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State dependence in access to credit☆

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ABSTRACT

This paper investigates whether firms' access to credit is characterized by state dependence. We introduce a first-order Markov model of credit restriction with sample selection that makes it possible to identify state dependence in presence of unobserved heterogeneity. The results, based on a representative sample of Italian firms, show that state dependence in access to credit is a statistically and economically significant phenomenon and that this is more prominent among medium-large firms.

1. Introduction

It is a well-established finding that bank lending occurs in cycles. Robust evidence indicates that financial accelerator mechanisms *á la* Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) are of primary importance for explaining economic fluctuations and firms' investment dynamics (Braun and Larrain, 2005; Liu et al., 2011; McLean and Zhao, 2014), and that bank lending standards are procyclical (Berger and Udell, 2004; Ruckes, 2004; Lown and Morgan, 2006; Gorton and He, 2008; de Bondt et al., 2010). Despite this broad consensus, the existence of lending cycles at the firm level is still a largely unexplored issue. This paper contributes to fill this gap by investigating whether firms' access to credit (specifically, the likelihood of applying for a loan and the outcome of loan applications) is characterized by state dependence in a representative sample of Italian manufacturing firms.

Borrowers are limited in their access to credit if they are restricted by banks in terms of quantity or price, or if they are discouraged from applying for a loan in anticipation of a future credit restriction (Jappelli, 1990). In a dynamic framework, state dependence in access to credit arises when a borrower whose loan application has been fully or partly restricted in the past exhibits a greater probability of being restricted and/or discouraged from applying for a loan in the future, relative to an identical firm whose access to credit was unrestricted.

An extensive empirical literature has investigated firms' access to credit and the determinants of loan applications and credit restrictions in a static context (Alessandrini et al., 2009; Han et al., 2009; Popov and Udell, 2012; Presbitero et al., 2014; Cole and Sokolyk, 2016). Very limited attention has been paid to whether and what extent firms can be "locked" in a state of credit restriction over time. A notable recent exception is Dougal et al. (2015,

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p. 1078), who analyze the spread on repeated loans registered in the Reuters Dealscan database from 1987 to 2008 and find that "the spread that a firm received on its most recent loan affects the spread it receives on a new loan, acting as an anchor", a pattern consistent with state dependence in firms' access to credit.[1]

The persistence in a state of credit restriction can be due to observed firm characteristics (i.e., firm size, risk, profitability), unobserved heterogeneity, and *true* state dependence (Heckman, 1981a). Unobserved heterogeneity reflects unmeasured firm attributes that may affect the likelihood of being restricted in access to credit in any period, but that are not driven by past credit constraints, such as the lack of entrepreneurial ability of managers or the lack of business opportunities. If these unobservables have some degree of persistence, they may originate the so-called *spurious* state dependence: other things being equal, past credit restrictions may turn out to be a significant predictor of the likelihood of present credit restrictions, even though they are only reflecting the influence of unobserved heterogeneity. In contrast, *true* state dependence refers to the fact that the very experience of a restriction in access to credit has a genuine causal effect on the risk of future restrictions.

Two broad, non-alternative mechanisms can explain *true* state dependence in access to credit. First, a restricted access to credit in a period can be associated with adverse changes in firms' characteristics and opportunities that make less profitable for banks to fund these firms in the future and less valuable for firms to apply for a loan. For example, an adverse shock to the borrower's productivity or to the credit supply can reduce the value of collateralizable assets (Bernanke and Gertler, 1989; Greenwald and Stiglitz, 1993; Kiyotaki and Moore, 1997). When credit markets are imperfect and applying for a loan is costly, a lower value of collateral hinders access to credit. Credit-constrained borrowers have to cut back investment and production levels, and the resulting decline in net worth further reduces their ability and willingness to borrow in the future. Another possibility is that a restriction in access to credit prevents the firm from exploiting a business opportunity and that the value of this opportunity decays over time as other competitors enter the market, making less worthy for banks to fund the project in the future (Levenson and Willard, 2000).

A second mechanism relates to information imperfections and screening technology frictions. To frame the empirical analysis, the online appendix presents a highly simplified information-based model of state dependence in access to credit. The intuition is simple. All lending decisions are made starting from some formal or informal imperfect test of borrowers' likelihood of default, like automated and semi-automated credit scoring models or soft-information-based screening technologies. To the extent that updating borrower information is costly or unfeasible (as it happens in the case of balance-sheet or other pieces of hard information), and switching banks is also a costly alternative or credit bureaus/registers reveal information on past credit ratings and rejections, banks' screening technologies result to be characterized by a degree of memory. This implies that the expected quality of a borrower that has applied for a loan in the past depends on the result of his/her previous credit-worthiness tests. Since such tests take on the lowest values for rejected borrowers, the likelihood that the current credit-worthiness test confirms the result of the previous test is higher for rejected than for non-rejected (and new) applicants. In addition, if loan application is costly, previously rejected borrowers may be discouraged from applying for a loan in the future, anticipating the higher probability of credit denial.

The investigation of phenomena that exhibit some form of persistence and the problem of isolating *true* state dependence effects are of increasing interest in many fields of economic research.[2] Besides controlling for the unobserved firm-specific characteristics and the possible dependence between the unobservables and the credit restriction status in the initial period (Heckman, 1981b), modeling state dependence in the context of access to credit requires dealing with two additional challenges. First, the use of standard binary response models might be inappropriate as firms demanding credit might be a non-random sample of population (Popov and Udell, 2012; Presbitero et al., 2014). In this view, ignoring the modeling of credit demand would produce inconsistent estimators of the transition probabilities into a credit restriction state. In addition, the economic significance of state dependence in access to credit would be understated by not considering the discouragement effect of past credit restrictions on current loan applications. A second concern is that the assumption of strict exogeneity of explanatory variables used in standard dynamic discrete-choice models is hardly tenable, and the presence of feedback effects from previous credit restrictions on future firm characteristics, such as firm size, export orientation and level of available liquidity, may hinder identification of the *true* state dependence in access to credit.

To deal with these issues, we develop a first-order Markov model for state dependence in access to credit with selection bias and unobserved heterogeneity. In each period t a firm can: (i) apply for credit and receive the requested amount; (ii) apply for credit and not receive the requested amount or receive it at more onerous terms (hereafter, we label this outcome credit restriction and these firms as restricted applicants); or (iii) not to apply for credit. We specify two binary outcome equations: one for the bank lending decision and the other for the firm credit demand at time t. To control for the presence of unobserved heterogeneity, we adopt a random-effects approach, with a full parametrization of the variance structure. Then, in the spirit of Heckman (1981b), we control for the correlation between the unobserved effects and the initial state of restriction by specifying two more equations for credit demand and supply as initial conditions. Finally, to circumvent the assumption of strict exogeneity of observables and address the concern for possible feedback effects of previous credit restriction on firms' characteristics, we follow the approach suggested by Cappellari and Jenkins (2004) and estimate a period-to-period reduced-form model on a dataset of pooled transitions, where the observation unit is the firm observed for every possible pair of consecutive periods.

We apply our model to a representative sample of Italian manufacturing firms, surveyed by the National Institute of Statistics (ISTAT). This survey provides detailed information on firm loan demand and access to credit, location and other firm characteristics on a quarterly basis from 2008:q2 to 2009:q4. Unfortunately, survey data do not contain very specific and detailed information about the screening process, switching costs, firms' net worth and returns. Besides, the identity of surveyed companies is undisclosed to researchers, and thus we cannot add information from firms' balance-sheets and other data sources. Hence, while it is possible to provide evidence of whether and to what extent there is *true*

[1] Levenson and Willard (2000, p. 91) explicitly recognize that "credit rationing has a duration dimension", even though their empirical analysis – based on a static two-stage probit model for the probability of credit denial and loan application – does not allow to test for state dependence in access to credit.

[2] For example, models accounting for state dependence have been used to study unemployment and wage dynamics (Heckman and Borjas, 1980; Stewart and Swaffield, 1999), labor market participation (Hyslop, 1999), poverty transitions (Cappellari and Jenkins, 2004), self-assessed health condition (Carro and Traferri, 2014), remittance decisions (Bettin and Lucchetti, 2016), and households' financial distress (Giarda, 2013; Brown et al., 2014).