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Productivity and equity market fundamentals: 80 years of evidence for 11 OECD countries

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The share market boom in the 1990s is often linked to the acceleration in labour and total factor productivities over the same period. This paper explores the argument that labour and total factor productivities are inaccurate measures of firm's earnings, which underlie equity valuations, and that capital productivity is a better measure of earnings. Using 80 years of data for 11 OECD countries, it is shown empirically that the link of capital productivity to share returns is indeed stronger than that of labour productivity and TFP.

1. Introduction

The worldwide increase in equity prices in the 1990s has often been linked to accelerating labour productivity, which has in turn been related to the information technology (IT) revolution (see the discussions in Campbell and Shiller, 2001; Greenwood and Jovanovic, 1999; Hobijn and Jovanovic, 2001; Keon, 1998; Hall, 2001; IMF, 2000; Madsen and Davis, 2006). It has been argued that the apparent acceleration in labour productivity is an accurate indicator of increases in firms' current and expected real earnings and thus dividends, and its acceleration has thereby contributed to an increase in the value of firms.

The contribution of this paper is twofold. First, it is shown that labour productivity and to a lesser extent total factor productivity (TFP) as well as potential output are misleading proxies for firms' earnings. It is shown that the more relevant productivity measure for the remuneration of capital, and

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hence a key element for proxying firms' earnings, is the marginal productivity of capital, which under certain assumptions is equivalent to capital productivity at a macro-level. Second, the relationships between share returns and various productivity measures are empirically investigated using historical data on share returns and productivity over 80 years for 11 countries (G7, Australia, Netherlands, Sweden and Denmark). Short run and long run Granger causality tests are first used to examine the bivariate relationship between real share returns and various productivity growth measures. Thereafter, the nexus between real share returns and productivity is investigated using a vector-error-correction-mechanism (VECM), where other variables than productivity are allowed to influence share returns. Finally, panel data estimates using similar variables are presented to exploit the cross-country correlation between the error terms. All results underpin the case for using capital productivity as a measure for firms' earnings and hence as a predictor of equity returns.

The paper is organised as follows. Section 2 establishes a model of firms and consumers to show that share prices are linked to the marginal productivity of capital, the bond yield and the equity risk premium. Section 3 shows why other macro-indicators of productivity, such as growth in labour productivity and to some extent also TFP, are misleading indicators of earnings. Empirical estimates are presented in Sections 4 and 5. They show that capital productivity is indeed the measure which is most closely linked to share returns.

2. Equity prices and productivity

Using an optimising framework for the firm and consumers, this section shows that equity prices are determined by capital productivity, the bond yield and the covariance between equity returns and consumption growth. It is highlighted that capital productivity is the relevant measure of firms' earnings. The model is based on Abel and Blanchard (1983), Blanchard and Fischer (1989), King et al. (1988), Cochrane (1991, 1996), and Romer (2001). All corporate earnings are assumed to be distributed as dividends in the model. This assumption does not affect the conclusions in this section, since the dividend policy is irrelevant for stock returns in an economy with no taxes, as shown by Miller and Modigliani (1961).

2.1. Households

The economy consists of identical, infinitely lived households that derive utility from consumption, C_t, and leisure, $L_t = 1 - N_t$, where N is labour services. Thus, the representative household solves

$$\max_{C_t, N_t, A_{t+1}} E_0 \left\{ \sum_{t=0}^{\infty} \beta^t U(C_t, 1 - N_t) \right\}, \tag{1}$$

s.t.

$$C_t + P_t A_{t+1} \leq (P_t + D_t) A_t + W_t N_t, \tag{2}$$

where β is the subjective discount factor, P is the share price, W is the real wage, D is dividends per share, and A is the number of shares. Following King et al. (1988), a constant-relative-risk-aversion utility function with inelastic labour supply, i.e., $N_t = N_{t+1} = N$, of the following form is assumed:

$$U(C, L) = \frac{C^{1-\theta} - 1}{1 - \theta} g(L), \tag{3}$$

where θ is the coefficient of relative risk aversion. The key first-order conditions (FOCs) of Eqs. (1)–(3), where λ_t denotes the Lagrange multiplier for the budget constraint (2), are given by

$$\beta^t U_C = \lambda_t, \tag{4}$$

and

$$\lambda_t P_t = E_t[\lambda_{t+1}(P_{t+1} + D_{t+1})], \tag{5}$$