021c, 2021d) show that equity prices are sensitive to absolute levels of emissions but not to emission intensity measures. These considerations lead us to the recommendation of focusing on mandating disclosure of absolute values. To the extent that financial variables are used in the denominator of the intensity measure, users can readily available calculate these measures for public firms. For private firms, admittedly, the additional information contained in intensity metrics may be more valuable to report. Yet, nothing prevents a

<sup>3</sup> <https://www.toyota-industries.com/csr/environment/process/scope3/>

company from voluntarily disclosing carbon intensity metrics in addition, if it believes that such measures provide a more informative picture of the company's progress in reducing emissions.

## CARBON OFFSETS

As part of their voluntary carbon reporting, many companies currently calculate net emissions by subtracting offsets from their gross emissions. These carbon offsets can be undertaken by the company itself, for instance, by building a renewable power plant in some location, which then sells clean electricity to the local grid. Increasingly, companies also purchase offsets in voluntary carbon offset markets (McKinsey 2020). These markets have grown rapidly, yet the average price of offsets has fallen to a mere \$3 per tonne of CO<sub>2</sub> in 2020 (*The Economist* 2020).

This extremely low average market price for voluntary carbon offsets (compared with the recent allowance prices of €60 per tonne of CO<sub>2</sub> in the EU ETS) is generally believed to reflect the predominance of so-called avoidance offsets, for which one party claims a carbon credit for  $x$  tonnes of CO<sub>2</sub> because another party agreed not to emit  $x$  tonnes of CO<sub>2</sub> (The Economist 2020). Avoidance offsets are essentially counterfactual claims: because of A's intervention, B did not emit the CO<sub>2</sub>, but would have done so otherwise. Our reporting recommendation excludes such avoidance offsets and only allows long-term removal offsets in the calculation of the NDE. Offsets are eligible only if a firm, or its contractor, directly removed  $x$  tonnes of CO<sub>2</sub> from the atmosphere. Applicable examples in this context include direct air capture combined with geological sequestration and a range of nature-based removal mechanisms (Comello et al. 2022).

## ANTICIPATED EFFECTS OF THE CARBON REPORTING MANDATE

The reporting mandate we advocate in this Policy Insight is intended not only to provide additional information to policymakers, asset managers, and the general public, but also to become a mechanism that spurs companies to reduce their GHG emissions in the future. With a reporting mandate in place, stakeholders can evaluate and benchmark GHG emissions across companies. Moreover, corporations will anticipate more focused stakeholder pressure from investors, customers, and employees to show improvements in the disclosed annual emissions.

For the UK mandate of 2013, several recent studies have found that, in comparison to various control groups of firms in other European countries, UK firms significantly reduced their absolute GHG emissions in subsequent years (Downar et al. 2021, Grewal 2021, Jouvenot and Krueger 2020). The estimated magnitudes of these reductions are in the range of 8–16%, depending on the study and the sample of firms. At the same time, Downar et al. (2021) find that both revenues and costs of sales for UK firms increased only by relatively small and insignificant percentages in comparison to the control group, resulting in no tangible bottom-line effect on operating profitability. In 2010, when the US Environmental Protection Agency mandated carbon-intensive production facilities to report their direct emissions to a publicly accessible registry, similar effects were observed. Tomar (2021) finds that US facilities reduced their carbon emissions by roughly 8% following the mandate. The aforementioned studies attribute their evidence of emission reductions to inter-firm learning and benchmarking as well as stakeholder and capital market pressures.

In addition, a mandate to provide firm-level GHG emissions is likely to produce new information that is relevant to capital markets (Krueger et al. 2020). This new information will reduce uncertainty for investors. Indeed, following the introduction

of mandatory carbon disclosure in the UK, both stock return volatility and the carbon premium (the higher expected stock returns required to compensate investors for holding carbon transition risk) went down on average for the companies that were newly disclosing their emissions to comply with the regulation, although the carbon premium increased for the companies with the highest emissions (Bolton and Kacperczyk 2021a).

Our recommendation to mandate annual GHG reporting pertains to all corporations, not just publicly listed companies. Otherwise, we anticipate the possibility that certain emissions-intensive activities migrate to private firms (Rauter 2020), or that some emitters go private to avoid the scrutiny that comes with the reporting mandate. There is such evidence of public market exit as an avoidance strategy in response to financial market regulation (Leuz and Wysocki 2016).

## 4 Concluding remarks

Mandatory disclosure of important information is the bedrock on which capital markets are founded. Given the urgency of the climate crisis, information about corporate carbon emissions is becoming increasingly important. A requirement for all companies to report their carbon emissions would provide a similar bedrock on the path to net zero. Our proposal is to err on the side of simplicity and immediate feasibility – only mandate disclosure of direct greenhouse gas emissions for now – but to be ambitious in the range of the mandate – require carbon disclosures from all firms, private and publicly traded.

Research suggests that mandatory disclosure regimes have many benefits but they can also have unintended consequences (e.g. Dranove and Jin 2010, Leuz and Wysocki 2016, Christensen et al. 2021). Therefore, broadening the carbon disclosure mandate to include other ESG and sustainability dimensions will require careful economic analysis. However, when it comes to GHG emissions, there is such urgency in reducing global emissions to avoid a catastrophic rise in temperatures that mandating the disclosure of direct GHG emissions can be expected to be met with broad support from many nations. We therefore call for a focused but comprehensive reporting mandate of GHG emissions before considering extensions to other sustainability or social issues.

Our recommendation is explicit in requiring firms not only to report their GDE and NDE for the most recent calendar year, but also to include the trajectory of past emission reports beginning with the year in which the mandate went into effect. We expect that an increasing number of firms will supplement these reports with forecasts that specify targets for emission reductions in future years (milestones) on the path to net zero. For these firms, the interested public will be able to assess over time how the firm met its emissions reduction targets (Comello et al. 2021).

We recognise that a carbon reporting mandate is unlikely to be sufficient to solve the climate problem. Nevertheless, based on existing evidence, it is our belief that a reporting mandate can make a significant contribution on the path to net zero, both in terms of providing necessary and better data, which is useful for other carbon policies and managing transition risks, and in incentivising carbon reductions.

The Montreal Protocol established in 1987 to regulate the substances that deplete the ozone layer provides a good illustration and precedent for how the international community can quickly push forward a broad agreement to implement a comprehensive

mandatory carbon emission reporting regime. Remarkably, 24 governments quickly agreed to phase out chlorofluorocarbons (CFCs) by 2000, bringing about a long-term recovery of the ozone layer (Schoenmaker and Schramade 2019).

## References

- Bolton, P and M Kacperczyk (2021a), “Signaling through Carbon Disclosure”, Imperial College Working Paper.
- Bolton, P and M Kacperczyk (2021b), “Firm Commitments”, Imperial College Working Paper.
- Bolton, P and M Kacperczyk (2021c) “Do Investors Care about Carbon Risk”, *Journal of Financial Economics*, forthcoming.
- Bolton, P and M Kacperczyk (2021d) “Global Pricing of Carbon Transition Risk”, Imperial College Working Paper.
- Busch, T, M Johnson and T Pioch (2018), *Consistency of corporate carbon emission data*, University of Hamburg and WWF Deutschland.
- Christensen, H, L Hail and C Leuz (2021), “Mandatory CSR and Sustainability Reporting: Economic Analysis and Literature Review”, *Review of Accounting Studies*, forthcoming.
- Comello, S, J Reichelstein and S Reichelstein (2021) “Transparency of the Net Zero by 2050 Club”, Steyer-Taylor Center for Energy Policy and Finance, Stanford University.
- Comello, S, J Reichelstein and S Reichelstein (2022) “Corporate Carbon Reduction Pledges: An Effective Tool for Mitigating Climate Change?”, in N Malhotra (ed.), *Frontiers in Social Innovation*, Harvard Business Press (in press).
- Downar, B, J Ernstberger, S Reichelstein, S Schwenen and A Zaklan (2021), “The Impact of Mandatory Carbon Reporting on Emissions and Financial Operating Performance”, *Review of Accounting Studies*.
- Dranove, D and G Z Jin, (2010), “Quality Disclosure and Certification: Theory and Practice”, *Journal of Economic Literature*.
- IPCC (2021), *Climate Change 2021: The Physical Science Basis*.
- Gensler, G (2021), “Prepared Remarks Before the Principles for Responsible Investment ‘Climate and Global Financial Markets’ Webinar”, 28 July.
- Google (2019), *Google Environmental Report 2019*.
- Grewal, J (2021), “Real Effects disclosure regulation on voluntary disclosers”, *Journal of Accounting and Economics*, forthcoming.
- IEA (2021), *Global Energy Related CO<sub>2</sub> emissions, 1990-2020*.
- Impact Institute (2021), *Integrated Profit & Loss Assessment Methodology: The Core*.
- Jouvenot, V and P Krueger (2020), “Reduction in corporate greenhouse gas emissions under prescriptive disclosure requirements”, Working Paper, University of Geneva.
- Krueger, Z Sautner and L T Starks (2020), “The Importance of Climate Risks for Institutional Investors”, Swiss Finance Institute Research Paper No. 18-58.
- Leuz, C and P Wysocki (2016), “The Economics of Disclosure and Financial Reporting Regulation: U.S. and International Evidence and Suggestions for Future Research”, *Journal of Accounting Research* 54(2): 525–622.
- Rauter, T (2020), “The Effect of Mandatory Extraction Payment Disclosures on Corporate Payment and Investment Policies Abroad”, *Journal of Accounting Research* 58(5): 1075–1116.
- Rocky Mountain Institute (2020), *The Next Frontier of Carbon Accounting: A Unified Approach for Unlocking Systemic Change*.
- Schoenmaker, D and W Schramade (2019), *Principles of Sustainable Finance*, Oxford University Press.
- The Economist* (2021), “Sustainable finance is rife with green wash. Time for more disclosure”, 22 May.

*The Economist* (2020), “Cheap Cheats: Why Are Carbon Offsets so Cheap?”, 25 September.

Tomar, S (2021), “Greenhouse Gas Disclosure and Emissions Benchmarking”, Working Paper.



## Appendix: Further relevant findings from the academic literature

In this appendix, we provide a broader perspective on the adoption and enforcement of disclosure mandates and their effects. This perspective is grounded in the findings of academic studies in accounting, economics and finance as they apply to the implementation of a mandatory carbon reporting regime.

### ENFORCEMENT

The effectiveness of a reporting mandate for GHG emissions depends, among other things, on its enforcement. It is important to recognise that some firms that currently do not report GHG emissions likely do so for a reason. Many of these will seek to avoid the stakeholder pressures that come with disclosure. These firms will also seek to find ways to underreport their GHG emissions (e.g. by using relatively cheap, low-quality offsets). Without enforcement, these firms could also attempt to evade reporting by using boilerplate language or claiming the information is immaterial. Moreover, while there are well-established standards for carbon accounting, the standards necessarily allow for certain reporting discretion. For example, both the Greenhouse Gas Protocol and the ISO 14064 allow for some degree of flexibility in the choice of methodological approaches, assumptions and estimation procedures (e.g. emission factors, boundaries, or the use of primary or secondary data). This flexibility opens up the possibility that some firms find ways to underreport their GHG emissions. Heterogeneity in the application of the standards could also undermine comparability even if there is no intention to hide or manipulate emissions information. Addressing these challenges is critical, as efficient asset allocation and pricing of carbon risks requires complete, accurate, and comparable information. Thus, if the goal of the reporting mandate for GHG emissions is to facilitate the drive to net zero and to change firm behaviour, an effective enforcement regime for the reporting mandate is critical.

There is ample empirical evidence highlighting the importance of enforcement in the academic literature studying the adoption of global accounting standards (e.g. Byard et al. 2011, Landsman et al. 2012, Christensen et al. 2013), the enactment of insider-trading laws (Bhattacharya and Daouk 2002), and the introduction of new securities regulation in the EU (Christensen et al. 2016). An appropriate level of enforcement can be achieved in different ways. There is private enforcement, which involves actions taken by private parties (e.g. investors or interest groups) to enforce laws and/or regulations, including market discipline, private litigation, and any other non-regulatory force (e.g. public shaming) that induces firms to comply with a regulation (Jackson 2008). The efficacy of private enforcement critically depends on the well-functioning of the country's legal institutions, which often suffer from important problems (e.g. La Porta et al. 1998, 2002). Therefore, it often makes sense to combine private enforcement with public enforcement by government or quasi-governmental oversight agencies (Djankov et al. 2003, Shleifer 2005).

We highlight several considerations for the design of an enforcement system in the context of GHG reporting. Regarding the enforcement architecture, a careful selection of the institution in charge of supervising GHG reporting is critical. It is also important to keep in mind that enforcement agencies that oversee compliance with securities regulation and financial reporting do not necessarily have the skills and

resources to extend their oversight to the measurement of carbon emissions. As such, effective enforcement of emission reporting likely involves substantial infrastructure investments and acquisition of expertise by the oversight bodies.

The objective of obtaining emissions estimates that are globally comparable requires at least some degree of coordination among countries' enforcement bodies. The literature provides evidence that such coordination can enhance enforcement efficiency. Two examples are the Single Supervisory Mechanism, in the context of the European Banking Union (see Hirtle 2020 for a review of the evidence), and the Multilateral Memorandum of Understanding, an international cooperation agreement among national securities regulators created by IOSCO (Lang et al. 2019). In fact, IOSCO supports the IFRS Foundation's creation of the ISSB. If establishing a central enforcement mechanism for GHG reporting is not feasible, we recommend that a supranational institution assume the role of achieving at least a minimum degree of coordination among national enforcers.

The literature also shows that the efficacy of enforcement is significantly undermined if the enforcement body is understaffed and lacks sufficient authority (Kedia and Rajgopal 2011). We therefore emphasise the need to carefully define the scope of the powers conferred to the institutions in charge of the enforcement of GHG reporting. Experience with enforcement for financial reporting suggests that the implementation of GHG reporting could easily end up being very different across the world. Uneven enforcement, just like uneven regulation, can lead to avoidance strategies and shifting of activities to weaker regimes (Rauter 2020, Christensen et al. 2021).

The selection of enforcement strategies also deserves close attention. Here we discuss two examples. One popular strategy in financial reporting and corporate governance is to adopt a 'complain or explain' approach. This approach is unlikely to induce a majority of firms to disclose carbon emissions, as firms could give perfunctory explanations for non-compliance. We therefore advise against this approach. A second common strategy is to disclose information related to the oversight process. In some jurisdictions, enforcers disclose ex ante their oversight priorities or selection criteria. In other cases, there is ex-post disclosure of enforcement outcomes. For example, it is not uncommon to publish statistics on reviewed firms, compliance issues, non-compliance rates, or corrective actions. Some regulators even publish the names of the non-compliant firms. These types of regulatory disclosure may enhance the effect of enforcement efforts (Kleyменова and Tomy 2021).

Regardless of the exact design of the enforcement architecture, what is clear is that simply mandating global reporting standards for GHG emissions will achieve very little if they are not backed up by a set of robust enforcement mechanisms and other institutions that provide incentives for compliance. Moreover, as we are proposing a global regime of carbon reporting, we emphasise the need to coordinate – to the extent possible – enforcement strategies across jurisdictions.

In sum, our discussion suggests that implementing a universal mandate to report corporate carbon emissions is not free of challenges. At the same time, we note that those jurisdictions that have already implemented carbon regulation mechanisms, in particular carbon pricing, also had to adopt verification and enforcement procedures such as, for instance, the Monitoring, Verification and Reporting (MVR) framework that the EU adopted in connection with the ETS.

## INCENTIVES

Aside from enforcement, it is also important to consider the role of incentives and market forces. As discussed earlier, reporting mandates can create incentives for firms to reduce their carbon emissions. But incentives also matter for firms' carbon reporting. As shown in the accounting literature, firms' reporting incentives are shaped by capital market forces. Therefore, capital markets, and in particular institutional investors, could also play an important role in incentivising firms to provide useful carbon disclosures. There is ample evidence that the need to raise outside capital critically affects firms' financial reporting behaviour (e.g. Ball et al. 2003, Burgstahler et al. 2006). There is also evidence that institutional investors can promote not only reporting transparency, but also a reduction in carbon emissions (Azar et al. 2021) and more generally more corporate responsibility (Christensen et al. 2017, Dyck et al. 2018).

While it is unlikely that capital market forces alone can ensure consistent and universal GHG reporting, institutional changes that facilitate activism for carbon disclosure can add to the enforcement efforts. This argument also extends to activism by other stakeholders or by the general public, as Dyreng et al. (2015) document for corporate disclosure and tax avoidance.

Banks can also play a role in promoting the disclosure of carbon emissions. Requiring banks to report the emissions of their loan portfolios would induce these institutions to demand such information from their borrowers. This is particularly important considering that a large number of bank borrowers are relatively small private firms and that public enforcers have limited resources to oversee the disclosure of the universe of private firms.

Some gatekeepers are also likely to play a key role in the implementation of a mandate to disclose carbon emissions. In particular, assurance could be even more important for GHG reporting than for financial reporting. This in turn suggests that an audit mandate for GHG reporting should be considered. Regarding the question of who should be the certifier, extant research suggests that accounting firms are better than consultants because of their experience in financial accounting (Michelon et al. 2019). While it is not clear that accounting and consulting firms currently have the capacity and expertise to provide high-quality audits of reported GHG emissions for a large set of firms, these firms are rapidly creating capabilities for this purpose.

Finally, it is important to recognise that mandated disclosures are used not only by investors, but also by competitors, customers and suppliers, which can result in proprietary costs. Forcing firms to reveal proprietary information could reduce their incentives to innovate (Breuer et al. 2020). Christensen et al. (2021) argue that such considerations are less relevant for highly aggregated disclosures and are more likely to arise for fairly specific or detailed disclosures. By limiting the disclosure mandate to firm-level direct GHG emissions, the risk of revealing sensitive information to competitors is substantially reduced, while still providing the desired incentives and pressures on firms to reduce their GHG emissions.

## References for appendix

Azar, J, M Duro, I Kadach and G Ormazabal (2021), "The Big Three and Corporate Carbon Emissions around the World", *Journal of Financial Economics*, forthcoming.

- Ball, R, A Robin and J Wu (2003), “Incentives versus standards: properties of accounting income in four East Asian countries”, *Journal of Accounting and Economics* 36: 235–270.
- Bhattacharya, U and H Daouk (2002), “The world price of insider trading”, *Journal of Finance* 57: 75–108.
- Breuer, M, C Leuz and S Vanhaverbeke (2020), “Reporting regulation and corporate innovation”, Working paper.
- Burgstahler, D C, L Hail and C Leuz (2006), “The importance of reporting incentives: Earnings management in European private and public firms”, *The Accounting Review* 81(5): 983–1016.
- Byard, D, Y Li and Y Yu (2011), “The effect of mandatory IFRS adoption on financial analysts’ information environment”, *Journal of Accounting Research* 49: 69–96.
- Christensen, H B, L Hail and C Leuz (2013), “Mandatory IFRS reporting and changes in enforcement”, *Journal of Accounting and Economics* 56(2-3): 147–177.
- Christensen, H B, L Hail and C Leuz (2016), “Capital-market effects of securities regulation: Prior conditions, implementation, and enforcement”, *Review of Financial Studies* 29: 2885–2924.
- Christensen, H B, E Floyd, L Y Liu and M Maffett (2017), “The real effects of mandated information on social responsibility in financial reports: Evidence from mine-safety records”, *Journal of Accounting and Economics* 64(2-3): 284–304.
- Christensen, H, L Hail and C Leuz (2021), “Mandatory CSR and Sustainability Reporting: Economic Analysis and Literature Review”, *Review of Accounting Studies*, forthcoming.
- Hirtle, B (2020), *Bank Supervision: The perspective from economics*, Federal Reserve Bank of New York.
- Djankov, S, E Glaeser, R La Porta, F Lopez-de-Silanes and A Shleifer (2003), “The new comparative economics”, *Journal of Comparative Economics* 31(4): 595–619.
- Dyreng, S, J Hoopes and J Wilder (2015), “Public Pressure and Corporate Tax Behavior”, *Journal of Accounting Research* 54: 147–186.
- Kedia, S and S Rajgopal (2011), “Do the SEC’s enforcement preferences affect corporate misconduct?”, *Journal of Accounting and Economics* 51: 259–278.
- Kleymanova, A and R E Tomy (2021), “Observing Enforcement: Evidence from Banking”, Chicago Booth Research Paper No. 19-05.
- La Porta, R, F Lopez-de-Silanes, A Shleifer and R Vishny (1998), “Law and Finance”, *Journal of Political Economy* 106: 1113–55.
- La Porta, R, F Lopez-de-Silanes, A Shleifer and R Vishny (2002), “Investor protection and corporate valuation”, *Journal of Finance* 57: 1147–1170.
- Landsman, W R, E L Maydew and J R Thornock (2012), “The information content of annual earnings announcements and mandatory adoption of IFRS”, *Journal of Accounting and Economics* 53(1-2): 34–54.
- Lang, M, M Maffett, J Omartian and R Silvers (2019), “Regulatory cooperation and foreign portfolio investment”, *Journal of Financial Economics* 138: 138–158.
- Michelon, G, D Patten and A Romi (2019), “Creating legitimacy for sustainability assurance practices: Evidence from sustainability restatements”, *European Accounting Review* 28: 395–422.
- Shleifer, A (2005), “Understanding regulation”, *European Financial Management* 11: 439–451.

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