



Air pollution and stock returns: Evidence from a natural experiment



Gabriele M. Lepori *

Department of Finance, Copenhagen Business School, Solbjerg Plads 3, A5.36, 2000 Frederiksberg, Denmark

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ABSTRACT

Previous studies have documented the existence of a relationship between air pollution and people's moods and between people's moods and stock returns. To investigate if the link between local air pollution and domestic equity returns is mediated by the trading floor community, we use the transition of Italy's main stock exchange from a trading floor technology to an electronic and delocalized trading system as a natural experiment. In addition, we take advantage of differences in trading technology across a sample of major international stock exchanges. In both instances, we document the existence of an air pollution effect only when trading is conducted on the floor, which provides evidence in support of the view that the air pollution effect is at least partly mediated by the behavior of the trading floor community.

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There's so much pollution in the air now that if it weren't for our lungs there'd be no place to put it all

– Robert Orben

1. Introduction

Marketing researchers have been investigating for decades whether and how the store environment can be manipulated so as to influence consumer purchases (Turley and Milliman, 2000). For example, background music has long been in use in retail stores and offices, allegedly to elicit certain desired behaviors or attitudes among shoppers or employees (Bruner, 1990; Milliman, 1982). This kind of analysis finds support in the psychological literature, which has shown that the emotional state experienced at the time of making a choice can bias the decision-making process.¹ In the field of finance, there is a growing body of evidence that some local environmental factors influence trading decisions and equity returns. For example, Saunders (1993) and Hirshleifer and Shumway (2003) document the existence of a negative relationship between local cloud cover (i.e. measured in the city that hosts a given stock exchange) and domestic stock returns; analogously, Levy and Yagil (2011) find that air pollution levels near the NYSE and AMEX are negatively related to U.S. stock returns. However, a question that is still unresolved is who are the agents that are responsible for such effects. In the present paper, we replicate and extend the work of Levy and Yagil and other behavioral finance scholars by investigating both whether there exists a relationship between air pollution, trader mood,

* Keele Management School, Keele University, Staffordshire, ST5 5BG, United Kingdom. Tel.: +44 1782 733889.

E-mail address: g.lepori@keele.ac.uk.

¹ See, for example, Schwarz and Clore (1983), Johnson and Tversky (1983), Schwarz (1990), MacLeod and Campbell (1992), Mann (1992), and Isen and Labroo (2003).

and equity returns and whether such a relationship is mediated by the impact that local air pollution exerts on the behavior of the trading floor community.² We initially test our air pollution hypothesis using data from the Italian stock market and exploiting a natural experiment generated by the transition of the Milan Stock Exchange (MSE) from a trading floor technology to a floorless one in the middle of the 1990s. Using a binary response model and controlling for well-known calendar anomalies and behavioral factors, we estimate that, during the centralized market era, a $10 \mu\text{g}/\text{m}^3$ (one standard deviation) increase in the concentrations of particulate matter on day $t - 1$ reduces the probability that stock returns will be positive on day t by approximately 1.5% (7%). In terms of magnitude, we estimate that a $10 \mu\text{g}/\text{m}^3$ (one standard deviation) increase in air pollution on day $t - 1$ is followed by a drop in stock returns of about 3 (14) basis points on day t . These results are both statistically and economically significant and stay qualitatively unchanged when we employ an IV estimation to control for potential sources of endogeneity. Though we find some evidence that the magnitude of the pollution effect decreased after the transition to a floorless technology, our data do not irrefutably show that such an effect disappeared entirely and, as such, based on the natural experiment in question it is not possible to conclude that the relationship between local air pollution and equity returns is entirely mediated by the influence that the former exerts on the trading floor community.

To shed more light on the issue, we then replicate our analysis using data for the leading stock exchanges of the United States, Canada, Ireland, Spain, UK, France, Germany, China, and Australia. We do so in order to exploit the variation in trading technology across stock exchanges, as some of the exchanges in question featured an active trading floor community during the sample period while some others employed a floorless technology. In the case of the exchanges that employ a trading floor technology, we find evidence of a negative link between local air pollution and the probability that the corresponding market indices will deliver a positive return. On the other hand, no significant relationship is detected when floorless exchanges are considered. The results we present are remarkable on two grounds. First, they corroborate the findings on the role that psychological factors play in asset pricing. Second, they provide evidence that the trading floor community plays a mediating role between local air pollution (and possibly other local environmental variables) and aggregate asset price fluctuations.

The rest of the paper is organized as follows. Section 2 discusses the mechanisms through which psychological factors are conjectured to sway investment decisions and comments on the empirical evidence produced so far. Section 3 describes how the trading floor community may exercise an influence on asset prices. Section 4 gives an overview of the air pollution phenomenon and examines the effects it has been found to exert on the human body and psyche. Section 5 discusses the hypotheses under investigation, and Section 6 illustrates the dataset. The empirical analysis is conducted in Section 7, which also contains a battery of robustness checks and addresses some potential sources of endogeneity. Section 8 provides some international evidence, and Section 9 discusses the overall results.

2. Affective state and decision-making

The link between affect and choice has long interested psychologists. Byrne and Clore (1970) maintain that “affect elicited by a stimulus conditions behavior and attitudes toward other stimuli merely associated with it”. In other words, the emotional state experienced at the time a decision is being made is likely to condition the decision itself (Forgas, 1995; Frijda, 1988; Isen et al., 1978; Loewenstein, 2000), for emotions are believed to regulate thought and inform judgment and cognitive evaluations (Damasio, 1994; Loewenstein et al., 2001). Many emotions are believed to have emerged as useful responses from evolutionary conditioning (Frank, 1988; LeDoux, 1996), and help individuals economize on information processing, as “emotion allows people to transcend the details, prioritize, and focus on the decision to be made” (Ackert et al., 2003). Psychologists posit that the same rules of thumb (or heuristics) that regularly help people make decisions, might occasionally lead them astray. When mood works as a “source of information” to individuals, it might influence their choices even in those circumstances when the source of the mood state does not have anything to do with the decision (Schwarz, 1990; Schwarz and Clore, 1983). Product choice, purchase intentions, behavior traits, and actual purchases have all been shown to be partly affected by (apparently irrelevant) factors such as in-store music, ambient scent and illumination.³ In the field of finance, what has attracted the attention of scholars is the link between mood and trading decisions. The focus has been on trying to identify some environmental variables that act as mood proxies for large groups of investors, the rationale being that changes in the environment may trigger mood changes and, ultimately, have an impact on investment decisions (for example, through the mood misattribution mechanism). One of the earliest contributions in this area can be traced back to Saunders (1993), who, utilizing the level of cloud cover in New York City as a proxy for trader mood, observes that such a factor exhibits a significant relationship with the returns of three global indices of the U.S. stock market. Along similar lines, alternative environmental factors have been used as proxies in an attempt to measure collective mood-swing patterns.⁴ Here the focus will be on ambient air pollution, which is one of the most critical environmental stressors to which individuals are exposed and has been found to be responsible for a broad spectrum of physical and psychological effects on human beings.

² Among the authors suggesting that floor traders not only execute orders but can also affect stock prices, see for example Saunders (1993), Sofianos and Werner (2000), and Limpaphayom et al. (2007). The role played by the floor community will be discussed in depth in Section 3.

³ See, for example, Milliman (1982), McElrea and Standing (1992), Areni and Kim (1993), Gulas and Bloch (1995), North and Hargreaves (1996; 1997; 1998), and Summers and Hebert (2001).

⁴ These include temperature (Cao and Wei, 2005; Chang et al., 2006), humidity (Chang et al., 2006; Pardo and Valor, 2003), rain and snow (Hirshleifer and Shumway, 2003), and the seasonal light cycle (Kamstra et al., 2003). For a review of this literature, see Lucey and Dowling (2005).

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