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Journal of Financial Economics 66 (2002) 341–360

JOURNAL OF  
Financial  
ECONOMICS

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# Synchronization risk and delayed arbitrage<sup>☆</sup>

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Received 17 July 2001; accepted 4 March 2002

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## Abstract

We argue that arbitrage is limited if rational traders face uncertainty about when their peers will exploit a common arbitrage opportunity. This *synchronization risk*—which is distinct from noise trader risk and fundamental risk—arises in our model because arbitrageurs become sequentially aware of mispricing and they incur holding costs. We show that rational arbitrageurs “time the market” rather than correct mispricing right away. This leads to *delayed arbitrage*. The analysis suggests that behavioral influences on prices are resistant to arbitrage in the short and intermediate run.

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*JEL classification:* G14; D82

*Keywords:* Limits to arbitrage; Synchronization risk; Market timing; Efficient markets hypothesis; Behavioral finance

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## 1. Introduction

It is puzzling that professional traders often mutually agree that certain assets are overvalued or undervalued and yet do not trade accordingly. An often-cited example of an overpriced stock is Priceline.com, whose market capitalization reached \$30 billion in April 1999, surpassing the combined market capitalization of all major

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<sup>☆</sup>The authors would like to thank Ming Huang, Harrison Hong, José Scheinkman, Andrei Shleifer, Marcelo Pinheiro, and an anonymous referee for their insightful comments. We acknowledge financial support from the National Science Foundation and Princeton’s CEPS program. The second author is grateful to the Kellogg School of Management at Northwestern University for its hospitality during an extended visit.

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U.S. airlines.<sup>1</sup> Stocks can also be underpriced. Brennan (1990) refers to “latent assets” and considers large takeover bid premia as evidence of underpricing. Mispricing may arise in other asset markets, too. Dammon et al. (1993) report large and persistent mispricing in the bond market based on a comparison of three high-yield bonds of RJR Nabisco that differ only in the form in which interest is paid. The cash-paying bond traded at a huge premium compared to identical pay-in-kind bonds and deferred-coupon bonds over a two-year period. Standard market imperfections cannot explain such substantial mispricing. Similarly, certain currencies in the foreign exchange market are often known to be under/overvalued over many years, but arbitrageurs are afraid to trade on this mispricing too early. The objective of this paper is to provide a rationale for why this type of mispricing can persist even when professional arbitrageurs are present in the market.

One possible explanation is that not all market participants are fully rational. For example, behavioral traders can trade based on investor sentiment and ignore relevant information. Even though there is little controversy in the literature about the presence of behavioral traders, there is disagreement about whether these boundedly rational traders actually affect prices. Proponents of the *efficient markets hypothesis*, like Fama (1965) and Ross (2001), maintain that rational arbitrageurs will undo any mispricing caused by behavioral traders. Hence, “the price is right.” Our paper disputes this claim, offering a new reason—“synchronization risk”—for why mispricing can persist despite the presence of rational arbitrageurs.

The efficient markets hypothesis is self-evident when arbitrage strategies are riskless and professional traders are willing to take unbounded positions. In reality, though, any arbitrage involves some risk since markets are not complete. Whenever a mispriced asset is not redundant, an arbitrage strategy is risky even if rational traders care only about the final payoff of the arbitrage strategy. In other words, an arbitrage trade is riskless only if a perfect substitute for the mispriced asset exists. Therefore, arbitrageurs can rarely fully hedge their arbitrage strategies. The recent literature on the limits to arbitrage has identified two broad categories of risk: fundamental risk and noise trader risk. An arbitrage strategy can be risky because the fundamental value of a partially hedged portfolio might change over time. In addition, arbitrageurs understand that their model might not coincide with the true data-generating process. Thus, arbitrageurs have to bear a *fundamental risk* even if they can sustain the arbitrage strategy until the final payoff is realized. While these fundamental shocks are permanent, the activity of behavioral noise traders might lead to temporary price movements. These price changes temporarily reduce the value of the arbitrage portfolio if the price moves even further away from the fundamental value. If arbitrageurs are compelled to liquidate their positions in the intermediate term, then they are forced to take losses exactly when the arbitrage opportunity is greatest. DeLong et al. (1990a) call this *noise trader risk*. There are many reasons why arbitrageurs have to liquidate their position before the arbitrage

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<sup>1</sup> Likewise, the market capitalization of eBay exceeded that of RJR Nabisco, Yahoo that of Boeing, and Amazon.com that of Borders, Barnes & Noble, Kmart and JC Penney combined. Ofek and Richardson (2001) provide a detailed account of overpricing of Internet stocks during the 1990s.

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