



# The bright side of financial derivatives: Options trading and firm innovation<sup>☆</sup>



Iván Blanco<sup>a,b,\*</sup>, David Wehrheim<sup>b,c</sup>

<sup>a</sup> CUNEF, Calle de Leonardo Prieto Castro 2, 28040 Madrid, Spain

<sup>b</sup> Universidad Carlos III de Madrid, Spain

<sup>c</sup> IESE Business School, Avenida Pearson 21, 08034 Barcelona, Spain

## ARTICLE INFO

### Article history:

Received 11 August 2015

Revised 17 February 2016

Accepted 26 May 2016

Available online 22 April 2017

### JEL Classification:

G12

G14

G34

G38

O31

O32

### Keywords:

Innovation

R&D productivity

Options market

Price informativeness

Career concerns

## ABSTRACT

Do financial derivatives enhance or impede innovation? We answer this question by examining the relationship between equity options markets and standard measures of firm innovation. We find that firms with more options trading activity generate more patents and patent citations per dollar invested in research and development (R&D), after accounting for other confounding factors. These results are confirmed when we use a propensity score matching procedure and an instrumental variable approach to control for the potential endogeneity of options trading. The evidence is consistent with the notion that the enhanced informational efficiency induced by options leads to an improved allocation of corporate resources. We further discuss possible underlying economic mechanisms through which more active options markets boost innovation and show that the effect remains substantial even after controlling for these mechanisms. Considering the average increase in the dollar volume of options traded for our sample firms, we conclude that a 200% move in options volume increases firm innovation by about 31%.

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<sup>☆</sup> Work on this paper was partly done while Wehrheim was visiting the Department of Management and Technology at Bocconi University. Wehrheim acknowledges financial support from the Spanish Ministry of Economics and Competition through project n° ECO2012-33427. The authors thank Alejandro Balbás, Emre Ekinci, Andrea Fosfuri, Marco Giarratana, Jose Marin, Eduardo Melero, Neus Palomeras, Rosa Rodríguez, Sergio García, Pablo Ruiz-Verdú and Marti G. Subrahmanyam, as well as conference participants at the Ratio Colloquium for Young Social Scientists (Stockholm, 2014), Barcelona GSE Summer Forum (2015), XXIII Finance Forum (Madrid, 2015), XXX Jornadas de Economía Industrial (Alicante, 2015), IP Statistics for Decision Makers (Vienna, 2015) and internal seminar participants at Universidad Carlos III de Madrid (2015) for useful comments on previous versions of this paper. The authors are also grateful to Bill Schwert (the editor) and Andrew W. Lo (the referee) for their help in improving the manuscript through a most constructive review process. All remaining errors are ours.

\* Corresponding author at: CUNEF, Calle de Leonardo Prieto Castro 2, 28040 Madrid, Spain

## 1. Introduction

Innovation is the main driver of growth and the wealth of nations. As emphasized by Porter (1992, p. 65), “[t]o compete effectively in international markets, a nation’s businesses must continuously innovate and upgrade their competitive advantages. Innovation and upgrading come from sustained investment in physical as well as intangible assets.” Given the importance of innovation for competitiveness, it is a priority to understand those factors that determine incentives to innovate at the firm level. There has been much debate on the role of financial markets in promoting innovation. While developed capital markets

E-mail addresses: [ivan.blanco@cunef.edu](mailto:ivan.blanco@cunef.edu) (I. Blanco), [dwehrheim@iese.edu](mailto:dwehrheim@iese.edu) (D. Wehrheim).

can improve the efficiency of long-term resource allocation through their monitoring and disciplining mechanisms, the need to meet quarterly or annual financial objectives gives rise to adverse externalities that may impair firms' incentives to innovate (Holmström, 1989; Porter, 1992).<sup>1</sup>

In this paper, we focus on one cornerstone of public equity markets, namely, financial derivatives. Specifically, we study whether the volume of equity options written on the underlying asset encourages or impedes firm innovation. Since the beginning of the new century, the total equity options volume traded on U.S. exchanges has grown exponentially, from 676 million contracts in 2000 to over 3,727 million contracts in 2015.<sup>2</sup> Unlike stock market listings, where firms apply, options listings are exogenous to firm decisions; they are made within exchanges. These exchanges are self-regulating institutions that are members of the Options Clearing Corporation (OCC), which operates under the jurisdiction of the Securities and Exchange Commission (SEC) (for exchange-listed options). Because the SEC plays an important role in determining the eligibility criteria for securities in options trading, this topic is of particular interest to policy makers.<sup>3</sup>

Did the significant rise in the volume of trading undermine innovative efforts or did it encourage firms to invest in innovation? We argue that for firms that are listed on options markets, greater trading activity is associated with an increased propensity to innovate. The literature suggests that active options markets alter incentives for market participants to gather private information that is especially relevant for long-term investments, and trading on such information makes stock prices more efficient (e.g., Cao, 1999; Chakravarty, Gulen and Mayhew, 2004; Pan and Potesman, 2006; Hu, 2014). If stock prices are more efficient, other types of (perhaps less-informed) investors learn more about the fundamental value of the firm, which reduces some of the asymmetric information problems connected to R&D. Because prices play an active role (i.e., managers learn from prices) when investment decisions are made, this should then provide firm management with more incentives to engage in value-enhancing innovative activities. The notion that informed agents in financial markets can ameliorate asymmetric information related to innovative activities is widely recognized in the literature (e.g., Hall and Lerner, 2010; Aghion, Van Reenen and Zingales, 2013; He and Tian, 2013).<sup>4</sup>

In this paper, we focus on whether options trading spurs firm innovation in the context of R&D-intensive industries. We believe that these firms provide an ideal research setting for our study. For firms that invest more heavily in R&D, innovation is a core component of their competitive strategy, but they might also be forced to make only partial disclosure and be subject to a larger degree of information asymmetry (Bhattacharya and Ritter, 1983; Anton and Yao, 2002). It follows that these firms are more likely to be undervalued by equity holders and have a greater exposure to hostile takeovers (Stein, 1988). Moreover, survey evidence obtained by Graham, Harvey and Rajgopal (2005) shows that managers in technology-intensive industries are more prone to sacrifice long-term sustainability to meet desired short-term earnings targets, relative to managers in other industries, due to their personal wealth and career concerns. Those authors explain that meeting earnings benchmarks (particularly the earnings in the same quarter of the previous year) helps to maintain a firm's current stock price. Taken together, if the enhanced informational efficiency induced by options leads to better monitoring by reducing information asymmetries, making firms more willing to invest in innovation, we claim that this mechanism is particularly relevant for firms operating in R&D-intensive industries.

To test this conjecture, we assemble a rich and original data set containing time-varying information on standard measures of innovation based on U.S. patent data, R&D, options trading, governance, etc. To approximate the total annual dollar options volume, we use the approach proposed by Roll, Schwartz and Subrahmanyam (2009). We run panel data regressions on a sample of 548 publicly traded U.S. firms during the period from 1996 to 2004. This sample consists of large firms that are active in five broadly defined high-tech sectors, where we observe high patenting propensities, and patents have been recognized as a meaningful indicator of innovation at the firm level (as explained in Section 3).

Our baseline test reveals a positive association between innovation and options trading. Options trading has a positive impact on R&D spending but a larger positive effect on the quality and/or productivity of R&D (i.e., citations per dollar of R&D invested). These results are robust to using alternative subsamples, alternative measures of innovation, the inclusion of a wide range of control variables, lagged explanatory variables, and several econometric models. While these findings are consistent with the beneficial effect of the production and aggregation of information in options markets, we have concerns that our results could be biased if informed agents trade on the basis of unobservable characteristics that are correlated with options volume and innovation. We account for such selection issues by weighting sample observations using their

<sup>1</sup> Laurence D. Fink, Chairman and Chief Executive Officer (CEO) of BlackRock, recently summed this up in a letter to Standard & Poor's 500 CEOs that BlackRock invests in (*Business Insider*, April 14, 2015): "Over the past several years at BlackRock, we have engaged extensively with companies, clients, regulators and others on the importance of taking a long-term approach to creating value. We have done so in response to the acute pressure, growing with every quarter, for companies to meet short-term financial goals at the expense of building long-term value. This pressure originates from a number of sources—the proliferation of activist shareholders seeking immediate returns, the ever-increasing velocity of capital, a media landscape defined by the 24/7 news cycle and a shrinking attention span, and public policy that fails to encourage truly long-term investment."

<sup>2</sup> See <http://www.optionsclearing.com>.

<sup>3</sup> See Mayhew and Mihov (2004) for initial listing requirements.

<sup>4</sup> If we believe that informed agents can reduce information asymmetries related to innovative activities and that the stock market is an ef-

ficient resource allocation mechanism, then the "prospective role" (Dow and Gorton, 1997) whereby stock prices provide managers with information relevant for investment decisions could generate the same prediction. Our focus on the disciplining role of stock prices (as in Holmström and Tirole, 1993) is a natural choice for understanding the role of options trading in innovation, although we consider the two approaches to be complementary.

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