Harvard Economics Review Jun 19, 2020

Swimming Against the Tide: The Robust Role of the State in the Era of Knowledge-Based Economy

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There have been numerous growth models presented by economists since the early emergence of capitalism as a new form of organizing economic resources. Broadly, the growth models can be divided into three main categories: 1) the Smithian theories of development that place the division of labor and the 'invisible' hands of the market as the engine of growth and dynamism; 2) the Marxian theories of development that place profits maximization motive and constant re-investment of capital and, of course, access to reserve army of labor as the purse-strings of growth in any capitalist society; 3) the Schumpeterian theories of development, which suggest that the main determinants of economic growth are technical change and production of knowledge and innovations, which themselves are resulted from entrepreneurial investments. Quibbles in the literature notwithstanding, the broad trend is unmistakable that most of the later growth models that economists bequeath to us can be subsumed under these classifications.

Against the backdrop of these 'macroeconomic' theories of growth, there has been a substantial literature developed in organizational sciences on knowledge-based economy: the works of Paul Adler (2001), Nicolai Foss (2003) and Charles Sabel (1993) are a few among many others. This line of research in organizational sciences, while recognizing the importance of macroeconomic indices of growth generally and technical change particularly, suggests that at micro-levels of organizational structure (i.e. business firms), hierarchy—once seen as an instrument towards high rates of technological progress—is actually not *optimally* suited for that very same end. The organizational science literature, however, understates the fact much of innovations and technical change that are key components in promoting knowledge-based economy occurs *outside* of the markets and in *non-capitalist* settings—research centers, laboratories, and universities—often directed and advanced by the state itself—not merely as an endogenous factor within firms . The organizational science literature also tends to ignore the fact that the state even in the Global North still plays a tremendous role in promoting technological development.

In what follows, I will first explicate the arguments that the partisans of organizational science on knowledge-based economy put forward. I will then briefly discuss the various growth model theories that have emerged in order to locate technological progress and innovations as the main component of the knowledge-based economy within broader economic contexts. In the final section of the paper, I will demonstrate, by presenting various examples, the robust role that the state—independent of the markets—continues to be play in promoting technical change in the Atlantic world, particularly the United States. My analysis would focus primarily on the U.S. economy since it is considered to be one of the paradigmatic cases of knowledge-based economy, even though the interventionist role of federal government is often hidden from public debates.

Knowledge and the Organizational Science Literature

The organizational science literature on knowledge-based economy argues that neither market nor hierarchy—nor any combination of the two—is appropriate for a knowledge-based economy. For them, hierarchy is deemed to be a non-optimal structure at organizational levels to induce innovations and knowledge creations. As Alder asserts:

"Hierarchy uses authority (legitimate power) to create and coordinate a horizontal and vertical division of labor. Under hierarchy, knowledge is treated as a scarce re- source and is therefore concentrated, along with the corresponding decision rights, in specialized functional units and at higher levels of the organization. A large body of organizational research has shown that an institution structured by this mechanism may be efficient in the performance of routine partitioned tasks but encounters enormous difficulty in the performance of innovation tasks requiring the generation of new knowledge (2001:216).

While the diffusion of hierarchy with elements of market control helps simultaneously increase entrepreneurial spirit and motivation, it also entails an important disadvantage that Foss (2000) highlights: an incentive problem for establishing credible managerial commitments of non-intervention in delegated decision making processes. Foss develops this theme and examines it in the context of a world-leading hearing aid manufacturing firm namely, Oticon as the canonical example of non-hierarchy—"spaghetti"—organizational form—whereby, the conventional managerial hierarchy within the business firm is dissolved. The spaghetti organizational form is based on five major principls: (1) No barriers to open communication in order to develop and support workers within the organization; (2) No job titles or descriptions which eliminates categorization of employees based on rank and file; (3) salaries, fiscal and non-fiscal rewards are based on team performance in order to induce cooperation and knowledge sharing; (3) No line management or departments except for executive corporate management; (4) Each employee select their own mentor who conducts annual reviews and guidance sessions in order to support employee learning and development, and establish performance feedback; (5) Each employee must organize themselves in teams in order to tackle and track projects.

Whatever the shortcomings of the spaghetti organization, Foss argues in his study that the it increased the pace of knowledge production and transfer across subgroups at Oticon, where every member of the firm was granted full access to the same information available. Intuitively, too, diffusing hierarchy with elements of market control seems to ease the flow of knowledge and skill at an organization. The most powerful reason for this is, perhaps, the absence of restriction on the number of projects that employees could join. Suppose, for example, that a human resource specialist with completely different skill sets wants to join the IT division at any given firm. The specialist has to first develop those skill sets outside of his/her domain of profession, which is an investment in human capital in and of itself. Moreover, as Foss also states, the probability that a particular project team would consist of the right mix of complementary

skills and knowledge increases, since individuals usually join projects that they have—or have acquired–the necessary skill sets.

Hence, there is little doubt that the relative diffusion of hierarchy in firms and organizations will increase the incentive for higher rates of knowledge production. Even among the economists, this recognition that price mechanism embedded in the market structure *fails* to optimize production and allocation of knowledge is salient (Arrow 1962, Stiglitz 1994). Knowledge is therefore considered to be a 'public good,' and its availability to one consumer is not diminished by its use another. Therefore, with knowledge, as with other public goods, reliance on the price mechanisms of the market forces a trade-off between production and allocation. While intellectual property rights create incentives for generating new knowledge, its enforcement will certainly preclude socially optimal allocation (ibid). The optimal allocation of knowledge thus requires ensuring free access simply because the marginal cost of supplying another consumer with the same knowledge is close to zero. The question that arises, however, is that where do various growth theories that have emerged in the capitalist world locate 'technology' and 'knowledge' in their models? In this section of the essay, I will briefly discuss the dominant growth models that have been developed in the economics literature.

Growth Models: Old and New

Theories of economic development date back to the classical texts within the discipline of economics. Classical economists in 18th and 19th centuries namely, Adam Smith, Jean-Baptiste Say, David Ricardo, Thomas Malthus, and John Mill have all presented various models of growth. Indeed, even today, the foundations of almost every neoclassical growth model is influenced in one way or another by the classical theories of economic development. Most growth models, however, can be subsumed under three categories namely, Smithian, Marxian and Schumpeterian that that I delineated earlier. More recent theories—especially those that emerged in the post-World War II era—focus on massive injections of capital to boost investments in order to achieve high GDP growth rates. The two famous models are Rostow's four-stages growth model and Harrod–Domar model (Todaro and Smith 2009), which viewed development as a sequence of historical stages: the traditional society, the preconditions for take-off, the take-off, and the age of high mass consumption. During the take-off stage, increasing the level of aggregate investment was seen to be the steppingstone that would uphold the economy unto the path of growth and dynamism.

The Marxian theories of economic development, while recognized the importance of aggregate investments, argues that investment is not the only variable which induces growth and dynamism in an economy. For the partisans of Marxian growth model, development is a highly nonlinear process, that by only increasing the rates of investment, achieving economic development on aggregate scale is far from guaranteed. For them, the availability of skillful labor concomitant with the increasing aggregate investments are both necessary conditions of rapid development. Among the economists whose growth models fall in this category, Arthur Lewis has argued for this availability of reserve army of labor—as a crucial factor of economic development—more forcefully than anyone else. In Lewis' (1954) two-sector model (or theory of surplus labor), as *productive* investment on aggregate increases, the surplus labor from the less productive sector namely agriculture is absorbed into the more productive sector namely manufacturing. Observing the tremendous economic growth rates that the early developers in the Atlantic world (i.e. the United Kingdom, United States, Germany, France, etc.) achieved during the 19th and 20th centuries, Arthur Lewis argued that the development of an economy is regarded as a process that entails sustained increase in output per capita coupled with structural and system-wide shift in the productive capacities and employment patterns within an economy. This structural shift in modern economic development includes the sectoral relocation of the workforce from a subsistence, informal, low-productivity sector (i.e. agriculture) to a modern, formal, high-productivity sector (i.e. manufacturing). The transition from the former to the latter is often concomitant with a massive

migration of the workforce from rural to urban settings. This trend posits a trade-off between growth in GDP per capita and the reduction of shares of the labor force in less productive sectors; namely, agriculture, forestry, fishing, mining and animal husbandry. The same structural transformation in the pattern of employment can also be clearly observed in the successful cases of late development in the post-World War II era such as Japan, South Korea, Taiwan and recently the Chinese behemoth. The causal relationship between the increase of productivity in the labor-intensive industries of an economy and the process of capital accumulation that drives economic growth and dynamism was first captured in Lewis's seminal book *Economic Development with Unlimited Supplies of Labor* (1954). Specifically, Lewis argued that the transition from agricultural to industrial economy as the steppingstone of increasing system-wide productivity is accompanied with a shift in the balance of labor demand and supply. In the initial stage of this transition, the labor force, once remained in rural areas and engaged primarily in agricultural production will gradually move to the industrial cities as the pattern of employment changes in favor of manufacturing, albeit, with no pressure to raise wages. However, as the industrial sector develops to the point where the supply of labor from the agricultural sector becomes limited, industrial wages begin to rise quickly, which will increase the rates of saving and investment. The defining nature of this structural shift in the sectoral composition of the economy entails a transition period from agriculture to labor-intensive manufacturing—which is to say, from an excess supply of labor—or what Lewis coined the "unlimited supply of labor"—to one of labor shortage.

The Schumpeterian growth model and its derivative namely, 'knowledge-based economy' emphasizes on the role of innovation and technology as the main determinant of economic development. The technology-driven growth model itself went through two distinctive phases: 1) innovation and technology being modeled as an exogenous factor; 2) innovation and technology being modeled as an *endogenous* factor. Prior to 1990s, the technology-driven growth model considered technological change as an exogenous element, which ushered into the famous Solow model (Acemoglu 2009). The Solow growth model posits that as labor supply increase through population growth, and capital is accumulated as aggregate savings increase, the rate of technical change is therefore an exogenous factor of growth. At around early 1990s, however, there was a rethinking in the old Schumpeterian growth models. The new growth theories linked the technological change as endogenous factor to the production of knowledge. That is to say, economic development results from increasing returns to the use of knowledge rather than labor and capital. The endogenous growth model argues that the higher rates of return as expected in the Solow model is greatly compromised by lower levels of complementary investments in human capital (education), infrastructure, or research and development (R&D). Additionally, there are certain properties associated with knowledge as an economic good (or capital for that matter) which distinguishes it from other forms of economic goods. First, knowledge can grow boundlessly. There is no limit to how far knowledge in any given field can develop. Second, knowledge and also innovations can be used and reused at *no* additional cost, which suggests that investment in knowledge and technical change can bring about constant and sustained growth. Third, the circulation of knowledge can create the 'spillover' benefits to other economic actors (i.e. individuals, firms, and states). It is important to note, however, that markets fail to produce enough knowledge, simply because individuals cannot capture all of the gains related to creating new knowledge by their own investments. To remedy this market failure, there has to be some exogenous interventions.

It is herein that the important role that the state has to play independent of the market in promoting technological change to ensure growth in the long term. The interventions of the state—as complementary investments in human capital formation and encouraging private capital to invest in knowledge-intensive industries such as computer engineering and software as well as telecommunications—are instrumental in maintaining a knowledge-based economy. In this final part of the essay, I will highlight the crucial role that the state plays—not just in the countries that caught up with the advanced world namely the East Asian Tigers—but also those of the advanced world. I will provide various examples as to how the

American state actively induces technological progress in often non-capitalist settings (i.e. universities, research centers, science foundations) and encourages the innovators to commercialize their innovations into new brands and products for a competitive market.

The State and Technical Change

Despite the dominant role of the market fundamentalist ideas in the U.S. politics over the past few decades, the federal government has continued to expand its interventions not only to promote new innovations and technologies, but also encourage the private sector to commercialize those new innovations and technologies. While concomitant to these efforts, there has been a tendency to make them 'invisible' from the public debates by the market fundamentalists (Block 2007). Thus, the robust role that the state plays in the Atlantic world and particularly the United States in promoting innovations and technological progress cannot be denied. Consistent with the ideas of 'knowledge-economy' that stresses on scientific and technological progress as the determinant of growth and dynamism, federal government have embraced the kinds of interventionist policies that advance and enhance research in cutting-edge industries *and* make sure that such innovations are turned into commercial products by firms (Brick 2008). The U.S. federal government particularly, but also the European states generally do so because they recognize that in world market where other countries in the Global South can make use of the available technology and produce ever more competitive products for the exports market, but *with lower prices*, their failure to remain competitive will ultimately threaten their dominance abroad and their citizens' standards of living at home. However, the way that the U.S. government does enforce such interventions is somehow *invisible* from public debates or in media (Block 2007; 2008). For example, the U.S. Congress, under the rubrics of "competitive policy," constantly passes legislations that buttress the capacity of the state to intervene in areas where research for new innovations is needed (Hughes 2005). But if the U.S. government constantly intervenes to promote innovations, why is this role so hidden in public debates? As Fred Block has forcefully argued (2008), the answer to this question lies in the fact that acknowledging state's central role in promoting technology and innovations for the sake of advancing knowledge-based economy is *inconsistent* with the market fundamentalist claim that the private sector to should be left alone, and that it has to only respond autonomously from any intervention to market signals.

It should be emphasized that the kinds of interventions one currently sees by the U.S. federal state is *very different* than those by the East Asian Tigers namely the "developmental states." If the aim of the Japanese or the Korean states were to help the domestic firms to develop their own productive capacities to 'catch up' with countries in the Atlantic world, the aim of the federal government in the U.S. is to help the domestic firms to process innovations that *do not yet exist* such new software applications, products in stem cells and nanotechnology as well as new medical instruments. Examples of such interventions, both in channeling funds to certain industries and also providing non-pecuniary aids by concentrating resources in certain geographical loci are copious. Take, for example, the close ties of Pentagon and national security agencies namely Atomic Energy Commission and the National Aeronautics and Space Agency (NASA), and the funding and infrastructure it provided in developing technologies such as computers, jet planes, civilian nuclear energy, nuclear medicine involving the application of radioactive substances in the diagnosis and treatment of disease as well as biotechnology (Alic 2007).

Another telling example is the existence of one particular office in Pentagon itself: the Advanced Research Projects Agency (ARPA), which is designed to push technological frontier of Pentagon procurement efforts. The ARPA provides funding for "beyond the horizon" technologies ranging from aerospace and informatics to material sciences and microbiology (Hughes 2005). The National Science Foundation itself is also an important agency that relied on practices (i.e. funding peer review research proposals across disciplines) that help advance technologies in university departments and beyond.

Therefore, what these examples of state agencies and organs show us is that a series of relatively small and enormously influential offices staffed with leading scientists and engineers are given tremendous autonomy to use the funds at their deposal to support and *direct* promising ideas associated with new technologies (Block 2007; 2008). Such advancement in developing such technologies occur in non-capitalist settings, where some funds are made available to scientists to innovate independent of the market. But the officials in those agencies also try to encourage the scientists who come up with these new technologies to commercialize their innovations turning them into new brands and products for sales in the market. A good example of the push for commercialization of innovations is the Advanced Technology Program (ATP) which is housed at the Department of Commerce. ATP provides matching grants for private sector research efforts and blatantly encourages the new technologies to be commercialized by large and small firms. Hence, one clearly sees the visible helping hand of the state not only presiding over the climate of private investment, but also fueling technological change independent of the markets.

Conclusion

The organizational science literature on knowledge-based economy posits that the old hierarchical regimes in firms across capitalist societies are not optimal structures to promoting knowledge and technological change as the essential components of the new and knowledge-based economy. As Alder, Foss and Sabel demonstrate, the diffusion of hierarchy is helpful to bolster knowledge production and transfer across organizations at micro-level. This line of research, however, understates the exogenous role that the state plays in promoting knowledge-based economy in the Atlantic world. In this essay, I first located knowledge and technical change in various growth models that economists bequeathed to us over the past two centuries. I then explicated the core tenets of the arguments that the organizational science literature on knowledge economy offers. In the final section, I presented examples from various state organs and federal agencies in the United States whose missions are not just to promote technologies in cutting edge sectors, but also commercialize them into products for capitalist market. In short, while the production of new knowledge can happen both capitalist (i.e. in business firms) and non-capitalist settings (i.e. research centers, universities, laboratories, science foundations, etc.), the federal government's interventions are designed in such way as to incentivize commercialization of those technologies for a capitalist market. This is an enormous role that the state plays in promoting technologies in the Atlantic world, which tends to be slighted in the organizational science literature on knowledge-based economy.

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