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Estimating contract indexation in a Financial Accelerator Model ☆

Charles T. Carlstrom [a], Timothy S. Fuerst [b,c,*], Alberto Ortiz [d,e], Matthias Paustian [f]

[a] Federal Reserve Bank of Cleveland, Cleveland, OH 44101, USA
[b] Department of Economics, University of Notre Dame, Notre Dame, IN 46556, USA
[c] Federal Reserve Bank of Cleveland, 419-320-300, USA
[d] Centro de Estudios Monetarios Latinoamericanos, Mexico
[e] EGADE Business School, Tecnologico de Monterrey, Mexico
[f] Division of Research and Statistics, Federal Reserve Board, Washington, DC 20551, USA

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ABSTRACT

This paper addresses the positive implications of indexing risky debt to observable aggregate conditions. These issues are pursued within the context of the celebrated financial accelerator model of Bernanke et al. (1999). The principal conclusions include: (1) the estimated level of indexation is significant, (2) the business cycle properties of the model are significantly affected by this degree of indexation, (3) the importance of investment shocks in the business cycle depends upon the estimated level of indexation, and (4) although the data prefers the financial model with indexation over the frictionless model, they have remarkably similar business cycle properties for *non-financial* exogenous shocks.

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1. Introduction

The fundamental function of credit markets is to channel funds from savers to entrepreneurs who have some valuable capital investment project. These efforts are hindered by agency costs arising from asymmetric information. A standard result in a subset of this literature, the costly state verification (CSV) framework, is that risky debt is the optimal contract between risk-neutral lenders and entrepreneurs. The modifier risky simply means that there is a non-zero chance of default. In the CSV model external parties can observe the realization of the entrepreneur's idiosyncratic production technology only by expending a monitoring cost. Townsend (1979) demonstrates that risky debt is optimal in this environment because it

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* Corresponding author at: Department of Economics, University of Notre Dame, Notre Dame, IN 46556, USA. Tel.: +1 574 631 4853; fax: +1 574 631 4783.
E-mail addresses: charles.t.carlstrom@clev.frb.org (C.T. Carlstrom), tfuerst@nd.edu (T.S. Fuerst), ortiz@cemla.org (A. Ortiz), matthias.o.paustian@frb.gov (M. Paustian).

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minimizes the need for verification of project outcomes. This verification is costly but necessary to align the incentives of the firm with the bank.

Aggregate conditions will also affect the ability of the borrower to repay the loan. But since aggregate variables are observed by both parties, it may be advantageous to have the loan contract indexed to the behavior of aggregate variables. Therefore, even when loan contracts cannot be designed based on private information, we can exploit common information to make these financial contracts more state-contingent. That is, why should the loan contract call for costly monitoring when the event that leads to a poor return is observable by all parties? Carlstrom et al. (2013),[1] hereafter CFP, examine questions of this type within the financial accelerator of Bernanke et al. (1999), hereafter BGG. CFP demonstrate that the privately optimal contract in the BGG model includes indexation to: (i) the aggregate return to capital (which we will call R^k-indexation), (ii) the household's marginal utility of wealth, and, (iii) the entrepreneur's valuation of internal funds. CFP also demonstrate that the latter two forms of indexation quantitatively largely cancel out, so our focus will be on R^k-indexation.

In this paper we thus explore the business cycle implications of indexing the BGG loan contract to the aggregate return to capital. There are at least two reasons why this is an interesting exercise. First, as noted above, CFP demonstrate that the privately optimal contract in the BGG framework includes indexation of this very type. Second, indexation of this type is not so far removed from some financial contracts we do observe. Since we are assuming that the CSV framework proxies for agency cost effects in the entire US financial system, it seems reasonable to include some form of indexation to mimic the myriad ex post returns on external financing. For example, in contrast to the model assumption where entrepreneurs get zero in the event of bankruptcy, this is clearly not the implication of Chapter 11 bankruptcy. In any event, we use familiar Bayesian methods to estimate the degree of contract indexation to the return to capital.

To avoid misspecification problems in the estimation we need a complete model of the business cycle. We use the recent contribution of Justiniano et al. (2011), hereafter JPT, as our benchmark. A novelty of the JPT model is that it includes two shocks to the capital accumulation technology. The first shock is a non-stationary shock to the relative cost of producing investment goods, the "investment specific technology shock" (IST). The second is a stationary shock to the transformation of investment goods into installed capital, the "marginal efficiency of investment shock" (MEI). For business cycle variability, JPT find that the IST shocks are irrelevant, while the MEI shocks account for a substantial portion of business cycle fluctuations.

Our principal results include the following. First, the estimated level of R^k-indexation significantly exceeds unity, much higher than the assumed BGG indexation of approximately zero. A model with R^k-indexation fits the data significantly better when compared to BGG. This is because the BGG model's prediction for the risk premium in the wake of a MEI shock is counterfactual. A MEI shock lowers the price of capital and thus leads to a sharp decline in entrepreneurial net worth in the BGG model. But under R^k-indexation, the required repayment falls also so that net worth moves by significantly less.

Second, with R^k-indexation, this financial model and JPT have remarkably similar business cycle properties for *non-financial* exogenous shocks. For example, for the case of MEI shocks, the estimated level of indexation leads to net worth movements in the financial model that accommodate real behavior quite similar to the response of JPT to an MEI shock. We also nest financial shocks into the JPT model by treating fluctuations in the financial variables as serially correlated measurement error. This model horserace results in the R^k-indexation model dominating BGG, which in turn significantly dominates JPT. The financial models are improvements over JPT in two ways. The financial models make predictions for the risk premium on which JPT is silent, and the financial models introduce other exogenous shocks, e.g., shocks to net worth or idiosyncratic variance, that are irrelevant in JPT.

Third, we find that whether financial shocks or MEI shocks are more important drivers of the business cycle depends upon the level of indexation. Under BGG, financial shocks account for a significant part of the variance of investment spending. But under the estimated level of R^k-indexation, financial shocks become much less important and the MEI shocks are again of paramount importance.

Two prominent papers closely related to the current work are Christiano et al. (2014), and DeGraeve (2008). They each use Bayesian methods to estimate versions of the BGG framework in medium-scale macro models. Both papers conclude that the model with financial frictions provides a better fit to the data when compared to its frictionless counterpart. The chief novelty of the current paper is to introduce contract indexation into the BGG framework, and demonstrate that it is empirically relevant, altering the business cycle properties of the model. Neither of the previous papers considered indexation of this type.

The paper proceeds as follows. Section 2 presents a simple example that illustrates the importance of contract indexation to the financial accelerator. Section 3 develops the DSGE model. Section 4 presents the estimation results, while Section 5 provides some sensitivity analysis. Section 6 concludes.

2. Why does indexation matter? A simple example

This section presents a simple intuitive example that demonstrates the importance of indexation in determining the size of the financial accelerator. Consider a world with agency costs in which the portion of net worth owned by entrepreneurs

[1] This is the logic behind Shiller and Weiss's (1999) suggestion of indexing home mortgages to movements in aggregate house prices.