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Neoclassical vs evolutionary theories of financial constraints: Critique and prospectus

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ABSTRACT

Empirical models based on neoclassical theory predict that if investment is sensitive to current financial performance, this is a sign that something is 'wrong' and is to be regarded as a problem worthy of a policy intervention. Evolutionary theory, however, refers to the principle of 'growth of the fitter' to interpret investment-cash flow sensitivities as the workings of a healthy economy. In particular, I attack the neoclassical assumption of rational profit-maximizing firms. Such an assumption is not a helpful starting point for empirical studies into firm growth. One caricature of neoclassical theory could be "Assume firms are perfectly efficient. Why aren't they getting enough funding?", whereas evolutionary theory considers that firms are heterogeneous and that not all firms should grow. This essay highlights how interpretations and policy interventions can be framed by the initial modelling assumptions, even though these latter are often chosen with analytical tractability in mind rather than realism.

1. Introduction

This paper is a critical survey of the "contradictory and inconclusive evidence from almost two decades of cash-flow sensitivity and Euler equation tests" (Whited, 2006, p. 498). I highlight the differences between competing theoretical perspectives on firm growth, and also the rather different policy implications that emerge from them. The three perspectives are the neoclassical q-theory of investment (and the related Euler equation approach—see Chirinko, 1993 and Schiantarelli, 1996 for surveys), the 'imperfect capital markets' perspective (following on from Fazzari et al. (1988a); see Hubbard (1998) and Bond and Van Reenen (2007) for surveys), and also an evolutionary viewpoint that I develop by considering the contributions of writers such as Nelson and Winter (1982), Metcalfe (1998) and Dosi (2000).

How does firm investment/growth react to current-period financial performance? How *should* it? Should investment-cash flow sensitivities be interpreted as evidence of financial constraints? The standard q-theory prescribes that the only significant regressor in investment regressions should be marginal q (proxied by average q). However, for a variety of reasons the empirical results have been disappointing. More recent work on investment highlights the additional explanatory power of current cash-flow, and in interpreting this result it attributes the positive relationship between cash-flow and investment to information asymmetries and market imperfections. In contrast, evolutionary theory predicts that it should not be surprising that firm growth responds to current financial

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performance; in fact, this is what the 'replicator dynamics' model of industry evolution would predict.

It is perhaps surprising that the neoclassical and evolutionary approaches have such diverging interpretations of the same basic result. Previously, it had been claimed that the evolutionary attempts to relax the restrictive neoclassical assumptions led in any case to something close to the neoclassical 'equilibrium' solution concepts (Friedman, 1953; Rubin, 1983; see also Winter, 1971). In the case of financial constraints, however, we will see that the two approaches are strongly opposed. Whilst neoclassical studies expect that current financial performance (proxied by cash flow) should have no influence on investment, they are disappointed to observe that it does in fact have a significant influence. Evolutionary economists, on the other hand, apply the principle of 'growth of the fitter' to the data in the hope that the most profitable firms will grow faster, but they are nonetheless disappointed by their weak results.

This paper also emphasizes that policy recommendations are sensitive to the initial assumptions made by the economist. It is misleading and potentially harmful to derive policy implications from complicated mathematical models, that are constructed from assumptions that are chosen not for their economic relevance but because they ensure mathematical tractability. Unrealistic assumptions have frequently been included in mathematical models under the reasoning that the models do not suffer as a result of these simplistic assumptions, but I attempt to show that this is not the case here. In particular, I argue that mathematical models of 'optimal' firms are not suitable for deriving policy implications such as government subsidies and loan schemes, especially in a world of irrational firms that seek to maximize growth.

In Section 2 we review the three approaches—q theory, the imperfect markets approach, and evolutionary theory. A comparison of the regression equations used can be found in Section 3. We then discuss these three perspectives (Section 4) and also compare the policy recommendations that emerge from them (Section 5). Section 6 concludes.

2. A review of the three theories

2.1. q Theory

q-Theory states that firm-level investment should be determined by future prospects of return. Assuming that stock prices can accurately summarize future profits, the viability of investment opportunities can be determined by the firm's value of marginal q (i.e., market value of assets/book value of assets). However, data on marginal q are difficult to obtain, and are usually proxied by average q. Average q has been shown to be a valid proxy for marginal q when four assumptions are met (Hayashi, 1982): that firms operate in perfectly competitive product and factor markets, that firms also have linear homogenous production and adjustment cost technologies, that capital is homogenous, and that investment decisions are separable from other real and financial decisions. Assuming that firms seek to maximize shareholder value and possess 'rational expectations', it is possible to take the first-order condition of a mathematical model as the basis for a regression model. In this final model, q should be the only predictor for investment (Chirinko, 1993).

Table 1
An example of a neoclassical q model: how Blundell et al. (1992) derive the regression equation.

Equation	Description
(1)	Intertemporal capital market arbitrage condition
(2)	Solving (1) on an infinite horizon
(3)	Defining the discount factor β over an infinite horizon
(4)	Substituting for dividend payments in the firm's stock market value
(5)	Defining the firm's after-tax net revenue
(6)	First-order condition for investment
(7)	The evolution of the shadow price of capital
(8)	Rearranging (6) to obtain marginal q
(9)	Rearranging (8) assuming a quadratic functional form for adjustment costs
(10)	Rewriting marginal q assuming linear homogeneity of production and adjustment costs
(11)	Expressing the expected depreciation allowances on an infinite horizon
(12)	Expressing the expected present value of all cash flows associated with debt
(13)	Regression equation

As an example of an influencial empirical study based on the neoclassical q model, Table 1 shows how Blundell et al. (1992) derive their regression equation. This Table illustrates how the interpretation of the empirical results obtained from regression analysis of their Eq. (13) is framed by a rather long list of previous assumptions, that are not entirely realistic. Empirical analyses such as these could be deemed as 'hyper-parametric' because their results are only open to identification and interpretation within the restrictive context of an elaborate mathematical model. Perhaps unsurprisingly, we observe that "Q models have not been noticeably successful in accounting for the time series variation in aggregate investment" (Blundell et al., 1992, p. 234).

An alternative to the q model is the Euler equation model. The Euler equation describes the optimal path of investment in a parametric adjustment costs model. Although it is derived from the same dynamic optimization problem as the q-theory model, it has the advantage of avoiding the requirement of measuring q. "It states that the value of the marginal product of capital today, net of adjustment costs, must equal the cost of a new machine minus the cost savings due to the fact that the firm can invest less tomorrow and still maintain the capital stock on its optimal path" (Schiantarelli, 1996, p. 75). Taking a prominent example of a Euler equation study, Table 2 describes how Whited (1992) arrives at the regression equation after a lengthy theoretical introduction. (For other examples of Euler equation studies, see Bond and Meghir, 1994a; Galeotti et al., 1994 and Bond et al., 2003a.) Again, I direct the reader's attention to how the regression results are placed squarely in the context of the preceding mathematical models. Any interpretation of the results as evidence of 'suboptimal' behaviour on the part of the firm is thus precluded.