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# Aggregate consequences of dynamic credit relationships <sup>☆</sup>

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## ABSTRACT

I investigate the aggregate consequences of canonical financial frictions in the supply of credit to firms: private information and limited enforcement. I propose a general equilibrium model in which entrepreneurs finance their firm through a long-term contract with a financial intermediary. The contract is inefficient because firm cash flow is costly to monitor, and borrowers that repudiate cannot be excluded from capital markets. By investing in enforcement capacity, an intermediary can delay debt repayment and maintain incentive compatibility. Reforms that seek to decrease either the cost of monitoring or enforcing contracts, or both, affect firm dynamics and can generate complementarities. Estimating the model with data on Colombian manufacturing firms in the 1980s and 1990s, I find that financial frictions are responsible for a significant aggregate output loss. Most of this distortion can be attributed to private information. Reforms that only reduce private information create significant economic growth and welfare gains, while those that only improve enforcement do not. There are significant complementarities between different types of reforms, as moral hazard is less significant when contracts are more enforceable.

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## 1. Introduction

Which financial frictions matter for aggregate resource allocation and for economic development and growth? A large microeconomic literature on firm and industry dynamics has studied financial frictions that arise when information about firms is expensive to acquire and when financial contracts are difficult to enforce. Limits to contract enforceability and the cost of acquiring information are incentives for lenders to design different types of financial contracts (Levine, 2005). These differences shape the supply of credit to firms and, in the aggregate, the efficiency at which the economy transforms savings into investment. Although there is broad consensus that financing frictions raise the cost of external finance for firms (see

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Hubbard, 1998 and Stein, 2003 for surveys), considerable debate surrounding the importance of financial frictions for the determination of macroeconomic outcomes remains.<sup>1</sup>

The main contribution of this paper is to propose and estimate a general equilibrium model in which different forms of financial frictions affect financial contracting and the supply of credit to firms. Recent developments in the theory of dynamic financial contracting have shown that private information and limited enforcement frictions can individually account for some of the empirical regularities on firm dynamics.<sup>2</sup> Although many properties of this class of financial contracts are well understood, their implications for the determination of macroeconomic outcomes remain largely unexplored.<sup>3</sup>

In the model, entrepreneurs with uncertain lifetimes can operate a long-lived firm. Starting a firm requires incurring a partially sunk fixed cost and working capital each period. New entrepreneurs do not have enough resources to finance their firms and may obtain external financing by entering into a long-term contract with a financial intermediary. Once in business, firms generate a random cash flow that is a function of the working capital input. Borrowing constraints emerge because firms operate under limited liability, firm cash flow is costly to monitor, and entrepreneurs repudiating their debt are not excluded from capital markets. A financial intermediary may invest in enforcement capacity to reduce the value of the entrepreneur's outside option, but doing so is costly.

Financial development in the model is a combination of lower costs of monitoring firms and investment in enforcement capacity. A less financially developed economy is subject to more severe moral hazard and limited enforcement frictions because the costs of monitoring firms and enforcing contracts are higher. Reforms to increase financial development in the model aim to reduce either one or both of these costs, which expands the set of feasible contracts and can thus have significant effects on firm dynamics and the distribution of firms.

The financial arrangement at the core of the general equilibrium model adds to the literature on dynamic contracting by considering the role of multi-period contracting, limited enforcement, and imperfect capital market exclusion in an environment with private information.<sup>4</sup> In the benchmark economy, investing in enforcement capacity and monitoring is not feasible because it is too costly, and the resulting optimal contract can be interpreted as the union of the optimal long-term contract that arises under private information studied by [Quadrini \(2004\)](#) and [Clementi and Hopenhayn \(2006\)](#) and the optimal long-term contract that arises under limited enforcement studied by [Albuquerque and Hopenhayn \(2004\)](#). Consistent with the predictions of these models, younger and smaller firms tend to grow disproportionately faster than older and larger firms, and the growth of smaller firms is also more volatile.

New contract structures arise from the interaction of private information and limited enforcement frictions when the cost of investing in monitoring and enforcement capacity is sufficiently low. Investing in enforcement capacity under private information has two effects on the optimal contract. First, greater enforcement capacity provides greater insurance against debt repudiation by decreasing the value of the entrepreneur's outside option. Second, a lower value of debt repudiation allows the intermediary to delay debt repayment while maintaining incentive compatibility at smaller firms, which increases the supply of credit to these firms. Moreover, when the cost of investing in monitoring is sufficiently low, financial intermediaries always monitor young and small firms while only relying on state-contingent promised continuation values to discipline moral hazard at older and larger firms. These mechanisms are central to the complementarities that arise in the aggregate between financial reforms that decrease the cost of monitoring and enforcing contracts.

I quantitatively investigate the aggregate effects of financial frictions by calibrating and estimating the parameters of the benchmark model economy using data from Colombia in the 1980s and 1990s and by conducting a series of counterfactual reform experiments. Colombia in this period provides an ideal benchmark to analyze the effect of different types of financial reforms, as a number of institutional and legal features prevented efficient firm monitoring and contract enforcement. An innovation in this paper is to use a simulated method of moment estimation (SMM) procedure more widely used in the dynamic corporate finance literature to structurally estimate the contract parameters using firm-level data.<sup>5</sup>

The quantitative analysis yields five results. First, financial frictions lead to a substantial misallocation of resources. Aggregate output in the benchmark model economy is about 15 percent lower than its potential first-best level. Although limited enforcement frictions can by themselves cause a 7 percent aggregate output loss, their relative effects in the presence of private information are small—that is, private information absent any enforcement frictions leads to roughly the same output loss as in the benchmark economy. Second, financial development can lead to significant economic growth. A reform that eliminates private information frictions leads to 10 consecutive years of economic growth at an average growth rate of about 1 percent per year before the economy reaches its new steady state. This effect is in sharp contrast to a reform that

<sup>1</sup> For example, [Gilchrist et al. \(2013\)](#) and [Midrigan and Yi Xu \(2014\)](#) argue that the misallocation due to financial frictions is much lower than previous estimates.

<sup>2</sup> Empirical studies of firms have shown that smaller and younger firms pay fewer dividends, take on more debt, and experience more rapid but also more volatile growth, and that small and young firms' investments are more sensitive to cash flows ([Cooley and Quadrini, 2001](#); [Cabral and Mata, 2003](#); [Oliveira and Fortunato, 2006](#); [Fagiolo and Luzzi, 2006](#), and [Lu and Wang, 2010](#)). The seminal contributions on dynamic financial contracting to account for firm dynamics include [Albuquerque and Hopenhayn \(2004\)](#), [Quadrini \(2004\)](#), and [Clementi and Hopenhayn \(2006\)](#). See also [Hopenhayn and Werning \(2008\)](#), [Li \(2013\)](#), [Kovrijnykh \(2013\)](#), and [Popov \(2014\)](#).

<sup>3</sup> The seminal work in this area is [Cooley et al. \(2004\)](#) and [Smith and Wang \(2006\)](#). More recent work includes [Quintin \(2008\)](#) on the size distribution of manufacturing establishments, [Li \(2010\)](#) on employment flows, [Dyrda \(2014\)](#) on the effect of aggregate uncertainty shocks, [Gross and Verani \(2011\)](#) and [Dovis and Brooks \(2014\)](#) on international trade, and [Veracierto \(2014\)](#) on consumers' decisions.

<sup>4</sup> See previous work by [Atkeson \(1991\)](#), [Khan \(2001\)](#), [Castro et al. \(2009\)](#), [Buera et al. \(2011\)](#), [Greenwood et al. \(2013\)](#), and [Arellano et al. \(2012\)](#).

<sup>5</sup> See [Strebulaev and Whited \(2012\)](#) for a survey of the recent dynamic corporate finance literature.

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