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Vertical separation versus vertical integration in an endogenously growing economy

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ABSTRACT

This paper sets up an endogenous growth model with a learning-by-doing externality in capital accumulation under both vertical separation and vertical integration structures. Some major findings emerge from our analysis. First, an increase in monopoly power has a detrimental effect on the balanced growth rate. Second, a vertical integration structure leads to a more balanced economic growth rate than a vertical separation structure. Third, the first-best subsidy rates on labor income and capital income under a vertical separation regime are higher than those under a vertical integration regime. Finally, with the additional externality from productive government spending, the government may levy positive taxes on both labor income and capital income if the extent of the productive public spending externality is sufficiently high.

1. Introduction

A vast number of recent studies have focused on macroeconomic policies in the presence of an imperfectly competitive final good market; e.g., Blanchard & Kiyotaki (1987); Dixon (1987); Startz (1989); Heijdra & van der Ploeg (1996); Devereux, Head, & Lapham (2000), and Chen, Shieh, Lai, & Chang (2005). The main purpose of these studies is to explore how macroeconomic policies affect the relevant macro variables in the presence of market imperfections. However, these studies are implemented in the context of a single-period analysis, and hence cannot deal with the issue of sustainable economic growth. More recently, Shaw, Chang, & Lai (2006); Wang & Wen (2011), and Jensen (in press) have set up an endogenous growth model with imperfect competition. In these studies, the production side of the economy includes two sectors: a perfectly competitive final good sector and a monopolistically competitive intermediate goods sector. They find that monopoly power in the imperfectly competitive intermediate goods market plays an important role in economic growth.[1] Moreover, these studies unanimously assume that the downstream (final good) firms purchase their production inputs from

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[1] The literature on R&D-based economic growth, such as Romer (1990) and Jones (1995a), stresses that the engine of economic growth is R&D investment. This strand of research emphasizes that the R&D sector produces blueprints, and each of these blueprints can be used to produce a differentiated good (i.e., an imperfectly competitive good). As a result, the literature on the R&D-based economic growth is also able to deal with the linkage between monopoly power in the imperfectly competitive goods market and economic growth. In departing from the literature on R&D-based economic growth, these studies stress that economic growth is driven by production externalities.

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the upstream (intermediate good) firms. This implies that the downstream firms (final good firms) are vertically separated from their upstream firms (intermediate good firms).

Even though some studies have been devoted to examining the linkage between the market power and economic growth, it is surprising that the relationship between the *industrial structure* and economic growth has not been further developed. It is a common belief in the field of industrial economics that vertical separation and vertical integration are two important industrial structures, and a large number of studies (for example, Bonanno & Vickers (1988); Salinger (1988); Gal-Or (1991), and Abiru, Nahata, Raychaudhuri, & Waterson (1998)) have been devoted to each of them. In general, the price of goods in a vertically separated industry is higher than in a vertically integrated industry. The reason for this is that vertical integration can avoid the double price distortion that occurs under the regime of vertical separation when both upstream and downstream firms add their own price–cost margin at each stage of production.[2]

A common feature of existing studies on vertical integration is that they only focus on the partial equilibrium framework, and hence neglect the mutual interaction between the product market and the other markets. To avoid this deficiency, Lai, Chin, & Chang (2010) develop a monopolistic competition macroeconomic model, and use it to compare the relative performance of macro variables between vertical separation and vertical integration regimes. However, as with almost all existing studies concerned with vertical separation and vertical integration, the Lai, Chin, & Chang (2010) analysis is conducted in a static single-period framework, and hence the accumulation of capital is totally ignored. Accordingly, their analysis is unable to deal with issues such as whether the industrial structure can govern economic growth.[3]

This paper attempts to bridge this gap and to provide a systematic analysis to formally address the issue of whether economic growth is related to the industrial structure. In departing from existing studies on vertical integration, this paper is a first attempt to develop a *dynamic* general equilibrium model that features an optimizing microfoundation, in which not only is the mutual interdependence between the goods market and other markets explicitly taken into consideration, but also both the vertical integration and vertical separation structures can be described. Moreover, a common feature of almost all existing studies concerning vertical separation and vertical integration, such as Bonanno & Vickers (1988); Salinger (1988), and Gal-Or (1991), is that some of their behavioral functions, in particular the demand function for goods, are based on ad hoc specifications. Compared with these existing studies, this paper has the advantage of being able to present an optimizing dynamic macro model based on a solid microfoundation for the behavioral functions.

More specifically, this paper builds a simple endogenous growth model with the learning-by-doing externality in capital accumulation under either vertical separation or vertical integration, and uses it to examine whether the industrial structure will govern macroeconomic performance including economic growth, employment, and social welfare. The analysis of this study is roughly divided into four parts. Firstly, we set up a benchmark model, in which industry is vertically separated and both the upstream and downstream markets are imperfectly competitive. To be more specific, we deal with a vertically separated industry in which there are a certain number of upstream firms, each of which has an exclusive relationship with a downstream firm. Then, we examine the existence and uniqueness of the balanced growth equilibrium under the regime of vertical separation. Secondly, we develop an endogenous growth model in which industry is integrated and the integrated goods market is imperfectly competitive, before analyzing the balanced growth equilibrium under the regime of vertical integration. Vertical integration we deal with is that, to attain the profit and efficiency gains of cooperation, an upstream and a downstream firm are motivated to merge into a vertically integrated firm. Moreover, we compare the relative performances of relevant macroeconomic variables (including the balanced growth rate and employment) between the vertical separation regime and the vertical integration regime. Thirdly, and more importantly, in addition to positive analysis concerning the relationship between the industrial structure and economic growth, this paper also deals with normative analysis from the point of view of the social optimum. To be more precise, we discuss how the social planner sets the package of tax rates on labor and capital income to achieve the social optimum under the vertical separation regime and the integrated regime, respectively. Finally, we deal with two extensions of the benchmark model. The first extension is that monopoly power stems from the supply side rather than the demand side, and the second extension is that the productive public spending externality is present. Then, we make a brief discussion on whether our analytical results regarding optimal package of tax rates on labor and capital income are tenable with each extension.

The remainder of this paper proceeds as follows. In Section 2 we build a simple endogenous growth model under the vertical separation regime, and solve the balanced growth equilibrium. Section 3 modifies the theoretical model in Section 2 from the vertical separation regime to the vertical integration regime, and compares the relative performance of the balanced growth rate and the level of employment between the two regimes. Section 4, in order to achieve the social optimum, focuses on whether the social planner can set a package of tax rates on labor and capital income to remedy the distortions stemming from market imperfections under both regimes. Section 5 discusses two extensions of the benchmark model, and then provides a brief discussion on whether our analytical results in Section 4 are tenable with each extension. Finally, Section 6 summarizes the main findings of the analysis.

[2] However, the upstream firm can, for example, impose a two-part tariff by choosing a franchise fee in such a way that all the profit is extracted from the downstream firm. By setting the wholesale price equal to the marginal cost, the downstream firm will produce a quantity of goods that is optimal for the upstream monopoly. Based on this observation, Hart & Tirole (1990) argue that double marginalization will provide no motive for integration when a two-part tariff is allowed.

[3] To be more specific, this paper differs from Lai, Chin, & Chang (2010) in three significant respects. First, this paper is based on a dynamic intertemporal optimizing model, while the Lai, Chin, & Chang (2010) analysis is based on a static single-period framework. Second, in addition to the monopolistic distortion in the product market, this paper introduces a new distortion, namely, a capital externality in the form of learning-by-doing. Third, this paper focuses on whether the social planner can establish a package of tax rates on labor and capital income to remedy the distortions stemming from market imperfections. However, the Lai, Chin, & Chang (2010) analysis ignores the government sector, and hence is unable to discuss how the fiscal authority can choose the optimal tax rule to maximize welfare.