

General equilibria in large economies with endogenous structure of division of labor

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Abstract

We study a general equilibrium model with specialization and division of labor. The market coordinates all individuals' decisions in choosing their patterns of specialization in order to utilize positive network effects of division of labor net of transaction costs. We establish the equilibrium existence theorem, the first and second welfare theorems, and the core equivalence for a family of general equilibrium models with both possible increasing returns and transaction costs. Using an analytical framework with consumer–producers, economies of specialization, and transaction costs, we resurrect the spirit of the classical economics of the division of labor in a modern body of mathematical formalism. © 2004 Elsevier B.V. All rights reserved.

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1. Introduction

In this paper, we study a general equilibrium model that allows for increasing returns to labor specialization. Adam Smith (1776) made a forceful point in *the Wealth of Nations* that

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an individual's productivity increases if the individual specializes in a particular productive activity. As a result, the overall efficiency of an economy increases as all individuals specialize in production of different goods and trade with others for what they do not produce themselves. However, this classical idea of Smith's had received so little formal treatment in the modern general equilibrium theory that Stigler (1976, pp. 1209–1210) made the following comment on the 200th anniversary of publication of *the Wealth of Nations*:

“The last of Smith's regrettable failures is one for which he is overwhelmingly famous — the division of labor. . . . (A)lmost no one used or now uses the theory of division of labor, for the excellent reason that there is scarcely such a theory. . . . (T)here is no standard, operable theory to describe what Smith argued to be the mainspring of economic progress. Smith gave the division of labor an immensely convincing presentation — it seems to me as persuasive a case for the power of specialization today as it appeared to Smith. Yet there is no evidence, so far as I know, of any serious advance in the theory of the subject since his time, and specialization is not an integral part of the modern theory of production, which may well be an explanation for the fact that the modern theory of economies of scale is little more than a set of alternative possibilities.”

In the last two decades, many authors, including Rosen (1978, 1983), Becker (1981), Becker and Murphy (1992), Baumgardner (1988), Kim (1989), Locay (1990), Yang (1991), Yang and Borland (1991) and Yang and Ng (1993), have made some significant contributions to the growing literature on specialization and division of labor (see Yang, 2003, for a more complete survey). In these models, each individual chooses optimally her pattern of production specialization, and the aggregation of all individuals' specialization patterns yields the structure of division of labor for society as a whole. While these contributions provide useful insights into specialization and division of labor, they are accomplished in very specific models. Sun et al. (2003) have studied a general equilibrium model with a continuum of ex ante identical individuals in which all production activities exhibit increasing returns to labor specialization. Although they manage to prove the existence of competitive equilibrium in their model and obtain some other interesting results, their assumption of identical individuals and increasing returns for all production activities puts a serious limitation on the applicability of their work.

The model we consider in this paper is as follows. An economy consists of many agents. Each agent is both a consumer *and* a producer: she can use her labor to produce various goods for herself and for sale, and she can also choose between self-provision and purchase of each good. There are transaction costs when agents purchase goods from the markets. Production functions are specified for each individual and there are no collective production activities.¹ Agents may differ from each other in terms of three characteristics: their preferences, their production functions, and their transaction technology functions. There may exist increasing returns to specialization, but any such returns are local since each agent's labor endowment is fixed. For each agent, the optimal decision involves two parts: what goods and how much of each good to produce, and what and how much to trade. The optimal decision obviously

¹ A more general form of production is dealt with in some versions of the model in this paper (Yang and Ng, 1995). We plan to devote more future research to extending our work here by allowing more general forms of production.

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