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Consuming durable goods when stock markets jump: A strategic asset allocation approach

João Amaro de Matos [a,*], Nuno Silva [b,c,1]

[a] Nova School of Business and Economics, Faculdade de Economia da Universidade Nova de Lisboa, Campus de Campolide, 1099-032 Lisbon, Portugal
[b] Faculdade de Economia, Universidade de Coimbra, Av. Dias da Silva, 165, 3004-512 Coimbra, Portugal
[c] GEMF, Portugal

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ABSTRACT

In this paper we show the impact of considering jumps in the return process of risky assets when deciding how to invest and consume throughout time. Agents derive their utilities from consumption over time. We consider an agent that invests in the financial market and in durable and perishable consumption goods. Assuming that there are costs for transacting the durable good, we show that an agent who does not consider the possibility of jumps will make suboptimal decisions, not only regarding the fraction of wealth invested in the stock market, but also with respect to the timing for trading on the durable good. Furthermore we also show that jumps cause a non-obvious asymmetric impact on the thresholds that lead the consumer to trade the durable good, even when the jump distribution is symmetric.

1. Introduction

In times of financial crisis such as the one that we are living, the role of downward jumps in financial decisions becomes particularly relevant. A quick look at the performance of financial markets in the recent past makes this point clear, when the intensity of jumps has been particularly high.

In this paper we aim to analyze the impact of such jumps in the investment and consumption decisions, particularly when agents consume durable goods for which there are transaction costs.

The main problem faced by investors is the uncertainty regarding their future income and capacity to consume. Such uncertainty is typically characterized by the first two moments of the returns distribution. However, in the presence of jumps, higher moments are affected and the returns distribution becomes skewed and leptokurtic, strongly affecting the investment decisions.

* Corresponding author. Tel.: +351 213 887 480; fax: +351 213 871 105.
E-mail addresses: amatos@novasbe.pt (J. Amaro de Matos), nunos@fe.uc.pt (N. Silva).
[1] Tel.: +351 239 790 545; fax: +351 239 790 514.

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As an example of a common durable good we can think about the investing problem of the owner of a house. The decision to sell the house happens when the ratio wealth to house value is below a certain threshold. When there is the possibility of significant jumps in the stock market, the higher moments of the stock return distribution change, which leads to changes, not only in the optimal perishable good consumption and stock market investment strategy, but also in the optimal durable good trading strategy. We show that the boundaries at which the individual chooses to trade the durable good change in a non-obvious asymmetric way, due to the combination of the direct impact of jumps on the statistical properties of stock returns and the indirect effect of jumps on the optimal stock investment strategy.

We followed Damgaard et al. (2003) who considered a similar problem in a market where risky assets prices evolve according to a geometric Brownian motion. Given the extensive evidence of non-normality in stock market returns in the financial literature, we consider an extension of this model that includes jumps in stock market prices.

Stock market returns distributions are usually left skewed and leptokurtic,[1] which suggests the existence of jumps. There is a wide array of papers in the financial literature that empirically confirm the existence of jumps in stock market returns such as Andersen et al. (2002), Eraker et al. (2003) and Jarrow and Rosenfeld (1984) who analyze daily time-series of several American stock market indexes and find evidence of jumps in stock market returns. Also, Dunham and Friesen (2007) and Lee and Mykland (2008) among others used ultra-high frequency data on the S&P 500 and concluded that there were jumps in the index returns. Ait-Sahalia et al. (2001), Carr and Wu (2003), Jackwerth and Rubinstein (1996) and Pan (2002) studied the jump-risk premia implicit in the S&P 500 options and also found evidence of jumps on the underlying index distribution. Bollerslev and Todorov (2011), Kelly (2011) and Zhang et al. (2009), using different methods, have shown that jumps play a crucial role in explaining the equity risk premium, and also the price of several securities, such as index options and credit default swaps.

To our knowledge, not many papers have focused on optimal portfolio selection with transaction costs in a stock market with jumps.[2] Our paper is the first to analyze this problem, where jumps are driven by a Lévy process, and in the presence of both perishable and durable consumption goods. In order to understand the contribution of this paper, we briefly describe the evolution in the literature.

The problem of finding closed-formed solutions for the optimal investment strategy, in a model where stock markets jump, is not an easy one. Ait-Sahalia et al. (2009) accomplished this task, for specific types of utility functions and jump processes, and found that jumps decrease the investor's exposure to risky assets. The impact of jumps on stock markets investment was also studied by Liu et al. (2003), who conclude that jumps can lead to a substantial decrease in stock market investment, particularly for individuals with low risk-aversion. The equivalent wealth losses from ignoring jumps were estimated in Ascheberg et al. (2013) and in Das and Uppal (2004). These authors conclude that these losses are generally small, but they can be substantial for individuals with a relatively low risk-aversion.

Merton (1969) studied the optimal investment and consumption problem of an individual who consumes only a perishable good with no transaction costs. He assumed that the agent could invest in a riskless asset and a risky asset, whose price process follows a (continuous) geometric Brownian motion. Ignoring transaction costs and other market imperfections, he concluded that a CRRA consumer should invest a constant fraction of his wealth in the risky asset. Obviously, this strategy is not optimal for an investor who faces transaction costs whenever he trades the risky stock since such a strategy would involve continuous trading. Since Merton (1969), a vast number of papers focused in transaction costs and/or other market imperfections. Among others Davis and Norman (1990) and Shreve and Soner (1994) studied the problem of an infinitely lived investor facing proportional transaction costs when trading the only risky asset available in the economy. They showed that there is a wedge shaped region where it is optimal for the investor not to trade the risky asset. Whenever the risky asset investment becomes sufficiently low (high) relative to the riskless investment, the investor buys (sells) the risky asset in order to return to the no-trading region limit. Akian et al. (1996) extended the previous works by considering that the individual can invest in n risky assets concluding that, almost surely, the investor never trades more than one risky asset simultaneously. Liu (2004) considered n risky assets, but with fixed transaction costs and shows that, if risky assets' returns are uncorrelated, the optimal investment policy is to keep the amount invested in each risky asset between two constant levels. Whenever either of these bounds is reached, the agent trades to the corresponding optimal targets. Chellathurai and Draviam (2005, 2007), Dai and Yi (2009), Liu and Loewenstein (2002) and Zakamouline (2002, 2005) considered the optimal investment problem of a finite horizon individual, under several specifications for the transaction costs, and concluded that the no-trading region widens as the horizon gets shorter.

In our paper we use very similar techniques to measure the impact of jumps in the financial markets together with the simultaneous consumption of durable and perishable goods. The importance of considering both goods at the same time is that it allows for analyzing the impact of different transaction cost structures in the presence of the financial market prices' discontinuities. As we show in the remaining of the paper, the combination of these effects implies quite subtle changes in the investment strategy that has been over-regarded in the literature. Not only the presence of jumps affects the investment strategy in the stock market, as one would expect, but also affects the shape of the no-trading region for the durable consumption good. The presence of jumps has two different effects. A first direct effect is that jumps may force the investor to trade in a very unfavorable position, too distant from the boundaries of the no-trading region – leading to narrower

[1] See, for example, Andersen et al. (2002).

[2] Benth et al. (2002) and Framstad et al. (1999) are two exceptions.