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## Asset fire sales in equity markets: Evidence from a quasi-natural experiment

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### ABSTRACT

In November of 2007 a fire sale of Chilean stocks was triggered by a change in the constraints that regulate pension fund portfolios. This regulatory shock provided a cleanly identified fire sale unrelated to fundamentals. Stocks with more selling pressure from pension funds lost approximately 4% in November compared to other stocks. Although the selling pressure was temporary, prices reverted only after four to six months. Pension funds initially mitigated the impact of the fire sale by selling large index stocks in which demanding liquidity was less costly. Coordination across pension funds increased during the fire sale. We find no significant evidence of real effects on firm investment in the quarters after the fire sale.

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### 1. Introduction

A fire sale is a forced sale triggered by financial distress or by constraints that impact investors' portfolios. A fire sale is not driven by bad news about fundamentals, however, given that the sale is sudden, prices are discounted below these fundamentals or long run values (Shleifer and Vishny, 2011). Price dislocations of this sort open up the door for potential policy interventions. For example, direct purchases of financial assets by the government, such as those following the crisis of 2008, can be in part justified if fire sales contributed to the fragility of the financial system. Should the government decide to directly purchase assets, when should it stop buying? At what level of recovery do prices need to get before stopping the purchasing of assets by the government? Policy recommendations in this area hinge on having precise knowledge of the inner workings of fire sales and their price impact. Unfortunately, disentangling fire sales from ordinary sales is not easy because in practice it is difficult to know whether price discounts are motivated by a fire sale or by bad news about fundamentals.

In this paper we contribute to the fire sales literature by providing a cleanly identified fire sale – unrelated to news about fundamentals – that occurred in an emerging stock market. Identifying fire sales is particularly hard in the stock market because the flow of information is continuous and liquidity in comparison to other markets is high. Hence, price dislocations of the type pro-

duced by fire sales are, at least in principle, rare in this market. Conversely, as noted by Coval and Stafford (2007), the stock market does have the advantage of being a relatively transparent market, where prices and trading volume are publicly known, and therefore, we can trace the impact of a fire sale, should there be one. We exploit a quasi-natural fire sale to answer several open questions from the literature. First question to consider is, how big are the price dislocations caused by fire sales? And, how long does it take for prices to revert to pre-crisis levels? Do financial intermediaries try to mitigate the price impact of a fire sale? If so, what mitigation mechanisms do they use? Does coordination among intermediaries increase or decrease during fire sales?

The event that we study is a fire sale of Chilean stocks by the local private pension funds. These institutional investors have dominated the Chilean market since the privatization of social security in the early 1980s. The regulator of the pension fund industry set limits on different asset classes according to the risk profile of each one of the five types of funds that are offered. For example, type-C funds – in a scale from A to E, where A represents the most risky fund and E the least risky fund – can invest up to 40% in equities (domestic or international). Until October of 2007, these limits were not enforced in a strict way, mainly due loopholes or a lax interpretation of the law. In particular, some funds exceeded the investment limit in equities by almost 10%.

On October 26th, 2007 the regulator sent a memorandum to all pension funds asking them to strictly obey the portfolio limits set by law. The memo specified that excess investments had to be eliminated regardless of their cause. The memo did not intend to be an opinion about the future of equity markets or a piece of

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investment advice. For instance, the memo did not make any reference to market perspectives or asset fundamentals. The reason for the memo was simply that, according to the regulator, excess investments were not in line with the true spirit of the Chilean multi-fund system established in 2002. The main purpose of introducing the multi-fund system was to offer a menu of funds with markedly different risk-return profiles. Excess investments conspire against this by making some of the funds too similar to each other. Excess investments can also lead to confusion for investors. For example, the level of excess investments in type-C funds made them in practice look like type-B funds. Therefore, investors who chose type-C funds were taking more risk than what they really wanted to take according to their risk preferences.

Although the regulator gave a year to reduce excess investments, pension funds immediately started selling domestic stocks, which represented close to half of their equity portfolios at the time. Whether this was the optimal response from pension funds or simply a lack of experience with similar situations is something that is hard to determine with the data at hand. However, from a private perspective, pension funds most likely acted rationally by selling quickly instead of smoothing sales over time. Unloading a large portfolio of stocks without having a price impact requires coordination between funds, and this type of coordination is hard to sustain in a competitive environment. Also, regulatory incentives can undermine coordination. For instance, Chilean regulation imposes fines on funds that perform poorly in comparison to their peers, hence there was an incentive for selling ahead of other funds if sales would lead to poor returns. In this respect, the fire sale that we study provides a cautionary tale for similar regulatory actions that do not provide explicit coordination mechanisms for financial intermediaries to pace portfolio rebalancing.

Chilean pension funds disclose their portfolios at a monthly frequency, thus we can measure precisely how they dealt with the regulator's request to reduce excess investments. In November 2007, pension funds sold shares that represented, for the average domestic stock in their portfolios, 0.21% of total shares outstanding (almost 0.64% of the float). This represented a quarter of the average monthly turnover for the typical stock, which is quite high compared to other fire sales in the literature. For instance, the fire sales studied by Coval and Stafford (2007) represent only 2% of average volume. During November, pension funds reduced positions in 30% of the stocks they held and increased positions in only 10%. For comparison, in the surrounding months the average number of positions that increased was about the same as the average number of positions reduced. In short, the selling pressure felt in November was highly unusual. We find that foreign investors absorbed a large fraction of this pressure. The local mutual fund industry was too small to absorb a significant fraction of pension fund sales.

The price impact of the fire sale was substantial. In November 2007 the return on stocks that were most affected by the selling pressure was close to 4% lower than the return on other stocks. We focus on this cross-sectional effect since the market wide effect is harder to identify given that we have only one event. Price differentials did not revert until March–May of 2008, i.e., price impact lasted for 4–6 months. Documenting the reversal of the initial effect is crucial for distinguishing the fire sale from the alternative of information-based trading, which predicts no reversal. Also, the pattern of reversal that we find is not consistent with a short-run liquidity effect, because in that case the price impact should disappear immediately after the abnormal selling pressure subsides. Instead, we find that prices only revert long after the selling pressure of November is over. This reversal result points to an alternative model with downward sloping demands (Shleifer, 1986) or slow-moving capital (Duffie, 2010).

The regulator mandated a reduction in equities, but it did not specify which stocks to sell. The easiest thing to do was to reduce the portfolio proportionally, in which case pressure would be related to the ownership stake that pension funds have in each stock. Simply put, under the proportionality hypothesis, pension funds create more pressure in segments where they represent a larger fraction. We find that pension fund ownership is indeed correlated with pressure during November, although not before or after the event. We also find evidence consistent with the alternative hypothesis that there was conscious selection of stocks during the fire sale. Similar to the finding of Jotikasthira et al. (2012), we find that pension funds systematically tried to mitigate price impact by selling large index stocks, which have lower costs of demanding liquidity. We also find some evidence that stocks with large over- or under-weights in comparison to the market portfolio received more selling pressure, which increased benchmarking with respect to the local equity index. We do not find that past stock performance (i.e., momentum) is a predictor of pressure during the fire sale, which one could expect if there is a preference for locking-in profits.

When looking at the cross-section of pension funds we find signs of increased coordination during the fire sale. Equity portfolios became more alike since we find a reduction of their active share (as in Cremers and Petajisto, 2009) measured with respect to the industry average, and we also find that the sensitivity of a fund's change in holdings with respect to changes in the other funds increased during the fire sale.

Finally, we find a statistically insignificant reduction in investment by firms during the quarters after the fire sale. This suggests that the real effects of the fire sale were limited.

The rest of the paper is organized as follows. In Section 1 we relate our results to the fire sales literature and highlight our contribution. In Section 2 we describe the event and data in detail, including some background on the Chilean private pension fund system. Section 3 shows the results on price impact. Section 4 explores mitigation and amplification mechanisms of the fire sale. Section 5 gives suggestive evidence on the real effects of the fire sale. In Section 6 we present our conclusions.

## 2. Relationship to the fire sales literature

Our paper contributes first and foremost to the literature on fire sales in financial markets (see Shleifer and Vishny, 2011 for a summary of the theoretical models). Within fire sales, we study fire sales in equity markets as in Coval and Stafford (2007) and Mitchell et al. (2007).

Our framework is similar to Coval and Stafford (2007) in that we derive a measure of pressure from the portfolios of institutional investors.<sup>1</sup> However, we are focused on a particular event with the goal of providing an alternative identification strategy that complements their broader approach. The regulatory shock that we exploit represents an ideal experiment because exogenous constraints rather than information about fundamentals initiate the selling. Also, our event study methodology is closer to Mitchell et al. (2007).

Although identification is key to get good estimates of the effect of the fire sale, our use of a particular event comes at the potential cost of external validity. Four things are important to keep in mind when extrapolating our results to other settings. First, the shock occurred in late 2007 when signs of the crisis of 2008 were starting to appear. Second, Chile represents a relatively small stock market without the depth and diversification of more developed mar-

<sup>1</sup> Their measure is then used by several other papers. See for example Edmans et al., 2012; Frazzini and Lamont, 2008; Jotikasthira et al., 2012; and Lou, 2012.

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