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Externalities, endogenous productivity, and poverty traps

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ABSTRACT

We present a version of the neoclassical model with an endogenous industry structure. We construct a distribution of firms' productivity that implies multiple steady-state equilibria even with an arbitrarily small degree of increasing returns to scale. While the most productive firms operate across all the steady states, in a poverty trap less productive firms operate as well. This results in lower average firm productivity and total factor productivity. The distributions of employment by firm size across steady states are consistent with the empirical observation that poor countries have a higher fraction of employment in small firms than rich countries. Differences in output and total factor productivity across steady states are increasing in the degree of returns to scale, the capital share, and the Frisch elasticity of labor supply.

1. Introduction

Several models of poverty traps relying on increasing returns have been proposed in the literature, surveyed by Azariadis and Stachurski (2005, Section 5).[1] Previous studies of poverty trap models with endogenous total factor productivity (TFP) pointed to the failure of adopting the most productive technologies as the cause of low TFP and income in poor countries (Murphy et al., 1989; Ciccone and Matsuyama, 1996). In contrast, we focus on differences in the usage of the least productive technologies. Evidence points to the fact that differences in TFP across economies are related to the lowest level of firms' productivity. Comin and Hobijn (2010) take a comprehensive look at the uses of various technologies as determinants of TFP and find that the key is not when new, better technologies are adopted, but when old, obsolete ones are relinquished. The empirical evidence on the importance of international knowledge spillovers summarized in Klenow and Rodriguez-Clare (2005) suggests that all countries can easily access frontier technologies. Banerjee and Duflo (2005) cite the McKinsey Global Institute (2001)(McKinsey Global Institute, 2001) report on India, which finds that while larger production units (firms) use relatively new technologies, smaller (in home) production units have low productivity.

We endogenize the industry structure in a neoclassical model with increasing returns to scale at the aggregate level. Final goods are produced with a CES technology. Intermediate goods are produced by heterogeneous firms that face an entry and an operating decision. Many ex-ante identical potential firms obtain a random productivity draw upon payment of an entry cost. Only firms productive enough to pay an overhead labor cost choose to operate. We construct a distribution of firms' productivity, characterized

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[1] An earlier survey of the literature can be found in Azariadis (1996). Kraay and McKenzie (2014) provide a more recent survey and cast doubts on the empirical relevance of poverty traps models.

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by a high fraction of similarly unproductive firms, that implies multiple steady-state equilibria even with an arbitrarily small degree of increasing returns to scale.[2] In a steady state with a high productivity cutoff and a large capital stock the wage is high, as is the operating cost. A high operating cost makes low productivity firms unprofitable, effectively cleansing the pool of firms. This justifies the cutoff being high in the first place. Since only high productivity firms are operating, TFP is high. Conversely, in a steady state where capital is low and lower productivity firms are operating, the wage is low and lower profits are sufficient to cover the operating cost. Low productivity firms sully the pool of producers, leading to low TFP and capital. In a good equilibrium high productivity firms produce more than in a bad equilibrium, despite facing a higher wage and the same interest rate, because they face a higher demand.

As in most models with heterogeneous firms, firms' sizes are proportional to their productivity. Assuming that the distributions by size across countries are the result of the same underlying distribution of productivity across firms, truncated at different levels, the data are supportive of the kind of distribution that generates multiple equilibria in the model. In fact, the key feature of the distribution of firms by size in poor countries is that it has a much higher share or employment in small firms than the distribution of firms in rich countries (see Tybout, 2000). We use a numerical example that captures this feature of the data to show that differences in TFP and output across steady states are increasing in the degree of returns to scale and in the share of capital in income.

In the benchmark model labor is supplied inelastically. Multiplicity of steady states with an arbitrarily small degree of increasing returns is maintained when the supply of labor is endogenized. Furthermore, differences in capital, labor, TFP, and output across steady states are increasing in the Frisch elasticity of labor supply.

The role of an endogenous industry structure as a powerful amplifying mechanism is well established in the literature, building on the seminal work of Hopenhayn (1992). Endogeneity of the industry structure allows to obtain countercyclical markups and indeterminacy (Jaimovich, 2007). It can rationalize the business cycle characteristics of entry, profits, and markups, while accounting for the standard business cycle moments (Bilbiie et al., 2012). It provides an amplification mechanism for differences in prices of investment goods to translate into large differences in output across countries (Armenter and Lahiri, 2012).

Finally, the endogenous response of the industry structure to various institutional and policy failures induces misallocation of inputs across firms (for a survey, see Hopenhayn, 2014). Models similar to the one we analyze, with constant returns to scale and a unique steady state, have been used to study the effects of cross-country differences in entry barriers. Barseghyan and DiCecio (2011) show that the observed differences in entry costs across countries generate sizeable differences in output and TFP. Boedo Moscoso and Mukoyama (2012) show that entry regulations and firing costs have important effects on cross-country differences in TFP and output. Poschke (2010) argues that small differences in entry costs, by affecting firms' technology choices, can explain a substantial part of the TFP differences across similarly developed economies.

The rest of the paper is organized as follows. Section 2 presents the benchmark model with inelastic labor supply. Section 3 studies its steady state and dynamics properties. In Section 4 we present comparative statics of the benchmark model, using a calibrated numerical example. Section 5 discusses the implications of endogenizing the supply of labor. We conclude in Section 6.

2. The model

Our model is a variant of the neoclassical growth model. The model departs from the standard framework by having a richer structure of the production side of the economy. We model firms are following Lucas and Autumn (1978), Jovanovic (1982), and Hopenhayn (1992). Firms are heterogeneous: each firm has monopoly power over the good it produces, and firms have different productivity levels. Two features of the production side of the economy are crucial for the results of the paper:

1. A sunk entry cost.
2. An operating cost: in addition to capital and labor used directly in production, firms pay for a fixed amount of overhead labor.

A part of the entry costs stems from satisfying different official regulatory requirements (see Djankov et al., 2002). In addition, in some countries, entry requires significant side payments to local officials.[3] Entry cost may also include expenses related to acquisition of firm-specific capital,[4] acquisition of appropriate technology,[5] and market research.

The operating cost typically refers to overhead labor and expenses that are lumpy in nature (e.g., renting a physical location). According to the findings of Domowitz et al. (1988), in U.S. manufacturing plants, the overhead labor accounts for 31 percent of total labor. Ramey et al. (1991) suggest that overhead labor is about 20 percent. The preferred estimate of overhead inputs in Basu (1996) is 28 percent.

We also assume that firms learn their productivity only after a sunk entry cost is paid. This assumption reflects very high uncertainty faced by entering firms and is a stylized fact documented, for example, by Klette and Kortum (2004).

[2] Galí (1995) obtains multiple equilibria and poverty traps in a model where large increasing returns stem from endogenous markups. However, subsequent empirical evidence suggests that the degree of increasing returns is small.

[3] In the case of Peru, this is documented by De Soto (1989).

[4] Ramey and Shapiro (2001) show that in some instances the specificity of firm capital is so extreme that the sale price of such capital after a firm has been dissolved is only a small fraction of the original cost.

[5] See, for example, Atkeson and Kehoe (2005).