



ESCAPING FROM DEVELOPMENT TRAPS: INDUSTRIALIZATION AND RACING FROM THE BOTTOM

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Abstract

For development economies, escaping costly development traps an industrialization policy is likely to be gradual rather than take a "big push" form and becoming more balanced over time. Under certain conditions the optimal industrialization policy should be more unbalanced the weaker are the sectorial linkages, the stronger are increasing returns, entrepreneurial resources, and the smaller are the domestic market size and the lesser the degree of dynamic competition. We show how to make tradeoffs at different levels of development and from the perspective of the industrialization debate in a historical context of modern development policies.

Key words

Development traps; Tradeoffs; Industrialization.

INTRODUCTION

The cumulative literature on industrialization has formalized the long-standing idea that development traps are the result of a failure of economic organization rather than a lack of resources or other technological constraints. The so-called "big push" models of industrialization have shown how, in the presence of increasing returns, there can exist preferable states to advance the economic states of countries in contest with other countries. Such a view not only provides an explanation for the co-existence of industrialized and less industrialized economies, but also a rationale for government intervention to coordinate investment in a "big-push" toward industrialization. Moreover, unlike competing theories, these models emphasize the temporary nature of any policy. Thus, industrialization policy involves facilitating an adjustment from one equilibrium to another rather than any change in the nature of the set of equilibria per se. While recent formalization makes clear the possible role for the government in coordinating economic activity, little has been said about the form such policy should take. Is there a conceptual model to analyze the question: what precise form should the "big push" take? It should be part of mechanism design for economic development (Gottinger, 2014). It is argued that while many different industrialization policies can be successful in generating escapes from development traps, the form of the policy that minimizes the costs of this transition depends on the characteristics of the economic situation at hand. Factors such as the strength of the complementarities, externalities and increasing returns, among others, all play a role in influencing the nature of a "getting-ahead" industrialization policy. Such ideas were already present in the debates in development economics in the 1940s and 1950s regarding the form of industrialization policy. The models underlying these less formal debates inspired the recent more formal research but the policy elements of these have not been addressed, to date, in any substantive way.

The paper proceeds as follows. We first give a brief history to recall different development strategies proliferating in the literature, in Section 2. Then we show how the increasing returns debate on industries impact structural change and development paths, in Section 3. Section 4 gives the industrialization policy-development context in an optimization framework. Conclusions follow in Section 5.

A BRIEF HISTORY OF MAJOR DEVELOPMENT STRATEGIES

Principal among the earlier policy debates was that surrounding the efficacy and costs involved in the alternative strategies of "balanced" versus "unbalanced growth." Rosenstein-Rodan (1943, 1961) and Nurkse (1952, 1953) provided the rationale for the notion that the adoption of modern technologies must proceed across a wide range of industries more or less simultaneously. It was argued that the neglect of investment in a sector(s) could undermine any industrialization strategy.

Reacting to this policy prescription was the "unbalanced growth" school led by Hirschman (1958) and Streeten (1956). They saw the balanced strategy as far too costly. The advantages of multiple development may make interesting reading for economists, but they are gloomy news indeed for underdeveloped countries. The initial resources for simultaneous developments on many fronts are generally lacking. By targeting many sectors, it was argued that scarce resources would be spread too thin- so thin, that industrialization would be thwarted. It seemed more fruitful to target a small number of "leading sectors" (Rostow, 1960). Then those investments would "....call forth complementary investments in the next period with a will and logic of their own: they block out a part of the road that lies ahead and virtually compel certain additional investment decisions" (Hirschman, 1958: 42). Thus, the existence of complementarity between investments (in particular those involving human capital) and increasing returns motivated an unbalanced approach (Easterly, 2002). Curiously, at the same time, "[c]omplementarity of industries





provides the most important set of arguments in favor of a large-scale planned industrialization" (Rosenstein-Rodan, 1943: 205). Further, one of the first to preview the connection between Big Push, Poverty Traps and Takeoffs was the essay by W. Easterly (2005) who integrated historical sources with present day modern development strategies. Both sides appeared to have agreed that a "big push" was warranted, but they disagreed as to its composition. Our purpose here is to use the guidelines provided by the more recent formalization of the "big push" theory of industrialization to clarify the earlier debate of the appropriate degree of focus for industrialization policy. After all, the more recent literature has stressed the roles of complementarities and increasing returns that both schools saw lying at the heart of their policy prescriptions.

The seminal article formalizing the "big push" theory of industrialization is that of Murphy et al, (1989). In their model, firms choose between constant returns and an increasing returns technology based on their expectations of demand. However, these choices spill over into aggregate demand creating a strategic interaction among sectors in their technology adoption decisions. Thus, under certain conditions, there exist two equilibria: with all firms choosing the constant returns or all choosing the increasing returns technology. Clearly, in the latter equilibrium, all households are better off.

While the Murphy et al, (1989) model shows how increasing returns (and a wage effect) aggregate to strategic complementarity among sectors, it does not lend itself readily to the debate concerning the degree of balance in industrialization policy. First, the static content leaves open the question of whether the intervention should take the form of anything more than indicative planning. Second, the most commonly discussed policy instrument in the industrialization debate is the subsidization of investments. However, in the Murphy et al, (1989) example, use of this instrument biases one toward a more unbalanced policy. To see this, observe that it is the role of the government to facilitate a move to the industrializing equilibrium. This means that the government must subsidize a sufficient amount of investment to make it profitable for all sectors to adopt the modern technology.

Given the binary choice set, there then exists some minimum critical mass of sectors that must be targeted to achieve a successful transition. A greater range of successful industrialization policies might be more plausible, however, if firms had the choice of a wider variety of technology to choose from (Gottinger, 2006; Gottinger & Goosen, 2012). One might suppose that targeting a large number of sectors to modernize a little and targeting a small number of sectors for more radical modernization might both generate a big push. Thus, to consider the balanced approach properly, a greater technological choice space is required.

INCREASING RETURNS, STRUCTURAL CHANGE AND DEVELOPMENT PATHS

What would be the choice variables available to the government provided it would be able to pick up what is likely to be increasing returns industries in the future? First, in each period, the government can choose the set of firms that it targets for structural change. Second, for each targeted firm, the government can choose a target level for 'increasing returns industry' modernization in the period. Along this vein, the government could choose to target the same number of firms in each period but induce those firms to modernize gradually over time. Or in contrast, the government chooses a single level of modernization to occur across all firms and all periods. It then targets a mass of firms each period for entry and modernization. This means that industrialization policy is solely characterized by the critical mass of sectors targeted, and the target level of modernization. The level of modernization could be sequentially expanded by infrastructural upgrading across the board to benefit all major sectors as suggested by the Chinese economist Justin Yifu Lin (2013).

Given a parameterized development path, the most significant parameter represents the strength of increasing returns in the technology adopted by industrial sectors, which generates a rationale for "big push" intervention. A "big push" can be activated if the economy is stuck in a "development trap" from which an escape could be made through sufficient coordination of decisions by input producers. For a developing economy in its early phase a "poverty trap" is a special case of a "development trap" defined by Barro and Sala-i-Martin (1995: 49) as a stable steadystate with low levels of per capita output and capital stock. This is a trap because, if agents attempt to break out of it, the economy has a tendency to return to the lowlevel steady-state. Only by a very large change in their behavior, can the economy break out of the poverty trap and move to the high-income steady state. To evaluate the economic characteristics, i.e., the strengths of complementarities and increasing returns, would affect the government's policy choices and industrial policies (Gans, 1994).

Big Push theories of industrialization could lead to 'development traps' if sequential industrialization would add more diminishing returns than increasing returns industries which could be a result of government's coordination failure. This would point to deficiencies in institutional quality as outlined by North (1990) impacting economic performance. They could give explanations for decade long lackluster performance of Latin American economies (Fukuyama, 2008). When a development trap is purely the result of coordination failure, to escape from the trap, would technically require the government to synchronize the expectations of individual agents (entrepreneurs) with targeting investment in industrialization activities. If a government were to announce that firms should modernize to a





certain degree, even if this were believed perfectly by individuals and firms, each firm might still have an incentive to wait before investing. In that case, the optimistic expectations by the government would not be realized and the policy would be ineffective. Irreversibility and the time lag of production mean that history rather than expectations matter (Krugman, 1991). The previous level of industrialization determines what path the economy will take in the future. This is why it is difficult to characterize the industrializing paths of the economy. There is econometric evidence that a contributing factor toward the emergence of development traps is the lack of surpassing some threshold of technological integration in the industrializing (manufacturing) sector (Ortiz et al, 2009).

INDUSTRIALIZATION POLICIES AND DEVELOPMENT

In the context of a big push development strategy the government faces a tradeoff between the number of sectors it targets and the degree to which it wishes them to modernize, that is, it chooses the critical mass of sectors that must be targeted at any point in time in order to generate an escape from a development trap and to achieve increasing returns. Let's take a simple case where the industrialization policy takes the form of a "big bang", that is intervention occurs for one period only granting that the resources exist in that period to allow for such a policy. This means that the industrialization policy is solely characterized by the critical mass of sectors targeted s^{*} and the target level of modernization *f*.

Suppose naturally that individual transition costs are non-decreasing in f, the optimal critical mass in terms of f can be described by the path

 $s^*(f,\phi) = (f+1)^{\theta(1-\sigma)} [((1-\delta)(\sigma-1)/L \overline{\lambda})^{(1-\sigma)/(\sigma-1-\sigma)} - s_I)] + s_I$ with s_I as the basic input varieties of the industrial economy.

Substituting this into the objective function with cost c (f,1; s_i , ϕ), the 'big bang' industrialization policy problem becomes

$$\min_{f} (f+1)^{\theta(1-\sigma)} [((1-\delta)(\sigma-1)/L \overline{\lambda})^{(1-\sigma)/(\sigma-1-\sigma)} - s_{I})] c(f,1; s_{I}, \phi)$$

where use is made of the symmetry of the cost functions and the fact that $s*-s_{I}$ firms are targeted. ϕ could represent any given exogenous parameter, i.e. $\sigma, \theta, \delta, \alpha$, or $L \lambda$ a given parameter linked to L

In designing an optimal industrialization policy it shows that a cost minimizing policy in the industry transition entails setting certain development model (exogeneous) parameters such as labour productivity improvements (θ), upstream firms discount future earnings (δ) the fixed size of the labour force (L⁻), the number of basic industrial sector varieties (si), the product linkages between intermediate input producers (σ), and the use of the intermediate input composite (α), the latter two showing a certain degree of interaction referring to as the returns to

specialization (Romer, 1986). Discussing these parameters qualitatively in terms of comparative statics would indicate industrial change. Raising any of these parameters θ , δ , L⁻, and s₁ increases the marginal returns to upstream firms in both their entry and modernization decisions.

Raising θ means that sunk costs are translated into labor improvements more effectively. Similarly, since the costs of modernization and entry are carried today and most of the returns occur in the future, the more likely they are to undertake those actions. A large market, a higher L, also raises the marginal return to entry and modernization. Finally, more industrial varieties mean that the past level of industrialization is greater, thereby, reducing the marginal costs of inducing firms to adopt more modern technologies. Given this, the responsiveness of firms to inducements by the government is enhanced when any of these parameters is raised. Therefore, the higher are these parameters, the fewer firms need to be targeted to facilitate an escape (from a development trap). Of these parameters θ has probably received the most discussion. In many ways, this parameter represents the strength of increasing returns in the technology adopted by upstream producers. This is because higher levels of θ imply that, when they choose to modernize, upstream firms will choose technologies involving greater sunk (or fixed) costs. Therefore, while one requires some degree of increasing returns or economies of scale in production to generate a rationale for a "big bang" intervention, the stronger are those increasing returns to support a more unbalanced industrialization policy. This relates back to arguments made on balanced vs. unbalanced growth. Of the three other parameters, only the discount rate δ seems to have been given a potential role in the past debate on industrialization policy. Matsuyama (1992) interprets the discount rate as measure of effectiveness of entrepreneurship in coordinating investment, with a low discount rate indicating existence of greater entrepreneurial resources. If so, then the above result seems to imply that with a relative scarcity of entrepreneurial talent a more balanced approach should be followed.

The comparative statics results for α and σ require more restrictions because each of these has two effects. On the one hand, lowering σ and increasing α raises the strength of strategic complementarities among upstream sectors. This tends to favor a more balanced growth approach. On the other hand, α and σ each affect the marginal returns to entry and modernization of firms. The second effect reinforces the first and leads to more balanced strategy that is, lowering σ and lifting α increase the marginal returns to entry and modernization. A lower σ also implies stronger technical complementarities. This effect is sometimes referred to as the returns to specialization (Romer, 1987). The consequence is that a lower σ raises the marginal returns to employing greater variety of inputs in production. The higher is σ the weaker linkages among intermediate input sectors. Conversely, stronger linkages between sectors raise the marginal return to targeting an additional sector for change supporting the arguments of the balanced growth strategy.





Looking at α , it is a measure of the appropriability of the returns from supply as an additional intermediate input. As Romer (1994) discusses, the larger is α , the greater is the surplus gained by intermediate input producers from the employment of their product in final goods production. Therefore, producers of inputs targeted in an industrialization policy are more likely to react positively (in terms of adopting better technology) when the appropriable returns from the introduction of their variety is larger. This effect would tend to favor a more unbalanced approach as α increases.

Summarizing, we have outlined the role of several parameters in influencing the kind and degree of balance in industrialization policy. Factors addressed in the earlier literature such as strength of linkages, increasing returns and entrepreneurial resources all influence the composition of the 'big push'. By considering a 'big bang' policy, some results are possible. For instance, strong increasing returns in conjunction with weak sector linkages tend to favor a more unbalanced approach in order to minimize costs.

CONCLUSIONS

A major problem of the industrialization debate is the timing of the industrialization policy and its degree of focus is complex and dependent on the characteristics of the case specific economy. A 'big push' perspective on industrialization does not imply that transition can be a simple matter of coordinating expectations via some kind of indicative planning. Nor does it mean that policy must be balanced and take a 'big bang' form in order to be successful. A wide variety of industrialization policies can generate a 'big push' and the choice between them is therefore a matter of costs.

In a dynamic model, however, this wide variety of industrialization policies makes a characterization of the optimal policy quite difficult. To take advantage of full marginal modernization and entry costs, a gradual policy is always optimal.

Moreover, in a policy of gradual entry, the number of sectors targeted in each period is rising over time. However, pairwise interactions between choice variables and exogenous parameters tend to be qualitatively ambiguous in a dynamic setting. For instance, strong increasing returns accompanied by weak sector linkages tend to favor a more unbalanced approach in order to minimize costs. The former effect favors the arguments of the balanced growth school, while the latter was part of the intuition of the unbalanced growth school.

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