



Animal spirits as an engine of boom-busts and throttle of productivity growth[☆]



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ARTICLE INFO

Article history:

Received 18 December 2014

Received in revised form

10 April 2015

Accepted 6 May 2015

Available online 14 May 2015

JEL:

C68

E00

E2

E3

O3

O4

Keywords:

Expectations-driven business cycle

Technological adoption

Sunspot

Multiple equilibria

News shock

Intangible capital

ABSTRACT

The news-shock literature interprets empirical news-shock identifications as signals about future productivity. Under this view, changes in productivity cause changes in expectations. I investigate an alternative interpretation whereby changes in expectations cause changes in productivity. I present a model where firms adopt the technology of a deterministic frontier, and where self-fulfilling expectational-shocks unleash a frenzy of adoption through which firms increase productivity. Consistent with the news evidence, stock prices and aggregate activity boom, yet TFP increases with a lag. Simulations using i.i.d. expectational-shocks yield moments consistent with the data, and qualitatively capture both high-frequency boom-busts and lower-frequency fluctuations. Finally, estimating a Beaudry–Portier style VECM on the simulated model output to identify a “news shock” recovers impulse response functions largely consistent with the [Beaudry and Portier \(2006\)](#) results.

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1. Introduction

Much has been made about the role of “over-exuberance” and “optimism” in the great stock market run-ups of the 20th century¹. Moreover the fact that these events did not exist in isolation in asset markets alone – the real economy boomed during these periods – has lent credence to some about the possibility of an independent role for the “animal spirits” of consumers and firms in driving the economy independent of fundamentals such as productivity. Yet with the advantage of hindsight, one could argue that this exuberance was not completely unfounded: the boom of the 1990s eventually led to a period of growth in total factor productivity (TFP) not seen in 20 years; the 1920s yielded similar growth in TFP.

Indeed this casual observation about a connection between stock market booms and growth in fundamentals has empirical support. Using a VAR-based empirical strategy including stock prices and total factor productivity (TFP), [Beaudry](#)

[☆] This research was supported by a research grant from the Social Sciences and Humanities Research Council (SSHRC) of Canada.

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¹ See [Shiller \(2005\)](#).

and Portier (2006) investigate the connection between changes in expectations, aggregate economic activity, and long-run economic fundamentals (TFP). They find that (i) a shock to expectations produces a boom in stock prices and aggregate economic activity; (ii) such booms can account for a material fraction of the variance of economic activity at business cycle frequencies; and (iii) these booms precede eventual growth in TFP.

Nearly universally, the theoretical literature has interpreted these results in terms of “news shocks”, whereby economic agents receive advanced information about changes in future TFP, to which their response induces an economic boom.² Yet from the empirical analysis alone, it is not clear which direction the causation runs: do exogenous changes in (future) fundamentals cause the change in expectations, or could exogenous changes in expectations cause the changes in fundamentals?³ In this paper I investigate this alternative interpretation whereby exogenous changes in sentiment can produce not just business cycle booms and busts, but also shape productivity growth itself. I develop a theoretical model where firms endogenously increase productivity by adopting new technology into production through a costly-adoption process. The frontier of technology evolves without shocks, yet the rate that firms implement new technology is a function of their self-fulfilling beliefs. When agents are suddenly optimistic, a frenzy of adoption ensues that leads to a boom in stock prices and aggregate quantities followed by eventual productivity growth, consistent with the empirical news-shock evidence. Moreover, consistent with the literature on intertemporal shocks, the relative price of capital falls. Yet in contrast with the traditional stochastic view of technology, the rapid growth in technology is a consequence of the increase in optimism, the same mechanism responsible for the business cycle boom. I also show that simulated business cycle moments in response to only these belief shocks are consistent with various unconditional moments in the data. Moreover, I demonstrate that in simulations over 100-year spans, i.i.d. expectational shocks can qualitatively account for both high-frequency boom-busts in asset prices and macro variables, as well as also occasional medium-frequency highly persistent secular “bull” and “bear” markets that seem to have characterized the 20th century U.S. data. Finally, I estimate a Beaudry-Portier style VECM on both data and on the simulated sunspot model output to identify a “news shock”, and show that the procedure recovers impulse response functions from the sunspot model largely consistent with those estimated on the data.

In illustrating this alternative view, I provide not just a different way to think about the connections between expectations and technology over business cycles in general, but also way to think about several key macroeconomic episodes of concentrated technological change such as the 1920s and 1990s and their connection to the business cycle and asset markets. In particular, my model is consistent with the view that the concentrated growth in productivity that we observed during these periods was not necessarily a unique outcome of technological change. For example, during the technology boom of the 1990s in the United States we observe a dramatic rise in stock prices accompanied by an overall boom in economic activity, and then towards the latter part of the decade, a broad-based increase in productivity growth. A strict interpretation of this phenomena through the traditional stochastic view of technology would suggest that stock prices, economic activity and productivity rose uniquely given a change in the state of technology. In contrast, from the perspective of the model that I present in this paper, firms’ independent enthusiasm about the newly emerging technologies increased their rates of adoption, which as a consequence increased economic activity and subsequent productivity growth.

While many existing models of sunspots, such as Benhabib and Farmer (1994), allow for theories of self-fulfilling cycles whereby exogenous changes in agents’ beliefs trigger business cycle responses, many such models typically rely on contemporaneous externalities or point-in-time increasing returns that imply a “recovered” productivity that appears to rise contemporaneously. For example, Farmer and Guo (1994) show that one can generate a simulated series of business cycle and “TFP” from the model of Benhabib and Farmer (1994) to produce an observationally equivalent series to that of a standard real business cycle model with contemporaneous productivity shocks. Yet contemporaneous TFP shocks are inconsistent with the types of business cycles identified by the empirical news literature where the benefits of technology appear to follow the boom through the growth in technology.

Instead, my modeling approach draws upon the long literature on technological adoption and diffusion and incorporates two critical features emphasized by this literature: the inherently time-consuming nature of technological adoption and the role of physical capital in embodying new technology.⁴ Thinking about the frontier of technology as “technological ideas”, I model technological ideas as embodied in new capital, in the sense that firms must first purchase new capital in order to implement these ideas. Thus in the process of increasing their stock of physical capital through new investment, firms also effectively grow a stock of “technology capital” that represents potential productivity increases to the firm. Firms then undergo a process of costly adoption through which they transfer resources out of goods production in order to convert this potential productivity into a form of intangible capital which serves as an additional input into goods production, thereby increasing their productivity of goods production for given levels of labour and physical capital.

² See Beaudry and Portier (2004), Jaimovich and Rebelo (2009), Christiano et al. (2008), and Gunn and Johri (2011).

³ In a recent empirical news-shock paper that largely corroborates the results of Beaudry and Portier (2006), Beaudry et al. (2011) write, “we find that there is a very close link between [identified mood shocks and subsequent developments in fundamentals], suggesting that agents’ feelings of optimism and pessimism are at least partially rational as total factor productivity (TFP) is observed to rise 8–10 quarters after an initial bout of optimism. While this later finding is consistent with some previous findings in the news shock literature, we cannot rule out that such episodes reflect self-fulfilling beliefs.”

⁴ See Greenwood and Yorukoglu (1997), Aghion and Howitt (1998), David (1990), Helpman and Trajtenberg (1994), Jovanovic and Rousseau (2005), Carlaw and Lipsey (2002), Atkeson and Kehoe (2007), Basu and Fernald (2008), Bresnahan et al. (2002), Oliner et al. (2007) and Comin and Hobijn (2007).

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