



# Revisiting the model of credit cycles with Good and Bad projects <sup>☆</sup>

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## Abstract

We revisit the model of endogenous credit cycles by Matsuyama (2013, Sections 2–4). First, we show that the same dynamical system that generates the equilibrium trajectory is obtained under a much simpler setting. Such a streamlined presentation should help to highlight the mechanism through which financial frictions cause instability and recurrent fluctuations. Then, we discuss the nature of fluctuations in greater detail when the final goods production function is Cobb–Douglas. For example, the unique steady state possesses *corridor stability* (locally stable but globally unstable) for empirically relevant parameter values. This also means that, when a parameter change causes the steady state to lose its local stability, its effects are *catastrophic* and *irreversible* so that even a small, temporary change in the financial friction could have large, permanent effects on volatility. Other features of the dynamics include *an immediate* transition from the stable steady state to a stable *asymmetric cycle* of period  $n \geq 3$ , along which  $n - 1 \geq 2$  consecutive periods of gradual expansion are followed by one period of sharp downturn, as well as to a

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*robust chaotic attractor*. These results demonstrate the power of the skew-tent map as a tool for analyzing a regime-switching dynamic economic model.

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## 1. Introduction

The idea that market mechanisms are fundamentally unstable is not new. Indeed, the earliest mathematical models of business cycles, those proposed by Hicks, Kaldor, Kalecki, Goodwin, etc., may be viewed as attempts to capture such an idea. Recent events have also renewed interest in the Kindleberger–Minsky hypothesis that financial frictions can be a source of macroeconomic instability and volatility. Yet, following the seminal work of [Bernanke and Gertler \(1989\)](#) and [Kiyotaki and Moore \(1997\)](#), a vast majority of macroeconomic research on financial frictions study propagation mechanisms of exogenous shocks in the presence of financial frictions, within a theoretical setting that ensures the stability of the steady state. Nevertheless, there exist some micro-founded, intertemporal general equilibrium models, in which financial frictions are responsible for making the unique steady state unstable, thereby creating persistent volatility without exogenous shocks; see, e.g., [Aghion et al. \(1999\)](#), [Azariadis and Smith \(1998\)](#), [Matsuyama \(2007, 2008, 2013\)](#) and [Myerson \(2012, 2014\)](#).<sup>1</sup>

The present paper builds on one such model developed by [Matsuyama \(2013, Sections 2–4\)](#), which generates endogenous fluctuations of borrower net worth and aggregate investment. This model considers an overlapping-generations economy in which entrepreneurs arrive sequentially with their endowments of inputs, which are used to produce the final good. Upon arrival, they first sell their endowments of inputs to acquire some net worth that is used later to finance their own projects or to lend to finance the projects run by others. There are two types of investment projects, *the Good* and *the Bad*. The Good projects generate capital, which produces the final good using inputs supplied by the next generations of entrepreneurs who might undertake projects of their own. By competing for these inputs, more Good projects drive up the price of these inputs, thereby improving the net worth of next generations of entrepreneurs. In contrast, the Bad projects are independently profitable as they directly generate the final good. Without generating demand for any inputs, these projects do not improve the net worth of next generations of entrepreneurs. Furthermore, the Bad projects are subject to borrowing constraints due to the limited pledgeability of their revenue so that the entrepreneurs need to have enough net worth of their own to finance them. The unique equilibrium path of this economy, governed by a one-dimensional nonlinear piecewise smooth map, may fluctuate persistently for almost all initial conditions. With a low net worth, all the credit flows to finance the Good, even when the Bad

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<sup>1</sup> See also [Favara \(2012\)](#), [Figueroa and Leukhina \(2013\)](#), [Martin \(2008\)](#), and [Reichlin and Siconolfi \(2004\)](#). There is also a literature on dynamic models of financial frictions that generate multiple equilibrium trajectories, some of which exhibit “expectations-driven” fluctuations. In these models, such fluctuating equilibrium trajectories co-exist with an equilibrium trajectory that does not fluctuate. In contrast, the models cited here generate fluctuations along the unique equilibrium trajectory for almost all initial conditions.

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