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# Adverse selection, slow-moving capital, and misallocation☆

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ABSTRACT

We embed adverse selection into a dynamic, general equilibrium model with heterogeneous capital and study its implications for aggregate dynamics. The friction leads to delays in firms' divestment decisions and thus slow recoveries from shocks, even when these shocks do not affect the economy's potential output. The impediments to reallocation increase with the dispersion in productivity and decrease with the interest rate, the frequency of sectoral shocks, and households' consumption smoothing motives. When households are risk averse, delaying reallocation serves as a hedge against future shocks, which can lead to persistent misallocation. Our model also provides a micro-foundation for convex adjustment costs and a link between the nature of these costs and the underlying economic environment.



## 1. Introduction

To maximize output, resources need to be deployed efficiently. Changes in the economic environment, for instance, due to productivity shocks, often require the reallocation of resources across firms to maximize efficiency. Markets serve as the natural mechanism for reallocation. However, markets sometimes fail to function properly. For example, a firm may delay divestment of capital until it is able to recover its fair market value. In this paper, we propose a theory to explain slow movements in capital flows based on adverse selection. We then ask how firms' reallocation decisions depend on the economic environment and explore the implications for aggregate quantities.

Our economy features two sectors of production. Firms in both sectors use the same resource: capital. Each sector is subject to productivity shocks and, therefore, the relative productivity of these sectors changes over time, creating a reason for reallocating capital from the less

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productive sector to the more productive one.[1] Capital reallocation takes place in a competitive market. Firms in the less productive sector sell their capital to firms in the more productive sector. Capital is heterogeneous in its quality (i.e., profitability), and firms privately observe the quality of the capital they own and operate, leading to an information asymmetry.

Following a productivity shock, if all capital were to trade immediately, the market price should reflect average quality. However, firms that own the most profitable capital units would refuse to trade at this price, causing the market to unravel as in Akerlof (1970). In our dynamic economy, the equilibrium involves delays in capital reallocation. Following a productivity shock, firms in the less productive sector face a trade-off between selling their capital immediately or waiting to sell at a potentially higher price. Naturally, firms are more anxious to sell less profitable capital units. Firms in the more productive sector recognize this and offer lower prices initially. Firms with higher quality capital delay divesting longer to obtain a higher price. These delays in reallocation generate real economic costs, both at the firm level (lower profitability) and in the aggregate (lower output and total factor productivity (TFP)), due to misallocation of resources.

We demonstrate that delays in reallocation increase with the dispersion in capital quality and decrease with the level of interest rates. Increases in the dispersion of capital quality worsen the information asymmetry and, therefore, slow the equilibrium rate of reallocation. A decrease in interest rates lowers firms' cost of waiting for a higher price and thus also slows down reallocation. Thus, our model suggests a potential drawback of expansionary monetary policy. This last prediction is especially relevant in light of the 2007–08 financial crisis. Despite very low interest rates, many markets remained frozen well after the crisis ended.

Another implication of our model is that, when shocks are more persistent, firms reallocate capital more slowly. The intuition is that a firm looking to purchase capital today internalizes the inefficiency associated with selling capital in the future. As a result, they care not only about the quality of capital they buy, but also about its endogenous liquidity. This leads to an illiquidity discount in capital prices, which in turn influences a firm's decision of when to sell its capital. In equilibrium, the illiquidity discount and the rate of reallocation are jointly determined. Higher quality capital takes longer to be reallocated and is therefore associated with a larger discount. As productivity shocks become more persistent, the discount falls, which increases the incentive for firms to wait for a higher price, thereby resulting in more delay in the reallocation process.

The baseline model features risk-neutral households. Thus, the interest rate is equal to the subjective discount rate. We introduce households with constant relative risk aversion (CRRA) utility to explore how our results extend to the case in which the stochastic discount factor varies endogenously over time. We obtain several new insights resulting from general equilibrium effects. First, households' desire to smooth consumption increases firms' cost of delay and translates into faster reallocation. Second, the model predicts that large downturns are followed by fast recoveries, whereas smaller downturns are followed by slower recoveries. Both of these predictions are in contrast to the predictions of models with convex adjustment costs. Third, when shocks are recurring, there is a motive for diversification. Interest rates adjust so that some firms choose to continue to operate capital in the inefficient sector indefinitely. As a result, the reallocation process stops even though some capital remains inefficiently allocated, leading to long-run persistence in misallocation.

We offer supporting evidence consistent with our theory. Because the model's predictions pertain to unobservable characteristics, implementing a direct test of the mechanism is inherently challenging.[2] To do so, we focus on the change in ownership from entrepreneurs to investors following a firm's initial public offering (IPO). Our model has two clear predictions. The first prediction is that owners of high-quality firms wait longer before selling. Thus, the length of time that has elapsed between a firm's incorporation and its IPO should be positively related to post-IPO measures of its profitability, after controlling for observable characteristics at the time of the IPO. The second prediction is that, because the equilibrium is fully separating, prices at the time of the IPO should incorporate all the information contained in the timing decision. Both predictions are supported by the data. We find that the age of the firm at the time of the IPO is strongly related to post-IPO measures of profitability. By contrast, we find no corresponding relation between firm age at IPO and subsequent changes in firm valuations, suggesting that these post-IPO increases in profitability are not news to investors.

The equilibrium dynamics of our model resemble those in models with convex adjustment costs. Depending on the degree of complementarity between capital quality and sectoral productivity, our model can generate aggregate

[1] The model is sufficiently flexible to admit multiple interpretations. Capital can represent physical capital, human capital (workers), or existing matches between physical and human capital, such as a division of a firm, whose productivity cannot be verified or contracted upon. Sectors in our model can be interpreted as industries, physical locations or firms. Productivity shocks can represent changes in the terms of trade, preferences, or technological progress. The exact mapping between the model and the real world depends on how the above terms are interpreted. For example, equipment used for construction during the real estate boom was put to use in the shale gas industry after 2008. As oil prices drop and real estate prices recover, machinery changes hands from oil prospectors back to real estate developers. Matches of workers and physical capital could also move together as firms or divisions are sold. As battery technology improves, both physical and human capital used by firms manufacturing gasoline-powered cars is reallocated to firms making electric vehicles. Similarly, there are many job-to-job transitions in the labor market. As social networking sites attract more users, programmers and entrepreneurs move from developing e-commerce websites to those focused on social networking.

[2] The reallocation decision of firms in our model operates based on unobservable characteristics. Absent this distinction, some of the model's predictions can appear to run counter to what intuition would suggest. For example, one might expect that, in contrast to our model, higher types should reallocate faster than lower types. However, this intuition refers to observable characteristics. If higher types can receive a higher price regardless of the timing of their reallocation decision, then they will naturally more quickly.