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"The planet is swimming in discarded plastic": How do circular economy policy statements affect corporate engagement in addressing plastic pollution?

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Abstract

With the global economy only 7.2% circular, strong collaboration among diverse stakeholders becomes increasingly required to tackle plastic pollution. Aware of the role of businesses as key stakeholders in designing new forms of resource use, this study seeks to answer how publicly announced circular economy (CE) policies affect the businesses' engagement against plastic waste. For this purpose, an event study methodology is used to evaluate differences in abnormal returns of large, mid and small-cap securities across 23 developed markets and 24 emerging markets - considered aligned with the overall objective of managing plastic waste and promoting circularity. The findings reveal that all companies react positively to CE policy announcements though with varying extent. Specifically, the plastic transition index appears more responsive to the CE Action Plans incorporating the product's whole life cycle into the waste management system (in particular, Australia, Danemark, France, Germany, South Africa). It is also shown that the European Union's initiatives introducing both legislative and non-legislative measures targeting areas have led to a decline in systematic risk for the plastic transition index. Overall, the results highlight that public awareness and support are pivotal factors in changing businesses' behaviour and thus can be crucial for the success of CE and waste policies.

1. Introduction

The crisis of global plastic waste continues to escalate regardless of international and national policy responses, as well as industry commitments. This is mainly owing to continued economic growth, industrialization and the increased global population, driving significant increases in materials use. Various regions have obstacles in appropriately managing plastic waste. The total plastic waste produced in the EU in 2021 was 16,13 million tonnes. 6,56 million tonnes of plastic waste were recycled. Recent OECD modelling indicates that the use of materials is projected to double by 2060 if no urgent and more ambitious policy actions are taken (see Figure A1 in the Appendix, OECD, 2019). Evidently, this would exacerbate plastic pollution, threaten human health, harm food and water safety, and burden economic activities. Without coordination of trade policies and investment programmes to rapidly scale up the circular economy, the production of plastics around the world will continue to increase as demand for plastics is projected to remain high and further rise in developed, emerging and developing economies (Figure A2, OECD, 2024).With the rising spotlight on unsustainable plastic production, use and mismanagement inducing increased global plastic pollution (Walker and Fequet, 2023), countries around the world began to focus explicitly on how much plastic waste they produced, how much was managed, and whether that management was sustainable. Accordingly, as businesses have a responsibility to defend the environmental and sustainable values of society and need to show it to their stakeholders (Lahti et al., 2018), the circular economy has been growingly perceived as a potential solution to accelerate the transition towards sustainable development (Geissdoerfer et al., 2018).

Given the aforementioned considerations, the circular economy has devoted particular attention as having the potential to break with the unsustainable business-as-usual models. Various recent studies have attempted to explain the circular economy as an economic system in which companies are transitioning towards a circular business model while incorporating sustainability practices in the businesses' strategies (Ferasso et al., 2024). Including circular economy practices, where products are designed for reuse and recycling, can yield to sharp collapse of plastic pollution. In that context, collaboration among businesses and governments seems of utmost importance to create comprehensive strategies for effectively addressing the current global plastic pollution (Kristensen and Mosgaard, 2020). Despite rising awareness of the necessity for sustainable solutions, little is known about the impacts of circular economy policies and/or laws from governments on the engagement of businesses in tackling plastic pollution. Several studies underscored the lack of research on policy measures and interdisciplinary approaches to achieve sustainability and CE (Pomponi and Moncaster, 2017) or the insufficient data and measures enabling to track the CE transition (Petit-Boix et al., 2022).Chang et al. (2015) assessed how the implementation of environmental policies and how government engagement affect Chinese firms' environmental performance, and revealed that that government engagement is positively associated with a firm's environmental performance. Selmi et al. (2022) tried to answer how governments' green stimulus announcements affect business sustainability transition in Europe, emerging countries, Asia-Pacific developed region and North America, and showed that the stimulus announcements dedicated to green investments positively (moderately) contribute to sustainability transition in Europe and North America (emerging and Asia-Pacific countries). Segarra-Blasco et al. (2024) claimed that policymakers should consider that more intense knowledge spillovers and a greater institutional framework will raise the likelihood of European small- and medium-sized enterprises adopting CE practices.

The present study complements the literature on the impacts of governments' green packages on business sustainability (for instance, Allan et al., 2020; Brahmbhatt, 2021;

Hepburn et al., 2020; Selmi et al., 2021; 2023), and research works aimed at exploring the linkage between the performance of businesses and the implementation of CE initiatives (Barros et al., 2021; Lahti et al., 2018), and assessing the association between sustainability and CE practices (Geissdoerfer et al., 2017, Schroeder et al., 2019); and policy (McDowall et al., 2017, Milios, 2018).

As the environmental, social, economic and health risks of plastics become clearer, the implications for businesses and market participants will rise accordingly. The main objectives of this research are to address (i) How do businesses respond to CE policy statements and laws? (iii) Does a plastic transition plan involve public politics accomplished through private politics (i.e., an engagement with businesses)? To effectively address these questions, we perform an event study methodology to assess the differences in abnormal returns for the MSCI ACWI IMI Plastics Transition share prices including large, mid and small-cap securities across 23 developed markets and 24 emerging markets countries[1] in response to announcements of governmental CE initiatives and/or laws. An event study methodology mainly consists of quantifying the abnormal return in the plastics transition index following the announcement dates. Based on the modern financial theory, the stock price indices consider all available information and expectations about the future.

The remainder of the study is organized as follows. Section 2 describes the data and conducted methodology. Section 3 reports and discusses the results. Section 4 provides concluding remarks and some policy implications.

2. Methodology and data collection

This study carries out an event study methodology to assess the differences in abnormal returns for the MSCI ACWI IMI Plastics Transition stock prices as responses to governments' CE policy announcements.

2.1. Sample and selection criteria

In an event study, we need first to determine the event, the announcement day, the event window, the estimation window and the estimation model. The CE policy announcements for different developed and emerging countries are considered as the event dates for our study. More particularly, we consider the following dates:

January 1, 2019: The aim of the German Packaging Act is to avoid or reduce the impact of packaging on the environment. Where possible, packaging waste should not be generated in the first place or, if this is not possible, it should be reused or recycled to the highest possible quality. The aim of the law is also to ensure fair competition between both the obligated manufacturers and the systems that implement product responsibility for the manufacturers. Companies are also required to take measures to increase the recycling and disposal rates of used packaging materials.

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[1] Developed markets' economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the US. Emerging Markets' countries incorporate Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Kuwait, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and United Arab Emirates.

January 28, 2020: The Minister of Forestry, Fisheries and Environment of South Africa published the National Waste Management Strategy 2020 ("NWMS 2020") for implementation. The latter aims at promoting approaches to the design of products and packaging that limit waste and encourage reuse and recycling.

February 10, 2020: France announced a new law on the fight against waste and the circular economy. France plans to progressively put an end to the production of plastic packaging. According to the Anti-Waste Law, producers and importers of waste-generating products should inform consumers, by marking or labelling their products in an accurate way of their environmental qualities and main features including the incorporation of recycled materials, and whether sustainability the environmental goals are considered.

March 11, 2020: The European Commission adopted the new circular economy action plan. The latter aims to promote circular economy processes, and ensure that waste is overlooked. It also introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

July 30, 2020: The UK's government proposed a legislative framework, clearly explaining steps for a long-term path for waste management and recycling.

December 15, 2020: The Australian government lunched the Recycling and Waste Reduction Act 2020. The main purposes of this act are to minimize the environmental and human health impacts of products and waste, realize the economic benefits of responsible waste management, and help Australia meet its international environmental obligations.

July 7, 2021: China is constantly introducing new legislation to enhance the efficacy and the relevance of their circular economy initiatives. Every five years, the Chinese Government introduces a new five-year plan, with different sustainability goals the country want to fulfill. China is currently on its 14th Five-Year Plan covering the period of 2021-2025, which was announced on July 7, 2021. It introduces various initiatives; These incorporate motivating green product design, recycling, remanufacturing.

July 20, 2021: The Danish government published Action Plan for Circular Economy, its national strategy for the prevention and management of waste for 2020-2032. The Action Plan for Circular Economy depicts clearly the Danish targets, indicators, policies and initiatives in the entire circular value chain. Besides, this Action Plan focuses on three areas with relevant environmental and climate implications, including biomass, construction and plastics.

November 15, 2021: The US. Environmental Protection Agency (EPA) Administrator announced the National Recycling Goal in an attempt to raise the US recycling rate to 50 percent by 2030, and to improve policies and programs to support Circularity.

July 1, 2022: Indian government introduces the Plastic Waste Management Amendment Rules, 2021, prohibiting identified single use plastic items by 2022.

June 19, 2023: The Canadian government developed a circular economy Action Plan for that outlines near-term priorities and focus areas for advancing the circular economy. This plan is a comprehensive open-source guide to allow a better understanding of how several stakeholders can participate in its implementation.

June 17, 2024: The Brazilian President signed a decree creating the country's first National Circular Economy Strategy aimed at spurring the economic transition from a business-as-usual model to a circular economy, to create lasting and more conscious economic growth while preventing waste and pollution.

The day "0" is defined as the announcement date of CE policy strategy plans or laws by the governments of developed and emerging economies. Then, the estimation and event windows can be determined. The interval t_0-t_1 in Figure 1 is the estimation window which provides the information needed to specify the normal return (i.e., prior to the announcement date). The interval t_2-t_1+1 is the event window, and the interval t_3-t_2 is the post event window which is used to assess the performances of the MSCI ACWI IMI Plastics Transition share prices including large, mid and small-cap securities across 23 developed markets and 24 emerging markets countries following their governments' CE policy statements. The event window consists of 21 days from t_{-10} to t_{+10} days.

Figure 1. Data structure of an event study
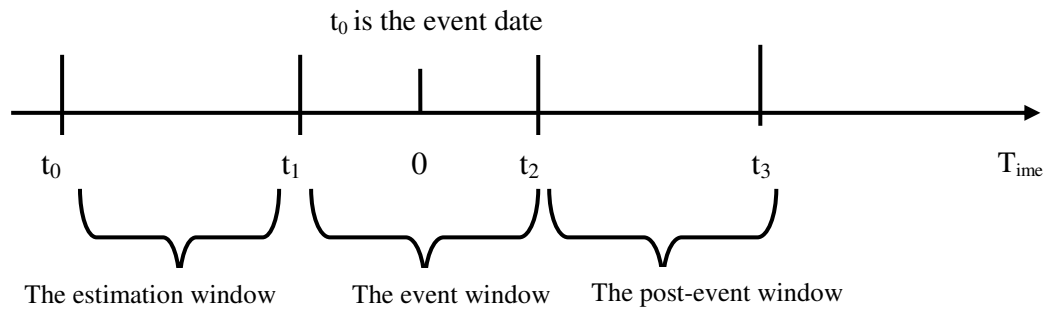
Source: Selmi et al. (2022).

2.2. The estimation procedure

Several techniques have been used in event studies to calculate the abnormal returns (*ARs*). These include the market model, the net-of-market return, and the equilibrium asset pricing model. Dyckman et *al.* (1984) compared the efficacy of three models and found that the market model provides better findings. Accordingly, the OLS market model is performed to determine the expected returns. We, thereafter, compare those expected returns to actual returns to find abnormal returns. The market model supposes that the only driving force of the return on stock *i*, at time *t*, is the return on the market at time *t*, denoted as:

$$E(R_{it}) = \alpha + \beta R_{mt} \qquad (1)$$

Where α and β correspond, respectively, to the intercept and the slope coefficients of the OLS regression model; R_{mt} refers to the rate of return on the benchmark index (*MSCI World*[2]) on day *t*.

The market model predicts what the return should be on the stock under normal states. This is measured by the difference between actual and predicted returns at each point in time during the event window to derive the daily abnormal returns. The event window under study is -10 to +10 relative to the announcement at day 0. The abnormal return, AR_{it} , is expressed as follows:

$$AR_{it} = R_{it} - E(R_{it}) \qquad (2)$$

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[2] For more details about this index, you can refer to this link: https://www.msci.com/documents/10199/178e6643-6ae6-47b9-82be-e1fc565ededb

Where AR_{it} is the abnormal return on index i on day t; R_{it} is the actual return on index i on day t; $E(R_{it})$ is the normal return on the index i on day t.

The abnormal returns of each day and for each of the indices under study are aggregated to examine the common response of stocks to the stimulus announcement date. This aggregation is for the 21 days event window. The aggregated abnormal daily returns are then divided by the sample size N to obtain the average abnormal return as follows:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \qquad (3)$$

Where AAR_t is the Average Abnormal Return on day t, N is the number of industries included in the index.

These *AARs* are then employed to determine the cumulative average abnormal return (*CAARs*) for the event window as follows:

$$CAAR_t = \sum_{i=1}^{T} AAR_t \qquad (4)$$

To test for significance of *AARs* and *CAARs*, we determine the standard deviation of the abnormal returns for the estimation period:

$$\sigma_{i,e} = \sqrt{\frac{\sum_{-120}^{-21}(AR_{it}-AAR_e)^2}{n}} \qquad (5)$$

Where $\sigma_{i,e}$ is the estimation period standard deviation of daily returns; AAR_e corresponds to the average abnormal return of index i; n refers to the number of days in the estimation period.

The aggregate estimation period standard deviation, $\sigma_{N,e}$, is measured as follows:

$$\sigma_{N,e} = \sqrt{\frac{\sum_{i=1}^{N}\sigma_{i,e}^2}{N^2}} \qquad (6)$$

The t-statistics for *AARs* are determined by dividing the *AARs* by the aggregate estimation period standard deviation of the daily returns.

$$AAR_t t = \frac{AAR_t}{\sigma_{N,e}} \qquad (7)$$

The t-statistics for *CAARs* are determined using the following formula:

$$CAAR_t t = \frac{CAAR_t}{\sigma_{N,e}\sqrt{N_{t+1}}} \qquad (8)$$

Where $CAAR_t$ denotes the cumulative average abnormal return on day t; N_{t+1} refers to the absolute value of event day t plus 1.

To assess the abnormal returns of the MSCI ACWI IMI Plastics following CE policy statements from several governments, we consider the period spanning between November 2016 and January 2025. For a complete description of the MSCI Plastics Transition index methodology and the data, please see https://www.msci.com/index-methodology. This recently developed index includes large, mid and small-cap securities across 23 developed markets and 24 emerging markets countries. It applies exclusions criteria to screen companies that are not considered aligned with major goals of protecting plastic waste and halting plastic pollution.

Figure 1. The evolution of MSCI ACWI IMI Plastics Transition share prices

Source: https://www.msci.com/index-methodology.

We transform the variable of interest by taking natural logarithms to correct for potential heteroskedasticity. Then, we first-difference the time series studied to generate daily changes in MSCI Plastics Transition price index (*MSCI PTI*). The descriptive statistics of return series included in the analysis are displayed in Table 1. Our preliminary results reveal that the returns of the focal variable exhibit negative skewness. The Jarque-Bera test indicates that the *MSCI PTI* returns are non-normal.

Table 1. Descriptive statistics for return series

	Mean	*Std. Dev.*	*Skewness*	*Kurtosis*	*JarqueBera*
MSCI PTI	0.0398	2.4561	-0.8941	3.8892	134.62 ***

Notes: Std. Dev. corresponds to the standard deviation. *** indicates the rejection of the null hypothesis of normality at the 1% significance level.

3. Main findings

Using an event study methodology, we try to address whether the governments' CE policy announcements have had a game-changing role in accelerating businesses awareness about material circularity and the sustainable use of plastics. To do so, we look at the responses of the Plastics Transition share prices including large, mid and small-cap securities across 23 developed markets and 24 emerging markets countries in terms of circularity and sustainability to different circular economy policy announcement dates. Table 2 reports the cumulative abnormal returns of the MSCI ACWI IMI Plastics Transition price index prior to and after various governments' announcements including CE initiatives, action and strategy plans and anti-waste laws. It is shown that all companies respond positively and significantly to circular economy policy announcements. This outcome is consistent with Chang et al. (2015). By delving into the experience of China, the authors find that the government' environmental policies exert a significant impact on firms' environmental performance. Our findings also corroborate Selmi et al. (2022)'s results revealing that governments' green policy announcements affect business sustainability transition in emerging and developed countries. Our results are also in line with Borghesi et al. (2022) showing the presence of

positive cumulative abnormal returns both in the green and brown sectors following green policy-related announcements made by major European governments in 2020.

However, we notice that the investigated companies react more to CE action and strategy plans consisting of incorporating the product's whole life cycle into the waste management system (Australia, Danemark, and EU). Also, the governments' CE initiatives introducing legislative and non-legislative measures targeting areas have led to a decline in systematic risk for the plastic transition index (in particular, the case of the EU). Not surprisingly, each initiative by the European Union clearly identified the direction of circular solutions proposed in accordance with the waste hierarchy: i) limiting waste generation via re-use of products; and ii) mitigating mixed waste and increasing preparation for re-use or recycling of waste by enhancing separate collection. Overall, the announced EU circular economy initiatives highlight that the concept of the CE at the European Union has moved beyond a focus on plastics waste and towards tackling more priorities embedded in the waste hierarchy, including reducing and reusing products (Watkins and Meysner, 2022). It is also noticed that the reactions of companies to different CE policy announcement is relatively moderate, except for Australia, Danemark, France, and Germany. This can be explained by the fact that many developed and emerging countries still lack effective institutional arrangements and accurate data to achieve a coherent CE transition. In addition, the extent of private sector involvement in planning and policy stages is conditional on the intensity of interlinks between public and private sectors within a country. Nevertheless, many economies have enlisted private sector cooperation to spur recycling and address plastic pollution, and the role played by the private sector seemingly increases in the transition to a circular economy (OECD, 2019).

As the volatility clustering and leptokurtosis are widely observed in stock returns series (Brockett et al., 1999), one can cast doubt on the way abnormal returns are measured in standard event studies. We, therefore, carry out a market model which controls for GARCH effects to reflect the heteroskedastic behavior of the error variance over time. In doing so, the obtained outcomes remain fairly robust (see Table A1 in the Appendix).

Table 2. The responses of the MSCI Plastics Transition price index to governments' circular economy policy announcements (the cumulative abnormal returns)

	Germany t_0: Jan1, 2019	South Africa t_0: Jan20, 2020	France t_0: Jan1, 2019	EU t_0: Mar11, 2020	UK t_0: July 30, 2020	Australia t_0: Dec 15, 2020	China t_0: July 7, 2021	Danemark t_0: July 20, 2021	US t_0: Nov 15, 2021	India t_0: July1, 2022	Canada t_0: June 19, 2023	Brazil t_0: June 17, 2024
-10	0.043**	0.009**	0.017**	-0.010	-0.104	0.011*	0.013*	0.004*	-0.007*	0.045	-0.024*	-0.016*
-5	0.028*	0.015*	0.092	0.016**	0.093	0.004**	0.010**	0.011	0.041	-0.012**	-0.019	-0.009**
-2	-0.019	0.011**	0.020*	0.025*	0.005**	0.006*	0.128	0.008**	-0.011*	-0.010*	-0.02**	0.001*
0	0.032**	0.019**	0.024**	0.022***	0.013*	0.024	0.017**	0.034	0.014*	-0.006**	-0.004*	0.010
+2	0.067**	0.023*	0.008*	0.031*	0.010**	0.009**	0.021*	0.012*	0.016**	-0.011*	0.009*	0.004*
+5	0.081***	-0.061	0.041**	0.039**	0.019*	0.017**	0.019**	0.017**	-0.039	0.008***	0.01**	0.011***
+10	0.069*	0.022**	0.052*	0.045**	0.007*	0.031*	0.016*	0.035***	0.018**	0.014**	0.034	0.010**

Notes: t_0: the announcement or the event date; *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

After calculating the cumulative abnormal returns of the MSCI ACWI IMI Plastics Transition index including large, mid and small-cap securities across 23 developed and 24 emerging markets due to various governments circular economy policy announcements (including initiatives, strategy and action plans, and anti-waste laws), the changes in the short-term systematic risk following these governments' announcements are summarized in Table 3. The systematic risk, also dubbed β in Equation (1), is a measure of stock's large changes in relation to the broad market (*MSCI World*). It reflects the relative risk exposure of holding

a particular stock in relation to the entire market. Investors can mitigate their sensitivity to systematic risk by measuring the MSCI Plastics Transition stock's Beta. The results indicate that the different governments' circular economy policy announcements have yielded to decline in systematic risk for these companies, with large extent for the European Union.

Table 3. Changes in short-term systematic risk (β) of the MSCI Plastics Transition companies following the governments' circular economy policy announcements

	Germany t_0: Jan1, 2019	South Africa t_0: Jan20, 2020	France t_0: Jan1, 2019	EU t_0: Mar11, 2020	UK t_0: July 30, 2020	Australia t_0: Dec 15, 2020	China t_0: July 7, 2021	Danemark t_0: July 20, 2021	US t_0: Nov 15, 2021	India t_0: July1, 2022	Canada t_0: June 19, 2023	Brazil t_0: June 17, 2024
(1)	0.161**	0.181*	0.234*	0.134***	0.181	0.169**	0.141**	0.152***	0.138*	0.192**	0.098**	0.134**
(2)	0.110**	0.155**	0.189	0.087*	0.149**	0.151***	0.136*	0.111**	0.144*	0.161***	0.113	0.129*
(3)	0.081*	0.110***	0.096**	0.056**	0.135**	0.101*	0.092**	0.071***	0.127**	0.133**	0.081**	0.095**

Notes: (1): Beta prior to the governments' circular economy policy announcement; (2): the immediate risk; (3): the Beta post-the governments' announcements; t_0: the announcement or the event date; *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

4. Conclusions and some policy implications

Plastics are a strategically important material for developed and emerging economies, with applications in almost every sector. Due to unsustainable production, use, and disposal, plastic pollution has become a severe threat to natural ecosystems and sustainability. Globally, 9% of plastic waste has ever been recycled, 12% incinerated, and 79% has accumulated in natural ecosystems (Walker and Fequet, 2023). Aware of the severity of climate and nature crises and the challenge of plastic waste, the present research assesses how publicly announced circular economy policies affect the businesses' engagement against plastic waste by promoting reuse, return, and recycling.

Our results reveal that governments' circular economy policy announcements exert a positive and significant impact on the performances of companies in terms of material circularity and the sustainable use of plastics. These companies are likely to be more reactive to the Circular Economy Action Plans supplemented with a waste management plan. Therefore, the CE policy announcements provide an incentive for businesses to coalesce circularity considerations into their products, and in turn can be one of the effective ways to accelerate a solution-driven approach to the circularity and climate goals of a sustainable plastics industry. Moreover, it is noticed that the European Union governments' initiatives introducing both legislative and non-legislative measures have yielded to a sharp decrease in systematic risk for the plastic transition index. CE and plastics waste policies are widely perceived as a complex landscape, with developed, emerging and global economies' dimensions to be considered. Because of this complexity, it seems highly prominent to account for both legislative and non-legislative measures that will help to accelerate the transition to a circular, net zero plastics and efficient resource management system. However, according to Friant et al. (2021), the European Union is sending a signal to remain a global leader in environmental policymaking, while doing little to disrupt linear business-models. This underscores that public communication alone cannot bring about the necessary plastic transition and is not always the most effective tool to use. Nevertheless, when employed alongside other policy tools (including taxes or regulations), communication can be an appropriate policy tool that can yield to a better implementation of circular economy policies. Ultimately, countries should strengthen international cooperation for the dissemination of policies and good practices for CE and appropriate waste management practices (OECD,

2019). The second inauguration of Donald Trump as the president of the United States, represents a step away from a focus on international collaborative efforts to solve the plastics pollution. The US President has recently announced America's second withdrawal from the Paris Agreement, and signed an executive order ending a US government effort to replace plastic straws with paper. Future research will address how such successive US government' announcements impact recycled materials and the transition to circular economy.

One of the major limitations of this work is that the state of implementation of the CE policies for the developed and emerging economies under study has not been examined as the circular economy policies are so recent that it is too early to effectively quantify their outcomes. Even though the aggregate stock market may be responsive to CE policy announcements, companies in certain sectors or with specific properties may have distinct reactions in terms of the sustainable use of plastics. Despite our awareness of the relevance of conducting such an analysis, the disaggregated data of this newly developed transition index is still unavailable.

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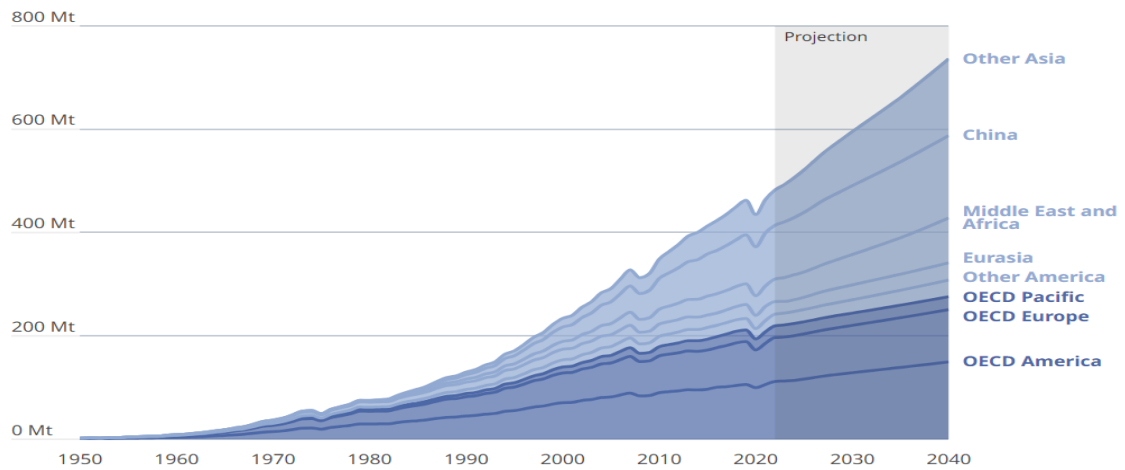
Appendix

Figure A1. Evolution of materials use and GDP
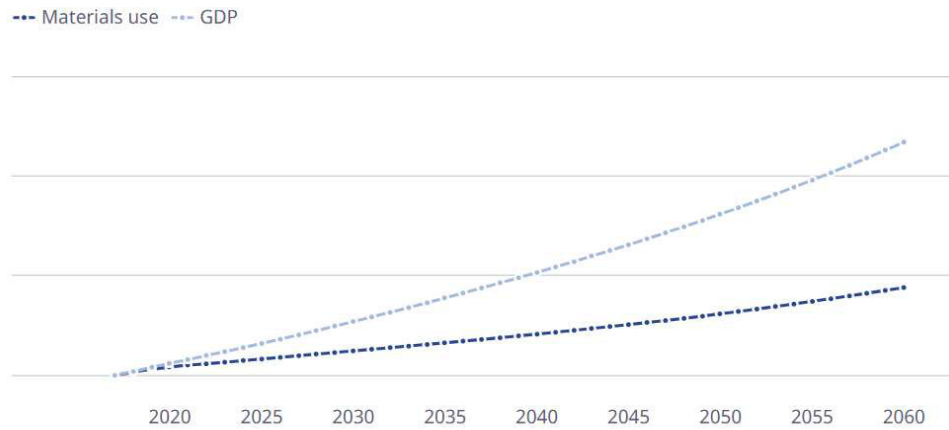
Source: OECD (2019), Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, OECD Publishing, Paris, https://doi.org/10.1787/9789264307452-en.

Figure A2. Plastics use projections from 2022

Source: OECD (2024), Policy Scenarios for Eliminating Plastic Pollution by 2040.

Table A1. The responses of the MSCI Plastics Transition price index to governments'
circular economy policy announcements (Control for GARCH effects)

	Germany t0: Jan1, 2019	South Africa t0: Jan20, 2020	France t0: Jan1, 2019	EU t0: Mar11, 2020	UK t0: July 30, 2020	Australia t0: Dec 15, 2020	China t0: July 7, 2021	Danemark t0: July 20, 2021	US t0: Nov 15, 2021	India t0: July1, 2022	Canada t0: June 19, 2023	Brazil t0: June 17, 2024
-10	0.056*	-0.054	-0.084	0.441	-0.111	0.005**	0.010**	0.014	0.003**	0.041	-0.013*	-0.011**
-5	-0.123	0.012**	0.011**	0.008***	0.010*	0.013*	0.004**	0.002*	0.007**	-0.111	-0.011*	0.003**
-2	0.067	0.014*	0.035	-0.127	0.016	0.099	0.000*	0.005***	-0.001*	-0.008**	0.001**	0.006**
0	0.044*	-0.106	0.014**	0.019*	0.011**	-0.110	0.011*	0.011*	0.010**	-0.003*	0.003**	0.011**
+2	-0.073	0.019**	0.017**	0.028**	0.008**	0.015**	0.017*	0.018**	0.019*2	0.001**	0.010**	0.004*
+5	0.092**	0.013*	0.028*	0.103	0.013***	0.023**	0.010**	0.029***	0.016*	0.013**	0.014*	0.033
+10	0.074**	0.034***	0.049**	0.059*	0.014*	0.040***	0.015**	0.032*	0.021*	0.017***	0.012**	0.015***

Notes: All regressions are controlled for heteroscedasticity; t0: the announcement or the event date; *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively.