



## Empirical test of the efficiency of the UK covered warrants market: Stochastic dominance and likelihood ratio test approach

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### ABSTRACT

This paper represents the first attempt to apply a stochastic dominance (SD) approach to examine the efficiency of the UK covered warrants market. Our empirical analyses reveal that neither covered warrants nor their underlying shares stochastically dominate the other, indicating the nonexistence of potential arbitrage gains in either wealth or utility, which implies market efficiency. To complement the SD results, we also employ a likelihood ratio (LR) test to examine information efficiency. A bootstrap methodology is developed to correct the size distortion of the LR test. Our findings show that UK covered warrant returns efficiently reflect the return information of the underlying shares.

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### 1. Introduction

Financial derivatives, developed about four decades ago, have been a topic of interest for both market participants and academics. Researchers such as Black (1975), Roll (1977), and Biais and Hillion (1994) claim that the introduction of derivatives conveys information regarding their underlying shares and that both can share the same information context—to a certain extent, information transmissions exist between options and their underlying assets. In contrast, Stein (1987) argues that the trading of options brings in more noise traders and makes the market less efficient. The results obtained by Cox (1976) and Figlewski (1981) support this argument.

Covered warrants are option-like contracts that give holders the right to buy or sell an asset at a strike price over a determined period. The most distinct difference between covered warrants and the options is that covered warrants are issued by a third

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party (e.g., an investment bank), whereas the options are offered in a regular sequence by a clearing house on an options exchange. Covered warrants normally contain a “covered agreement,” which stipulates the amount of the underlying asset to be held by the issuer to cover (hedge) the position. Further, the majority of covered warrants are traded via the same investor's share trading account on a stock exchange (e.g., the London Stock Exchange (LSE)). Individual market participants do not have to qualify as members of an options exchange (e.g., Euronext-Liffe) to trade covered warrants. This convenience of covered warrants being a more accessible hedging and speculation tool is considered one of the major advantages related to trading in covered warrants. Hence, it is plausible to claim that with the same trading platform and less legislative limitations to comply with, covered warrants provide market participants with greater ease of accessibility. Many countries now allow investment banks to issue and trade in warrants with different underlying assets—such as shares, indices, commodities, and interest rate futures—without having to comply with sophisticated regulatory requirements. In the UK, the Financial Services Authority (FSA) retains a supervisory role pertaining to the establishment of warrant trading regulations, while the issuance of covered warrants is authorized by the LSE. Finally, unlike corporate warrants, covered warrants are not issued by companies on their own shares, and no new shares are issued upon their exercise.

The LSE announced the launch of the covered warrants market on October 28, 2002. Some claim that the introduction of this financial derivative benefits both individual retail investors and institutional investors through a higher gearing ratio, a larger range of underlying assets, easier accessibility, and lower transaction fees based on the lower stamp duty and trading cost. Because of these advantages, the covered warrants market in the UK has grown very quickly. By 2003, there were approximately US\$419.7 million worth of accumulated call and put warrants. By 2007, trading value in UK covered warrants reached US\$1418 million. Despite the increased trading in covered warrants all over the world, the academic literature that examines the performance of this financial instrument remains scarce, which serves as our motivation for the present study.

Recent studies highlight the difference between option-like covered warrants and the corresponding trading options (Aitken and Segara, 2005; Petrella, 2006). Researchers have also indicated that the introduction of covered warrants provides an alternative investment choice for market participants (Horst and Veld, 2008). In addition, covered warrants have gained in popularity among retail investors (Aitken and Segara, 2005; Bartram and Fehle, 2007). However, previous studies have predominantly focused on price differences between warrants and options. In addition, to our knowledge, no previous study has attempted to provide a direct assessment of the relationship between prices in the covered warrants market and their underlying share prices. Our study is the first to take into account the entire probability distribution to determine whether an investor prefers warrants in terms of average return, risk aversion or decreasing absolute risk aversion. The current paper contributes to the existing literature by showing how to directly derive the implied market price from the covered warrants market price, thereby negating the need to consult options trading information or embed any restriction in the pricing model. Another contribution of this paper centers on our investigation of the dominance relationship between traded warrants and their underlying shares. Rather than following the typical approach of testing market efficiency by comparing observed returns with expected returns as generated by equilibrium models such as the capital asset pricing model (CAPM),<sup>4</sup> we first adopt a stochastic dominance (SD) approach to examine market efficiency. This approach is superior because it allows us to compare the preferences of different investors and it does not require any assumption about asset return distributions. Confirmation of the dominance relationship would imply that higher expected wealth/utility can be obtained by trading in the dominant asset. On the other hand, the confirmation of a lack of a dominant/dominated relationship between the covered warrants implied share prices and the actual share market prices may suggest that arbitrage opportunities are nonexistent, thereby confirming that the introduction of the covered warrants market improves trading efficiency. Interestingly, we find that neither warrants nor shares dominate the other, which implies that the market is efficient with no arbitrage opportunity.

Additionally, in this study, to complement the SD methodology, we also provide an alternative method, the GARCH model with a variance equation, including the warrant implied volatility and the likelihood ratio (LR) efficiency tests proposed by Xu and Taylor (1994) and Claessen and Mittnik (2002), to test whether the covered warrants returns efficiently reflect the past return information of the underlying shares. Since the original LR efficiency test suffers from a very large size distortion, we have developed a bootstrap version of this test. Our findings support the argument that trading in UK covered warrants is sufficient for hedging and speculation needs.

The empirical results in this paper serve as a useful reference for market participants who are interested in trading covered warrants, and hence contribute to the codification of academic research and knowledge regarding this relatively new financial instrument.

The remainder of this paper is organized as follows: Section 2 briefly describes the literature pertaining to covered warrants. The data, sample characteristics, and methodology are discussed in Section 3. The empirical results are provided in Section 4, while Section 5 offers conclusions.

## 2. Literature review

Using data from the Australian covered warrants market between 1997 and 1998, Chan and Pinder (2000) investigate the relative price difference between warrants and options with the same underlying shares. Adopting a regression analysis, they find

<sup>4</sup> The presence of abnormal returns estimated from such models indicates market inefficiency on the one hand, as opposed to misestimated factors, omitted factors or model misspecification on the other.

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