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# Finance Research Letters

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## Do business models matter? Evidence from the SRI companies performance and the COVID-19 pandemic

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### ABSTRACT

Business models of companies are rarely analysed in the context of their financial performance, so little is known about how much they should actually matter in the decision-making processes of investors. In this study, we examine the performance of the SRI stocks portfolios in the US market, which are divided into four main business models types. Our results evidence that Brokers business model clearly outperformed the market in the whole period from February 2016 to January 2021. However, when the entire sample is divided into the pre-COVID-19 sub-sample and COVID-19 sub-sample, the outperformance and underperformance effects among the SRI firms disappeared during the COVID-19 pandemic period.

*JEL codes:* G1, G11, G15, Q56, L10, M1, M14.

### 1. Introduction

Financial analysts, stock market investors and academics alike have been interested in how socially responsible investment (SRI) affects financial performance. The meta-analyses conducted by e.g. [Revelli and Viviani \(2013\)](#) and [Revelli and Viviani \(2015\)](#) show, however, inconclusive results and paint a very mixed picture in that regard. On the other hand, corporate business models have rarely been investigated in the context of their financial performance, in particular using stock market data and the SRI lens. Therefore, little is known from the existing literature about how much they actually matter and whether SRI investors or financial analysts should pay attention to firms' business models (BMs) in their investment decisions.

In this study, we investigate the performance of SRI stocks portfolios in the US market. SRI is referred to as ethical, socially conscious or sustainable investment. It is an investment strategy that is focused on the social and environmental benefits along with the financial return and it seeks to link environmental, social and corporate governance (ESG) concerns to financial outcomes.

Given that socially responsible investing takes non-financial concerns extensively into account in the decision-making processes [Yan et al. \(2019\)](#), this approach means that ESG criteria are used in addition to purely financial measures when making investment decisions ([Talan and Sharma, 2019](#); [Widyawati, 2020](#)). One explanation for why SRI may be successful as a strategy calls on slack resources theory, which proposes that the positive financial performance experienced by companies through SRI gives the firm additional resources to engage further in socially responsible behaviours (see [Ullmann, 1985](#); [McGuire et al., 1988](#); [Waddock and Graves, 1997](#)). Another theoretical foundation is the instrumental stakeholder theory, which postulates that companies adopt SRI

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attitudes and strategies in order to satisfy their stakeholder groups (see [Freeman and Evan, 1990](#); [Hill and Jones, 1992](#); [Jones, 1995](#); [Clarkson, 1995](#)). There exist also other ‘mediating effects’, which provide further theoretical perspective for the explanation of patterns in SRI companies financial performance (see a wider discussion in [Brzezczynski and McIntosh, 2014](#)). However, while there is an increasing number of studies on SRI, the overall picture regarding the financial performance of such investment strategies remains unclear ([Revelli and Viviani, 2013](#); [Revelli and Viviani, 2015](#); [Avetisyan and Hockerts, 2017](#); [Friede, 2019](#); [Widyawati, 2020](#)).

In this paper, we focus on SRI companies, which we categorize within the SRI stocks portfolios into different business models types based on the classification proposed by [Weill et al. \(2011\)](#). The framework described in [Weill et al. \(2011\)](#) is the one that investors prefer in contrast to other business model frameworks that are favoured by, for example, entrepreneurs ([Osterwalder et al., 2005](#)). In consequence, we distinguish four distinct business models, namely: Creators, Distributors, Landlords and Brokers. Subsequently, we examine their performance on the US stock market over the 5-year period from 2016 to 2021. This sample also allowed us to identify changes in performance between the pre-COVID-19 period and COVID-19 period.

The paper is organised as follows. [Section 2](#) contains a concise literature review about business models, [Section 3](#) provides a description of data and methodology, [Section 4](#) reports the results and presents their discussion and [Section 5](#) concludes.

## 2. Literature review

The COVID-19 pandemic has been harmful for financial markets ([Yousfi et al., 2021](#); [Szczygielski et al., 2021](#); [Managi et al., 2022](#); [Szczygielski et al., 2022a](#); [Szczygielski et al., 2022b](#)). ESG investing, which is considered to be a part of wider SRI ([Avetisyan and Hockerts, 2017](#); [Friede, 2019](#)), and responsible investments more broadly defined, were not protected either against financial losses during the COVID-19 period ([Folger-Laronde et al., 2020](#)). This situation raises the question of whether other factors, such as the type of business models adopted by firms, may shed more light on what leads to resilience during a pandemic-level crisis.

The academic literature about how companies, and in particular the SRI firms, perform depending on their business models is scarce. However, the discussion about the role of business models is gradually intensifying and it has already become an important element of the debates about the future of business, in particular banks and other financial institutions, in a post-COVID-19 world ([Haskel, 2021](#)).

At a basic level, BMs identify how firms create and capture value ([Chesbrough, 2007](#); [Zott and Amit, 2010](#); [Zott et al., 2011](#); [Foss and Saebi, 2017](#); [Battistella et al., 2017](#)) in the systems and markets where they operate ([Boons and Lüdeke-Freund, 2013](#); [Ehret et al., 2013](#); [Lecocq et al., 2006](#)). Scholars have suggested a wide variety of strategic uses for BMs, such as a tool to understand business strengths ([Massa et al., 2017](#)) and firm activities ([Spieth et al., 2014](#)), to innovate toward greater sustainability ([Geissdoerfer et al., 2018](#); [Lüdeke-Freund, 2010](#); [Press et al., 2020](#)) and to commercialize innovations ([Teece, 2010](#); [Zott et al., 2011](#)). However, as the interest in BMs has increased, none of the approaches to defining the elements of BMs or the strategic use for BMs has gained prominence ([Jensen, 2013](#); [Weking et al., 2020](#)). There is a general consensus that BMs include different building blocks ([Osterwalder et al., 2005](#)) that work together as a whole. In the review of BM research, [Zott et al. \(2011\)](#) found a few commonalities across the available literature. First, the BM is a unit of analysis in its own right, separate from the product, organization or industry. Second, BM research emphasizes a systemic point of view to explain how a firm does business. That is, the BM affects how an organization is set up and managed affects how BMs are conceptualized; and the BM explains how value is both created and captured. There exist different approaches to defining what a BM is and what being clear about a BM can do for a company.

Some scholars have also identified a functional role for BMs. In this view, the BM is used as a strategic management tool ([Jensen, 2013](#)) to understand how a company operates in a market or ecosystem and how it interacts with its strategic partners and customers ([Osterwalder et al., 2005](#); [Chesbrough, 2007](#)). Used this way, a BM can drive strategy development and among entrepreneurs and it can be exploited as a narrative tool to help clarify the purpose and structure of the company ([Lecocq et al., 2010](#)). Other applications of BMs include a more systemic view ([Jensen, 2013](#)) that explores how a company innovates and adjusts to its environment ([Amit and Zott, 2011](#)).

The BMs can also be focused on the assets of an organization and how they are managed to create value ([Weill et al., 2011](#)). The approach proposed by [Weill et al. \(2011\)](#) identifies different asset types, such as financial assets (which include cash, stocks, bonds, insurance policies, etc.), physical assets (which include durable and consumable items), intangible assets (such as intellectual property, knowledge and brand value) and human assets (which include e.g. employee time). Furthermore, they distinguish four ways in which the assets rights are managed: Creators transform or assemble raw materials into products that are then sold, Distributors sell products that they bought but did not create or transform in a substantial way, Landlords sell use rights for a specific period of time, including those for intellectual property, and Brokers match buyers with sellers without taking ownership of products. Following [Weill et al. \(2011\)](#) we adopt the use of asset rights management approach in our research (as it is preferred by financial investors in contrast to other business model frameworks favoured by e.g. entrepreneurs).

## 3. Data and methodology

In this section, we first discuss the data used in our study and, subsequently, we outline the methodology.

Our data sample covers the period of 5 years from February 2016 until January 2021 and the data frequency is monthly. We investigated the performance of portfolios composed of SRI stocks from the US stock market, which were divided into four business model groups. The SRI companies were identified from the ‘Global 100 Most Sustainable Corporations in the World’ list (known also as: ‘Global-100 list’), which served as a source of the SRI stocks selection. Global-100 list provides classification of international socially responsible firms compiled by Corporate Knights Inc. The new Global-100 list is published annually during the World Economic

**Table 1**  
Companies and classification of their business models.

Company	Business Models
Adobe Systems	Brokers
Agilent Technologies	Landlords
Apple	Creators
Applied Materials	Creators
Biogen	Creators
Cisco Systems	Creators
Coca-Cola Enterprises	Distributors
Ecolab	Creators
EMC (DELL)	Landlords
General Electric	Landlords
General Mills	Distributors
Hewlett-Packard Company	Creators
Intel	Creators
Johnson & Johnson	Creators
Johnson Controls	Creators
Prologis	Brokers
Prudential Financial	Landlords
Varian Medical Systems	Creators

Forum (WEF) in Davos at the end of January and it is freely available.<sup>1</sup>

As our sample period covers 5 years, and this sample length is typically determined by the conventionally used historical period in estimations of Fama-French and Carhart models, we selected the US companies from the Global-100 list published in January 2016, which contained 18 firms from the US market.

Table 1 presents all companies in our sample and indicates their business models. We assigned the specific business models to all 18 firms as follows. After reviewing the different ways in which business models have been conceptualized, we decided to classify companies in terms of the asset management approach, which they use for generating a profit. Because we want to connect business model classification to stock performance, it made sense to choose a business models classification framework that defines the type of business according to the approach to profit generation. Specifically, we chose to use the business models laid out in Weill et al. (2011), which focus on the ways companies manage assets to generate revenue. Following Weill et al. (2011), we categorized companies into four groups: *Creators* (i.e. firms that transform or assemble raw materials into products), *Distributors* (i.e. firms that sell products that they bought, i.e. did not create them), *Landlords* (i.e. firms that sell use rights for a period of time, including IP) and *Brokers* (i.e. firms that match buyers and sellers without taking ownership of products).

In order to classify the 18 companies into these four business models, we first analysed the revenue-generating activities of each firm. Most of the companies in our sample fit clearly into one business model. Next, we examined which companies have revenue-generating activities across more than one business model classification and we investigated their activities across the different market segments where they operate to identify their primary area of profit generation. Firms were then classified in their primary area of profit generation.

We assessed the performance of portfolios composed of companies representing different business models by employing first the Fama-French three-factor model (Fama and French, 1992, 1993):

$$R_{pt} - R_{ft} = \alpha_p + \beta_{1p}RMRF_t + \beta_{2p}SMB_t + \beta_{3p}HML_t + \varepsilon_{pt} \quad (1)$$

where  $R_{pt}$  is the return of the respective business model stocks portfolio in period  $t$ ,  $R_{ft}$  is the risk-free return in period  $t$ ,  $R_{mt}$  is the return of the S&P500 stock index in period  $t$  and  $RMRF_t = R_{mt} - R_{ft}$ ,  $SMB_t$  is the difference in returns between small-cap and large cap portfolios in period  $t$ ,  $HML_t$  is the difference in returns between high book-to-market stocks (i.e. value stocks) and low book-to-market stocks (i.e. growth stocks) in period  $t$  and  $\varepsilon_{pt}$  is the error term.<sup>2</sup> We further estimated the Carhart (1997) four-factor model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{1p}RMRF_t + \beta_{2p}SMB_t + \beta_{3p}HML_t + \beta_{4p}MOMENTUM_t + \varepsilon_{pt} \quad (2)$$

where  $MOMENTUM_t$  variable is defined as the difference in returns between stocks classified as those that have strong momentum and stocks classified as those that have weak momentum and the Fama-French five-factor model (2015):

<sup>1</sup> See: <https://www.corporateknights.com/rankings/global-100-rankings/>

<sup>2</sup> Research on socially responsible investing, often signalled by the environmental, social and corporate governance (ESG) criteria, is riddled with such challenges as inconsistency, reliability and transparency (Talan and Sharma, 2019; Widyawati, 2020). Systematic reviews of this line of literature show that the performance of ESG funds is affected by how it is measured and by the context of measurement, so the actual performance outcomes are often unclear (Widyawati, 2020; Busch et al., 2016). While legitimacy for SRI investing comes from various ESG rating agencies, the actual SRI stocks classifications and measurement of their performance may be problematic (Giamporcaro and Gond (2016), Jun (2016)). We address these issues in our study by: (1) Using reliable data about the classification of SRI companies based on the well established and broadly respected Global-100 list and (2) Employing factor models (Fama-French and Carhart models along with their extensions), which control for various external influences and are widely accepted as reliable performance evaluation tools for assessment of stocks portfolios.

**Table 2**

Returns and Modified Sharpe Ratio (MSR) for portfolios of stocks composed of Creators, Distributors, Landlords and Brokers business models companies.

<b>Returns</b>				
	<b>Business Models</b>			
	<b>Creators</b>	<b>Distributors</b>	<b>Landlords</b>	<b>Brokers</b>
Full sample: 2016.02 - 2021.01	157.68%	7.50%	90.83%	288.09%
Sub-samples				
- Pre-Covid period: 2016.02 - 2019.11	93.96%	9.39%	46.04%	189.61%
- Covid period: 2019.12 - 2021.01	24.98%	-0.43%	19.37%	30.47%
Sub-samples				
- Pre-Covid period: 2016.02 - 2019.12	102.45%	11.87%	51.93%	197.94%
- Covid period: 2020.01 - 2021.01	20.13%	-2.27%	15.48%	27.44%
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.01	102.49%	14.24%	47.65%	214.64%
- Covid period: 2020.02 - 2021.01	20.54%	-3.15%	16.69%	20.88%
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.02	88.32%	5.67%	28.65%	200.37%
- Covid period: 2020.03 - 2021.01	29.34%	4.29%	34.50%	27.69%
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.03	66.91%	-1.76%	13.17%	180.34%
- Covid period: 2020.04 - 2021.01	47.55%	9.46%	59.18%	36.28%
<b>Modified Sharpe Ratio (MSR)</b>				
	<b>Business Models</b>			
	<b>Creators</b>	<b>Distributors</b>	<b>Landlords</b>	<b>Brokers</b>
Full sample: 2016.02 - 2021.01	0.3308	0.0405	0.1463	0.4648
Sub-samples				
- Pre-Covid period: 2016.02 - 2019.11	0.3557	0.0473	0.1314	0.4964
- Covid period: 2019.12 - 2021.01	0.2860	0.0216	0.1838	0.3647
Sub-samples				
- Pre-Covid period: 2016.02 - 2019.12	0.3691	0.0574	0.1405	0.4994
- Covid period: 2020.01 - 2021.01	0.2566	0.0000	0.1692	0.3534
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.01	0.3622	0.0643	0.1389	0.5157
- Covid period: 2020.02 - 2021.01	0.2726	-0.0001	0.1760	0.2992
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.02	0.3143	0.0224	0.0759	0.4712
- Covid period: 2020.03 - 2021.01	0.3925	0.1048	0.3491	0.4256
Sub-samples				
- Pre-Covid period: 2016.02 - 2020.03	0.2410	0.0000	0.0103	0.4255
- Covid period: 2020.04 - 2021.01	0.7370	0.2220	0.8266	0.6337

Note: Highlighted cells indicate the highest results in the given period.

$$R_{pt} - R_{ft} = \alpha_p + \beta_{1p}RMRF_t + \beta_{2p}SMB_t + \beta_{3p}HML_t + \beta_{4p}RMW_t + \beta_{5p}CMA_t + \varepsilon_{pt} \quad (3)$$

where  $RMW_t$  variable is defined as the difference between the returns of diversified portfolios of stocks with robust and weak profitability and  $CMA_t$  variable is the difference between the returns of diversified portfolios of stocks of low and high investment firms.

We additionally extended the Fama-French five-factors model to the six-factors model version by adding the momentum factor to its specification:

Table 3

Estimation results for the portfolio of stocks composed of Creators, Distributors, Landlords and Brokers business model companies.

A. Estimation results for the portfolio of stocks composed of Creators business model companies.			
	Fama-French three-factor model	Carhart model	Fama-French five-factor model
$\alpha_p$	0.002250 (0.727428)	0.002258 (0.727970)	0.002335 (0.744024)
$RMRF_t$	0.916171 *** (13.16815)	0.894937 *** (12.05011)	0.924381 *** (11.59206)
$SMB_t$	0.055519 (0.468636)	0.033079 (0.271574)	0.008295 (0.061624)
$HML_t$	-0.084082 (-0.854954)	-0.120788 (-1.118451)	-0.032364 (-0.283071)
$MOMENTUM_t$	-	-0.000813 (-0.833779)	-
$RMW_t$	-	-	-0.185593 (-0.877656)
$CMA_t$	-	-	-0.141859 (-0.714855)
	$R^2 = 0.796397$ $Q(10) = 8.1412$	$R^2 = 0.798938$ $Q(10) = 7.4560$	$R^2 = 0.800931$ $Q(10) = 8.2576$
	$LM(10) = 10.18955$	$LM(10) = 10.37009$	$LM(10) = 7.863576$
B. Estimation results for the portfolio of stocks composed of Distributors business model companies.			
	Fama-French three-factor model	Carhart model	Fama-French five-factor model
$\alpha_p$	-0.006525 (-1.614596)	-0.006505 (-1.632604)	-0.007111 * (-1.859219)
$RMRF_t$	0.703528 *** (7.740310)	0.650775 *** (6.821203)	0.706947 *** (7.274628)
$SMB_t$	-0.647754 *** (-4.185389)	-0.703503 *** (-4.496141)	-0.529123 *** (-3.225590)
$HML_t$	0.048523 (0.377672)	-0.042669 (-0.307562)	-0.149093 (-1.070057)
$MOMENTUM_t$	-	-0.002020 (-1.612486)	-
$RMW_t$	-	-	0.506846 * (1.966764)
$CMA_t$	-	-	0.591982 ** (2.447847)
	$R^2 = 0.524567$ $Q(10) = 6.6051$	$R^2 = 0.546028$ $Q(10) = 6.7200$	$R^2 = 0.595482$ $Q(10) = 7.1706$
	$LM(10) = 4.154344$	$LM(10) = 5.052884$	$LM(10) = 4.349930$
C. Estimation results for the portfolio of stocks composed of Landlords business model companies.			
	Fama-French three-factor model	Carhart model	Fama-French five-factor model
$\alpha_p$	-0.003819 (-0.833960)	-0.003240 (-0.780702)	-0.003169 (-0.641457)
$RMRF_t$	1.044608 *** (11.17547)	0.913342 *** (9.192994)	1.006612 *** (10.45266)
$SMB_t$	0.107310 (0.554201)	0.066356 (0.407238)	0.132672 (0.660123)
$HML_t$	0.241706 (1.340456)	0.111901 (0.774555)	0.314022 * (1.754251)
$MOMENTUM_t$	-	-0.003994 *** (-3.061135)	-
$RMW_t$	-	-	-0.031199 (-0.112443)
$CMA_t$	-	-	-0.272194 (-0.844760)
	$R^2 = 0.747636$ $Q(10) = 4.8146$	$R^2 = 0.786297$ $Q(10) = 9.8684$	$R^2 = 0.750544$ $Q(10) = 5.9962$
	$LM(10) = 15.67622$	$LM(10) = 9.295696$	$LM(10) = 15.06001$
D. Estimation results for the portfolio of stocks composed of Brokers business model companies.			
	Fama-French three-factor model	Carhart model	Fama-French five-factor model
$\alpha_p$	0.007153 * (1.821379)	0.007146 * (1.809061)	0.008124 ** (2.264965)
$RMRF_t$	0.956819 *** (10.83290)	0.976174 *** (10.32207)	0.918669 *** (10.07978)
$SMB_t$	-0.233788 (-1.554482)	-0.213334 (-1.375445)	-0.318316 ** (-2.069088)
$HML_t$	-0.375609 *** (-3.008461)	-0.342151 ** (-2.488019)	-0.134242 (-1.027320)
$MOMENTUM_t$	-	0.000741 (0.596822)	-
$RMW_t$	-	-	-0.421474 * (-1.743876)
$CMA_t$	-	-	-0.771806*** (-3.402921)
	$R^2 = 0.692784$ $Q(10) = 6.7539$	$R^2 = 0.694761$ $Q(10) = 7.3319$	$R^2 = 0.756537$ $Q(10) = 7.4697$
	$LM(10) = 4.648699$	$LM(10) = 4.679467$	$LM(10) = 4.912107$

Notes: (1) Statistical significance is denoted as follows: \* - significant at 10% level, \*\* - significant at 5% level and \*\*\* - significant at 1% level.

(2)  $t$ -statistics are reported in brackets.

$$R_{pt} - R_{ft} = \alpha_p + \beta_{1p}RMRF_t + \beta_{2p}SMB_t + \beta_{3p}HML_t + \beta_{4p}RMW_t + \beta_{5p}CMA_t + \beta_{6p}MOMENTUM_t + \varepsilon_{pt} \quad (4)$$

All the factors for the construction of models (1) to (4) were obtained directly from Kenneth French website<sup>3</sup> and the source of the stock prices for all our 18 companies was Bloomberg.

The key advantage of the analysis relying on factor models outlined above is that it takes into account possible influences of firms' characteristics, such as company size, profitability and investments profiles, types of stocks (value or growth), but also stock price momentum effects etc., thus naturally allowing to control for various firm-specific attributes.

In all models we tested for autocorrelation and heteroscedasticity as well as we checked possible multicollinearity.

Below we present the results of our empirical analysis.

<sup>3</sup> Available at: [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\\_library.html#Research](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research)

**Table 4**

Estimation results for  $\alpha_p$  parameter from the Fama-French five-factor model for portfolios of stocks composed of Creators, Distributors, Landlords and Brokers business models companies in the pre-COVID-19 period and in the COVID-19 period.

	Business Models			
	Creators	Distributors	Landlords	Brokers
Pre-COVID-19 period: 2016.02 - 2019.11	0.002398	-0.008898 **	-0.004589	0.010364 ***
COVID-19 period: 2019.12 - 2021.01	-0.009435	-0.011053	-0.005785	0.006089
Pre-COVID-19 period: 2016.02 - 2019.12	0.002574	-0.008849 **	-0.004662	0.010308 ***
COVID-19 period: 2020.01 - 2021.01	-0.015323	-0.017058	-0.005730	0.006990
Pre-COVID-19 period: 2016.02 - 2020.01	0.002453	-0.008787 **	-0.004287	0.010393 ***
COVID-19 period: 2020.02 - 2021.01	-0.015814	-0.014858	-0.006473	0.004065
Pre-COVID-19 period: 2016.02 - 2020.02	0.002675	-0.007675 *	-0.005437	0.009454 ***
COVID-19 period: 2020.03 - 2021.01	-0.017732	-0.011282	0.003807	0.003595
Pre-COVID-19 period: 2016.02 - 2020.03	0.003069	-0.008077 **	-0.004723	0.009890 ***
COVID-19 period: 2020.04 - 2021.01	-0.015811	-0.010476	0.002899	0.006462

Notes: Statistical significance is denoted as follows: \* - significant at 10% level, \*\* - significant at 5% level and \*\*\* - significant at 1% level.

#### 4. Results and discussion

Table 2 presents returns as well as modified Sharpe ratio (*MSR*) values for all four portfolios of companies classified according to the distinguished business models (Creators, Distributors, Landlords and Brokers). It shows that the Brokers exhibited the best performance. In the entire sample period from February 2016 to January 2021, the Brokers portfolio recorded the return of 288.09%, while Creators, Distributors and Landlords portfolios delivered 157.68%, 7.50% and 90.83%, respectively (whereas the return of the S&P500 index during the same period was 116.61%). This pattern of outperformance is also visible when the sample is divided into pre-COVID-19 and COVID-19 periods, albeit during the COVID-19 pandemic the advantage of the Brokers decreases. The values of the modified Sharpe ratios (*MSRs*) reveal a very similar picture, which means that the pattern of performance is consistent also on the risk-adjusted basis.

Tables 3 reports estimation results from Fama-French three-factor models, Carhart models and Fama-French five-factor models.<sup>4</sup> They confirm that Brokers outperformed the market and the results are robust with respect to different model specifications. In panel B in Table 3 there is also weak evidence indicating that Distributors companies underperformed relative to the market.<sup>5</sup>

As our sample period encompasses COVID-19 pandemic, we further investigated the performance of all four business models stocks in the respective sub-periods. We selected a few alternative division dates delineating COVID-19 sub-sample ranging from 1 December 2019 to 1 April 2020 as the COVID-19 pandemic has been spreading over time. Table 4 shows that our results are robust to the choice of the division date.

The key finding from the estimates summarised in Table 4 is that the outperformance of Brokers and the underperformance of Distributors disappeared during the COVID-19 pandemic (the estimated  $\alpha_p$  parameters, obtained from the Fama-French five-factor model, which were significant in the pre-COVID-19 period, are not significant later in the COVID-19 sub-samples). This result evidences a substantial change in financial performance of the analysed companies on the stock market.

A possible explanation of this effect may be related to the dramatic change in social patterns. For example, Distributors business model firms in our sample deal in consumable physical products, whereas the radical change in work and socialization behaviour has led to an increase in consumption of certain products at home as a proxy for what used to happen while socializing or working outside the house. With an extreme focus on health, caring and schooling responsibilities, the products and services offered by Brokers firms may have been seen as frivolous or unnecessary during this period.

<sup>4</sup> We also estimated the version of the Fama-French five-factor model extended to the six-factor model by adding the momentum factor variable, however in such case the multicollinearity appeared to be an issue, so we present the results without that variant.

<sup>5</sup> Results from the factor models also show that in the analysed portfolios there were different effects present with all the estimates for factors statistically significant, although in varying combinations across particular business models. For example, in the Fama-French five-factor models, the market factor  $RMRF_t$  was significant in all cases of all four business models,  $HML_t$  factor was significant in case of Landlords model, while  $SMB_b$ ,  $RMW_t$  and  $CMA_t$  factors were significant in case of Distributors and Brokers models. These findings show the importance of controlling for such effects as e.g. small / large stocks effect (captured by  $SMB_t$  factor) and other effects measured through other factors ( $RMW_b$ ,  $CMA_t$  etc. factors).

## 5. Robustness analysis

We conducted further robustness analysis of key findings in form of the following additional investigations. First, we verified our results by performing calculations for alternative groupings of business models classifications. Second, we also checked the performance in shorter pre-COVID-19 sub-periods covering 12 months before the respective alternative starting month of the COVID-19 pandemic.<sup>6</sup>

Although most firms in our sample could be clearly classified within one business model, there were however a few other companies which may be potentially assigned to more than one group. These stocks are as follows: Cisco Systems, Hewlett-Packard Company, Johnson Controls and Intel. Therefore, we further created two alternative variants of adjusted classifications with alternative groupings that ensure more equal distribution of companies across the four business models as well as with distinguished one more new group, which includes firms with mixed business models.

Returns of portfolios for these alternative variants are reported in [Table A1](#) in the Appendix. They confirm again a dominance of the Brokers business model in all three variants. Interestingly, in case of five distinguished business models groups, the performance of stocks of firms allocated to the Mixed business models group is positioned exactly in the middle, i.e. after Brokers and Creators, which achieved better returns, and before Landlords and Distributors, which returns were worse. Hence, the structure of performance across all these groups is maintained and we can conclude that our results are robust even to the adjustments in possible other alternative allocations of companies' business models in such cases where firms' classifications could not be regarded as entirely obvious.

[Table A2](#) in the Appendix presents results for shorter pre-COVID-19 sub-periods covering always 12 months before the respective alternative starting month of the COVID-19 pandemic. They also evidence a very clear advantage of Brokers business model. In addition, the pattern of all other results is very similar regardless of the different alternative division dates between the pre-COVID-19 and COVID-19 periods, which provides further robustness check of our main findings.

## 6. Conclusions

Our results clearly indicate that when the SRI firms' performance is investigated from the point of view of their particular business models, the companies classified as Brokers (i.e. the business model relying on matching buyers and sellers without taking ownership of products) substantially outperformed other business models. However, this effect appears to have weakened during the COVID-19 sub-period. At the same time, the companies representing Distributors business model (i.e. the firms which sell products that they bought and did not create them), which severely underperformed in the pre-COVID-19 period, showed signs of improved performance in the subsequent period during the COVID-19 pandemic.

This picture demonstrates that the dramatic shift in social patterns affects BMs in different ways. Our results show that BMs have been influenced by COVID-19 crisis and they may point to new ways to think about risk exposure across a variety of extreme scenarios. The BM perspective is a new strategic approach to investment analysis that has implications for how we understand the interplay among BMs as well as performance and risk in the BM literature and management literature more broadly.

Furthermore, gaining insight into the link between BMs and stock performance has practical implications for managers in terms of their choices regarding which BMs to develop from the point of view of financial performance and resilience. As firms grow and change, strategic decisions can be made to develop those aspects of the business that focus on Brokers vs. Distributors differences in these business models. As we move forward from/with COVID-19, exploring firms performance in terms of asset management style provides a different perspective and a new set of criteria to explore what could build more resilience in increasingly volatile environments. Last but not least, the knowledge about how companies with particular business models perform on the stock market will be helpful for investors, financial analysts and fund managers to improve their investment strategies, the design of stock portfolios and stock selection rules (in particular in conjunction with the SRI criteria).

## CRedit authorship contribution statement

**Melea Press:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Janusz Brzeszczyński:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

## Appendix

<sup>6</sup> We would like to thank two anonymous Reviewers for these suggestions.



**Table A1**

Returns for portfolios of stocks composed of Creators, Distributors, Landlords and Brokers business models companies as well as for alternative portfolios.

	Business Models – Original Groupings				
	Creators	Distributors	Landlords	Brokers	-
Full sample: 2016.02 - 2021.01	157.68%	7.50%	90.83%	288.09%	-
	Business Models – Alternative Groupings				
	Creators	Distributors	Landlords	Brokers	-
Full sample: 2016.02 - 2021.01	200.87%	61.53%	88.45%	288.09%	
	Business Models – Alternative Groupings with Mixed Group				
	Creators	Distributors	Landlords	Brokers	Mixed
Full sample: 2016.02 - 2021.01	200.87%	7.50%	90.83%	288.09%	92.90%

Note: (1) The original portfolio groupings are as follows: Creators (Intel, Applied Materials, Johnson & Johnson, Biogen, Cisco Systems, Ecolab, Johnson Controls, Varian Medical Systems, Apple and Hewlett-Packard Company), Distributors (General Mills and Coca-Cola Enterprises), Landlords (Agilent Technologies, EMC (DELL), Prudential Financial and General Electric) and Brokers (Prologis and Adobe Systems). The first alternative portfolio groupings were formulated as follows: Creators (Applied Materials, Johnson & Johnson, Biogen, Ecolab, Varian Medical Systems and Apple), Distributors (General Mills, Coca-Cola Enterprises, Cisco Systems, Hewlett-Packard Company and Johnson Controls), Landlords (Agilent Technologies, EMC (DELL), Prudential Financial, General Electric and Intel) and Brokers (Prologis and Adobe Systems). The second alternative portfolio groupings – with the additionally distinguished Mixed business models group – were further formulated as follows: Creators (Applied Materials, Johnson & Johnson, Biogen, Ecolab, Varian Medical Systems and Apple), Distributors (General Mills and Coca-Cola Enterprises), Landlords (Agilent Technologies, EMC (DELL), Prudential Financial and General Electric), Brokers (Prologis and Adobe Systems) and Mixed business models (Cisco Systems, Hewlett-Packard Company, Johnson Controls and Intel). (2) Highlighted cells indicate the highest results in the full sample period.

**Table A2**

Returns of portfolios of stocks composed of Creators, Distributors, Landlords and Brokers business models companies with alternative 12-month lengths of the pre-COVID-19 periods.

	Business Models			
	Creators	Distributors	Landlords	Brokers
Full sample: 2016.02 - 2021.01	157.68%	7.50%	90.83%	288.09%
Sub-samples				
- Pre-Covid period: 2018.12 - 2019.11	13.59%	15.99%	13.71%	29.66%
- Covid period: 2019.12 - 2021.01	24.98%	-0.43%	19.37%	30.47%
Sub-samples				
- Pre-Covid period: 2019.01 - 2019.12	31.65%	27.22%	25.49%	48.79%
- Covid period: 2020.01 - 2021.01	20.13%	-2.27%	15.48%	27.44%
Sub-samples				
- Pre-Covid period: 2019.02 - 2020.01	20.37%	19.42%	14.18%	37.99%
- Covid period: 2020.02 - 2021.01	20.54%	-3.15%	16.69%	20.88%
Sub-samples				
- Pre-Covid period: 2019.03 - 2020.02	9.13%	10.97%	-8.45%	25.89%
- Covid period: 2020.03 - 2021.01	29.34%	4.29%	34.50%	27.69%
Sub-samples				
- Pre-Covid period: 2019.04 - 2020.03	-2.63%	-1.80%	-21.30%	15.56%
- Covid period: 2020.04 - 2021.01	47.55%	9.46%	59.18%	36.28%

Note: (1) The pre-COVID-19 periods cover in every case 12 months before the respective alternative starting month of the COVID-19 pandemic. (2) Highlighted cells indicate the highest results in the given period.

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