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Patterns of technology, industry concentration, and productivity growth without scale effects

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ABSTRACT

This paper investigates the relationship between geographic patterns of industry and economic growth in a two-country model of trade with no scale effect, where productivity growth is generated by firm investment in process innovation. We find that dispersed equilibria with industry located in both countries produce higher growth rates than concentrated equilibria with all industry located in one country. The highest growth rate arises for equal industry shares and no productivity gap, implying that industry concentration has a negative effect on overall growth. Convergence towards a dispersed equilibrium is contingent on transport costs and knowledge dispersion.

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1. Introduction

Even the most casual observer of economic geography will recognize that the distribution of industrial activity is uneven at local, regional, and international levels. A distinctly more subtle issue, however, relates to unravelling the relationship between these patterns of industrial concentration and economic growth. Although a broadly historical perspective generally leads to the prediction that a higher concentration of industry supports a greater rate of economic growth (Baldwin et al., 2001), the results obtained by recent empirical studies are mixed. For example, Braunerhjelm and Borgman (2004) report a positive relationship between industry concentration and labor productivity growth in Sweden, while Brülhart and Sbergami (2009) investigate cross-country data that suggest the relationship between industry concentration and GDP growth depends on a country's level of economic development. Bosker (2007), on the other hand, finds that, on average, European regions with a denser spread of employment tend to experience slow rates of growth in GDP. In addition, Gardiner et al. (2011) report a negative relationship between a number of measures of industry concentration and GDP growth for several levels of agglomeration using European regional data. These mixed results are difficult to interpret as the

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existing theoretical models of the "new economic geography" literature predict a positive relationship between agglomeration and growth (Baldwin and Martin, 2004).

In this paper, we introduce a novel theoretical approach that supports a negative relationship between the geographic concentration of industry and aggregate economic growth. In particular, building upon the "endogenous market structure and endogenous growth" framework (Smulders and van de Klundert, 1995; Peretto, 1996; Aghion and Howitt, 1998; Dinopoulos and Thompson, 1998), we develop a two-country model of trade in which the distribution of manufacturing activity and the rate of productivity growth are determined endogenously by the in-house process innovation activities of monopolistically competitive manufacturing firms. In a world of imperfect knowledge dispersion and costly trade, the lure of better market access causes industry to concentrate in the larger country, thereby generating external economies of scale as the proximity between firms improves knowledge dispersion and lowers the costs of innovation activity. As a result, the total number of firms rises, leading to a greater level of market concentration. With falling market shares, however, lower internal returns to scale reduce firm-level employment in production and innovation and hinder the pace of productivity growth. Thus, the negative relationship between industry and economic growth derives from the tension between market concentration and growth that arises with the endogenous market structure and endogenous growth approach.

Our framework produces two types of long-run equilibrium: a concentrated equilibrium in which all industry, and hence all productivity growth, occurs in one country, and a dispersed equilibrium in which industrial activity and productivity growth are spread across both countries. These equilibria can be characterized fully in terms of the shares of manufacturing activity located in each country and an international productivity differential. In a dispersed equilibrium the larger country always has a greater share of industry and a higher relative productivity, and thus the model is consistent with the well-established empirical result that firms are more productive in regions with a greater density of economic activity (Melo et al., 2009). Investigating the dynamics around the dispersed equilibrium, we find that the long-run pattern of industry location is determined by the balance between two opposing forces, both with direct and indirect effects. One the one hand, starting from a symmetric dispersed equilibrium, a rise in the relative productivity of one country directly increases the market shares of individual firms, but the number of firms based in the advanced country also rises indirectly causing individual firm market shares to fall. As firm scales of production and innovation are positively tied with firm-level market shares, the balance of these direct and indirect effects determines whether the rise in relative productivity results in greater employment in process innovation, leading to further increases in relative productivity for the more advanced country. We refer to this first force as the *production* effect. On the other hand, the increase in the productivity differential also directly raises the relative level of knowledge spillovers to firms based in the less advanced country allowing them to achieve a greater rate of productivity growth with the same level of employment in innovation, while at the same time indirectly leading the relative level of knowledge spillovers to firms in the advanced country to increase, as its share of relatively productive firms rises. We refer to this force as the *innovation* effect. Convergence in industry shares, relative productivity, and the rate of productivity growth to a dispersed equilibrium is contingent on the relative strengths of the direct and indirect components of these *production* and *innovation* effects.

Our paper is closely related to studies in the "new economic geography" literature that emphasize key elements of the variety-expansion model of innovation-based endogenous growth (Grossman and Helpman, 1991). These studies tend to find that agglomeration economies and growth are reinforcing processes; that is, a higher concentration of industry tends to promote economic growth (Baldwin and Martin, 2004). A key feature of the models adopted in this literature, however, is a scale effect in which the rate of growth is positively correlated with the labor endowment of the economy. Indeed, the scale effect appears to play a central role in the relationship between industry concentration and the endogenous pace of growth. The existence of the scale effect, however, has generally been rejected by empirical studies (Jones, 1995a; Dinopoulos and Thompson, 1999; Barro and Sala-i-Martin, 2004; Lainez and Peretto, 2006) indicating the need for a reassessment of this relationship in a framework that corrects for the scale effect.

To this end, Minniti and Parello (2011) adapt the semi-endogenous growth framework in order to investigate the relationship between trade integration and scale invariant economic growth. Following Jones (1995b), the scale effect is removed by introducing decreasing returns in research and development (R&D) and adding population growth.[1] Interestingly, under this modification of the variety-expansion model, long-run growth is proportionate to population growth and determined independently of the level of industry concentration. In contrast, the endogenous market structure and endogenous growth framework that we adopt in this paper removes the scale effect by shifting the focus from R&D activity at the aggregate level towards innovation at the level of individual product lines. As the long-run rate of productivity growth depends on the average productivity of technical knowledge spillovers between firms and the number of researchers per firm, rather than in the population, an increase in population raises the number of firms but has no effect on growth. There is now a large empirical literature establishing the validity of the endogenous market structure and endogenous growth approach over the semi-endogenous growth approach (Zachariadis, 2003, 2004; Lainez and Peretto, 2006; Ha and Howitt, 2007; Madsen, 2008, 2010; Madsen et al., 2010a, 2010b). Thus, our key contribution is a re-examination of the relationship between industry concentration and economic growth in an empirically robust framework that allows for the endogenous determination of both the distribution of industry and the growth rate without a scale effect.

[1] For more details on models that adopt the semi-endogenous growth approach, see Futagami and Iwaisako (2007) and Iwaisako et al. (2011). In addition, rising product quality models of semi-endogenous growth are developed in Segerstrom (1998) and Li (2003).

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