THE IMPACT OF LOW-CARBON POLICY ON STOCK RETURNS

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Overview

Climate change risks can be partitioned in two components: the risk associated with the impacts of global warming on natural and human systems and the risk originating from anthropogenic climate change mitigation. Literature designates the first component with the label "climate risk" (Carney, 2015; World Resources Institute, 2015): changes in extreme climate phenomena — e.g. temperature extremes, high sea levels extremes, precipitation extremes (Intergovernmental Panel on Climate Change, 2014) —, are likely to cause serious damages to agriculture, coastal zones, and human health (Ackerman & Stanton, 2013), and affect growth (Dell, Jones, & Olken, 2014; Pycroft, Abrell, & Ciscar, 2016), productivity (Graff Zivin & Neidell, 2014; Hallegatte, Fay, Bangalore, Kane, & Bonzanigo, 2015), the value of financial assets (Bowen & Dietz, 2016) and insurance claims (Farid et al. 2016). Addressing climate change implies greenhouse gases (GHG) mitigation: the process of adjustment towards a lower carbon economy carries a cost that the literature refers to as "transition risk" or "carbon risk" (Caldecott & McDaniels, 2014; Weyzig, Kuepper, van Gelder, & van Tilburg, 2014).

A close look to the Basel Committee on Banking supervision (BCBS) publications suggests that financial risk analysis fails to give appropriate attention to climate change risks (CISL & UNEP FI, 2014; BCBS, 2011; BCBS, 2006). Physics and Economics show that this disregard is not justified and climate change risks should be carefully considered. Today, the inclusion of climate change risks into the traditional financial risk analysis framework is focal as it permits to meet concerns of firms and investors on the consequences of global warming and of greenhouse gases mitigation efforts on their businesses and investments.

This paper focuses on low-carbon transition risk. To the present day, there is no available methodology for the assessment of transition risk at firm level, and, at portfolios level, the literature is scant. The paper fills the void by providing an environmental extension of Fama and French's five-factor pricing model capable of capturing the sensibility of portfolio returns to the carbon footprint risk factor. An application of the model to a set of European stock portfolios is also included.

Methods

The stated objective of the paper is to put forward a low-carbon transition risk measurement method at stock portfolio level. In order to accomplish this objective the Fama and French (2015) five factor asset pricing model has been extended with an environmental explanatory variable.

Alongside classical independent variables such as SMB (small minus big) and the excess market return (RM-RF), the amended model includes an LMI (liquid minus illiquid) variable, which is meant to mimic the risk factors in returns related to free cash flow (EBIT + non cash expense – change in current assets and liabilities – CAPEX). Free cash flow has been chosen as a proxy of operating profitability and investment, while the HML (High minus Low) variable has been discarded as Fama and French (2015) suggest. The environmental explanatory variable is GMC (green minus carbon). This is the difference, each month, between the simple average of returns on four green portfolios and four brown portfolios. Eight portfolios are used to build the stock market factors: SLG (Small, Liquid, Green), SLC (Small, Liquid, Carbon), SIG (Small, Illiquid, Green), SIC (Small, illiquid, Carbon), BLG (Big, Liquid, Green), BLC (Big, Liquid, Carbon), BIG (Big, Illiquid, Green) and BIC (Big, Illiquid, Carbon).

The returns to be explained are value weighted excess returns on five clusters (portfolios) of stocks obtained by implementing a K-means algorithm on the STOXX Large index. We believe this method delivers better results than just using the medians. In the end, due to data availability, 104 stocks have been retained out of 200.

The carbon footprint of the companies that are part of the STOXX Large Index has been calculated with an environmentally extended Input Output Analysis (EE-IOA). While process analysis is more suitable at product level, for mesosystems and macrosystems a top down approach is preferable (Wiedmann, Lenzen, & Barrett, 2009). Environmentally Extended Input-Output Analysis (EE-IOA) is the methodology employed for top-down calculations (Huang, Lenzen, Weber, Murray, & Matthews, 2009; Minx et al., 2009): it makes use of an input-output model, which represents the interdependencies between different sectors and final consumption in a national economy or between the sectors in different national economies and pairs it with national environmental accounts.

Results

Just as there are patterns in average returns related to Size, Profitability and Investment, there is also a pattern related to Carbon footprint. Such pattern exists, in Europe, since the implementation of carbon pricing policies (e.g. ETS, carbon taxes). The sensibility of stock portfolios excess returns to environmental policy has been isolated: as expected, carbon intensive portfolios underperform green portfolios in case of aggressive climate policies. The cluster that includes carbon intensive and big capitalization stocks is the most impacted (highest sensibility) by environmental policy.

The accuracy of the method used for the estimation of the carbon intensity of firms, along with the number and type of factors chosen to perform the sensibility analysis, permit us to assert that the results found are robust and significant.

Conclusions

Low-carbon transition risk originates from the attempt to achieve a low carbon economy. It follows that the essential property for an entity to be subject to the risk is GHG emission. This article has a stated objective: it aims at filling a void in the literature by developing an assessment methodology for low-carbon transition risk at portfolio level.

The article puts forward an instrument able to capture carbon footprint patterns in average stock returns. This is achieved by providing an environmental extension of Fama and French's five factor model: this specification is directed at capturing size, profitability, investment and carbon footprint patterns in average stock returns and, therefore, includes low-carbon transition risk into the traditional financial risk analysis framework.

Results are directly useable by portfolio managers and represent an advance in climate finance.

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