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Competition, taxation and economic growth

Ensar Yılmaz

Yildiz Technical University, Department of Economics, 34349 Yildiz, Besiktas, Istanbul, Turkey

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ABSTRACT

The paper mainly examines the relationship between economic growth, tax policy and sectoral labor distribution in an endogenous growth model with expanding varieties. For analyzing these relationships, we consider an economy where three sectors of production are vertically integrated: final goods sector, intermediate goods sector and research sector. We show that the extent of imperfect competition in the intermediate products market affects both economic growth and the allocation of the available labor to all the sectors employing this input. The resources from capital taxation, which are used for financing research sector, have a U-shaped effect on growth and lead to a movement of the labor from research sector to final goods sector. Additionally, we show that if there exists a higher competitive structure in an economy, the probability of the positive effect of an increase in tax on growth gets higher.

1. Introduction

In the last decades, the importance of the creation and diffusion of ideas to economic development has been well recognized. This fact is corroborated by increasing participation of the governments subsidizing R&D-activities. In order to observe the relevance of this public intervention, we analyze the effects of a subsidy financed by taxation to these activities on long-run economic growth and sectoral labor distribution, in addition to the effects of competition on them, using a generalization of Romer's (1990) and Grossman and Helpman's (1991: Ch. 3) endogenous growth model with expanding varieties of products.

Alesina and Rodrik (1994) discuss the economic growth, taxation and income distribution in a one-sector endogenous growth. In this model they postulate that government spending is financed by a proportional tax on capital income. We carry this postulation into a three-sector endogenous growth model, but rather than discussing income distribution, we discuss impacts of competition and taxation on economic growth and sectoral labor distribution. Even though the R&D-based models of growth generally consider a R&D-technology that uses skilled labor as an unique input, we use a technology of innovation based on both subsidy devoted to R&D by the government and labor as an input. This structure leads us to discuss the channels through which capital income taxes affect resource allocation and growth and investigate the role of the government in the determination of an economy's long-run performance.

Endogenous growth theory generates various predictions as to the relationship between competition and growth. In fact, those theoretical models can be categorized as suggesting that competitive market structures have monotone effects (e.g., Romer (1990), Aghion and Howitt (1992), Grossman and Helpman (1991)) or non-monotonic effects on innovation and productivity growth (Aghion et al. (2001), Aghion et al. (2005), Bucci (2003) and Bucci and Parello (2009)). While monotone models suggest that tougher competition has either positive or negative impact on innovation or growth, non-monotone models predict an inverted-U relationship between competition and innovation or growth.

What we found out in the paper is compatible with the studies presenting monotone effect of competition on growth. We show that the extent of imperfect competition in the intermediate products (denoted by the substitutability degree between intermediate products) influences both growth rate and the allocation of the available labor to all the sectors positively. An increase in competition affects the growth rate of the final goods production in two positive ways. One of these is positive contribution of the increased subsidy to growth. The other positive effect is arising from an increase in the share of labor working in the research sector. Even though the direction of wages following an increase in competition is ambiguous, the combined effects of changes in the prices of intermediate goods and wage of workers lead to a decrease in labor share devoted to final goods sector and an increase in labor share devoted to research sector.

In the paper the second important issue we are concerned with is the effects of (capital) income tax on growth and sectoral labor distribution. The effects of income taxation in the context of a two-sector endogenous growth model have been examined before by many authors. Some of these studies use numerical models to calculate the effect of tax reform on growth (e.g., Lucas (1990), Jones, Manuelli and

E-mail address: enyilmaz2000@yahoo.com.

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Rossi (1993), Stokey and Rebelo (1995) and Hendricks (1999)). Some other studies, like Chamley (1992) and Mino (1996), search for analytically the effect of income taxation on growth. Almost all these studies conclude that an income tax has a negative effect on growth. However, in a study by Uhlig and Yanagawa (1996), it is shown that higher capital income taxes may lead to faster growth in an overlapping generation structure.

In contrast to the literature mentioned above we find out that taxes have a hump-shaped effect on the steady-state growth rate. There are two counteracting factors that determine the direction of the change in growth rate. The first factor is positive subsidy effect on the research sector leading to an increase in growth rate. The second factor is negative labor share effect that arises from a change in the cost of labor and the cost of intermediate goods leading to the fall in labor share devoted to research sector. Consequently, the change in growth rate in the steady state depends on the size of these two counteracting effects. Nevertheless we show that if there is a higher competitive structure in an economy, the probability of the positive effect of an increase in tax on growth gets higher.

The remainder of this paper is organized as follows. Section 2 describes the model. Section 2.3 derives the equilibrium of the model. Section 3 analyzes the theoretical effects of competition on economic growth and sectoral labor distribution. Similarly Section 4 searches for the theoretical effects of taxation on economic growth and sectoral labor distribution. Section 4 concludes.

2. Model

We assume that there are three types of agents: firms, households and a government. Firms are operating in three sectors (final goods sector, intermediate goods sector and research sector) that are vertically integrated. Firms in the research sector produce the designs for new varieties of intermediate goods. The firms in the intermediate goods sector compete monopolistically, each producing a differentiated product using capital. The firms in final goods sector produce homogeneous consumption goods using labor and the available intermediate goods. Households are infinitely-lived agents who derive utility from consumption of final goods and supply labor inelastically. Finally, in the model, we have also a government that imposes taxes on capital gains and use these taxes to subsidize the research sector.

2.1. The firms

The final goods production uses the intermediate goods and labor as its inputs subject to a constant-returns-to-scale technology with the Cobb–Douglas form. Thus we postulate the production function of homogenous final good at time t as[1]

$$y = A.L_y^{1-\alpha}\int_0^n x_j{}^{\alpha} dj, \qquad 0<\alpha<1, \tag{1}$$

where A is a constant productivity coefficient, y is output of final goods production (the numeraire good), L_y is labor used in final good, x_j is the amount of the jth type of intermediate good, and n is the different varieties of intermediate products, each of which is employed in y.

The profit in the final goods sector at time t is

$$\pi_y = y - w_y L_y - \int_0^n p_j x_j dj, \tag{2}$$

where w_y is the wage rate in the final goods sector and p_j is the price of intermediate good j. These producers are competitive and hence take the price p_j as given. This profit is maximized with respect to L_y and x_j.

A representative firm in the perfect competition structure of this sector maximizes its own instantaneous profits defined by Eq. (2) with respect to the jth type variety of intermediates, taking all prices as given. From the first order conditions, and with final output being the numeraire good, we can derive the demand of the intermediate sector for the jth type of intermediate input

$$p_j = A\alpha L_y^{1-\alpha} x_j^{\alpha-1}. \tag{3}$$

Eq. (3) shows that the price of intermediate good p_j is equal to marginal productivity derived from the production function (1), thus representing a demand curve for intermediate product j, arising from profit maximization by the firms in the final goods sector. This demand function is the same for all intermediate products j, because all these products enter into the production function for the final goods in the same way.

The representative firm in the final goods sector also chooses L_y to maximize its profit function (2). The first order condition with respect to L_y yields the condition for labor demand,

$$w_y = (1-\alpha)\frac{y_t}{L_{yt}}. \tag{4}$$

Consequently, while Eq. (3) characterizes the demand function of the intermediate good j, Eq. (4) specifies the demand function of labor. Note that it is easy to derive from Eq. (4) that while α measures the share of total output going to intermediate goods, $(1-\alpha)$ gives the share of output going to labor.

In the intermediate sector, firms engage in monopolistic competition. Each firm in the intermediate sector uses one-to-one technology employing only capital to produce one horizontally differentiated intermediate good,

$$x_j = k_j. \tag{5}$$

This production function is characterized by constant returns to scale in the only input employed and one unit of capital is able to produce the same constant quantity at each time. Following Romer (1990), we continue to assume that each intermediate good represents a design created in the sector and that a patent law protects the patent holder against the usage of her good by others.

For given n, Eq. (5) implies that the total quantity of capital employed by the intermediate sector, K_j, at time t is equal to

$$K_j = \int_0^n k_j dj.$$

The intermediate good producing firm maximizes its own profit with respect to x_j at each time and is subject to the demand constraint (3). The firm chooses the optimal price p_j at each date to maximize its profit π_j,

$$\pi_j = p_j x_j - r k_j = \left(p_j - r\right) x_j, \tag{6}$$

where x_j is the quantity demanded over the producers from Eq. (3). Each intermediate firm finances its capital by loans at the interest rate r in the financial market, thus the total financial cost of obtaining the capital for each firm is rk_j.

Due to symmetry of demand curve $x(p_j)$ of all the firms in the intermediate sector, the maximization problem above is the same for all the firms. Hence, all firms are faced with the same price and quantity, $p_j = p$ and $x_j = x$, thus having the same gross profit, $\pi_j = \pi$.

[1] Whenever it is clear that variables considered pertain to period t, we will drop the time subscript t, to ease the notation.