Family connections and entrepreneurial human capital: The *uncertain* destiny of proprietary capitalism*

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Abstract

Two general conclusions can be drawn from the historical and empirical economic research on family firms: (1) it is impossible to identify a single definitive destiny for proprietary capitalism in the process of industrial development regardless of the cultural and institutional context in which the family firms operate; (2) in the same or similar economic environments well-performing (well managed) coexist with under-performing (poorly managed) family firms. In this paper, we develop an overlapping generations model, where agents are endowed with heterogeneous innate talent, and family firms have a comparative advantage over non-family enterprises as they have access to an additional source of immaterial capital, namely the network of family connections. Our results accommodate both the polarization of family firms into two groups with different levels of profitability and the uncertain destiny of proprietary capitalism between a crony and an entrepreneurial society, depending on the institutional framework and technological dynamism of the economy.

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1 Introduction

According to a well-established tradition in business history (Mathias and Postan, 1978; Payne, 1984) and economics (Ben-Porath, 1980; Pollak, 1980), the family firm, the firm owned and controlled by the family's members[1], is a crucial source of dynamism and progress in the early stages of industrialization, becoming a source of halfheartedness, conservatism and economic decline in the stages of mature development. During an industry's infancy, when markets are largely incomplete and institutions are untrustworthy, the family proves to be the appropriate unit around which to organize business activity, allowing information and incentive problems to be minimized without being an impediment to the emergence of entrepreneurial talent, firm entry or economic progress[2]. However, as industrialization advances and markets develop, the efficiency motivations for family firms lose importance. Concurrently, the firm's organization and its administration develop into an ever more complex and professional affair, hard to be met by the talents available within the family, and incompatible with dynastic motivations that typically drive succession in family firms[3]. In this new environment, the destiny of family capitalism seems ineluctable: either the weight of family firms in the country reduces, limited to small and specialized market niches, or the country is doomed to social immobility and economic decline (Chandler, 1990; Elbaum and Lazonick, 1986; Bertrand and Schoar, 2006).

Although seemingly persuasive, this deterministic view of the evolution of proprietary capitalism and its destiny has been recently disputed by historical research which has rehabilitated the role of family firms in the economic process, suggesting that its boosting or retarding nature depends to a greater extent on the cultural and institutional context in which entrepreneurial activities take place than on a technological pattern (Church, 1993; Cassis, 1995; Colli, 2003, 2012). In addition, it is not corroborated by present-day evidence on the importance of family-controlled corporations worldwide (La Porta et al., 1999) and the working of inherited firms, which are not unambiguously underperforming (Pérez-González, 2006; Mehrotra et al., 2013), but tend to polarize into well- and poorly-managed family firms (Bloom and Van Reenen, 2007).

In this paper, we present an overlapping generations model that accommodates both

[1] Although there is a huge number of specific definitions of what a "family firm" really is, a general consensus exists in business history and management studies (Litz, 1995; Colli, 2003) that keeping possession of the ownership and control of the business within the family are the common elements of family firms. However, this definition has been criticized for juxtaposing firms at the first with firms at the second and later generations (Bertrand and Schoar, 2006; Mehrotra et al., 2013). Hence, following Morikawa (2001), in the model we further distinguish between family and individual firms according to whether the firm is owned and managed by the founder's heirs or by the founder him/herself.

[2] For example, this view is clearly expounded by Landes (1965), Kocka (1981) and Lazonick (1991) among the historians, and modeled by Bhattacharya and Ravikumar (2001, 2005), Hassler and Mora (2000), Chami (2001) and Burkart et al. (2003) among the economists.

[3] An oft-quoted and vivid image of the damage produced by *entrepreneurship by inheritance* was given by the American financier Warren Buffet according to whom "[to] pass down the ability to command the resources of the nation based on heredity rather than merit .... [is like] choosing the 2020 Olympic team by picking the eldest sons of the gold-medalwinners in the 2000 Olympics" (reported in the *New York Times* article "Dozens of the wealthy join to fight estate tax repeal", D.C. Johnston, 14 February, 2001, electronic edition).

the polarization of family firms into two groups with different levels of profitability and managerial practices, and the uncertain destiny of proprietary capitalism between a stationary and a dynamic society, depending on the economy's institutional framework.

We consider a proprietary capitalist economy *à la* Lucas (1978) where firms are operated by a single manager and individuals have to decide whether to allocate their heterogeneous innate talent to managing an enterprise or working as an employee. The final output is produced by using managerial and general human capital. The managerial capital of a firm is shaped by two sources: the entrepreneurial human capital of the leader and the network of social, economic and political connections of the family to which he/she belongs. The entrepreneurial and general human capital of individuals are influenced by their innate ability and the education provided by their parents. By contrast, family connections can be established only by firms which are in operation and are assumed to be specific to the family and unresponsive to the innate ability of the heirs. The "productivity" of family connections for doing business is determined by the institutional/cultural environment of the society and by the degree of technological dynamism of the economy. When the latter is high the transfer of family reputation and connections across generations is rendered difficult and unproductive (Galor and Tsiddon, 1997; Galor and Moav, 2000; Hassler and Mora, 2000).

In such a context, the allocation of individuals' innate ability and the destiny of proprietary capitalism prove uncertain, both depending on the relative importance of entrepreneurial human capital and family connections in making a firm successful. In particular, we find that, starting from the same level of industrialization (i.e., number of firms), economies may develop along two different trajectories and converge to two equilibrium configurations of steady state, depending on the productivity of the family connections.

If the institutional, cultural and technological environments in which firms operate are such that the contribution of family connections to firm profitability is hardly at all decisive, an *entrepreneurial society* emerges in which proprietary capitalism does not impede the entry of new firms, social mobility or progress of the economy. More strikingly, we show that in this regime a polarization of family firms into two groups using different managerial practices prevails. In equilibrium, parent entrepreneurs transfer the control of the firms within the family to the most talented heirs, who are able to generate high profits by exploiting their entrepreneurial education, but also to the least talented heirs. This is because the network of connections embedded in the family guarantees a minimum level of profitability for the firm which is higher than the wage that a poorly talented heir could alternatively obtain by participating in the labor market. By contrast, since employees cannot invest in family connections, the workers' descendants found a company only if they are in the upper tail of the innate talent distribution; otherwise they find it more rewarding to supply their human capital in the labor market for a wage. As a consequence, while there is no difference in the firm level performance between the family (inherited) and non-family firms operated by highly educated entrepreneurs at the top of the ability distribution, at the aggregate level the family connections lower the average performance

of family firms, allowing a mass of low-ability heirs to continue doing business by using the economic and social relationships inherited from their parents.

In contrast, if the family connections are extremely productive, the entrepreneurial equilibrium becomes sclerotic (Acemoglu, 2008), leading the economy into a *crony*, fully immobile, society where the descendants of workers will be workers and the descendants of entrepreneurs will be entrepreneurs, exploiting the connections of their family instead of their talent.

As a step further, we analyze the aggregate economic inefficiencies generated by the family connections through their effects on the allocation of individuals' innate talent. In line with consolidated theoretical approaches (Galor and Tsiddon, 1997; Hassler and Mora, 2000; Acemoglu et al., 2006; Doepke and Zilibotti, 2013) and recent empirical evidence (Buera et al., 2011; Gennaioli et al., 2013), we posit that the growth rate of the aggregate technology depends on the share of talented entrepreneurs with an entrepreneurial education. In this context, the more profitable the family connections, the lower the steady state growth rate of the economy. Two mechanisms are at work here. When family connections are highly productive, current entrepreneurs tend to maintain the control of the firms within the family by introducing their low-ability heirs into the network of family connections. This increases the number of firms in the market, the labor demand and the wage rate, thus partially crowding out high-ability and well-educated entrepreneurs who prefer to work for a wage. The resulting reduction in the growth rate then further reinforces this crowding out effect, as the decrease in the rate of technological progress makes it relatively more rewarding to invest in the family connections rather than in the innate ability of the individuals. In the extreme case of the crony society, the growth rate of the economy is zero because of the lack of educated entrepreneurs. More importantly, the crony equilibrium can be very persistent: unless institutional changes reduce the productivity of family connections enough to turn a crony into an entrepreneurial society, the economy will be stuck in a no-mobility, zero-growth equilibrium.

This paper is related to two strands of the literature. First, we contribute to the microeconomic literature on family firms (Bhattacharya and Ravikumar, 2001; Burkart et al., 2003; Chami, 2001). These studies view the persistence of family firms as the result of amenity potential, financial market imperfections and agency problems, which make the leaving of the leadership to the descendants an inefficiently profitable alternative to selling the firm or hiring an external manager. As a result, the cutoff level of heirs' entrepreneurial talent above which it is optimal to maintain the control of the firm within the family is inefficiently low, although untalented heirs remain excluded from the firm's management (no polarization). In this paper, we highlight a new channel, family connections, which increases the profitability of transmitting the company within the family and which may explain the polarized distribution of the heirs' talent involved in the company and the existence of clusters of well- and poorly-managed family firms (Bloom and Van Reenen, 2007, 2010; Syverson, 2011).

Second, our paper is related to recent research on the macroeconomic consequences

of talent allocation and accumulation of entrepreneurial human capital[4], being closest in particular to Hassler and Mora (2000), Grossmann and Strulik (2010) and Caselli and Gennaioli (2013). Hassler and Mora (2000) assume that the children of entrepreneurs have an exogenously given information advantage in managing firms with respect to workers' descendants. As a result, in technologically stagnant economies, where the nature of entrepreneurial tasks changes slowly, this information advantage is sufficiently rewarding to allow low-ability entrepreneurs' descendants to exploit their parental background and start up a firm with negative feedback on technological innovation and economic growth. Grossmann and Strulik (2010) and Caselli and Gennaioli (2013) investigate succession of ownership and control from one generation to the other, where the entrepreneurial skills are assumed to be partly inherited. The model calibrations proposed by the authors indicate that financial market imperfections and systems of preferential taxation generate extremely high degrees of firm continuation thereby reducing total investment and factor productivity in the economy. In contrast to those papers, we abstract from credit market imperfections and assume that the children of entrepreneurs have exclusive access to a specific production factor, family connections, which allows the parent entrepreneurs to initiate low-ability children into the entrepreneurial career. According to whether the productivity of family connections is low or high, two economies at the same initial stage of industrialization may evolve into a regime with positive technological progress and social mobility or into a zero-growth regime. In this perspective, family connections are not only another source of advantage for family firms, but are the factor that accounts for the long left tail of underperforming companies among family firms and the uncertain fortunes of proprietary capitalism.

The rest of the paper is organized as follows. Section 2 presents the historical and empirical evidence on the performance of family firms and on the role of family connections. After presenting the basic structure of the model in Section 3, in Section 4 we analyze the occupational choice of the parents and the distribution of family firms in the society as well as the aggregate equilibrium of the economy. Section 5 presents the aggregate dynamics of the allocation of entrepreneurial talent and the feedback effects into the development of the economy. Then, in Section 6 we discuss a number of robustness checks and extensions and in Section 7 we conclude. All the proofs are reported in the Appendix.

2 Family firms and family connections

2.1 Role and performance of family firms

The common narrative among business historians is that the family firm has played a pivotal or an obstructive role in the economic process according to the stage of industrial development. At the beginning of the industrialization process, family ties permitted a number of information and incentive problems to be minimized by providing motivations

[4]For an updated review of this literature, see Doepke and Zilibotti (2013).

to start up and conduct a business, by making available financial resources, technical knowledge and entrepreneurial skills, by reducing opportunistic behaviors and promoting long-term commitments to work, invest and innovate. In these phases, the family firm and proprietary capitalism was supportive of the economic progress:

> family structures, processes and resources furthered the break-through of industrial capitalism and helped to solve problems of (capitalist) industrialization which could hardly have been solved otherwise (Kocka, 1981, p. 54).

> there can be little doubt that the family firm was the vehicle whereby the Industrial Revolution was accomplished ... [the] belief that the British family firm has been an important engine of economic progress is incontrovertible (Payne, 1984, p. 188).

As the industry grows, the social and economic institutions of the economy strengthen, by making the substitution role of kinship less important. In addition, as competition increases, running a company requires managerial competences that may not be available within the family. At this stage, the evolution of family capitalism was to have its influence limited to small businesses and other specific sectors in the economy – as occurred in the United States at the end of the nineteenth century, in Germany and Japan in the twentieth century (Chandler, 1990; Morikawa, 2001) – or it would degenerate into crony capitalism, by producing a misallocation of entrepreneurial talent, hindrance to technological innovations and a barrier to social mobility – as occurred in France throughout the nineteenth century, in the UK between the nineteenth and twentieth centuries, and in Italy at the end of the twentieth century (Landes, 1949; Elbaum and Lazonick, 1986; Chandler, 1990; Amatori, 1997).

However, several pieces of historical and contemporary evidence are inconsistent with the view of the family firm as a retarding factor in the mature stages of the industrial development. Already Alexander Gerschenkron (1954, p. 10), in opposition to Landes's (1949) view of the vices of French capitalism, argued that in France in the 19th century the influence and incidence of family firms were no stronger than in Germany, and that in order to maintain the thesis of the degenerative character of proprietary capitalism one "has to relegate vast and most significant fields of French entrepreneurial endeavor ... to qualifying footnotes" (see also Fridenson, 1997; Cassis, 2003). In the same vein, Roy Church (1993, p. 39) emphatically claimed that until the 1940s, "family firms persisted in Germany probably as widely as in Britain, while in Japan the family enterprise based on the holding company structure was even more dominant than in either country".

In many cases family firms were able to keep up with institutional and technological changes by professionalizing family descendants through rigorous routes of formal training and practical experiences. For example, Robert Fitzgerald (1995), returning on the cases of the two British food companies Cadbury and Rowntree singled out by Alfred Chandler (1990) as emblematic representations of the managerial failure of proprietary capitalism,

concludes that "there is no indication that Cadbury suffered from a lack of capital or managerial talent, despite remaining a family concern ... As far as Cadbury's great competitor and fellow Quaker firm Rowntree is concerned, managerial failure is even less likely" (Fitzgerald, 1995, pp. 42-43). Also, according to the account of Fernàndez Pèrez and Puig Raposo (2007, p. 480), in Spain family firms in the 1950s and 1960s promoted the foundation of private business schools like ESADE and IESE in Barcelona as a "strategy to get professional managers among the family members of big family firms"[5]. In this perspective, in contrast to the deterministic stage of development approach to proprietary capitalism, the existence of stories of success and economic decline in countries dominated by family firms has led many historians to view the different cultural and social environments and the institutional arrangements in which family firms are embedded as the key factors to understand "national differences in the capabilities and behavior of family firms [and] the distinctive characteristics of personal capitalism" (Colli and Rose, 2003, p. 341).

In the same way, the present-day figures on the incidence of family control in large enterprises around the world and econometric evidence on the performance of family firms return an image of personal capitalism which is much less clear-cut than the deterministic view of the stages of development. First, the family-controlled firm is a common form of business organization even among publicly listed companies of well developed countries. For example, in the United States, in the mid-1990s, four out of the top 20 listed companies by market capitalization and one third of companies included in "Standard & Poor 500" and in "Fortune 500" indexes had a family as ultimate controlling owner (Neubauer and Lank, 1998; La Porta et al., 1999; Anderson and Reeb, 2007). In the same years in Europe, 24% of listed companies in the UK were controlled by families, 60% in Italy and 65% in France and Germany (Faccio and Lang, 2002), while in eastern Asian countries the share of family-controlled firms was typically above 50% (Claessens et al., 2000).

Secondly, the recent empirical studies measuring the financial and market performance of family firms cannot unambiguously support the prediction that family firms underperform relative to non-family firms. For example, with regard to the US, Anderson and Reeb (2007) find that on average family firms tend to over-perform: the ROA is higher for family firms in which the founder or the founder's descendant serve as CEO while Tobin's q is higher for family firms with outside or founder CEOs. By contrast, Villalonga and Amit (2006) find that among the Fortune 500 firms those run by descendant CEOs have a lower market performance, even if this value destruction is limited to second-generation family firms[6]. What is more interesting, the impact of family ownership on the firm's performance is not uniform and the lower average performance of family firms appears to

[5] See also Chadeau (1995) and Colli (2012).

[6] Evidence for other countries is equally mixed: a negative, significant impact of the family succession on performance is found by Smith and Amoako-Adu (1999) and Morck et al. (2000) for listed firms in Canada, Cronqvist and Nilsson (2003) for listed firms in Sweden, Bennedsen et al. (2007) for Danish firms and Cucculelli and Micucci (2008) for small-medium Italian firms, while it is rejected by Favero et al. (2006), Sraer and Thesmar (2007) and Mehrotra et al. (2013) for listed firms in Italy, France and Japan, and by Barontini and Caprio (2006) for a large sample of public corporations in 11 European countries.

be due to a fat tail of poorly managed firms. Pérez-González (2006) considers a sample of 335 successions in publicly traded family-controlled US firms, finding that companies run by a family successor have a lower ROA and Market-to-Book value during the three years after the succession. However, the underperformance result disappears if the descendant CEO has accumulated enough human capital by attending a selective college. Bloom and Van Reenen (2007) consider instead the managerial practices of a sample of 732 medium-sized firms across France, Germany, the United Kingdom and the United States, documenting a strong polarization between badly and well managed firms. In addition, they show that the bad managerial practices (and the poor financial performance) of family firms can be traced back to an institutional feature of the society, the influence of the primogeniture tradition, under which the eldest heirs become the Chief Executive Officers of the family businesses, regardless of their abilities.

2.2 Family connections

Our model rests on some assumptions concerning the role and features of family connections. First, connections are more valuable for entrepreneurial than working activity, and they can be built during the firm's lifetime and bequeathed to successive generations. Second, inherited family connections need to be nourished generation by generation, as they tend to depreciate rapidly. Third, family connections are family-specific and are largely non-tradeable. Finally, the productivity of family connections is less dependent on the innate talent of the head of the family firm than his/her entrepreneurial human capital. The economic significance of such assumptions finds clear support in recent historical, sociological, management and economic research.

According to the social embeddedness perspective, all economic exchanges take place in a social context (Granovetter, 1985), and business organizations are embedded in webs of social, political and economic relations, strongly influencing access to information and resources, and economic performances (Uzzi, 1996; Faccio, 2006; Casson, 2010). For family businesses, the interpersonal ties that the family members establish with individuals outside the family and the special access to resources that these individuals control are often crucial factors for doing business successfully. Today, as in the past, the family network of relational ties and its social reputation represent an immaterial asset testifying to the quality and trustworthiness of the family business and what it produces, which are often strategically used by the family firm to facilitate access to intermediate and final markets (Uzzi, 1999; Craig et al., 2008; Boyce, 2010; Colli, 2012). In this perspective, for example, Mary Rose (2000) reports that the network of family-based relationships, in some cases promoted or cemented by arranged marriages, lay at the root of the success of the cotton industrial district in Lancashire during the eighteenth and nineteenth centuries. Again with reference to British capitalism in the nineteenth century, Fabio Braggion (2011) documents that small (family) companies not quoted on the London Stock Exchange whose managers were affiliated with Freemasonry had easier access to credit. Similarly, the pros-

perity of Italian industrial districts in the second half of the twentieth century was based on a system of shared, family-oriented cultural values producing a web of contractual and non-contractual relationships among local entrepreneurs (Dei Ottati, 1994). Further, the commercial success of overseas Chinese family businesses has proved to rest to a high degree on the traditional *guanxi* links centered on the notion of family and involving social and interpersonal connections founded on common cultural values, trust and loyalty (Perry, 1997; Peng and Luo, 2001)[7].

Beside the network created by social and cultural relationships, interlocking directorships and political connections are other typical forms of ties creating hedges to competition and advantages to family firms. In Italy, for example, the interfirm connections created by individuals sitting on multiple boards of directors have been a fundamental way through which major family businesses, like the Agnelli, Caltagirone, Falck and Pesenti families, formed and nourished their economic power (Rinaldi and Vasta, 2005; Aganin and Volpin, 2007; Santella et al., 2007)[8]. In emerging markets, like in Western countries, the establishment of political connections is a widespread strategy used by family firms to seize public resources, influence the execution of discretionary charges/rules and avoid expropriations (Amsden, 1997; Fisman, 2001; Goetzmann and Koll, 2007; Li et al., 2008; Cingano and Pinotti, 2013). Even in an uncorrupted country like Denmark, family connections with the local political sector appear to be significantly productive for doing business: doubling the political power of local politicians (measured by the ratio between a municipality's population and the number of elected politicians) nearly doubles the operating returns of firms whose CEOs and directors have family connections with the same politicians (Amore and Bennedsen, 2013).

In many cases, building a network of connections by investing time and effort in nurturing interpersonal relations is an explicit entrepreneurial strategy to create value for the family firm across generations. Once again, the historical and managerial literature provides numerous concrete examples of investment strategies in family connections. Alfani and Gourdon (2012) mention a number of historical cases and real data concerning the Parisian Protestant and Jewish economic elites, Swiss cotton entrepreneurs operating in Lombardy (Italy), Icelandic fishermen and Swedish dealers during the nineteenth century, which clearly illustrate the deliberate business use of godparenthood and marriage witnessing made by large and small entrepreneurs to gain access to economic resources and markets. Other cases of an entrepreneurial use of social interactions are reported in a detailed study by Salvato and Leif (2008) concerning four family-controlled companies currently in operation in Italy and Switzerland. Here we read, for example, that the Frescobaldi family, one of the largest wine producers (Marchesi de' Frescobaldi) in the Chianti area in Tuscany, has put in great effort to renew their network of social ties on a continual

[7]The same conclusion is reached by David Landes (2006) in his analysis of the most famous business dynasties across the world, while Mehrotra et al. (2010) find that family firms are less predominant in countries where arranged marriage norms are less widespread.

[8]Lester and Cannella (2006) provide a more general analysis of the importance of interlocking directorates in family businesses.

basis. During the first generation, Lamberto Frescobaldi assumed the posts of president of the main local bank in Florence, head of the local technical school for agronomists and member of the association ("Consorzio") of Chianti producers. "The Frescobaldi family leveraged these interpersonal relations to ease access to valuable resources, such as the acquisition of wine estates from members of the "Consorzio" and privileged access to the best human capital resources from the local technical school. Together, this allowed Frescobaldi to gradually transform its production from low-yield crops to quality wines" (Salvato and Leif, 2008, p. 265). During the second generation, Vittorio Frescobaldi became the president of the "Consorzio" while his wife Bona cultivated a large network of social relations which led her to be, "together with Giorgio Armani [the founder of another well known Italian family firm] ... the only Italian invited to Prince Charles' wedding in England" (Salvato and Leif, 2008, p. 268). During the third generation, the Frescobaldi family connections were further revived by the relationships built by Lamberto during his studies at the University of California at Davis thanks to which he gained contacts around the world[9].

The network of social, political and economic connections built by the family firm's founder and his successors is an immaterial capital which can be transmitted across generations and which pertains more to the family than to the firm. This, for example, finds clear corroboration in a recent study by Chung and Luo (2013). They look at the performance of Taiwanese firms during the two years after a CEO's succession and find that when the successor is a family member the ROA is positively correlated with the share of ownership controlled by the family, while when the successor is a non-family member future performance is lower in high family ownership firms. "Successors who are well connected and perceived as legitimate – Chung and Luo (2013, p. 339) conclude – may be more effective in acquiring resources, minimizing transaction costs, thus facilitating firm performance. ... For firms embedded in ... social relationships, family ... successors will be at an advantage in accessing network resources".

While the entrepreneurial ability of the descendants has an obvious impact on the performance of family firms, the value created by the network of family connections is less sensitive to the specific identity of the successor. As historians have widely documented, preserving and strengthening the family's name and connections has been considered a primary objective to guarantee the survival and success of the firm across generations (Boyce, 2010; Colli, 2012). As Aldo Fumagalli, a third-generation CEO of an Italian family firm, acknowledges in an interview reported by Andrea Colli (2012, p. 252-3),

> the most important thing my father passed on to me was not the company in itself, nor its financial good shape, nor the money and capital, nor even the business idea, which we (my brother and I) have now completely changed. The most important thing he gave us was the reputation of the company, and with the reputation, contacts and personal relationships. In this kind

[9] "When I am in South Africa, California or Chile – Lamberto Frescobaldi reveals – I always find somebody who studied at Davis. It's a community, a club"(Salvato and Leif, 2008, p. 268).

of business, everything is customized, and good relationships, contacts and reputation are indispensable. I work with many customers that my father, or even my grandfather, served. We, the third generation, now serve their third generation.

3 Model setup

Consider an overlapping generations economy in which economic activity extends over infinite discrete time. In each period t, a generation, populated by a continuum of individuals of measure one, is born. Individuals differ in their innate abilities, which are uniformly distributed over the unit interval, $a_t^i \sim U[0,1]$, and are publicly observable.

Each individual has a single parent and a single child such that there is no population growth. Individuals live for two periods and in each period of their life they are endowed with one unit of time. In the first period (childhood), they spend the unit of time acquiring either the managerial skills required to run a firm or general human capital that can be supplied on the labor market. In the second period of their life (adulthood/parenthood), individuals allocate their endowment of time between working for or managing a firm, according to the type of competences accumulated in childhood, and building up the human capital of their children and, possibly, family connections. Correspondingly, in adulthood individuals gain a payoff (profit or wage) and consume. Therefore, in each period t a number of entrepreneurs (n_t) and workers ($1-n_t$) coexist and both are endogenously determined by the occupational choices made by parents at time $t-1$.

3.1 Production

The economy is composed by a fringe of competitive firms that produce a single homogeneous good. Firms are operated by a single manager, who is also the owner[10], employing efficiency units of general human capital and managerial capital as inputs of the production process:

$$y_t^i = A_t m_t^i \left(H_t^i\right)^{1-\alpha} \tag{1}$$

where m_t^i indicates the managerial capital of the entrepreneur i, H_t^i the quantity of efficiency units of human capital employed in firm i, A_t the aggregate technology of the economy and $\alpha \in (0,1)$[11].

At the firm level, the production function (1) exhibits decreasing returns to scale in the variable factor (i.e., human capital), reflecting the limited span of control of the single manager (Lucas, 1978). Taking the equilibrium wage rate w_t as given, entrepreneurs choose the quantity of efficiency units of human capital so as to maximize profits per unit

[10] Hereafter, the terms manager, entrepreneur and firm will be used interchangeably. The possibility of external management is considered in Section 6.2.

[11] Following the original spirit of Lucas (1978), physical capital can be easily introduced, without affecting the results, by assuming a small open economy with perfect capital mobility and allowing the decreasing returns to scale to depend on a span of control parameter.

of time spent running the firm:

$$\max_{H_t^i \geq 0} \ \pi_t^i = A_t m_t^i \left(H_t^i\right)^{1-\alpha} - w_t H_t^i \tag{2}$$

The conditional demand function of human capital for firm i is therefore:

$$H_t^i = \left(\frac{(1-\alpha) A_t m_t^i}{w_t}\right)^{1/\alpha} \tag{3}$$

Substituting (3) in (2), for any given equilibrium wage rate, the maximum profits per unit of time of an entrepreneur with managerial capital m_t^i are:

$$\pi_t^i = \pi_t \left(m_t^i\right)^{1/\alpha} \tag{4}$$

where

$$\pi_t = \beta \left(\frac{A_t}{w_t^{1-\alpha}}\right)^{1/\alpha} \tag{5}$$

are the profits per efficiency unit of managerial capital, that depend positively on the level of the aggregate technology and negatively on the wage rate, with $\beta \equiv \alpha (1-\alpha)^{\frac{1-\alpha}{\alpha}}$.

3.2 Production factors

3.2.1 Managerial capital

The managerial capital of the firm originates from two sources: the entrepreneurial human capital and the family's connections. We assume that the former is more dependent on the individuals' innate abilities than the latter, but both need to be cultivated by time investments on the part of parents. The idea is that the innate abilities may transform into entrepreneurial human capital only after a period of formal and/or on-the-job training in childhood, which requires the investment of resources (unit of time) by the parents. Likewise, the family's connections are established by the parents who spend time and effort in cultivating a network of economic, social and political relations. Formally, the managerial skills of the individual i of generation $t+1$ are assumed to be equal to:

$$m_{t+1}^i = a_{t+1}^i \tau_{a,t}^p + \iota\phi \left(1 - g_{t+1}\right) \tau_{\phi,t}^p \tag{6}$$

where a_{t+1}^i is the innate ability of the individual i of generation $t+1$, and $\tau_{a,t}^p$ and $\tau_{\phi,t}^p$ indicate the fraction of time spent by the parent $p = e, w$ (e for entrepreneur and w for worker) to form, respectively, the entrepreneurial human capital of the child and the network of family connections.

Consistent with the evidence discussed in Section 2.2, equation (6) incorporates the idea that part of the individual managerial capital is embedded in the network of connections built by the previous generation of family entrepreneurs and that family connections are non-tradeable and slightly dependent on the identity of the firm leader. Accordingly,

the indicator function $\iota = 0, 1$ takes value 1 if the individual's parent is an entrepreneur and value 0 if he/she is a worker. Further, in order to capture the relatively greater importance of talent in shaping the entrepreneurial human capital rather than the network of family connections, we assume that the latter is not at all sensitive to the innate ability of the manager[12].

Accessibility to the network of family relations and contacts introduces a source of heterogeneity across families through which we can discriminate between two types of firms, namely family and individual, in accordance with the classification introduced by Hidemasa Morikawa (2001). The individual firms are those which are "owned and managed by its founder", while the family firms are "owned and managed by ... heirs of the founder .... after the founder retires" (Morikawa, 2001, pp. 3-4). In our setting, this dichotomy implies that while heirs can manage the family firm by exploiting both their entrepreneurial human capital and the network of family connections inherited from the previous generations of entrepreneurs, new potential entrepreneurs can rely only on their entrepreneurial human capital in order to found and run new individual firms.

The strength of the comparative advantage that entrepreneurs' descendants have with respect to new firm founders depends on the value of family connections in doing business and extracting profits from a given combination of inputs, which is determined by the institutional setting and the technological dynamism of the economy. The parameter $\phi \geq 0$ captures the extent to which the institutional arrangements of society causes a firm's economic, social and political connections to be a factor influencing its profitability: high values of ϕ are associated to institutional environments in which personal relationships, contacts and reputation are of great importance for doing business; at the other extreme, $\phi = 0$ describes societies in which family connections and social embeddedness have no influence on firm performance. Apart from the institutional environment, we assume that the productivity of the network of family contacts is subject to an erosion effect due to the dynamism of the economy, which is identified by the growth rate of the aggregate technology $g_{t+1} = (A_{t+1} - A_t)/A_t$. The idea is that in societies where new technologies are introduced at a high pace, the transfer of family reputation and connections across generations is less feasible and worthwhile. Although the erosion effect may also lead to depreciation of abilities, research (Galor and Moav, 2000; Hassler and Mora, 2000) suggests that human capital tends to deteriorate slowly relative to family connections. Hence, to simplify the analysis, we assume that the erosion effect impacts only on family connections.

3.2.2 General human capital

Alternatively, agents can find occupation as wage-earners by supplying efficiency units of general human capital h^i_{t+1}. Again, the human capital accumulated by individuals in the

[12] Our results are robust to more general functional forms for equation (6) that also account for some degree of complementarity between family connections and entrepreneurial human capital as well as for the possibility that family connections depend, at least partly, on individual innate ability (see Section 6).

childhood depends both on their innate ability and the time that parents spend on the education of children, $\tau^p_{h,t}$:

$$h^i_{t+1} = a^i_{t+1}\tau^p_{h,t} \tag{7}$$

3.3 Preferences and choices

At time t, two types of adult individuals coexist in the economy: the parent entrepreneurs and the parent workers. Individuals' preferences are defined over the second-period consumption and the potential income of their children. Specifically, they are represented by the following log-linear utility function:

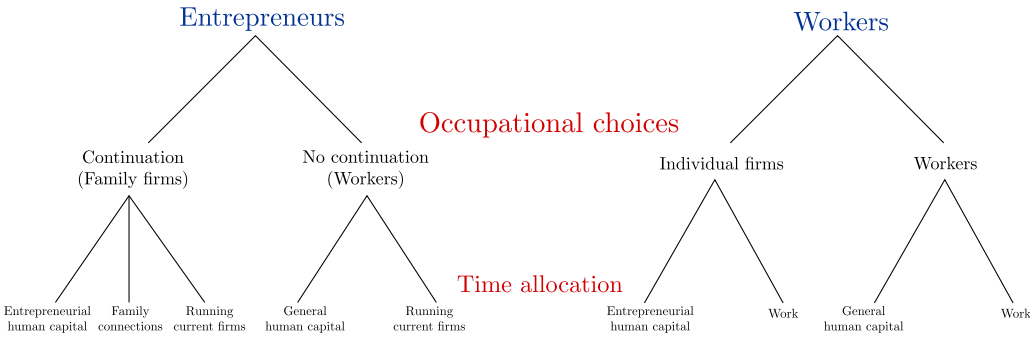
$$u^i_t = \gamma \ln c^i_t + (1-\gamma)\ln I^i_{t+1} \tag{8}$$

where c^i_t is the household consumption of a member i of generation t and I^i_{t+1} is the income of the children that depends on the occupational choice that parents makes for them.

The entrepreneurs have to decide whether to retain the control of the firm within the family or shut the firm down. Conditional on choosing to continue the firm within the family, they have to choose how to allocate their unit of time between nurturing the entrepreneurial skills of descendants ($\tau^e_{a,t}$), building a network of family connections ($\tau^e_{\phi,t}$), and running their own firm ($1-\tau^e_{a,t}-\tau^e_{\phi,t}$). Alternatively, the entrepreneurs can shut the firm down and share their unit of time between the upbringing of the general human capital of the children ($\tau^e_{h,t}$) and the management of their own firm ($1-\tau^e_{h,t}$).

Correspondingly, parent workers have to decide whether to initiate their children to the entrepreneurial or wage-earning career. In the first case, they devote their unit of time to cultivate the entrepreneurial human capital of descendants ($\tau^w_{a,t}$) and work for a wage. In the second case, instead, the allocation of time is between the descendants' general human capital ($\tau^w_{h,t}$) and their own job. Figure 1 summarizes the parents' choices.

Figure 1: **Parents' choices**



4 Optimal choices and market equilibrium

Moving backward, we first analyze the optimal allocation of time and then we study the occupational choices by comparing the maximum utilities received along each possible

career option for the descendants. Finally, we examine the aggregate consistency of the individual occupational and educational choices by deriving the aggregate demand and supply of general human capital, and the labor market equilibrium.

4.1 Allocation of time

4.1.1 Entrepreneurs

Continuation. Conditional on choosing to continue the firm within the family, parent entrepreneurs share their time between the accumulation of the managerial capital of the heirs and the operation of the firm they own, such that their budget constraint is:

$$\pi_t^i \left(1 - \tau_{\phi,t}^e - \tau_{a,t}^e\right) = c_t^i \tag{9}$$

The income of the heirs is determined by the profits they gain when in charge of managing the firm; as follows from (4) and (6), it is given by:

$$I_{t+1}^i = \pi_{t+1}^i = \pi_{t+1} \left[a_{t+1}^i \tau_{a,t}^e + \phi \left(1 - g_{t+1}\right) \tau_{\phi,t}^e\right]^{1/\alpha} \tag{10}$$

where $\iota = 1$ holds. Substituting (10) and (9) into (8), the optimization problem of the entrepreneurs of generation t is:

$$\begin{aligned} \{\tau_\phi^e, \tau_a^e\} = \arg\max \Big\{ & \gamma \ln \left[\pi_t^i \left(1 - \tau_{\phi,t}^e - \tau_{a,t}^e\right)\right] + \\ & + (1-\gamma) \ln \left[\pi_{t+1} \left(\phi \left(1 - g_{t+1}\right) \tau_{\phi,t}^e + \tau_{a,t}^e a_{t+1}^i\right)^{1/\alpha}\right] \Big\} \end{aligned} \tag{11}$$

$s.t.$

$$\begin{aligned} \tau_{a,t}^e + \tau_{\phi,t}^e &\leq 1 \\ \tau_{a,t}^e \geq 0;\ \tau_{\phi,t}^e &\geq 0 \end{aligned}$$

The optimal allocation of time between the heirs' managerial skills and networking is described by the following solution:

$$\left(\tau_\phi^e, \tau_a^e\right) = \begin{cases} \left(\dfrac{1-\gamma}{1-\gamma\left(1-\alpha\right)}, 0\right) & \text{if} \quad a_{t+1}^i < \bar{a}_{t+1} = \phi\left(1 - g_{t+1}\right) \\ \left(0, \dfrac{1-\gamma}{1-\gamma\left(1-\alpha\right)}\right) & \text{if} \quad a_{t+1}^i > \bar{a}_{t+1} = \phi\left(1 - g_{t+1}\right) \end{cases} \tag{12}$$

where $\bar{a}_{t+1}$ is the threshold level of heirs' ability for which parents are indifferent between the two choices. From (12), conditional on firm continuation, parent entrepreneurs invest a fraction of time, $\alpha\gamma/(1-\gamma(1-\alpha))$, in running their own firms and the rest either in nurturing the entrepreneurial skills of the heirs or in networking, according to whether the innate ability of the heirs (i.e., the marginal productivity of investment in entrepreneurial human capital) is higher or lower than the marginal productivity of networking, $\phi\left(1 - g_{t+1}\right)$. If the innate ability is low, parents prefer to invest time in building a system of family relationships that can facilitate the firm's performance and guarantee

a certain level of profits to the successor regardless of his/her innate talent. In contrast, if the heirs are very talented, it is more rewarding for parent entrepreneurs to spend their time enhancing the entrepreneurial ability of their heirs. Hence, the maximum utility of the parent entrepreneurs is described by the following piecewise indirect utility function:

$$v_e^e = \begin{cases} v_{e,\phi}^e := \delta + \gamma \ln \pi_t^i + (1-\gamma) \ln \left[\pi_{t+1} \left(\phi \left(1 - g_{t+1} \right) \right)^{1/\alpha} \right] & \text{if} \quad a_{t+1}^i < \bar{a}_{t+1} \\ v_{e,a}^e := \delta + \gamma \ln \pi_t^i + (1-\gamma) \ln \left[\pi_{t+1} \left(a_{t+1}^i \right)^{1/\alpha} \right] & \text{if} \quad a_{t+1}^i > \bar{a}_{t+1} \end{cases} \tag{13}$$

where the superscript indicates the occupation of the parent, the subscript indicates the occupational choice for the heirs and the type of managerial capital accumulated, and δ is a collection of parameters[13].

No continuation. Conditional on the entrepreneur choosing not to continue the firm, the income of the descendant is given by the wage earned on the labor market $I_{t+1}^i = w_{t+1} h_{t+1}^i$, which is determined by the equilibrium wage rate and the amount of efficiency units of human capital he/she accumulates and supplies. Hence, parent entrepreneurs choose how much time to devote to the accumulation of the general human capital of their children by solving the following maximization program:

$$\begin{aligned} \tau_h^e = \quad & \arg\max \left\{ \gamma \ln \left[\pi_t^i \left(1 - \tau_{h,t}^e \right) \right] + (1-\gamma) \ln \left(w_{t+1} a_{t+1}^i \tau_{h,t}^e \right) \right\} \\ s.t. \quad & 0 \leq \tau_{h,t}^e \leq 1 \end{aligned} \tag{14}$$

From (14), parent entrepreneurs optimally allocate a fraction of time $\tau_h^e = 1 - \gamma$ to cultivate the general human capital of their children such that their indirect utility function is:

$$v_w^e = \eta + \gamma \ln \pi_t^i + (1-\gamma) \ln \left(w_{t+1} a_{t+1}^i \right) \tag{15}$$

with $\eta \equiv \gamma \ln \gamma + (1-\gamma) \ln (1-\gamma)$.

4.1.2 Workers

Like the entrepreneurs, parent workers can choose between the working and entrepreneurial careers for their descendants. However, unlike parent entrepreneurs, workers cannot invest their time in building a network of social and political connections for their descendants. Hence, parent workers share their unit of time between working for a wage and improving either the general or entrepreneurial human capital of their children such that the two

[13] Namely, $\delta \equiv \gamma \ln \gamma + \gamma \ln \alpha + \alpha^{-1}(1-\gamma) \ln(1-\gamma) - \alpha^{-1}(1-\gamma(1-\alpha)) \ln(1-\gamma(1-\alpha))$.

maximization programs are:

$$\tau_h^w = \arg\max \left\{ \gamma \ln \left[w_t^i \left(1 - \tau_{h,t}^w \right) \right] + (1-\gamma) \ln \left(w_{t+1} a_{t+1}^i \tau_{h,t}^w \right) \right\} \tag{16}$$

$$s.t. \qquad 0 \leq \tau_{h,t}^w \leq 1$$

and

$$\tau_a^w = \arg\max \left\{ \gamma \ln \left[w_t^i \left(1 - \tau_{a,t}^w \right) \right] + (1-\gamma) \ln \left[\pi_{t+1} \left(a_{t+1}^i \tau_{a,t}^w \right)^{1/\alpha} \right] \right\} \tag{17}$$

$$s.t. \qquad 0 \leq \tau_{a,t}^w \leq 1$$

Solving the two programs, it can be verified that, likewise parent entrepreneurs, parent workers invest the fractions of time $\tau_h^w = 1-\gamma$ and $\tau_a^w = (1-\gamma)/[1-\gamma(1-\alpha)]$ to cultivate, respectively, the general or entrepreneurial human capital of the descendants, depending on the occupational choice made. This derives as, in our setting, the children of workers have exactly the same occupational opportunities as the descendants of entrepreneurs. The only difference between the two is that the former cannot rely on the network of family connections. Hence, the indirect utility functions of parent workers are:

$$\upsilon_w^w = \eta + \gamma \ln w_t^i + (1-\gamma) \ln \left(w_{t+1} a_{t+1}^i \right) \tag{18}$$

$$\upsilon_e^w = \delta + \gamma \ln w_t^i + (1-\gamma) \ln \left[\pi_{t+1} \left(a_{t+1}^i \right)^{1/\alpha} \right] \tag{19}$$

4.2 Occupational choice

4.2.1 Entrepreneurs

Parent entrepreneurs choose to continue the firm within the family or to shut it down and initiate their descendants to a wage-earning career by comparing the indirect utility functions in (13) and (15). Let a_{t+1}^{ϕ} be the level of the descendant's innate ability such that the parent is indifferent between leaving the leadership of the company to the heir by investing in networking and inducing the descendant to work for a wage; formally, $a_{t+1}^{\phi} \equiv a_{t+1}^i : \upsilon_{e,\phi}^e = \upsilon_w^e$. Likewise, let a_{t+1}^a be the level of the descendant's ability such that the continuation choice by investing in the descendant's entrepreneurial human capital and the non-continuation choice provide the same utility to the parent; formally, $a_{t+1}^a \equiv a_{t+1}^i : \upsilon_{e,a}^e = \upsilon_w^e$. From (13) and (15),

$$a_{t+1}^{\phi} = \theta \left[\frac{\phi \left(1 - g_{t+1} \right) A_{t+1}}{w_{t+1}} \right]^{\frac{1}{\alpha}} \tag{20}$$

$$a_{t+1}^a = \left(\frac{w_{t+1}}{\theta^{\alpha} A_{t+1}} \right)^{\frac{1}{1-\alpha}} \tag{21}$$

where $\theta \equiv \beta \exp[(\delta - \eta)(1-\gamma)^{-1}]$. The ability thresholds depend, *ceteris paribus*, on the equilibrium wage rate: the higher the income that descendants can gain on the labor market, the lower the incentive of parent entrepreneurs to transmit the firm within the family and hence the lower the threshold a^{ϕ}_{t+1} and the higher a^{a}_{t+1}.

Starting from (20) and (21), we can define the following three wage thresholds:

Definition 1. *Let us define:*

(a) $\tilde{w}_{t+1} = \theta^{\alpha} A_{t+1}$ *as the wage rate at which parents of the most talented individuals are indifferent between continuing the firm by investing in the heirs' entrepreneurial human capital and inducing them to become workers; formally,* $\tilde{w}_{t+1}$ *is the value of wage such that* $a^{a}_{t+1} = 1$*;*

(b) $\hat{\tilde{w}}_{t+1} = \theta^{\alpha} A_{t+1} \phi (1 - g_{t+1})$ *as the wage rate at which parents of the most talented individuals are indifferent between leaving the company to the heirs by investing in family connections and inducing them to become workers; formally,* $\hat{\tilde{w}}_{t+1}$ *is the value of wage such that* $a^{\phi}_{t+1} = 1$*;*

(c) $\hat{w}_{t+1} = \theta^{\alpha} A_{t+1} [\phi (1 - g_{t+1})]^{1-\alpha}$ *as the wage rate at which parents, conditional on choosing to continue the firm, are indifferent between investing in entrepreneurial human capital and family connections; formally,* $\hat{w}_{t+1}$ *is the value of wage such that* $a^{\phi}_{t+1} = a^{a}_{t+1}$.

From (20) and (21) and the above definitions, it immediately follows that for any equilibrium wage rate greater than $\tilde{w}$[14], the entrepreneurs' descendants will never operate the family firms with entrepreneurial human capital, regardless of their innate abilities, while for any equilibrium wage rate lower than $\hat{\tilde{w}}$ the entrepreneurs' descendants will never become workers. The third threshold, $\hat{w}$, indicates the wage at which parent entrepreneurs are indifferent between investing in family connections or the entrepreneurial human capital of their heirs, conditional on having chosen to continue the firm. By substituting $\hat{w}$ back into equations (20) and (21) we obtain:

Lemma 1. $a^{\phi}_{t+1}(\hat{w}) = a^{a}_{t+1}(\hat{w}) = \bar{a}_{t+1}$.

Lemma 1 states that the wage rate at which parents are indifferent between the investment in the two sources of managerial capital makes them also indifferent between the overall choice of continuing the firm or shutting it down. In addition, from Lemma 1 it follows that the decisions of parent entrepreneurs about the occupation and education of their descendants are intertwined and driven not only by the innate ability of the latter, but also by the relative magnitude of the three wage thresholds, which, in turn, depends on the productivity of family connections. In particular, using Definition 1 it follows that:

[14] In the rest of the paper and where it does not create ambiguity, we omit the time subscript on the wage thresholds $\tilde{w}$, $\hat{\tilde{w}}$ and $\hat{w}$, to save on notation.

Lemma 2. *If* $\phi(1-g_{t+1})<1$*, then* $\hat{\hat{w}}<\hat{w}<\tilde{w}$ *holds. Otherwise, if* $\phi(1-g_{t+1})>1$*,* $\tilde{w}<\hat{w}<\hat{\hat{w}}$ *holds.*

As long as the institutional setting and technological dynamism of the economy do not allow family connections to be very productive (i.e., $\phi(1-g_{t+1})<1$), the wage rate that makes parents indifferent between continuing the firm or shutting it down (i.e., $\hat{w}$) falls in the interval $\hat{\hat{w}}<\hat{w}<\tilde{w}$. This implies that, conditional on the choice of continuing the firm, the investment of time in family connections is never a dominant strategy for parent entrepreneurs, while the accumulation of entrepreneurial human capital is rewarding for, at least, some range of the heirs' abilities[15]. In contrast, when the productivity of family connections is high (i.e., $\phi(1-g_{t+1})>1$), building a network of family connections becomes the dominant investment strategy, and the accumulation of entrepreneurial human capital is never rewarding regardless of the innate talent of the heirs.

Proposition 1 summarizes the occupational choices of parent entrepreneurs distinguishing two possible regimes.

Proposition 1. *The equilibrium occupational choices of parent entrepreneurs are:*

Regime I. *If* $\phi(1-g_{t+1})<1$*,*

(a) for any $w_{t+1}<\hat{w}$*, all the descendants continue the family firms. For heirs with abilities* $a^i_{t+1}<\bar{a}_{t+1}$*, parents continue the firms by investing in family connections; for heirs with abilities* $a^i_{t+1}\geq\bar{a}_{t+1}$*, parents continue the firms by investing in the heirs' entrepreneurial human capital (fig. 2a);*

(b) for any $w_{t+1}\in[\hat{w},\tilde{w}]$*, the descendants with intermediate innate abilities,* $a^i_{t+1}\in(a^\phi_{t+1},a^a_{t+1})$*, become workers, while the others continue the family firms. For the least talented heirs, those with* $a^i_{t+1}\leq a^\phi_{t+1}$*, parents choose to invest in family connections, while for the most talented ones, those with* $a^i_{t+1}\geq a^a_{t+1}$*, parents choose to invest in their entrepreneurial human capital (fig. 2b);*

(c) for any $w_{t+1}>\tilde{w}$*, only low ability heirs, those with* $a^i_{t+1}\leq a^\phi_{t+1}$*, continue the family firms on account of family connections. All the others, those with* $a^i_{t+1}>a^\phi_{t+1}$*, become workers (fig. 2c).*

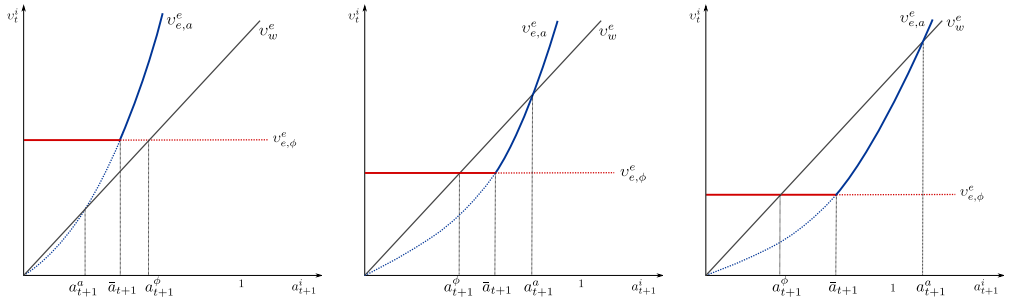
Regime II. *If* $\phi(1-g_{t+1})>1$*,*

(a') for any $w_{t+1}\leq\hat{\hat{w}}$*, all the descendants continue the family firms by exploiting family connections (fig. 2a');*

(b') for any $w_{t+1}>\hat{\hat{w}}$*, low ability heirs, those with* $a^i_{t+1}\leq a^\phi_{t+1}$*, continue the family firms on account of family connections. All the others, those with* $a^i_{t+1}>a^\phi_{t+1}$*, become workers (fig. 2b').*

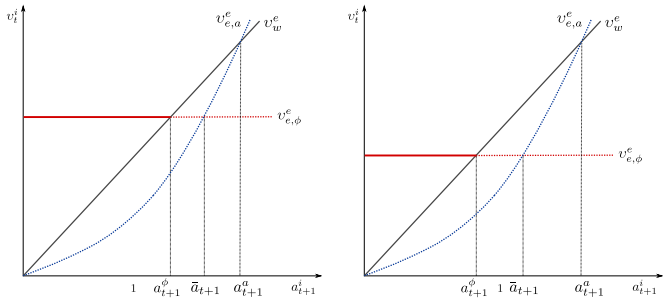
Figure 2: **Entrepreneurs' occupational choice**

Regime I: entrepreneurial society ($\phi(1-g_{t+1})<1$)



(a) $w_{t+1}<\hat{w}$ (b) $\hat{w}\leq w_{t+1}\leq\tilde{w}$ (c) $w_{t+1}>\tilde{w}$

Regime II: crony society ($\phi(1-g_{t+1})>1$)



(a') $w_{t+1}\leq\hat{\hat{w}}$ (b') $w_{t+1}>\hat{\hat{w}}$

In Figure 2 we provide a graphical representation of the occupational choice of parent entrepreneurs. In the first regime (hereafter, the entrepreneurial society), the productivity of family connections is sufficiently small such that continuing the family firm by investing time in the entrepreneurial human capital of descendants can be an optimal choice for parent entrepreneurs. When the equilibrium market wage is low (i.e., $w_{t+1}<\hat{w}$), the option of the employment sector is unattractive. The parent entrepreneurs will never shut their firms down, and the control of all the firms in the economy is retained within the family. Therefore, the heirs with an ability level lower than $\bar{a}_{t+1}$ continue operating the family businesses taking advantage of the system of relations inherited from their parents, while those with an ability level higher than $\bar{a}_{t+1}$ receive an entrepreneurial education that they employ in managing the family firms (panel 2a). For higher wage values, leaving the family business becomes a rewarding option. In particular, for intermediate wage rates, polarization of the family firms in terms of the talent of the leader does emerge (panel 2b): heirs with an innate ability lower than a^{ϕ}_{t+1} as well as heirs with an ability level higher than a^{a}_{t+1} continue the family business, while those with an ability level $a^{i}_{t+1}\in(a^{\phi}_{t+1},a^{a}_{t+1})$ leave the family business to work for a wage. In this case, low ability agents would earn a wage on the labor market lower than the profits they gain by running the family firm, taking advantage of the network of family connections; conversely, high ability heirs are

[15] In the extreme case of $\phi=0$ and/or $g_{t+1}\geq 1$, the model collapses to the benchmark case studied by Lucas (1978).

selected by their parents to continue the family business since the potential profits they can generate by exploiting their entrepreneurial ability exceed the wage they could earn as employees. Finally, for high wage rates, only descendants in the lower tail of the ability distribution (i.e., $a^i_{t+1} \leq a^\phi_{t+1}$) continue the firm by exploiting family connections, while all the others will leave the company to join the employment sector (panel 2c).

In the second regime (from now on, the crony society), the productivity of family connections is so high that it is never profitable for parent entrepreneurs to transfer the control of the firm within the family by investing in the entrepreneurial ability of their descendants. In this case, from Lemma 2, the only relevant wage threshold is $\hat{\hat{w}}$. If $w_{t+1} < \hat{\hat{w}}$, working for a wage is a low rewarding alternative and all the heirs retain the control of the company, exploiting the family connections inherited from their parents (panel 2a'). Otherwise, if the market wage is greater than $\hat{\hat{w}}$, the working career is a rewarding option for the highest ability individuals and parent entrepreneurs invest time in accumulating their general human capital (panel 2b').

4.2.2 Workers

As parent workers cannot invest time in building family connections for the descendants, their occupational choices are independent of the society's regime (entrepreneurial or crony). Thus, the decision between the entrepreneurial and the wage-earning career for their descendants is regulated only by the wage threshold $\tilde{w}$ and by the descendants' innate abilities. Using equations (18) and (19), it follows that, given the market wage w_{t+1}, the threshold level of the child's innate ability such that the parent worker is indifferent between initiating him/her into a wage-earning career, by investing in general human capital, and allowing him/her to found a new enterprise, by investing in entrepreneurial human capital, is exactly a^a_{t+1} as in (21). Therefore,

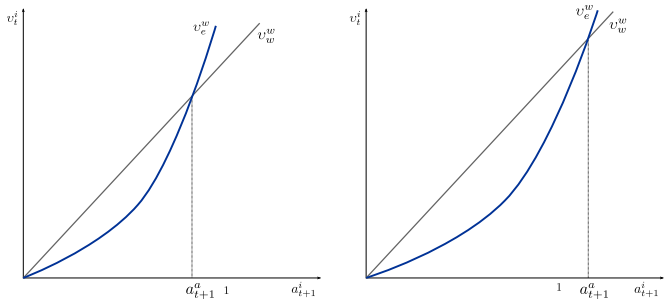
Proposition 2. *The equilibrium occupational choices of parent workers are:*

(a) For any $w_{t+1} \leq \tilde{w}$, the highest ability workers' descendants, those with $a^i_{t+1} \geq a^a_{t+1}$, accumulate entrepreneurial human capital and found new individual firms, while the least talented ones, those with $a^i_{t+1} < a^a_{t+1}$, become workers;

(b) For any $w_{t+1} > \tilde{w}$, all workers' descendants become workers, regardless of their innate abilities.

Figure 3 displays the occupational choice of parent workers. When the market wage rate is low, the employment sector is unattractive to highly talented descendants who may gain a higher income by starting an individual firm (panel 3a). In contrast, when the market wage rate is very high, working for a wage is the most rewarding option for workers' descendants whatever their innate talent (panel 3b).

Figure 3: **Workers' occupational choice**



(a) $w_{t+1} < \tilde{w}$ (b) $w_{t+1} > \tilde{w}$

4.3 Aggregation and labor market equilibrium

The aggregate supply and demand of general human capital are endogenously determined by the investment and occupational choices that parents make for their descendants. Using equations (3) and (7) and integrating the optimal choices of each type of parent (entrepreneur and worker) over the innate ability distribution of the young individuals, the aggregate supply and demand of human capital are:

$$H_{t+1}^{S,R}(w_{t+1}) = \int_{\mathcal{W}} h_{t+1}^{i} da_{t+1}^{i} = \int_{\mathcal{W}} a_{t+1}^{i} \tau_h^p da_{t+1}^{i} \tag{22}$$

and

$$H_{t+1}^{D,R}(w_{t+1}) = \int_{\mathcal{N}} H_{t+1}^{i} da_{t+1}^{i} = \int_{\mathcal{N}} \left(\frac{(1-\alpha) A_{t+1} m_{t+1}^{i}}{w_{t+1}} \right)^{1/\alpha} da_{t+1}^{i} \tag{23}$$

where $\mathcal{N}$ and $\mathcal{W}$ are the relevant sets of firms and workers at time $t+1$ reflecting the occupational choices of parents at time t and $R = E, C$ denotes society's regime, entrepreneurial or crony.

At any time $t+1$, the competitive equilibrium is defined by an allocation of talent, an allocation of time and a wage rate such that: (i) parents optimally choose the occupations for their descendants and allocate their unit of time between their own activity and the managerial or general human capital of their children; (ii) firms maximize profits; (iii) the labor market clears.

Proposition 3. *In both the entrepreneurial and crony regimes, for any n_t, a unique competitive equilibrium exists, defined by the tuple $\left\{ w_{t+1}^{R}, H_{t+1}^{S,R}, H_{t+1}^{D,R} \right\}$ such that $H_{t+1}^{S,R}\left(w_{t+1}^{R}\right) = H_{t+1}^{D,R}\left(w_{t+1}^{R}\right)$.*

The equilibrium wage rate w_{t+1}^{R} varies with the number of firms operating in the previous period t. This is due to the heterogeneity of firms associated to the possibility of accumulating and transmitting the family connections. The higher the number of firms in t, the higher the number of entrepreneurial parents who can choose to invest in family connections and transmit them to their descendants in $t+1$. This induces some individuals,

who, lacking family connections, would have chosen to work for a wage, to continue the family firm, thus causing an increase in the labor demand and a decrease in labor supply.

Hence, the occupational choices made by parents in t determine the number of firms in $t+1$, but at the same time they are regulated by the number of firms operating in t. This implies that to fully characterize the steady state equilibrium of the economy we have to study the joint evolution of the occupational choices and the number of firms in the economy. However, we can prove the following corollary stating a monotonic, increasing relation between w^R_{t+1} and n_t:

Corollary 1. *The equilibrium wage monotonically increases with the number of firms operating in the previous period:* $\partial w^R_{t+1}/\partial n_t > 0$. *Hence, there exist the thresholds* $\hat{n}_t$, $\tilde{n}_t$, $\tilde{\hat{n}}_t$ *and* $\hat{\hat{n}}$ *such that: in an entrepreneurial society, (a)* $n_t < \hat{n}_t \Rightarrow w^E_{t+1} < \hat{w}$*; (b)* $n_t \in [\hat{n}_t, \tilde{n}_t] \Rightarrow w^E_{t+1} \in [\hat{w}, \tilde{w}]$*; (c)* $n_t > \tilde{n}_t \Rightarrow w^E_{t+1} > \tilde{w}$. *In a crony society, (a')* $n_t < \tilde{\hat{n}}_t \Rightarrow w^C_{t+1} < \tilde{w}$*; (b')* $n_t \in [\tilde{\hat{n}}_t, \hat{\hat{n}}] \Rightarrow w^C_{t+1} \in [\tilde{w}, \hat{\tilde{w}}]$*; (c')* $n_t > \hat{\hat{n}} \Rightarrow w^C_{t+1} > \hat{\tilde{w}}$.

Corollary 1 greatly simplifies the analysis by allowing the wage thresholds determining the occupational choice to be matched to correspondingly one-period lagged threshold numbers of firms. In this way, in order to establish the existence and stability of a steady state equilibrium we can limit our attention to the dynamics of firm numbers under the assumption that in each period t the labor market clears.

5 Family firms and growth in the long run

The output per capita at time $t+1$ can be obtained by integrating the firm level productions over all the firms operating in the economy:

$$Y_{t+1} = \int_{\mathcal{N}} y^i_{t+1} da^i_{t+1} \tag{24}$$

Such output depends on the size of the industrial sector and the type of managerial practices ("entrepreneurial" versus "crony") used by firms. In what follows, we therefore analyze the evolution of family firms during the industrialization process and its effects on the long-run equilibrium. The analysis is initially conducted under the assumption that the rate of growth of aggregate technology, and hence the productivity of family connections, is exogenous and unvarying. Then, in order to consider the feedback effects that the social inertia created by family connections may have on economic development, we extend the analysis to the case in which the technology, and accordingly family connections productivity, evolves endogenously with the entrepreneurial talent of firm leaders.

5.1 Exogenous growth

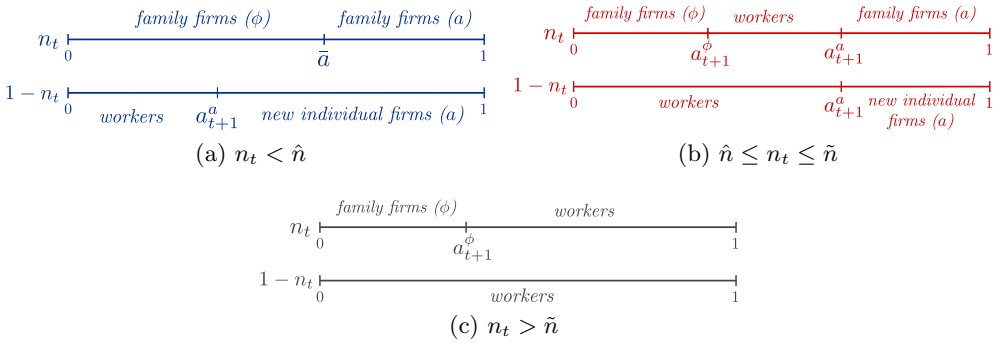
When the aggregate technology evolves over time at an exogenous rate $g_t = g$, the time path of the per-capita output (24) depends only on the dynamics of the number of firms in

the economy, which in turn is determined by the occupational choice of the parents. This choice depends crucially on the productivity of family connections and society's regime.

5.1.1 Entrepreneurial society

Steady state equilibrium. In an entrepreneurial society, when the institutional setting and the technological dynamism of the economy are such that the network of family connections are scarcely useful to manage a firm successfully, the occupational choices are those described in the first part of Proposition 1 (Regime I). Given Corollary 1, these choices can be made dependent on the number of firms at time t, as reported in Figure 4.

Figure 4: **Firms and workers in $t+1$: entrepreneurial society**



(a) $n_t < \hat{n}$ (b) $\hat{n} \leq n_t \leq \tilde{n}$

(c) $n_t > \tilde{n}$

When $n_t < \hat{n}$[16] the expected wage rate w_{t+1} is sufficiently low that all the family businesses in t continue their activity in $t+1$: low-ability heirs, $n_t\bar{a}$, come into the leadership of the family enterprise by taking advantage of the network of connections built by the previous generation of family business leaders, while $n_t(1-\bar{a})$ high-ability heirs receive the leadership of the family enterprise after accumulating entrepreneurial human capital in their childhood. In addition, a number of high-ability workers' descendants, $(1-n_t)(1-a^a_{t+1})$, start up new individual firms by using the entrepreneurial human capital accumulated in childhood (Fig. 4a).

If $n_t \in [\hat{n}, \tilde{n}]$, the wage rate at the intermediate level $w_{t+1} \in [\hat{w}, \tilde{w}]$ induces some exit from the family businesses and a polarization of the distribution of the talent of those inheriting the firms. In particular, $n_t(a^a_{t+1} - a^\phi_{t+1})$ entrepreneurs' descendants accumulate general human capital in childhood and work for a wage in adulthood, $n_t a^\phi_{t+1}$ inherit the business activity and family connections, and $n_t(1-a^a_{t+1})$ continue the firm by using the entrepreneurial human capital accumulated in childhood (Fig. 4b). Further, as in the previous case, the fraction $(1-n_t)(1-a^a_{t+1})$ of workers' descendants endowed with high innate talent enters in the entrepreneurial sector.

Finally, when $n_t > \tilde{n}$, the expected wage rate in $t+1$ is high. This means not only that all the workers' descendants prefer to work for a wage, but also that the most talented

[16] Note that when the growth rate is exogenous and unvarying the thresholds $\hat{n}_t$ and $\tilde{n}_t$ are time-independent. See Appendix.

descendants of entrepreneurs exit from the family businesses to enter the labor market. In this case, all the firms in the economy, $n_t a_{t+1}^{\phi}$, are family firms operated by the low ability heirs relying on the network of family connections built by their parents (Fig. 4c).

Summarizing, in an entrepreneurial society, the dynamic system governing the evolution of the industrial sector is the following:

$$n_{t+1} = \begin{cases} 1 - (1 - n_t)\, a_{t+1}^{a} & \text{if} \quad n_t < \hat{n} \\ n_t a_{t+1}^{\phi} + 1 - a_{t+1}^{a} & \text{if} \quad n_t \in [\hat{n}, \tilde{n}] \\ n_t a_{t+1}^{\phi} & \text{if} \quad n_t > \tilde{n} \end{cases} \tag{25}$$

The economy is said to be in a steady state equilibrium if the number of firms is constant over time, that is if $n_{t+1} = n_t = n^*$, for any $t = t...\infty$. The existence and characterization of the steady state equilibrium are described in the next Proposition 4.

Proposition 4. *In an entrepreneurial society, when $\phi < 1/(1-g)$, a unique and globally stable steady state number of firms exists:*

$$n^{E^*} = \frac{1 - a^a}{1 - a^{\phi}}$$

where $n^{E^*} \in [\hat{n}, \tilde{n}]$ such that the distribution of individuals' talent across occupations is that depicted in Figure 4b. At the steady state equilibrium, the output per capita grows at the exogenous rate, g, of aggregate technology.

In an entrepreneurial society, the long-run equilibrium is marked by a positive rate of social mobility between labor and industry and by a polarization in the distribution of individual abilities of the heirs succeeding to the leadership of the family firm and in the managerial practices deployed to lead a company. The highly talented descendants of entrepreneurs are left the guidance of the family firm and manage it by using the entrepreneurial human capital accumulated in their childhood. The least talented heirs also receive the leadership of the family firm, but they manage it by using the network of social, economic and political connections that their parents built when they were at the head of the company. Hence, in an entrepreneurial society a group of family firms characterized by good managerial practices and high performance levels coexists with a group of family firms following bad managerial practices and underperforming.

In addition, it is worth noting that, in steady state, there is no difference in the level of performance between new founded individual firms and the group of family firms adopting the best managerial practices: both are directed by highly talented individuals with the same level of entrepreneurial human capital. However, at the aggregate level, the average performance of family firms proves lower than that of individual firms because of the distortion in the allocation of talent caused by the possibility of investing in private family connections.

This polarization result is consistent with the empirical evidence reported in the In-

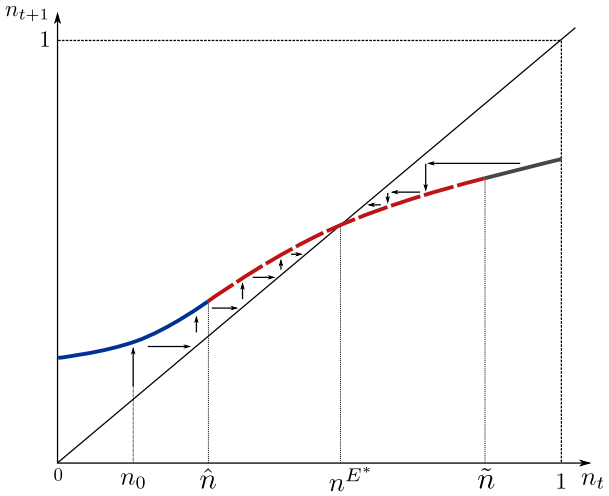
troduction. In particular, it can give a rationale to the findings of Bloom and Van Reenen (2007) who document that among the family firms there is a thick tail of badly managed firms performing poorly, but there is no significant difference between the performance of non-family and family firms that make use of the best managerial practices. Similarly, our results are in accordance with the evidence reported by Pérez-González (2006), showing that, while, on average, firms with a family-descendant CEO have lower returns than firms with unrelated CEOs, when the family CEO successor has accumulated entrepreneurial human capital in his/her youth the financial performance of the two types of firms are indistinguishable.

Family firms in the industrialization process. The evolution of proprietary capitalism in the course of the industrialization process can be characterized by looking at the transition of the economy toward the steady state.

Remark 1. *In an entrepreneurial society, the number of firms monotonically converges to the steady state equilibrium* n^{E^*} *(Fig. 5) and positively affects the output per worker. In addition, when* $n_t < n^{E^*}$*, the share of family firms decreases over time.*

In the first stages of the industrialization process, when the total number of firms n_0 is small, the expected wage rate w_{t+1} is low enough such that current generation of entrepreneurs will continue the firm within the family independently of the talent of their heirs. However, this does not prevent the most talented individuals who come from non-entrepreneurial families to found new individual enterprises. As a result, the number of firms in the economy tends to increase, along with the demand for labor, the expected wage rate and the output per capita.

Figure 5: **Dynamics: entrepreneurial society**



The industrialization process then enters the mature stage ($n_t > \hat{n}$) and working for a wage becomes an ever more rewarding prospect. Following Proposition 1, at this stage parent entrepreneurs find it optimal to induce some heirs, those who are endowed with an

intermediate level of innate ability, to choose a working career by investing in their general human capital. Therefore, while the number of firms still grows, albeit at a slower pace, the share of enterprises which are passed on within the family, generation by generation, tends to decrease. At the same time, family firms tend to divide into two sharply contrasting groups in terms of performance and managerial practices. This polarization has a negative impact on the aggregate output that however does not overwhelm the positive effect of the increasing number of firms.

Although the equilibrium distribution of the individuals' abilities across occupations is not responsive to variations in the level of technological progress of the economy, A_t, it reacts to changes in the rate g at which technology grows over time.

Proposition 5. *In the entrepreneurial regime, the thresholds a^ϕ and a^a are not dependent on the level of technological progress A_t. However, the higher is the growth rate of the aggregate technology, g, the smaller are both a^ϕ and a^a.*

The first part of Proposition 5 is an obvious corollary of the existence and stability of the long-run equilibrium. Both the wage rate and profit per efficiency unit of managerial capital have a unitary elasticity with respect to A_t, such that the occupational choices of parents are unaffected by the level of the technological frontier and, hence, the number and type of firms are independent of it. By contrast, changes in the growth rate of aggregate technology have both direct and general equilibrium effects on the allocation of talent between occupations and on managerial practices adopted by family firms. Higher values of g decrease the productivity of family connections, making the erosion effect stronger. This renders working for a wage a more rewarding occupation for medium-talented descendants who are therefore induced to abandon the family business. The resultant lower number of firms in the economy, and the lower aggregate demand of human capital, generate a reduction in the equilibrium wage rate[17] which, in turn, stimulates some of the individuals in the upper tail of the innate ability distribution to enter the entrepreneurial sector by accumulating entrepreneurial human capital.

Hence, in an entrepreneurial society, as the economy develops, the share of firms which are managed by relying on the entrepreneurial skills of the leader increases, while the share of badly managed family firms relying on the network of family connections decreases. This is consistent with the empirical findings of Gennaioli et al. (2013) who show a positive correlation between the education level of the entrepreneurial class and economic development. Also, the prediction that firms in growing countries are better managed than firms in the less developed countries is consistent with the cross-country variations in the managerial practices documented by Bloom and Van Reenen (2010) and Bloom et al. (2012). It is worth noting that the explanation suggested by the authors for

[17] It is worth noting that the total effect of g on the wage rate is the composition of a direct effect due to the increase in the level of the TFP, and of an indirect effect, working through the distribution of individuals across occupations. Although the combined effect of these two elements on the wage rate is ambiguous, the effect on thresholds a^ϕ and a^a is unambiguously negative as the elasticity of the wage with respect to g is, in absolute value, lower than one.

this finding alludes to the quality of institutional arrangements of the country, the second factor that in our model affects the productivity of family connections. In fact, the same comparative statics indications as in Proposition 5 derive by looking at changes in ϕ.

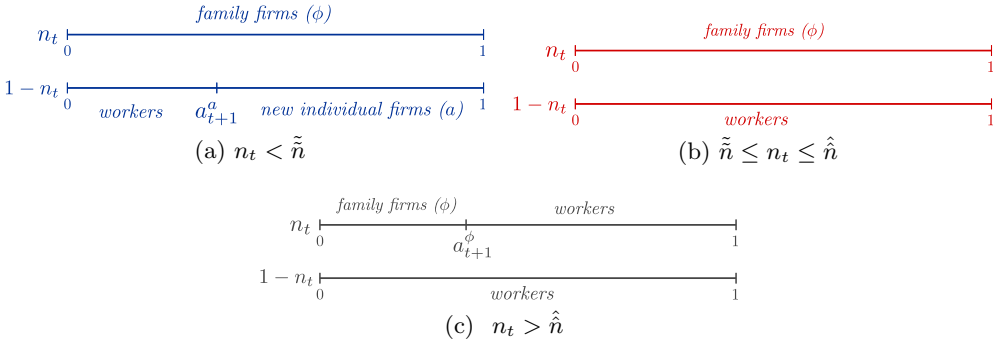
Proposition 6. *In the entrepreneurial regime, the less importance the society gives to family connections (the lower the value of ϕ), the lower the thresholds a^{ϕ} and a^{a}.*

As the growth rate of the economy, the quality of institutions does affect the allocation of talents between occupations and the adoption of managerial practices both directly, by affecting the productivity of family connections, and indirectly, by affecting the number of firms, the aggregate demand of labor and the wage rate.

5.1.2 Crony society

Steady state equilibrium. In the crony regime the institutional/cultural environment of society and the pace of technological progress are such that the productivity of family networking is high. In this scenario, as follows from Proposition 1 and Corollary 1, entrepreneurs have no incentive to invest in their heirs' entrepreneurial human capital, whatever their innate talent. Furthermore, the descendants of entrepreneurs never leave the family business unless the equilibrium wage rate becomes high enough to make working in the labor market especially rewarding (i.e., for $n_t > \hat{\hat{n}}$, Fig. 6c). In addition, the most talented workers' descendants choose to change the parents' occupation and set up new individual firms only if $n_t < \tilde{\tilde{n}}$ and the expected wage in the labor market is low enough (Fig. 6a). In this case, the total number of firms at time $t+1$ is composed by the number of family firms in t, plus $(1-n_t)(1-a^a_{t+1})$ new individual firms installed by the workers' descendants. Otherwise, if $n_t > \tilde{\tilde{n}}$, the workers' descendants never set up new firms and, at each time $t+1$, all the firms in the economy are family-run (Fig. 6b and 6c).

Figure 6: **Firms and workers in $t+1$: crony society**



(a) $n_t < \tilde{\tilde{n}}$ (b) $\tilde{\tilde{n}} \leq n_t \leq \hat{\hat{n}}$

(c) $n_t > \hat{\hat{n}}$

Hence, in a crony society, the dynamic system governing the evolution of the industrial

sector is given by:

$$n_{t+1} = \begin{cases} 1 - (1 - n_t)\, a_{t+1}^{a} & \text{if} \quad n_t < \tilde{\tilde{n}} \\ n_t & \text{if} \quad n_t \in [\tilde{\tilde{n}}, \hat{\hat{n}}] \\ n_t a_{t+1}^{\phi} & \text{if} \quad n_t > \hat{\hat{n}} \end{cases} \tag{26}$$

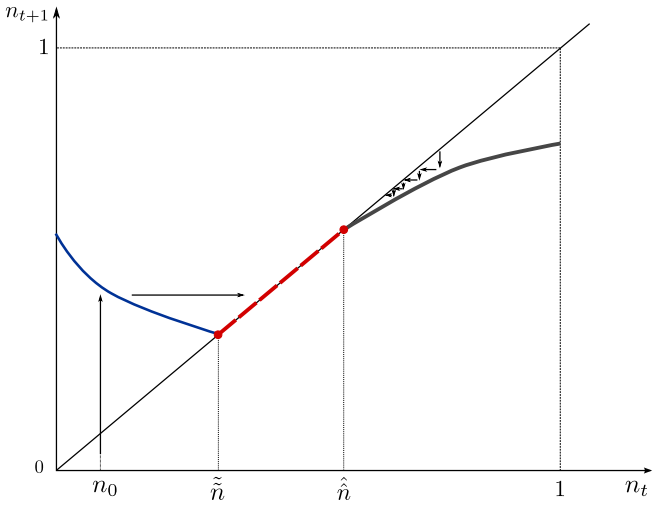
From (26), it follows that:

Proposition 7. *In a crony society, when $\phi(1-g) > 1$, the steady state number of firms is indeterminate in the interval $n^{C^*} \in [\tilde{\tilde{n}}, \hat{\hat{n}}]$.*

In the crony regime, the economy converges into a fully immobile society, where the current generation of individuals takes the same occupation as the previous generation, there is no entry of new individual firms and where, regardless of the innate ability of the current leader, all the family firms are managed by using the network of family connections built by the previous generation of firm leaders. The intuition is simple. Given the high productivity of family connections, all entrepreneurs transfer the control of firms within the family, using crony managerial practices. As an indirect effect, the large number of family firms in the economy sustains the aggregate demand for general human capital and the wage rate, thus inducing parent workers to invest in the general rather than entrepreneurial human capital of their children.

Family firms in the industrialization process. In the crony regime, the transition toward the long-run equilibrium differs from that characterizing the entrepreneurial regime.

Figure 7: **Dynamics: crony society**



Remark 2. *In a crony society, when $n_0 < \tilde{\tilde{n}}$ the number of firms instantaneously converge to a steady state equilibrium $n^{C^*} \in [\tilde{\tilde{n}}, \hat{\hat{n}}]$ (Fig. 7).*

When the initial number of firms is low, the dynamic system does not show any transitional dynamics. A large number of new individual firms are established by workers'

descendants, and this produces a jump in the total number of firms, that boosts the economy toward its steady state where the total number of firms can be any value in the interval $[\tilde{\tilde{n}}, \hat{\hat{n}}]$. Starting from this point, the high productivity of family connections dissuades the new generations of family firm leaders from investing in the entrepreneurial human capital of their descendants and the economy is stuck in a socially immobile equilibrium, where family firms perpetuate, using bad managerial practices.

This boosted dynamics can be viewed as being consistent with the historical evidence highlighting the crucial role of family firms and family ties during the early stages of industrial development. Unlike entrepreneurial societies, in crony societies the high productivity of family connections allows domestic industry and per capita income to grow rapidly, but at the cost of blocking the economy in a sclerotic equilibrium. The institutional and cultural environment of society are such as not to encourage investments in entrepreneurial human capital, but heighten the value of social, economic and political connections for running a firm successfully (Morck and Yeung, 2003). This makes family firms a source of economic backwardness and social immobility once industrialization reaches its mature stage.

In contrast to what happens in an entrepreneurial society, when the economy is blocked in a crony equilibrium, marginal reforms lowering ϕ and/or increasing g are unable to affect the size and composition of the entrepreneurial sector. Only "institutional shocks" switching the economy to a different (entrepreneurial) regime may induce some entrepreneurs to invest in the general or entrepreneurial human capital of their descendants and create mobility across occupations in society. Once again, historical research provides real-world testimonies to this "institutional shock" hypothesis, such as the different evolution of industrialization in Italy and Japan after the Second World War. In both countries the initial boost to industrialization was driven by powerful family firms. However, while in Japan the anti-*zaibatsu* laws passed by the Allied occupiers in the postwar period largely weakened the power of the largest family businesses of the country and the related network of connections, opening the route to the modern *keiretsu* system (Morikawa, 2001; Morck and Nakamura, 2007), in the case of Italy such an institutional shock never occurred. Even if there were in Italy a number of reforms to reduce the role of family firms and transform them into public companies, their marginal nature was unable to dismantle the pervasiveness of family control and promote the employment of modern managerial practices (Amatori, 1997; Colli, 2003).

5.2 Endogenous growth

Hitherto we assumed that the technology steadily evolves at an exogenous rate g, independent of the allocation of individual talent and the managerial technology employed to run firms. In this section, we remove this assumption and analyze the destiny of family firms and proprietary capitalism when the aggregate technology expands over time due to endogenous innovations.

Ever since Schumpeter published *The Theory of Economic Development* in 1911[18], entrepreneurship has occupied a special place in economics and economic history as a major factor explaining the capabilities of firms to ideate and introduce innovations and economies to prosper (Casson, 2010; Landes et al., 2012). In the modern growth economics, the driving role of the allocation of entrepreneurial talent and the accumulation of entrepreneurial human capital for the development of the aggregate technology and total factor productivity have been widely explored both theoretically and empirically[19].

On such grounds, we assume that the rate at which the aggregate technology grows over time, g_t, depends positively on the share of firms at time t that are managed by using entrepreneurial human capital, $n_{a,t}$, as given by:

$$g_t = n_{a,t} \tag{27}$$

Then, we can can prove the following proposition[20].

Proposition 8. *A threshold $\bar{\phi}_g > 1$ exists such that:*

(a) for $\phi < \bar{\phi}_g$, the economy converges to an entrepreneurial regime with a steady state number of firms $n_g^{E^*} \in [\hat{n}_g, \tilde{n}_g]$ and a positive growth rate $g^{E^*} = 1 - a^a(n_g^{E^*})$.

(b) for $\phi \geq \bar{\phi}_g$, the economy converges to a fully immobile crony regime with zero growth rate, $g^{C^*} = 0$.

Once the feedback effects of entrepreneurial human capital on the economy's innovation rate are taken into account, the crony-regime equilibrium is characterized for being a no-growth trap. In this case, the institutional arrangements of society are such as to make the effectiveness of family connections in extracting output and profits from a given combination of inputs so high that relatedness becomes the only rewarding way to manage a company. The social inertia arising from the need to possess an established network of social, economic and political connections to start up a new enterprise then eradicates any possible source of entrepreneurial human capital from the economy, wiping out technological advancements and blocking the economy into a zero-growth equilibrium.

In contrast, when the productivity of family connections is moderate, both entrepreneurs and workers invest in the entrepreneurial human capital of their descendants, as the adoption of entrepreneurial managerial practices is a privately advantageous choice. The steady-state number of firms $n_g^{E^*}$ belongs to the interval between $\hat{n}_g$ and $\tilde{n}_g$ confirming the polarization result of Proposition 4. The allocation of individual talent to the entrepreneurial activities produces the beneficial external effect to improve the aggregate technology, which, in turn, further erodes the productivity of family connections. This

[18] Schumpeter (1911).

[19] Among others, see Baumol (1990), Murphy et al. (1991), Iyigun and Owen (1999), Hassler and Mora (2000), Acemoglu et al. (2006), Gennaioli et al. (2013), Doepke and Zilibotti (2013).

[20] A more general representation of the relationship between economic growth and entrepreneurial human capital which allows for a scale parameter, $g_t = \lambda n_{a,t}$, would make algebra much more cumbersome, leaving our results qualitatively identical.

causes total factor productivity and per capita income to grow at a positive rate which negatively depends on the marginal productivity of family connections.

Proposition 9. *In an entrepreneurial society, the more productive the family connections, the lower is the steady state growth rate of the economy. In a crony society, marginal changes of ϕ have no effect on the steady state growth rate.*

Institutional arrangements which value most the managerial function of family connections increase the number of firms whose leadership is passed on to the next generation by relying on the network of contacts, alliances and friendships built in the past by previous generation of firm leaders. The higher wage resulting from the higher number of family firms in the economy discourages the accumulation of entrepreneurial human capital and deteriorates the innovation capacity of the economy.

6 Robustness

In this section we check the robustness of our two key results of polarization of talent allocation and managerial practices across family firms and of multiple regimes of proprietary capitalism to the removal of some simplifying assumptions and to extensions.

6.1 Managerial capital

A concern with our basic model may arise with regard to the assumptions of perfect substitutability and separability between family connections and entrepreneurial human capital for the accumulation of managerial capital introduced in equation (6). While these assumptions simplify the analysis, our results are robust to more general functional forms for the managerial capital that allows for complementarity between the two factors, with the only restriction of assuming that family connections warrant a minimum level of profits to the family firm, regardless of the innate talent of the leader. In particular, equation (6) can be replaced by the following general specification:

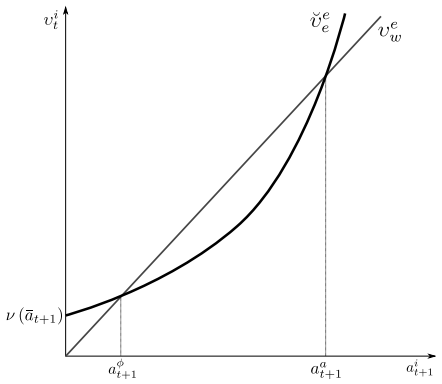
$$m_{t+1}^{i} = m\left(C_{t+1}^{f}, E_{t+1}^{i}\right), \tag{28}$$

where $C_{t+1}^{f} = \phi\left(1 - g_{t+1}\right)\tau_{\phi,t}$ and $E_{t+1}^{i} = a_{t+1}^{i}\tau_{a,t}$ denote family connections and individual entrepreneurial human capital, respectively, with $m(C_{t+1}^{f}, 0) > 0$, $m_C > 0$, $m_E > 0$ and $m_{CE} > 0$.

Equation (28) assumes not only that both family connections and entrepreneurial human capital provide a positive contribution to the accumulation of managerial capital, but also that the higher the entrepreneurial human capital acquired by the descendants, the stronger is the productivity of family connections. Notwithstanding, the positive lower bound of managerial capital ensured by the network of family connections, $m(C_{t+1}^{f}, 0) > 0$, stimulates parent entrepreneurs of low-ability children to continue the firms within the family. In the case of (28), the maximum utility of parent entrepreneurs described by the

piecewise function (13) is replaced by the convex function $\breve{v}_e^e$ with a lower bound $\nu(\bar{a}_{t+1})$, and the occupational choices are qualitatively the same as in the case of substitutability, without affecting the polarization result (Figure 8).

Figure 8: **Entrepreneurs' occupational choice**



6.2 Professional managers

Throughout the analysis we excluded the possibility of keeping the ownership of the firm within the family, while passing its leadership to professional managers external to the family[21]. Assume now that this alternative is open to parent entrepreneurs. In order to maintain the hypothesis that the web of social, economic and political relationships are embedded in the family and non-tradeable, assume that external managers cannot exploit family connections (Chung and Luo, 2013), and that their managerial skills reflect only the entrepreneurial human capital accumulated in childhood. Further, assume that professional managers are paid a share ψ of the profits they contribute to generate, while the residual part, $1-\psi$, accrues to the firm owners as dividends. A possible interpretation is that professional managers are offered incentive contracts that depend on the performance of the firm (Bandiera et al., 2011) and ψ reflects their bargaining power. Alternatively, ψ can be viewed as the maximum rent that external managers can steal due to agency problems (Caselli and Gennaioli, 2008, 2013; Song et al., 2011). In this setting, the existence of a market for managers is related to the existence of sunk costs of startup κ needed to establish a new individual enterprise. Indeed, when firms can be installed at no cost, for any $\psi < 1$, workers' descendants find starting up their own company or working for a wage always more rewarding alternatives than being employed as a professional manager in a family firm. In this case the market for managers is inactive and the model is identical to the basic one.

In contrast, when we admit the existence of setup costs, the managerial career may turn out to be more rewarding than the establishment of a new firm. In particular, it

[21] As Caselli and Gennaioli (2008) show, the conditions that ensure the existence of a *"market for managers"*, are similar to those that make a *"market for control"*, where firms are exchanged, active. Therefore, the problem of employing/becoming a professional manager can be considered isomorphic to that of selling/buying a firm.

can be verified that, if $\kappa > 0$, it exists a threshold value $\bar{\psi}$ of the share of the profits captured by the external managers such that, for any $\psi > \bar{\psi}$ a supply of managerial services arises, coming from the most or mid-talented workers' descendants according to whether $\bar{\pi}$ is lower or greater than $\kappa/(1-\psi)$, where $\bar{\pi}$ is the profit attainable by the most talented individual[22]. On the other side of the market, the demand for managerial services depends on the occupational choices of parent entrepreneurs that are now governed not only by the productivity of family connections, but also by the share of profit ψ which they have to relinquish in order to hire a professional manager. First, it immediately follows that for $\psi = 1$ there is no demand for external managers. Then, for continuity there exists a threshold value $\hat{\psi}$ such that, for any $\psi < \hat{\psi}$, a positive demand for professional managers emerges, coming from parents of the marginal heirs, namely those heirs with an innate ability close to the indifference thresholds a^{ϕ} and a^{a}.

Hence, the development of a market for managers does not exclude that the polarization in the talent of family-member successors and managerial practices may emerge in equilibrium. Indeed, it is possible to verify that, for any $\psi > \bar{\psi}$, an equilibrium with polarization exists[23]. Similarly, two different regimes of proprietary capitalism may prevail in the long run depending on the strength of the productivity of the family connections. In both regimes, however, the aggregate effects of the opening of the market for professional managers on the size of the industrial sector and on growth rates are ambiguous. On the one hand, the inflow of highly talented educated managers can ensure a larger number of firms and higher growth rates with respect to the basic setup. On the other, the existence of fixed startup costs discourages the establishment of new firms, shrinking both the size of the firm sector as well as the growth rate of the economy.

7 Conclusions

Family firms are an enduring player in capitalist economies. In spite of a well established tradition in economics and business history predicting their irreconcilability with industrial progress, they still maintain a major role even in advanced economies.

From a careful reading of the empirical literature it clearly emerges that family firms are heterogeneous in several respects – managerial practices, entrepreneurial human capital, economic performance and adherence to family values –, and that their evolution over time differs according to the institutional, social and historical conditions of the country in which they operate. In some cases, family firms have been able to evolve into managerial

[22] Interestingly, if $\bar{\pi} < \kappa/(1-\psi)$, the equilibrium would be characterized by no entry of new individual firms but by the social mobility of workers' descendants choosing the managerial career. If $\bar{\pi} > \kappa/(1-\psi)$, the most talented descendants of workers will establish new enterprises, the medium talented will be professional managers, while the least talented will supply their general human capital on the labor market.

[23] A formal proof is available upon request. That said, the main argument can be intuitively explored as follows. An equilibrium with professional managers can exist if and only if $\hat{\psi} > \bar{\psi}$. Then, for any $\psi \in [\bar{\psi}, \hat{\psi}]$, an equilibrium with polarization emerges with a share of workers' descendants employed as professional managers in the firms owned by the heirs. Otherwise, for any $\psi > \hat{\psi}$, no market for managers opens and the model collapses to the basic one.

companies, by carefully planning leadership succession and training new generations of managers. In others, the existence of family-based economic elites has produced cronyism, rent-seeking, social immobility and industrial sclerosis.

In this paper we presented a theoretical model that can accommodate both the heterogeneity of family firms and the uncertain destiny of proprietary capitalism. These results are obtained, as suggested by Bertrand and Schoar (2006, p. 96), by "taking seriously the "family" part of "family firms". We recognize that family firms are at an advantage in benefitting from social, political and economic connections built up by the family generation by generation. Such family connections produce private benefits for family firm successors, by assuring a sufficiently high level of profits even in the case of low talent. According to the institutional and cultural setting of society, the economy can therefore converge toward an entrepreneurial or crony equilibrium. In the first case, family firms polarize into two groups of well managed and well performing firms, relying on the entrepreneurial human capital of the leader successor, and of badly managed and under-performing firms, doing business thanks to the network of family connections left by the founder or the previous generation of family firm leaders. In a crony equilibrium, the value of family connections is especially high relative to the productivity of the entrepreneurial human capital. This boosts the growth of industry in the early stages of the industrialization process, without preventing the entrance of new firms employing entrepreneurial human capital. However, this rapid growth occurs at the cost of technological backwardness and social immobility in the later stages of industrialization, when the large number of firms in operation and the high productivity of family connections discourage the family firms from accumulating entrepreneurial human capital and the workers' descendants from founding new firms. This leads to a fully immobile society and a zero-growth economy, dominated by an oligarchy of family firms with strong political, economic and social connections.

Obviously, our analysis of the evolution of family firms in the process of industrialization and development leaves many issues open to further research. Two in particular, in our opinion, merit a great deal of attention. The first question is how the institutional and cultural factors which determine the productivity of family connections evolve over time. In this paper, we have investigated how social inertia produced by family connections and family firms affects economic growth. However, it is clear that institutional and cultural factors can change during the process of development in response, for example, to the size of the industrial sector or the degree of use of crony managerial practices. A second major question concerns the possible transition from a crony to an entrepreneurial society and vice versa. In other words, it is important to ascertain whether and under what conditions a crony society may endogenously evolve into an entrepreneurial society, or the latter may decline toward a crony capitalism, or whether and under what conditions the economy is locked into one of the two regimes.

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Appendix

Proof of Proposition 1

From Lemma 1 and Lemma 2, and using the maximum utilities in (13) and (15), it follows that:

Regime I (Entrepreneurial society) (a) $w_{t+1} < \hat{w} \implies a^{\phi}_{t+1} > a^{a}_{t+1}$, which implies that $v^{e}_{e,\phi} > \max\left\{v^{e}_{w}, v^{e}_{e,a}\right\}$ for $a^{i}_{t+1} < \bar{a}_{t+1}$, while $v^{e}_{e,a} \geq \max\left\{v^{e}_{w}, v^{e}_{e,\phi}\right\}$ for $a^{i}_{t+1} > \bar{a}_{t+1}$; (b) $w_{t+1} \in [\hat{w}, \tilde{w}] \implies a^{\phi}_{t+1} < a^{a}_{t+1} < 1$, which implies that $v^{e}_{e,\phi} \geq \max\{v^{e}_{w}, v^{e}_{e,a}\}$ for $a^{i}_{t+1} \leq a^{\phi}_{t+1}$, $v^{e}_{e,a} \geq \max\{v^{e}_{w}, v^{e}_{e,\phi}\}$ for $a^{i}_{t+1} \geq a^{a}_{t+1}$, while $v^{e}_{w} > \max\{v^{e}_{e,\phi}, v^{e}_{e,a}\}$ for $a^{i}_{t+1} \in (a^{\phi}_{t+1}, a^{a}_{t+1})$; (c) $w_{t+1} > \tilde{w} \implies a^{\phi}_{t+1} < 1 < a^{a}_{t+1}$, which implies that $v^{e}_{e,\phi} \gtreqless v^{e}_{w}$ for $a^{i}_{t+1} \lesseqgtr a^{\phi}_{t+1}$.

Regime II (Crony society) (a) $w_{t+1} < \hat{\hat{w}} \implies a^{\phi}_{t+1} > 1$, which implies that $v^{e}_{e,\phi} \geq v^{e}_{w}$ for $a^{i}_{t+1} \in [0, 1]$; (b) $w_{t+1} > \hat{\hat{w}} \implies a^{\phi}_{t+1} < 1$, which implies that $v^{e}_{e,\phi} \geq v^{e}_{w}$ for $a^{i}_{t+1} \leq a^{\phi}_{t+1}$, while $v^{e}_{e,\phi} < v^{e}_{w}$ for $a^{i}_{t+1} > a^{\phi}_{t+1}$.

Proof of Proposition 2

Using (18) and (19), it follows that: (a) $w_{t+1} \leq \tilde{w} \implies a^{a}_{t+1} \leq 1$, which implies that $v^{w}_{e} \gtreqless v^{w}_{w}$ for $a^{i}_{t+1} \gtreqless a^{a}_{t+1}$; (b) $w_{t+1} > \tilde{w} \implies a^{a}_{t+1} > 1$, which implies that $v^{w}_{e} < v^{w}_{w}$ for $a^{i}_{t+1} \in [0, 1]$.

Proof of Proposition 3

Entrepreneurial society. Using (22) and (23) and solving the integrals, aggregate human capital supply and demand are given by:

$$H^{S,E}_{t+1} = \frac{\tau^{p}_{h}}{2} \times \begin{cases} (1 - n_t)(a^{a}_{t+1})^2 & \text{if} \quad w_{t+1} < \hat{w} \\ (a^{a}_{t+1})^2 - n_t(a^{\phi}_{t+1})^2 & \text{if} \quad w_{t+1} \in [\hat{w}, \tilde{w}] \\ 1 - n_t(a^{\phi}_{t+1})^2 & \text{if} \quad w_{t+1} > \tilde{w} \end{cases} \tag{A.1}$$

and

$$H^{D,E}_{t+1} = \Xi \times \begin{cases} (1+\alpha)^{-1}\left\{n_t \bar{a}^{(1+\alpha)/\alpha}_{t+1} + \alpha\left[1 - (1 - n_t)(a^{a}_{t+1})^{(1+\alpha)/\alpha}\right]\right\} & \text{if} \quad w_{t+1} < \hat{w} \\ n_t a^{\phi}_{t+1} \bar{a}^{1/\alpha}_{t+1} + \dfrac{\alpha}{1+\alpha}\left[1 - (a^{a}_{t+1})^{(1+\alpha)/\alpha}\right] & \text{if} \quad w_{t+1} \in [\hat{w}, \tilde{w}] \\ n_t a^{\phi}_{t+1} \bar{a}^{1/\alpha}_{t+1} & \text{if} \quad w_{t+1} > \tilde{w} \end{cases} \tag{A.2}$$

where $\Xi \equiv [(1-\alpha)\tau^p_{e_j} A_{t+1} w_{t+1}^{R^{-1}}]^{1/\alpha}$, with $e_j = \{a, \phi\}$. Substituting (20) and (21) into (A.1) and (A.2), the equilibrium wage schedule is:

$$w^E_{t+1} = \begin{cases} \theta^\alpha A_{t+1} \left[\dfrac{\alpha + n_t \bar{a}_{t+1}^{(1+\alpha)/\alpha}}{\chi(1-n_t)}\right]^{\frac{\alpha(1-\alpha)}{1+\alpha}} \equiv \omega_1^E(n_t) & \text{if} \quad n_t < \hat{n}_t \\ \omega_2^E(n_t) & \text{if} \quad n_t \in [\hat{n}_t, \tilde{n}_t] \\ \theta^\alpha A_{t+1} \bar{a}_{t+1} \left[\dfrac{(1+\chi)n_t}{\chi - \alpha}\right]^{\alpha/2} \equiv \omega_3^E(n_t) & \text{if} \quad n_t > \tilde{n}_t \end{cases} \tag{A.3}$$

where $\omega_2^E(n_t)$ is the wage w_{t+1} implicitly defined by the function:

$$\Omega(w) = \mu \left(\frac{w_{t+1}}{A_{t+1}}\right)^{\frac{1+\alpha}{\alpha(1-\alpha)}} - \rho n_t \bar{a}_{t+1}^{\frac{2}{\alpha}} \left(\frac{A_{t+1}}{w_{t+1}}\right)^{\frac{1}{\alpha}} - \sigma = 0 \tag{A.4}$$

with $\mu \equiv [\tau^p_h (2\theta^{2\alpha/(1-\alpha)})^{-1}] + [\alpha \left((1-\alpha)\tau^p_{e_j}\right)^{1/\alpha}] [(1+\alpha)\theta^{(1+\alpha)/(1-\alpha)}]^{-1}$, $\rho \equiv \theta[(1-\alpha)\tau^p_{e_j}]^{1/\alpha} + 2^{-1}\theta^2\tau^p_h$, $\sigma \equiv \alpha[(1-\alpha)\tau^p_{e_j}]^{1/\alpha}(1+\alpha)^{-1}$, and where $\hat{n}_t$ and $\tilde{n}_t$ correspond to the number of firms such that the equilibrium wage rate is equal, respectively, to $\hat{w}$ and $\tilde{w}$:

$$\hat{n}_t = \frac{\chi\, \bar{a}_{t+1}^{(1+\alpha)/\alpha} - \alpha}{\bar{a}_{t+1}^{(1+\alpha)/\alpha}(1+\chi)} \tag{A.5}$$

$$\tilde{n}_t = \frac{\chi - \alpha}{\bar{a}_{t+1}^{2/\alpha}(1+\chi)} \tag{A.6}$$

where $\chi \equiv \alpha(\mu\theta^{2/(1-\alpha)})(\sigma\theta)^{-1}$ and $1 + \chi \equiv \alpha\rho(\sigma\theta)^{-1}$. From (A.3), $\omega_1^E(n_t)$ and $\omega_3^E(n_t)$ are single-valued functions and a unique equilibrium exists. Rewriting (A.4) as

$$\Omega_l(w) \equiv \mu \left(\frac{w_{t+1}}{A_{t+1}}\right)^{\frac{1+\alpha}{\alpha(1-\alpha)}} = \rho\, n_t \bar{a}_{t+1}^{\frac{2}{\alpha}} \left(\frac{A_{t+1}}{w_{t+1}}\right)^{\frac{1}{\alpha}} + \sigma \equiv \Omega_r(w)$$

we have that $\partial\Omega_l(w)/\partial w_{t+1} > 0$ and $\partial\Omega_r(w)/\partial w_{t+1} < 0$. Moreover, $\Omega_l(\hat{w}) = \mu\theta^{\frac{1+\alpha}{1-\alpha}} \bar{a}_{t+1}^{\frac{1+\alpha}{\alpha}} < \sigma + \rho\,\theta^{-1} n_t \bar{a}_{t+1}^{\frac{1+\alpha}{\alpha}} = \Omega_r(\hat{w})$ for any $n_t > \hat{n}_t$ and $\Omega_l(\tilde{w}) = \mu\theta^{\frac{1+\alpha}{1-\alpha}} > \sigma + \rho\,\theta^{-1} n_t \bar{a}_{t+1}^{\frac{2}{\alpha}} = \Omega_r(\tilde{w})$ for any $n_t < \tilde{n}_t$. Hence, $\Omega_l(w)$ and $\Omega_r(w)$ intersect once in $[\hat{w}, \tilde{w}]$.

Crony society. The aggregate supply and demand of human capital are given by:

$$H^{S,C}_{t+1} = \frac{\tau^p_h}{2} \times \begin{cases} (1-n_t)(a^a_{t+1})^2 & \text{if} \quad w_{t+1} < \tilde{w} \\ (1-n_t) & \text{if} \quad \in [\tilde{w}, \hat{\tilde{w}}] \\ 1 - n_t (a^\phi_{t+1})^2 & \text{if} \quad w_{t+1} > \hat{\tilde{w}} \end{cases} \tag{A.7}$$

and

$$H_{t+1}^{D,C} = \Xi \times \begin{cases} n_t \bar{a}_{t+1}^{1/\alpha} + \dfrac{\alpha(1-n_t)}{1+\alpha}\left[1-\left(a_{t+1}^{a}\right)^{(1+\alpha)/\alpha}\right] & \text{if} \quad w_{t+1} < \tilde{w} \\ n_t \bar{a}_{t+1}^{1/\alpha} & \text{if} \quad w_{t+1} \in [\tilde{w}, \hat{\tilde{w}}] \\ n_t a_{t+1}^{\phi} \bar{a}_{t+1}^{1/\alpha} & \text{if} \quad w_{t+1} > \hat{\tilde{w}} \end{cases} \tag{A.8}$$

The equilibrium wage schedule is:

$$w_{t+1}^{C} = \begin{cases} \theta^{\alpha} A_{t+1} \left\{ \dfrac{n_t[\bar{a}_{t+1}^{1/\alpha}(1+\alpha)-\alpha]+\alpha}{\chi(1-n_t)} \right\}^{\frac{\alpha(1-\alpha)}{1+\alpha}} \equiv \omega_1^C(n_t) & \text{if} \quad n_t < \tilde{\hat{n}}_t \\ \theta^{\alpha} A_{t+1} \bar{a}_{t+1} \left[\dfrac{(1+\alpha)n_t}{(\chi-\alpha)(1-n_t)} \right]^{\alpha} \equiv \omega_2^C(n_t) & \text{if} \quad n_t \in [\tilde{\hat{n}}_t, \hat{\hat{n}}] \\ \theta^{\alpha} A_{t+1} \bar{a}_{t+1} \left[\dfrac{(1+\chi)n_t}{\chi-\alpha} \right]^{\alpha/2} \equiv \omega_3^C(n_t) & \text{if} \quad n_t > \hat{\hat{n}} \end{cases} \tag{A.9}$$

where $\tilde{\hat{n}}_t$ and $\hat{\hat{n}}$ correspond to the number of firms such that the equilibrium wage rate is equal, respectively, to $\tilde{w}$ and $\hat{\tilde{w}}$:

$$\tilde{\hat{n}}_t = \frac{\chi-\alpha}{\chi-\alpha+(1+\alpha)\,\bar{a}_{t+1}^{1/\alpha}} \tag{A.10}$$

$$\hat{\hat{n}} = \frac{\chi-\alpha}{1+\chi} \tag{A.11}$$

From (A.9), ω_{t+1}^{C} is a single-valued function and a unique equilibrium exists for any n_t.

Proof of Corollary 1

From (A.3), $\partial\omega_1^E(n_t)/\partial n_t > 0$ and $\partial\omega_3^E(n_t)/\partial n_t > 0$ follow immediately; for $\omega_2^E(n_t)$, using the implicit function theorem, it results that:

$$\frac{d\omega_2^E(n_t)}{dn_t} = -\frac{\partial\Omega(w)/\partial n_t}{\partial\Omega(w)/\partial w_{t+1}} = \\ = \frac{\rho\,\bar{a}_{t+1}^{2/\alpha}\left(A_{t+1}w_{t+1}^{-1}\right)^{1/\alpha}}{\mu\left(\frac{1+\alpha}{\alpha(1-\alpha)}\right)\left(\frac{w_{t+1}^{1+\alpha^2}}{A_{t+1}^{1+\alpha}}\right)^{\frac{1}{\alpha(1-\alpha)}} + \rho\frac{n_t\bar{a}_{t+1}^{2/\alpha}}{\alpha w_{t+1}}\left(\frac{A_{t+1}}{w_{t+1}}\right)^{\frac{1}{\alpha}}} > 0 \tag{A.12}$$

From (A.9), it is easy to verify that $\partial w_{t+1}^{C}/\partial n_t > 0$, for any n_t. Finally, using (A.5)-(A.6) and (A.10)-(A.11) and the positive monotonic relation between w_{t+1}^{R} and n_t, the remaining part of the Corollary follows straightforwardly.

Proof of Proposition 4

Using (20) and (21) and the equilibrium wage (A.3), the dynamic system in (25) can be written as:

$$n_{t+1} = \begin{cases} 1 - \left(\frac{1-n_t}{\chi^\alpha}\right)^{\frac{1}{1+\alpha}} \left(\alpha + n_t \bar{a}_{t+1}^{1+\alpha/\alpha}\right)^{\frac{\alpha}{1+\alpha}} \equiv n_1^E(n_t) & \text{if} \quad n_t < \hat{n}_t \\ n_t\theta \left[\frac{\bar{a}_{t+1}A_{t+1}}{\omega_2^E(n_t)}\right]^{\frac{1}{\alpha}} + 1 - \left(\frac{\omega_2^E(n_t)}{\theta^\alpha A_{t+1}}\right)^{\frac{1}{1-\alpha}} \equiv n_2^E(n_t) & \text{if} \quad n_t \in [\hat{n}_t, \tilde{n}_t] \\ \left[\frac{(\chi-\alpha)n_t}{1+\chi}\right]^{\frac{1}{2}} \equiv n_3^E(n_t) & \text{if} \quad n_t > \tilde{n}_t \end{cases} \tag{A.13}$$

From (A.13), we can prove the following Lemma, which derives the properties of the dynamic system in (25) (proof is available upon request).

Lemma A.1. *If* $\phi < 1/(1-g)$,

1. $n_1^E(0) > 0$; $n_1^E(\hat{n}) > \hat{n}$; $\partial n_1^E/\partial n_t > 0$; $\partial^2 n_1^E/\partial n_t^2 > 0$.
2. $n_2^E(\hat{n}) = n_1^E(\hat{n}) > \hat{n}$; $n_2^E(\tilde{n}) = n_3^E(\tilde{n}) < \tilde{n}$; $\partial n_2^E/\partial n_t > 0$.
3. $\partial n_3^E/\partial n_t > 0$; $\partial^2 n_3^E/\partial n_t^2 < 0$; $n_3^E(1) < 1$.

Existence. Lemma A.1 ensures that the admissible steady state number of firms can only lie in the interval $[\hat{n}, \tilde{n}]$. To see this, note that the law of motion $n_1^E(n_t)$ is increasing, convex and ends in $n_1^E(\hat{n}) > \hat{n}$. In the interval $n_t \in [\hat{n}, \tilde{n}]$, $n_2^E(\hat{n}) > \hat{n}$, $n_2^E(\tilde{n}) < \tilde{n}$ and $n_2^E(n_t)$ is monotonically increasing in n_t; hence, $n_2^E(n_t)$ must intersect the 45° degree line from above *at least* once, with a slope less than one. Finally, in the interval $n_t \in (\tilde{n}, 1]$, $n_3^E(n_t)$ is increasing, concave and ends in $n_3^E(1) < 1$; hence, it cannot intersect the 45° degree line and there cannot exist any admissible steady state in the interval $n_t \in (\tilde{n}, 1]$.

Uniqueness. From the above, it results that the steady state of the dynamic system in (A.13) must satisfy the solution of the equation $n_2^E(n^{E^*}) = n^{E^*}$ in $[\hat{n}, \tilde{n}]$; formally, n^{E^*} is the solution of the following implicit function:

$$n^{E^*} = \frac{1 - a^a(n^{E^*})}{1 - a^\phi(n^{E^*})} \equiv f(n^{E^*}) \tag{A.14}$$

At the extremes of the interval, $f(n^{E^*})$ assumes the values $f(\hat{n}) = 1$ and $f(\tilde{n}) = 0$ since, as follows from (20) and (21), Definition 1 and Lemma 1, $a^\phi(\hat{n}) = \bar{a} = a^a(\hat{n})$, $a^\phi(\tilde{n}) = \bar{a}^{1/\alpha}$ and $a^a(\tilde{n}) = 1$. Further, from (A.14), it derives that:

$$\frac{\partial f(n^{E^*})}{\partial n^{E^*}} = -\frac{1}{(1 - a^\phi(n^{E^*}))} \frac{\partial a^a(n^{E^*})}{\partial n^{E^*}} + \frac{(1 - a^a(n^{E^*}))}{(1 - a^\phi(n^{E^*}))^2} \frac{\partial a^\phi(n^{E^*})}{\partial n^{E^*}} < 0$$

since

$$\frac{\partial a^a(n^{E^*})}{\partial n^{E^*}} = \frac{a^a(n^{E^*})}{(1-\alpha)\omega_2^E(n^{E^*})} \frac{d\omega_2^E(n^{E^*})}{dn^{E^*}} > 0$$

and

$$\frac{\partial a^{\phi}(n^{E^*})}{\partial n^{E^*}} = -\frac{a^{\phi}(n^{E^*})}{\alpha\omega_2^E(n^{E^*})}\frac{d\omega_2^E(n^{E^*})}{dn^{E^*}} < 0$$

where $d\omega_2^E(n^{E^*})/dn^{E^*} > 0$ follows from (A.12). Thus, there is a unique fixed point n^{E^*} of the function $f(n^{E^*})$ and hence a unique solution for the equation $n_2^E(n^{E^*}) = n^{E^*}$.

Stability. The unique steady state is also globally stable since, as shown above, $n_2^E(n_t)$ intersects the 45° degree line from above, with a slope less than one. Further, at the steady state n^{E^*}, the distribution of the individuals' abilities is stationary since the thresholds a^{ϕ} and a^a are independent of A_{t+1}, despite the constant positive growth rate of the technology. Indeed, differentiating (20) and (21) w.r.t. A_{t+1}, it results that:

$$\frac{\partial a^{\phi}}{\partial A_{t+1}} = \frac{\theta\bar{a}^{\frac{1}{\alpha}}}{\alpha}\left(\frac{A_{t+1}}{w_{t+1}^*}\right)^{\frac{1-\alpha}{\alpha}}\left(\frac{w_{t+1}^* - A_{t+1}\left(\frac{dw_{t+1}^*}{dA_{t+1}}\right)}{w_{t+1}^{*2}}\right) = \frac{a^{\phi}\left(1-\varepsilon_w^A\right)}{\alpha A_{t+1}} = 0 \tag{A.15}$$

$$\frac{\partial a^{a}}{\partial A_{t+1}} = \frac{1}{(1-\alpha)}\left(\frac{w_{t+1}^*}{\theta A_{t+1}}\right)^{\frac{\alpha}{1-\alpha}}\left(\frac{A_{t+1}\left(\frac{dw_{t+1}^*}{dA_{t+1}}\right) - w_{t+1}^*}{A_{t+1}^2}\right) = \frac{a^{a}\left(\varepsilon_w^A - 1\right)}{(1-\alpha)A_{t+1}} = 0 \tag{A.16}$$

where $\varepsilon_w^A = (dw_{t+1}^*/dA_{t+1})(A_{t+1}/w_{t+1}^*) = 1$ is the unitary elasticity of w_{t+1}^* with respect to A_{t+1}, with w_{t+1}^* the equilibrium wage rate of steady state implicitly defined by:

$$\Omega^*(w^*) = \mu\left(\frac{w_{t+1}^*}{A_{t+1}}\right)^{\frac{1+\alpha}{\alpha(1-\alpha)}} - \frac{\rho\,\bar{a}^{\frac{2}{\alpha}}A_{t+1}^{\frac{1-2\alpha}{\alpha(1-\alpha)}}}{\theta^{\frac{\alpha}{1-\alpha}}}\frac{\left(A_{t+1}^{\frac{1}{1-\alpha}}\theta^{\frac{\alpha}{1-\alpha}} - w_{t+1}^{*\frac{1}{1-\alpha}}\right)}{\left(w_{t+1}^{*\frac{1}{\alpha}} - \theta\left(\bar{a}A_{t+1}\right)^{\frac{1}{\alpha}}\right)} - \sigma = 0 \tag{A.17}$$

Proof of Remark 1

The first part of the Remark follows immediately from Lemma A.1. Using (24), the output per capita is:

$$Y_{t+1}^E = \Sigma\times\begin{cases}(1+\alpha)^{-1}\left\{n_t\bar{a}_{t+1}^{(1+\alpha)/\alpha} + \alpha\left[1-(1-n_t)(a_{t+1}^a)^{(1+\alpha)/\alpha}\right]\right\} \equiv y_1^E(n_t) & \text{if} \quad n_t < \hat{n}_t \\ n_t a_{t+1}^{\phi}\bar{a}_{t+1}^{1/\alpha} + \dfrac{\alpha}{1+\alpha}\left[1-(a_{t+1}^a)^{(1+\alpha)/\alpha}\right] \equiv y_2^E(n_t) & \text{if} \quad n_t \in [\hat{n}_t, \tilde{n}_t] \\ n_t a_{t+1}^{\phi}\bar{a}_{t+1}^{1/\alpha} \equiv y_3^E(n_t) & \text{if} \quad n_t > \tilde{n}_t\end{cases} \tag{A.18}$$

where $\Sigma = \Xi w_{t+1}^R/(1-\alpha) \equiv [(1-\alpha)^{1-\alpha}\tau_{e_j}^p A_{t+1} w_{t+1}^{R-(1-\alpha)}]^{1/\alpha}$. Substituting (20), (21) and the equilibrium wage schedule (A.3) in (A.18) it follows that:

$$\frac{\partial y_1^E(n_t)}{\partial n_t} \gtrless 0 \quad \text{if} \quad n_t \lessgtr \frac{\alpha(3-\alpha)\bar{a}_{t+1}^{(1+\alpha)/\alpha} - \alpha(1-\alpha)^2}{(1+\alpha)\bar{a}_{t+1}^{(1+\alpha)/\alpha}} \equiv \hat{\hat{n}}$$

Since $\hat{\hat{n}} > \hat{n}_t$, we have that for any $n_t < \hat{n}_t$, $\partial y_1^E(n_t)/\partial n_t > 0$. Using (A.4) and (A.12), it results that:

$$\frac{\partial y_2^E(n_t)}{\partial n_t} > 0$$

since

$$\alpha \bar{a}_{t+1}^{1/\alpha} a_{t+1}^{\phi} w_{t+1} > \frac{d\omega_2^E(n_t)}{dn_t} \left[(2-\alpha) \bar{a}_{t+1}^{1/\alpha} a_{t+1}^{\phi} n_t + \frac{\alpha^2 (3-\alpha) (a_{t+1}^a)^{1+\alpha/\alpha}}{1-\alpha^2} + \frac{\alpha(1-\alpha)}{1+\alpha} \right] \tag{A.19}$$

is verified for any $n_t \in [\hat{n}_t, \tilde{n}_t]$. As concern $y_3^E(n_t)$,

$$\frac{\partial y_3^E(n_t)}{\partial n_t} = \bar{\Sigma} n_t^{-\alpha/2} > 0 \tag{A.20}$$

where $\bar{\Sigma} \equiv \alpha^{-2} [(1-\alpha)^{1-\alpha} \tau_{e_j}^p]^{1/\alpha} [(\chi-\alpha)/(1+\chi)]^{2-\alpha/2} A_{t+1} \bar{a}_{t+1}$. Finally, from (20) and (21), as w_{t+1} increases, a_{t+1}^{ϕ} decreases and a_{t+1}^a increases, with $a_{t+1}^{\phi} < a_{t+1}^a < 1$, lowering the share of firms passed within the family.

Proof of Proposition 5

The first part has already been proved in Proposition 4. Moreover, using $A_{t+1} = (1+g) A_t$ in (20), (21) and (A.17), it follows that:

$$\frac{\partial a^{\phi}}{\partial g} = \frac{a^{\phi}}{\alpha} \left(-\frac{2g}{1-g^2} - \frac{dw_{t+1}^*}{dg} \frac{1}{w_{t+1}^*} \right) < 0 \tag{A.21}$$

$$\frac{\partial a^a}{\partial g} = \frac{a^a}{(1-\alpha)} \left(\frac{dw_{t+1}^*}{dg} \frac{1}{w_{t+1}^*} - \frac{1}{1+g} \right) < 0 \tag{A.22}$$

since

$$\frac{dw_{t+1}^*}{dg} = -\frac{\partial \Omega^*(w^*)/\partial g}{\partial \Omega^*(w^*)/\partial w_{t+1}^*} \in \left(-\frac{2g w_{t+1}^*}{1-g^2}, \frac{w_{t+1}^*}{1+g} \right)$$

Proof of Proposition 6

$$\frac{\partial a^{\phi}}{\partial \phi} = \frac{\theta \left(\bar{a} A_{t+1}\right)^{1/\alpha}}{\alpha \phi w_{t+1}^{*\,1/\alpha}} \left(1 - \frac{\phi}{w_{t+1}^*} \frac{dw_{t+1}^*}{d\phi} \right) = \frac{a^{\phi} \left(1 - \varepsilon_w^{\phi} \right)}{\alpha \phi} > 0 \tag{A.23}$$

$$\frac{\partial a^a}{\partial \phi} = \frac{w_{t+1}^{*\frac{\alpha}{1-\alpha}}}{(1-\alpha)\, \theta^{\frac{\alpha}{1-\alpha}} A_{t+1}^{\frac{1}{1-\alpha}}} \frac{dw_{t+1}^*}{d\phi} = \frac{a^a \varepsilon_w^{\phi}}{(1-\alpha)\, \phi} > 0 \tag{A.24}$$

since the elasticity of the steady state wage rate with respect to ϕ (i.e., ε_w^{ϕ}) is positive and less than one (proof is available upon request).

Proof of Proposition 7

Using (20), (21) and the equilibrium wage (A.9), the dynamic system in (26) can be written as:

$$n_{t+1} = \begin{cases} 1 - \left(\frac{1-n_t}{\chi^\alpha}\right)^{\frac{1}{1+\alpha}} \left[n_t\left((1+\alpha)\bar{a}_{t+1}^{1/\alpha} - \alpha\right) + \alpha\right]^{\frac{\alpha}{1+\alpha}} \equiv n_1^C(n_t) & \text{if} \quad n_t < \tilde{\tilde{n}}_t \\ n_t \equiv n_2^C(n_t) & \text{if} \quad n_t \in [\tilde{\tilde{n}}_t, \hat{\hat{n}}] \\ \left[\frac{(\chi-\alpha)n_t}{1+\chi}\right]^{\frac{1}{2}} \equiv n_3^C(n_t) & \text{if} \quad n_t > \hat{\hat{n}} \end{cases} \tag{A.25}$$

From (A.25), we can prove the following Lemma, which derives the properties of the dynamic system in eq. (26) (proof is available upon request).

Lemma A.2. *If* $\phi > 1/(1-g)$,

1. $n_1^C(0) > 0$; $n_1^C(\tilde{\tilde{n}}) = n_2^C(\tilde{\tilde{n}}) = \tilde{\tilde{n}}$.
2. $n_3^C(\hat{\hat{n}}) = n_2^C(\hat{\hat{n}}) = \hat{\hat{n}}$; $n_3^C(1) < 1$; $\partial n_3^C/\partial n_t > 0$; $\partial^2 n_3^C/\partial n_t^2 < 0$.

For any $n_t < \tilde{\tilde{n}}$, the economy jumps without transition into the interval $[\tilde{\tilde{n}}, \hat{\hat{n}}]$ where the condition for existence of the steady state is always verified since $n_2^C = n^{C^*}$ (see eq. (A.25) and Fig. 7). For any $n_t > \hat{\hat{n}}$, instead, the economy features transition dynamics toward the unique steady state $n^{C^*} = \hat{\hat{n}}$. Finally, note that for any $n^{C^*} \in [\tilde{\tilde{n}}, \hat{\hat{n}}]$, the distribution of the individuals' talent is unique and defined by $a^\phi > 1$ and $a^a > 1$, which implies that there is no social mobility.

Proof of Proposition 8

Entrepreneurial society. In the case of endogenous growth, the steady state falls in the interval $[\hat{n}_g, \tilde{n}_g]$, where we use the subscript g to indicate the variables in the endogenous case. In order to find the two thresholds, we consider that from Lemma 1, the proportion of skilled entrepreneurs in $\hat{n}_g$ is given by $1 - a_{t+1}^a$; hence

$$g_{t+1} = 1 - a_{t+1}^a = 1 - \left(\frac{w_{t+1}}{\theta^\alpha A_{t+1}}\right)^{\frac{1}{1-\alpha}} \tag{A.26}$$

Substituting $1 - g_{t+1}$ from (A.26) into the corresponding equilibrium wage equation (A.4), the wage rate can be rewritten as:

$$w_{g,t+1}^E = \theta^\alpha A_{t+1} \left[\frac{\alpha}{\chi - (1+\chi)n_t\phi^{2/\alpha}}\right]^{\frac{\alpha(1-\alpha)}{1+\alpha}} \tag{A.27}$$

Finally, substituting (A.27) back into (A.26), the growth rate is given by:

$$g_{t+1} = g\left(n_t\right) = 1 - \left[\frac{\alpha}{\chi - (1+\chi)n_t\phi^{2/\alpha}}\right]^{\frac{\alpha}{1+\alpha}} \tag{A.28}$$

Hence, the time path of the growth rate $\{g_{t+1}\}_{t=0}^{\infty}$ depends only on the dynamics of the number of firms, $\{n_t\}_{t=0}^{\infty}$. Using (A.28), the thresholds (A.5) and (A.6) can be rewritten as:

$$\hat{n}_g = \frac{\chi\left(\phi^{\frac{1+\alpha}{\alpha}} - 1\right)}{(1+\chi)\left(\phi^{\frac{1+\alpha}{\alpha}} - \phi^{\frac{2}{\alpha}}\right)} \tag{A.29}$$

$$\tilde{n}_g = \frac{\chi - \alpha}{(1+\chi)\,\phi^{2/\alpha}} \tag{A.30}$$

From (A.29), it follows that $\hat{n}_g < 0$ since sign $|$ num $| \neq$ sign $|$ den $|$. Hence, the economy will never be in the first stage of the entrepreneurial society (i.e., Fig. 4a). If $\tilde{n}_g < 1$, the economy can temporarily lie in the third stage of the entrepreneurial regime. However, since the properties of the dynamic system in this stage are equal to those of the exogenous case, for any $n_0 > \tilde{n}_g$, the economy would return to the second stage identified by $n_t \in [\hat{n}_g, \tilde{n}_g]$. In order for an entrepreneurial society to be active, it must be verified that $\phi < 1/(1 - g_{t+1})$, which, using (A.28), implies:

$$n_t < \frac{\chi - \alpha\phi^{\frac{1+\alpha}{\alpha}}}{(1+\chi)\phi^{2/\alpha}} \equiv \bar{n}_g \tag{A.31}$$

In order for $\bar{n}_g > 0$, the following must hold:

$$\phi < \left(\frac{\chi}{\alpha}\right)^{\frac{\alpha}{1+\alpha}} \equiv \bar{\phi}_g \tag{A.32}$$

that identifies the new threshold value of ϕ for which the entrepreneurial society is active. As follows from the above analysis, the steady state can lie only in the interval $[0, \tilde{n}_g]$. Then, substituting (A.26) and (A.27) into (A.13) and using (A.25), the corresponding dynamic system describing the evolution of the number of firms can be written as:

$$n_{t+1} = 1 - \left(1 - \phi^{1/\alpha} n_t\right)\left[\frac{\alpha}{\chi - (1+\chi)\phi^{2/\alpha} n_t}\right]^{\frac{\alpha}{1+\alpha}} \equiv n^E(n_t) \tag{A.33}$$

with the properties $n^E(0) \in (0,1)$, $n^E(\tilde{n}_g) < \tilde{n}_g$, $\partial n^E(n_t)/\partial n_t > 0$, $\left|\partial n^E(n_t)/\partial n_t\right| < 1$. These properties guarantee that the law of motion $n^E(n_t)$ in (A.33) admits a unique stable steady state $n_g^{E^*} : n^E(n_g^{E^*}) = n_g^{E^*}$, with $g^{E^*} = g(n_g^{E^*}) > 0$.

Crony society. For any $\phi \geq \bar{\phi}_g$, the crony society becomes active. As above, we rewrite the two thresholds $\tilde{\tilde{n}}_g$ and $\hat{\tilde{n}}_g$ in the endogenous case. From Lemma 1 and Lemma 2, $a^a_{t+1}(\tilde{\tilde{n}}) = 1$; hence, using (A.10), (A.11), we have that $\tilde{\tilde{n}}_g = \tilde{\tilde{n}}_{|g_{t+1}=0}$, while $\hat{\tilde{n}}_g = \hat{\tilde{n}}$. Since the properties of the dynamic system are equal to those of the exogenous case, the possible steady states $(n_g^{C^*})$ can only lie in $[\tilde{\tilde{n}}_g, \hat{\tilde{n}}_g]$, where the distribution is characterized by $a^a \geq 1$ and the corresponding dynamic system is given by:

$$n_{t+1} = n_t \equiv n^C(n_t) \tag{A.34}$$

Hence, the steady state number of firms is not determined and $g^{C^*} = 0$ for any $n_g^{C^*} \in [\tilde{\tilde{n}}_g, \hat{\hat{n}}_g]$.

Proof of Proposition 9

Using eq. (A.28), it results that:

$$\frac{\partial g^{E^*}}{\partial \phi} = -\frac{\alpha(1+\chi)\phi^{2/\alpha}}{1+\alpha}\left[\frac{\alpha}{\chi-(1+\chi)\phi^{2/\alpha}n_g^{E^*}}\right]^{\frac{\alpha}{(1+\alpha)}}\left[\frac{\left(\partial n_g^{E^*}/\partial\phi\right)+(2/\alpha)\phi^{-1}n_g^{E^*}}{\chi-(1+\chi)\phi^{2/\alpha}n_g^{E^*}}\right]$$

where $n_g^{E^*}$ is the solution to the implicit equation:

$$n_g^{E^*} = 1-\left(1-\phi^{1/\alpha}n_g^{E^*}\right)\left[\frac{\alpha}{\chi-(1+\chi)\,\phi^{2/\alpha}n_g^{E^*}}\right]^{\frac{\alpha}{1+\alpha}} \tag{A.35}$$

Hence,

$$\frac{\partial g^{E^*}}{\partial \phi} < 0 \quad \text{since} \quad \frac{\partial n_g^{E^*}}{\partial \phi} + \frac{2n_g^{E^*}}{\alpha\phi} > 0.$$