



A STUDY OF ENDOGENOUS GROWTH MODELS AND THEIR EXTENSIONS: IMPERFECT COMPETITION AND RENT-SEEKING

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Abstract : This study surveys key models of endogenous growth theory, focusing on Schumpeterian frameworks that emphasize innovation-driven growth through creative destruction. It explores extensions involving imperfect competition, firm entry, political economy, and labour composition. Central themes include how competition influences innovation, the impact of democracy on growth, and the role of skilled labour near the technological frontier. The study also highlights the political constraints on entry due to lobbying, and how decentralization and redistribution affect growth outcomes. It concludes by identifying research gaps around democracy's role in fostering innovation and proposes directions for future inquiry.

IndexTerms – Innovation, Growth, Rent-seeking, Imperfect Competition

1. Introduction

With technological progress being accepted as the engine of economic growth, two parallel strands of innovation-based growth models emerged in the 1990s – the first of which is considered to begin with Romer (1990), which is dubbed as a model of expanding product-varieties where innovation induces productivity growth through the creation of new varieties of products, thus offsetting the tendency for diminishing returns to individual inputs and sustaining long run growth. The second strand of innovation-based growth theory was influenced by what Schumpeter (1942) called “creative destruction”, where the focus is on innovations that improve product-quality. Schumpeter's expression characterises a situation where innovation drives growth by rendering old products obsolete, thereby forcing firms that produce the obsolete products to exit the market. The introduction of higher quality inputs counterbalances diminishing returns. Since the origins of this thought can be traced back to the work of Schumpeter, this strand of growth theory is dubbed as “Schumpeterian growth theory”. This was formalised by Aghion and Howitt (1992), who themselves largely borrow from modern industrial organisation theory. The innovation characterised by these two strands of growth-theory is called “horizontal” and “vertical” innovations respectively¹.

Over the years, work carried out on Schumpeterian growth theory has gone beyond merely explaining macroeconomic growth by extending into microeconomics and other issues. Aghion et. al. (2013) discuss four aspects on which Schumpeterian growth theory has unique predictions to make, which distinguishes it from other growth models. First, there is the relationship between growth and industrial organisation – innovation-led growth is accelerated by higher turnover rates of firms, which is to say that higher rates of creation of new firms that displace existing firms, leads to faster rate of economic growth. Thus, greater competition induces faster growth. Second, the relationship between growth and firm dynamics – small firms are more likely to exit the market than large firms; however, if small firms survive the prospective entry of new firms, they grow faster. Third, the relationship between

¹ Research activity is carried out to bring about product innovation. The innovation is considered to be of two types – horizontal and vertical. When the innovated product contains some novel features hitherto not contained in the existing products, the innovative activity is called “horizontal innovation”. On the other hand, when the innovated product performs the same functions as that of the existing products, but accounts for greater quality, the innovation activity is characterised as “vertical innovation”. Thus, horizontal and vertical innovations correspond to expanding product varieties and rising product qualities, respectively.

growth and institutions that foster development – there is a strong relationship between growth and democracy in economies that are at the frontier of technology. Fourth, the relationship between growth and long-term technological waves – it can be shown that technological waves are associated with an increase in the flow of entry and exit of firms; also, such waves may increase wage inequality between and within educational groups.

This literature review is structured as follows. Section 2 discusses the two versions of the Schumpeterian expanding product qualities models in the literature. Following Aghion and Howitt (2009), the basic one-sector Schumpeterian model in its entirety, and some basic comparative statics that directly follow from the model are discussed. A simple extension of the one-sector model into a multi-sector model, which is what is largely used as a framework in the rest of the paper, is then presented. The section ends with a brief discussion on how scale effects are dealt with in the literature.

Section 3 discusses a model of firm entry and competition, where an individual firm's decision on whether to invest in innovation activity is dependent on the firm's distance from the technology frontier and the entry threat that it faces. A firm that is closer to the technology frontier may choose to innovate and thereby capture the market and earn profits in the subsequent period. A firm that lags behind faces a lesser incentive to innovate. The section also considers the effect of labour market reforms on the firm's decision to invest in innovation.

Section 4 discusses the question of political economy and growth. Much of the literature on democracy and growth explores the causality from income to democracy and not vice versa. The section considers a model on democracy, firm entry and growth, which shows that democratic institutions favour growth in sectors that are technologically advanced. The section also briefly considers certain other models relating to democracy and growth. Section 5 concludes the review and presents pertinent questions that act as motivation for further research and identifies two research questions.

2. The basic one-sector Schumpeterian model

Two versions of models are primarily used in the literature that capture the Schumpeterian idea of creative destruction. One is due to Grossman and Helpman (1991) and the other is the Aghion-Howitt version, which was first developed in Aghion and Howitt (1990) and later expanded and widely discussed in Aghion and Howitt (1997) and Aghion and Howitt (2009). The two versions of the Schumpeterian models are similar on many counts. However, the key difference is in the way they model R&D activity. Aghion and Howitt (1990) model R&D activity in such a way that each successful innovation improves products across all industries in the economy. In contrast, Grossman and Helpman (1991) model R&D to be such that successful innovation benefits products within an industry and research activity happens across many industries simultaneously.

Another important difference lies in the way they model consumer preferences. Grossman and Helpman (1991) have an intertemporal utility function of the form:

$$U_t = \int_t^{\infty} e^{-\rho(\tau-t)} \log D(\tau) d\tau$$

And the consumer's intertemporal utility is given by:

$$\log D(\tau) = \int_0^1 \log \left[\sum_m q_m(j) x_{m\tau}(j) \right] dj$$

where $x_{m\tau}(j)$ denotes the consumption of good x of quality m , in the product line j at time t . The summation extends over the set of qualities of product line j that is available at time t . In each case, the highest available quality is the state of the art. Vertically differentiated products in a given industry are perfect substitutes of one another, subject to appropriate quality adjustments. Products of different industries enter the utility function symmetrically, and the elasticity of substitution between every pair of product line is equal to one. Therefore, households maximise their static utility by spreading their expenditure evenly across the product lines and they purchase that brand that carries the lowest price per unit of quality, in each product line.

Such a construction of consumer utility offers scope for discussion of aggregate consumer welfare, which the authors do carry out in their work. On the other hand, as we shall see in subsequent sections of this literature review, the Aghion-Howitt version (which is what is presented in the later parts of this literature review) models a consumer that demands a single final good, which is produced in a competitive environment. The final good contains in it various intermediate goods. By modelling the final good sector in a perfectly competitive environment, the authors shift their focus from consumer welfare, to a variety of other issues which are of topical interest, such as examining growth effects of firm entry and competition, effects of education composition on growth, etc. On the topic of consumer utility maximisation itself, we find in the literature an interesting version of the Dixit-Stiglitz model, which is called as the "quality-embedded Dixit-Stiglitz" consumption index in the literature, where consumers express a certain preference for the quality of the products that they consume.

2.1 The Aghion-Howitt version

An understanding of a basic version of the one-sector Schumpeterian model will be helpful to understand the finer issues that will be discussed subsequently. The version presented here is due to Aghion and Howitt (2009). The economy is characterised by a sequence of discrete time periods, $t = 1, 2, 3, \dots$. A fixed number of individuals, L , live in each period and they are endowed with one unit of labour services each, which they supply inelastically to the labour market. With the individual being risk-neutral and his utility depending entirely on his consumption, the only objective of the individual is to maximise his expected consumption. The "final good", which is the only good of consumption, is produced in a perfectly competitive set-up, using two inputs – labour and an intermediate good. The production function is of the following Cobb-Douglas form:

$$Y_t = (A_t L)^{1-\alpha} x_t^\alpha; \quad 0 < \alpha < 1, \quad (1)$$

where Y_t is the final output in period t , A_t is the productivity parameter of the intermediate input in period t and x_t is the amount of the intermediate input used in the production of Y . With the standard assumption of full employment being in place, the entire labour supply of the economy, L , (given exogenously) is engaged in the production of the final-good. $A_t L$, therefore, is the effective or augmented labour employed in production of Y_t .

In each period, the intermediate product is produced by using the final good as the input, one for one, by a monopolist. The rest of the final good, which is not used in the production of the intermediate good, is used for consumption and for research/ innovation. Therefore, the gross domestic product (GDP) of the economy is characterised by

$$GDP = Y_t - x_t. \quad (2)$$

2.2 Production and profits

The monopolist at time t maximises expected consumption by maximising the profits Π_t , which is measured in units of the final good:

$$\Pi_t = p_t x_t - x_t,$$

where p_t is the price of the intermediate product in terms of the final good. The revenue of the monopolist is price times quantity, $p_t x_t$ and his cost is the input of the final good, which is equal to his output x_t .

Since the monopolist producer of the intermediate good supplies his output to a perfectly competitive sector, his price will be equal to the marginal product of the intermediate good of the final sector. Therefore, from the production function in (1) we get,

$$p_t = \partial Y_t / \partial x_t = \alpha (A_t L)^{1-\alpha} x_t^{\alpha-1}. \quad (3)$$

Substituting p_t in the monopolist's profit function, we obtain,

$$\Pi_t = \alpha (A_t L)^{1-\alpha} x_t^\alpha - x_t \quad (4)$$

The equilibrium quantity is then arrived at by maximising the profit condition (4), such that

$$x_t = \alpha^{\frac{2}{1-\alpha}} A_t L. \quad (5)$$

And, the equilibrium profit is arrived at by substituting (5) in (4)

$$\Pi_t = \pi A_t L, \quad (6)$$

where $\pi = (1 - \alpha) \alpha^{\frac{1+\alpha}{1-\alpha}}$.

Note that both the equilibrium quantity and the equilibrium profit are proportional to the effective labour supply, $A_t L$.

By substituting (5) in the production function (1) and the GDP equation (2), it can also be seen that both, final output and GDP of the economy, are also directly proportional to the effective labour supply. That is,

$$Y_t = \alpha^{\frac{2\alpha}{1-\alpha}} A_t L; \\ GDP_t = \alpha^{\frac{2\alpha}{1-\alpha}} (1 - \alpha^2) A_t L. \quad (7)$$

2.3 Innovation

In every period, an entrepreneur attempts to innovate and if the attempt succeeds, a new version of the intermediate product is brought out, which is more productive as compared to all the previous versions. On the other hand, if the entrepreneur fails in his attempt, the intermediate product will be the same as the one in the previous period. Thus, at time t , the productivity will be given by:

$$A_t = \begin{cases} \gamma A_{t-1}; & \gamma > 1, \text{ if innovation is successful.} \\ A_{t-1}, & \text{if innovation is not successful.} \end{cases}$$

Innovation is a costly affair where the entrepreneur conducts research by using the final output as the only input for research. While research outcome is uncertain, the more the entrepreneur spends on research, the more likely is he to come up with a successful innovation. The probability μ_t that an innovation occurs in any period t is given by the innovation function:

$$\mu_t = \phi(R_t / A_t^*)$$

where R_t is the amount of final good spent on research activity, and $A_t^* = \gamma A_{t-1}$ is the productivity of the new intermediate product resulting out of the research activity. It can be seen that the probability of innovation is inversely proportional to A_t^* and this is because the more advanced the technology, the harder it is to improve upon, given the complexity of the product. Denoting the productivity-adjusted research expenditure, R_t / A_t^* , by n_t and assuming that the innovation function takes the Cobb-Douglas form:

$$\phi(n) = \lambda n^\sigma; \quad 0 < \sigma < 1 \quad (8)$$

where λ is the productivity parameter of the research sector. Thus, it can be shown that the marginal product of the productivity-adjusted research activity in generating innovations is positive but decreasing. That is,

$$\phi'(n) = \sigma \lambda n^{\sigma-1} > 0; \quad \text{and} \\ \phi''(n) = \sigma(\sigma - 1) \lambda n^{\sigma-2} < 0.$$

2.4 Research Arbitrage

On successful innovation at time t , the entrepreneur enjoys monopoly power over the intermediate good due to the better quality of his product. Consider the reward that a successful entrepreneur will enjoy, to be Π_t^* . With probability of successful innovation being $\phi(n_t)$, the expected net reward for the entrepreneur from his innovation activity will be:

$$\phi(R_t / A_t^*) \Pi_t^* - R_t$$

The entrepreneur chooses the optimal amount of research expenditure such that it maximises his net reward, that is to say that R_t that satisfies the following first-order condition is chosen:

$$\phi'(R_t / A_t^*) \Pi_t^* / A_t^* - 1 = 0.$$

Substituting for Π_t from (6), we have the following research equation:

$$\phi'(n_t)\pi L = 1 \quad (R)$$

This equation trades-off the marginal cost of research (LHS) with the marginal benefit of research (RHS). As seen earlier, ϕ is a decreasing function in n_t . Therefore, the marginal benefit is also a decreasing function in n_t . Any changes in the parameter that raise the marginal benefit or lower the marginal cost will result in an increase in the equilibrium intensity of research, n_t .

It can be seen from the research arbitrage equation (R) that the productivity-adjusted level of research, n_t , will be constant. Therefore, the probability of innovation, μ , will also be a constant $\mu = \phi(n)$. With the Cobb-Douglas form of innovation function that was assumed earlier in (8), the research arbitrage condition translates to:

$$\mu = \lambda^{\frac{1}{1-\sigma}}(\sigma\pi L)^{\frac{\sigma}{1-\sigma}} \quad n = (\sigma\lambda\pi L)^{\frac{1}{1-\sigma}} \text{ and} \quad (9)$$

2.5 Growth

The rate of economic growth is defined as the proportional rate of growth of per capita GDP (GDP_t/L). In equilibrium, from equation (7) above, this translates to proportional growth rate of the productivity parameter, A_t :

$$g_t = \frac{A_t - A_{t-1}}{A_{t-1}}$$

Therefore, in each period, growth rate will be as follows:

$$g_t = \begin{cases} \frac{\gamma A_{t-1} - A_{t-1}}{A_{t-1}} = \gamma - 1, & \text{if entrepreneur will successfully innovate.} \\ \frac{A_{t-1} - A_{t-1}}{A_{t-1}} = 0, & \text{if the entrepreneur fails to innovate.} \end{cases}$$

Since the probability that the entrepreneur will be successful is μ , the probability that he will fail is $1 - \mu$. The growth rate will be governed by this probability distribution in every period. The mean of the distribution will be:

$$g = E(g_t) = \mu(\gamma - 1),$$

which will also be the average growth rate of the economy in the long-run.

Note that μ is not just the probability of a successful innovation in each period, but also the long-run frequency of innovations – that is to say, it is also the fraction of periods in which a successful innovation will occur. Consequently, $\gamma - 1$ is the proportional increase in productivity every time a successful innovation occurs. This formula for the growth rate thereby carries an important result of the Schumpeterian growth theory which can be stated as: the average growth rate of the economy in the long run will be equal to the frequency of innovations times the size of the innovations $\mu(\gamma - 1)$.

Replacing μ from (9) in the preceding equation to obtain the growth equation:

$$g = \lambda^{\frac{1}{1-\sigma}}(\sigma\pi L)^{\frac{\sigma}{1-\sigma}}(\gamma - 1). \quad (G)$$

2.6 Comparative Statics

From the growth-equation (G), we can make the following observations:

Growth is positively correlated with the productivity of innovations, λ . This points towards channels that induce increase in the productivity of innovations, viz., education. If economies invest more in higher education and, thereby, increase the supply of skilled labour, they will be able to achieve higher productivity of research. This increase in the aggregate supply of skilled labour will in turn reduce the opportunity cost of research.

Growth also increases with the size of innovations, which is the parameter γ in equation (G). This result captures what Gerschenkron (1962) calls as the advantage of backwardness, i.e., the farther a country is from the world technology frontier, bigger will be its productivity gains from innovating and implementing the frontier technology, thereby boosting faster growth.

It can also be seen from the growth equation that an increase in the economy's population size has a scale-effect, i.e., it will also bring about an increase in the growth, since equation (G) shows that growth is positively related to the population size, L . This comes to pass under the assumption that an increase in the size of the population will increase the size of the market, which can thereafter be captured by a successful entrepreneur. Another channel to understand the scale-effect is that increase in the population-size will increase the supply of potential researchers.

2.7 Extending to a multi-sector economy

The simple Schumpeterian model discussed above, which captures innovation only in one sector, where the same product is constantly sought to be innovated and improved upon, is too simplistic for empirical purposes, and does not represent reality. Therefore, the basic one-sector model is needed to be extended to a multi-sector model where many different products are innovated upon in every given point in time. This is captured by Aghion and Howitt (1992) where now in the final-good production function (1) above, there is not one but a continuum of intermediate goods, indexed over the unit interval $[0,1]$. The final-good production function will now be of the form:

$$Y_t = L^{1-\alpha} \int_0^1 A_{it}^{1-\alpha} x_{it}^{\alpha} di \quad (10)$$

where each of x_{it} is a continuous flow of intermediate product i used in time t and A_{it} reflects the productivity parameter (quality) of each of the corresponding x 's. The productivity parameters will vary across intermediate products in each of the periods due to

the randomness of the innovation process. All the results of the one-sector model follow, and the comparative statics are qualitatively similar to those in the one-sector model.

3. Firm Entry and Competition

In the innovation-based growth model, in each period t , suppose a potential entrant may arrive in the market with the leading-edge technology and displace the incumbent firm. To protect itself from this threat of displacement, the incumbent firm undertakes innovation activity to remain at the frontier of technology. Growth is spurred by this innovative activity undertaken by an entrepreneur.

The presence of competition reduces the possible monopoly rents that the incumbent monopolist can obtain otherwise. Further, in the model described earlier, the presence of competition paves way to the threat of not just loss of monopoly rents but also displacement of the incumbent firm from the market. It is well known in firm theory that it is monopoly rents that incentivise innovation activity. Therefore, the presence of (displacing) competition is inimical to constraining innovation activity and thereby also not good for growth in the economy. Dasgupta and Stiglitz (1980) have shown that innovation activity should decline with increased competition since higher competition would reduce monopoly rents of successful innovators. In the Schumpeterian framework, there is not only a threat of losing monopoly rents, but also a more severe threat of displacement from the market.

However, with a host of empirical work disproving this claim, the prediction that existence of competition is not favourable to economic growth remains untenable. If economic growth is understood as increase in total factor productivity (as in the model described earlier), then Nickell (1996) analyses data for about 670 companies in the UK and presents evidence that the presence of competition – understood as increase in the number of competitors or lower level of rents – is associated with a significantly higher rate of total factor productivity growth. Aghion, Blundell et. al. (2004) also examine how entry of firms affects the growth of productivity of incumbents in the context of the opening of the United Kingdom's economy in the 1980s and show that with more entry, which is proxied by a larger share of industry employment in foreign firms, there has been a faster growth in total factor productivity of incumbent domestic firms and that has led to a faster growth of aggregate productivity.

Other models of endogenous growth fail to adequately explain these findings. In the AK model, there is no scope for analysing the impact of competition on entry since the model rests on the assumption of perfect competition. On the other hand, the expanding product-varieties model of Romer predicts a negative effect of competition on innovation and, thereby, on growth since a higher degree of substitutability between intermediate inputs (which is to be understood as higher competition) reduces the rents that prospective product innovators could obtain.

3.1 Leapfrogging vs. Step-by-step Technological Progress

The question of when competition fosters or discourages innovation is addressed in Aghion et al. (2013) by distinguishing between leapfrogging and step-by-step innovation. In leapfrogging, new entrants can overtake incumbents after successful research. In contrast, step-by-step progress requires lagging firms to first catch up before becoming leaders. Once caught up, firms engage in Bertrand competition. This model, accounting for tacit knowledge, allows for neck-and-neck competition in some sectors, offering a more nuanced view of how competition impacts innovation and growth.

In neck-and-neck sectors, increased competition pressures firms to innovate to gain an edge—this is the escape-competition effect. In non-neck-and-neck sectors, the effect is ambiguous. Firms far behind the leader see little chance of overtaking and focus on short-term gains, discouraging innovation—this is the Schumpeterian effect. The overall growth impact depends on the balance between level (neck-and-neck) and unlevel sectors, referred to as the composition effect.

The authors find this overall relationship to be an inverted-U. A change in competition shifts the steady-state balance: in level sectors, escape-competition dominates; in unlevel sectors, the Schumpeterian effect does. If initial competition is low, neck-and-neck firms lack incentive to innovate, while innovation is more likely in unlevel sectors. The industry quickly exits unlevel states and remains longer in level states, where escape-competition drives innovation. Conversely, if initial competition is high, lagging firms are discouraged from innovating, while neck-and-neck firms are incentivized. The industry stays longer in unlevel states, dominated by the Schumpeterian effect.

In short, when initial competition is low, more competition boosts innovation. But when initial competition is already high, further increases may slow innovation.

3.2 Distance to Frontier and Firm Entry

Aghion and Howitt (2009) present a model that analyses the relationship between firm entry and innovation. They show that incumbent firms will respond to an increase in the entry threat depending on their initial distance from the technological frontier. Domestic firms producing the intermediate product face an entry threat from foreign firms. Liberalisation here corresponds to the increase in the probability that a foreign entrant shows up in the domestic economy. The final-good production function is the same as in equation (10), except for labour, from which we abstract away here. The equilibrium profits are given by equation (6) above. At any time t , the frontier productivity is denoted by $\bar{A}_t$ and is expressed as

$$\bar{A}_t = (1 + g)\bar{A}_{t-1} \quad \text{where } (1 + g) = \gamma > 1. \quad (11)$$

At date t , an incumbent firm may be close to the technology frontier, in which case its productivity level is defined as $A_{it-1} = \bar{A}_{t-1}$. This firm may be characterised as Type-1 firm in sector i . Alternatively, an incumbent firm may be far below or away from the

technology frontier, in which case its productivity level is defined as $A_{it-1} = \bar{A}_{t-2}$. This firm may be characterised as Type-2 firm in sector i .

Before they set about producing products and making profits for themselves, firms can innovate and increase their productivity by γ . The probability rate of a successful innovation is given by z . Therefore, the level of investment that a type- j firm must make will be

$$c_{it} = c(z^2/2)A_{it-j}$$

where c is the per unit cost of production for the technologically advanced firm.

Foreign entrants are assumed to be at the frontier of technology. At date t , the foreign firms operate at the end-of-period frontier technology, $\bar{A}_t$.

In case the foreign firm enters the industry and competes with an incumbent domestic firm that has lower productivity, then it wipes out the incumbent firm from the market. However, if the foreign firm competes with an incumbent domestic firm that has the same productivity as itself, Bertrand competition follows and the profits of both the local as well as the foreign firm are reduced to zero. Suppose now that the foreign potential entrant can observe the post-innovation technology of the domestic incumbent firm before it decides on whether to enter the industry or not. Then the foreign firm will enter only if it observes that the post-innovation productivity of the local firm is lower than the frontier. On the other hand, the foreign firm will not enter the domestic market if the domestic firm has already achieved frontier technology. Therefore, the probability of actual entry in any intermediate sector i is:

$$\text{probability of actual entry} = \begin{cases} 0; & \text{if the domestic firm has successfully innovated;} \\ p; & \text{otherwise.} \end{cases}$$

3.2.1 Innovation decisions by incumbent firms

Consider, first, a firm that is initially far below the technology frontier (type-2 firm) at date t . It may choose to innovate by investing cost $c(z^2/2)\bar{A}_{t-2}$, but it earns positive profits only if the innovation activity is successful and if no entry occurs. Thus, its profit on successful innovation and no entry will be, $\pi\bar{A}_{t-1}(1-p)z$. If the innovation fails, the firm will still earn a profit only if no entry occurs, which will be $\pi\bar{A}_{t-2}(1-p)(1-z)$. Accordingly, the expected profit of the firm will be:

$$\pi\bar{A}_{t-1}(1-p)z + \pi\bar{A}_{t-2}(1-p)(1-z) - c(z^2/2)\bar{A}_{t-2}$$

Probability z will be chosen such that this expected profit will be maximised. This yields the following first-order condition:

$$z_2 = (1-p)(\gamma-1)(\pi/c) \quad (12)$$

Now, consider a firm that is initially closer to the technology frontier (type-1 firm) at date t . It may also choose to innovate by investing $c(z^2/2)\bar{A}_{t-1}$ and will earn profit $\pi\bar{A}_t$ on successful innovation. If innovation fails and no entry occurs, it will earn a profit of $\pi\bar{A}_{t-1}$. Thus, its expected profit will be:

$$z\pi\bar{A}_t + \pi\bar{A}_{t-1}(1-p)(1-z) - c(z^2/2)\bar{A}_{t-1}$$

This firm will choose probability z such that its expected profit will be maximised, which yields the following first-order condition:

$$z_1 = (\gamma-1+p)(\pi/c) \quad (13)$$

This model makes two important theoretical predictions. First, liberalisation, that is to say, an increase in the entry threat, is conducive to innovation in industries that are closer to the frontier, and discourages innovation in industries that are far below the technology frontier. This comes from the fact that

$$\frac{\partial z_1}{\partial p} = \pi/c > 0, \text{ and}$$

$$\frac{\partial z_2}{\partial p} = -\frac{\pi(\gamma-1)}{c} < 0$$

Second, labour regulations that are more pro-worker will discourage innovations in all firms, whereas labour regulations which are more pro-employer increase the positive impact of entry on innovation in firms that are closer to the technology frontier, assuming that a pro-employer labour regulations will increase the profits of a firm. This can be seen from the following partial derivatives:

$$\frac{\partial z_1}{\partial \pi} = (\gamma-1+p)/c > 0 \text{ and}$$

$$\frac{\partial z_2}{\partial \pi} = (1-p)g/c > 0$$

The authors also present interesting results when cross-partial derivatives with regards to entry-threat and labour reform:

$$\frac{\partial^2 z_1}{\partial \pi \partial p} = 1/c > 0 \text{ and}$$

$$\frac{\partial^2 z_2}{\partial \pi \partial p} = -\frac{g}{c} < 0$$

Thus, a more pro-employer labour reform will increase the positive impact that the higher entry will have on the innovation decision of the type-1 firm.

4. The Political Economy and Growth

Does democracy positively contribute to economic growth is a question that has been the subject of some empirical studies.

While many studies have emphasised on the relationship between democracy and income, the direction of causality that they explored was from income to democracy and not from democracy to income or income growth. Acemoglu et. al. (2008) use a cross-country panel data and test for the following regression model:

$$d_{it} = \alpha d_{it-1} + \gamma y_{it-1} + \beta X_{it-1} + \mu_t + \delta_t + u_{it},$$

where d_{it} measures democracy in country i at date t , y_{it-1} is the per-capita income of country i at time $t - 1$, X_{it-1} are all other potential covariates, μ_t controls for time effects, capturing common shocks to the democracy score of all countries in the panel, δ_t is set of country dummies, and u_{it} is the error term. Five years constitute a period of time here. The period of study is 1960-2000.

The study uses two democracy measures. The first is the Freedom House Political Rights Index, which scores countries based on criteria like free elections and competitive parties. The second is the Composite Polity Index, calculated as the difference between the Polity Democracy and Autocracy Indices (each ranging from 0 to 10), reflecting political openness and executive constraints. To compare both indices, the Polity Index is normalized between 0 and 1.

The study finds that once country fixed effects are included, the estimate for γ becomes insignificant. This indicates that while income and democracy are positively correlated, there is no evidence of a causal relationship.

Mulligan et al. (2004), analyzing data from 142 countries (1960–1990), assess democracy's effect on redistribution and institutional policies using the Polity Index. They find no strong correlations, except a negative one with military spending, suggesting democracy does not consistently affect growth-related policies.

However, democracy may still impact per capita GDP growth via two channels. First, it might reduce corruption and support freer firm entry, fostering innovation (Aghion et al., 2006). Second, it can lead to more redistribution, which in unequal societies discourages capital accumulation and hampers growth (Persson and Tabellini, 1994).

4.1 A simple model of democracy, firm entry and growth

Aghion et. al. (2006) present a model where democracy affects growth through the reduction in corruption route mentioned above. Here, by constraining the politicians' ability to collude with the incumbent firms who offer bribes to the politician, democracy positively affects growth. To the basic Schumpeterian model described earlier, a politician is now introduced. The politician determines p , the entry policy in each period. p is the probability that a potential entrant shows up in any intermediate sector. While the politician cares about growth, he also responds to bribes. That is, the politician is not benevolent. Therefore, the politician pay-off is as follows:

$$\text{Politician's pay} - \text{off} = \begin{cases} H\bar{A}_t, & \text{where } H > 0; \quad \text{if he chooses the policy that maximises current output } y_t; \\ B_t; & \text{otherwise.} \end{cases}$$

B_t is the bribe that incumbent firms offer the politician to limit the entry of new firms. The parameter H , which is used as a proxy for democracy, reflects the aggregate welfare concerns of the politician.

Recall that each potential entrant enters the market at time t with the leading-edge technology, $\bar{A}_t$. An incumbent firm that is technologically advanced in the previous period needs to undertake innovation activity and reach the new frontier to retain its monopoly power in the current period. However, if the incumbent fails to achieve the new frontier, and if there is a successful entry of a new firm (which arrives with the new frontier technology), then in the ensuing Bertrand competition between the incumbent and the entrant, the incumbent will be eliminated and replaced by the entrant. Thus, remaining at the frontier by undertaking innovation activity makes the technologically advanced incumbent firm immune to entry.

Note also that innovation is a costly activity. Therefore, on the one hand, considering the entry threat, an incumbent firm that is closer to the frontier escapes the entry threat by innovating more. On the other hand, an incumbent firm that is technologically backward in the previous period does not respond to an increase in the entry threat by innovating more because it will be unable to prevent a technologically advanced entrant from displacing him from the market anyway.

The authors arrive at the maximum bribe that both types of incumbent firms – the frontier firms as well as the below-frontier firms – would be willing to pay. These bribes are expressed as functions of p , the entry threat. The equilibrium entry probability, p^* , is arrived at using the following equation:

$$B(p^*) = B_a(p^*) + B_b(p^*) = H\bar{A}_t$$

where $B(p^*)$ is the total equilibrium bribes that both types of firms would be willing to pay the politician for preventing to move from entry probability, $p = 0$ to $p > 0$. $B_a(p^*)$ is the equilibrium bribe that a technologically advanced will be willing to pay and $B_b(p^*)$ is the equilibrium bribe that a technologically backward firm will be willing to pay.

The authors present the bribe-function as strictly increasing in p , the entry threat. Therefore, the equilibrium entry probability, p^* , is an increasing function of H , which is the level of democracy. Thus, higher the level of democracy, the less profitable it will be for the incumbent firms to bribe the politician. Also, an increase in democracy (i.e. an increase in H), will encourage the advanced firms to innovate whereas it discourages the backward firms from innovating. Thus, there is a higher impact of democracy on productivity growth in sectors that are closer to the world technology frontier. Simply put, democratic institutions favour growth in sectors that are technologically advanced.

4.2 Other models in brief

Aghion and Howitt (2009) discuss two additional models linking democracy and growth. The first, by Acemoglu et al. (2007), suggests that decentralization—viewed as democracy within firms—boosts innovation at the technological frontier. In less advanced sectors, where imitation dominates, decentralization is less critical, as objectives are clearly defined and firms can function hierarchically. In contrast, frontier sectors benefit from decentralization, which grants employees more autonomy and fosters innovation.

The second channel involves the impact of democracy on redistribution and growth. Aghion and Howitt reference Persson and Tabellini (1994) and Alesina and Rodrik (1994), who argue that redistribution—driven by democratic voting in unequal societies—can hinder capital accumulation and thus growth. In highly unequal economies, the poorer median voter benefits less from growth and more from redistribution, leading to policies that reduce incentives to invest and innovate, ultimately slowing growth.

5. Conclusion

We began by seeing a basic one-sector model of the Schumpeterian growth theory and saw how it can be easily extended to a multi-sector model, to account for more empirical reality. We have also seen how the model can be extended to understand the impact of firm entry and exit dynamics on the economic growth of a country. Then we have proceeded to discuss how the non-benevolent politician/ planner can be brought in who can impact the growth process by restricting entry and thereby being detrimental to growth. As a parallel contribution, we have seen how a richer analysis and policy prescriptions can be made by decomposing labour into skilled and unskilled and differentiating between innovation and imitation activity, in an extended version of growth model with endogenous technical change.

A summary study of the literature on Schumpeterian growth theory reveals that there is not enough research on how economic growth requires the development of an educated middle class (skilled labour force) that eventually pushes for the transition to democracy. This can act as sufficient motivation for further research. On growth and the appropriate political institutions in the economy, there is a lot of work going on trying to formalise and also empirically test how countries transition to a democracy in their growth process.

While democracy enhances growth the closer the country is to the world technological frontier, does it mean that countries automatically move towards democracies as they develop? While we have seen the inherent interest of firms in bribing a politician so as to block entry of firms, what is the role played by other agents in economy? Is there a conflict between the various agents in the economy in transitioning towards a democracy (i.e. moving towards a regime of freer entry of firms)? If so, how are these conflicts settled?

Particularly, the following two questions are of interest for future work.

1. In an economy where incumbent firms face potential competition from technologically advanced entrants, politicians—motivated by both citizen welfare and bribes—can be influenced to block entry. Incumbents may bribe politicians to eliminate entry threats and avoid R&D costs (Aghion et al., 2006). However, this harms consumers who benefit from higher-quality goods. Models like Melitz (2003), building on Romer's expanding product variety framework, show that consumer welfare increases with the number of firms. Melitz also demonstrates that the number of firms grows with country size. Thus, in larger countries, politicians may be more inclined to allow free entry, aligning with consumer interests. This argument can also extend to Schumpeterian models focusing on rising product quality, raising similar questions about how population size affects market openness.

2. In economies with both skilled and unskilled labour—where skilled labour is more elastic in innovation and unskilled in imitation—firms boost productivity by either imitating frontier technologies or innovating on existing ones. Vandenbussche et al. (2006) show that increasing skilled labour raises productivity more when an economy is closer to the technological frontier, while unskilled labour is more beneficial when farther from it. Thus, for economies aiming to reach or stay at the frontier, a larger stock of skilled labour can pressure politicians to support freer firm entry, encouraging innovation. In contrast, industry lobbies may push for restricted entry.

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