Abstract

Professionalisation has been, and still is, a process that has profoundly influenced the economies of the most industrialised countries. Professionalisation entails a radical transformation of the whole occupational system, since it gives the members of occupations characterised by a high degree of generalised and systematic knowledge the authority to decide whether or not to admit a potential recruit, to control the behaviour of those who belong to the profession and a monopoly power on the market for professional services. One consequence is the high position in the occupational hierarchy assumed by members of the professions.

This paper analyses the economic consequences of this phenomenon, concentrating in particular on the effects of technological innovation and growth. The argument put forward in this paper is that professionalisation may hamper the innovative activity because it reduces the number of researchers that innovative sector may use since social status makes more attractive to work in already professionalised sector, even if it may give rise to a lower monetary reward; besides professionals may impede the rise of new professions derived from the innovative activity to protect their monopoly power.

Innovation, rent seeking and social prestige: towards a dynamic theory of professions

Maria Rosaria Carillo[1] and Alberto Zazzaro[2]

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[1]University of Naples, "Parthenope".

[2]University of Ancona., Dipartimento di Economia, Piazzale Martelli 8, 60121 - Ancona; tel. +39-71-2207086; fax +39-71-2207102; e-mail: albertoz@deanovell.unian.it

1 Introduction

Professionalism is a historical-social phenomenon widespread in Western societies. It consists essentially in the regulation of the supply of services considered to be of public interest and based on possession of systematic and specialist knowledge applied to particular cases (Hughes, 1965).

The effects of professionalism on economic growth are many and relevant. It may influence the acccumulation of human capital and its allocation, the formation of applied knowledge, the ways in which this is used, and the pace at which the economy introduces innovations.

Professional markets and their features have been frequently analysed by economists. The main point under examination has been the economic rationality of the mechanisms that regulate such markets, characterized by State authorizations, by barriers to entry, by self-regulation through professional associations. The rationality of this type of market organization has been discerned in certain features of the services supplied by professionalized activities which entail the presence of a marked information asymmetry (Leland, 1979; Shaked and Sutton, 1980; 1981). Professionalized activities, in fact, are based on a specialist expertise not possessed by the clients, who are usually unable to assess, both ex-ante and ex-post, the quality of the service that they have purchased. Moreover, the services supplied by professionals often display marked externalities and in many cases take the form of outright public goods. The special forms of regulation to which the professions are subject, it is argued, reduce the information asymmetry and guarantee a minimum standard quality of the service provided, as well as ensuring supply of the public good (Matthews, 1991).

However, this approach to the economic analysis of professions is not entirely satisfactory. It only considers the static aspects of the phenomenon of professionalism and entirely neglects analysis of how certain occupations are able to become 'professions'. This is mainly due to the fact that the economic theory of the professions is based on a 'taxonomic' definition which consists in the mere description of certain 'natural' or 'technological' features of the services that professions supply, features that are displayed by all of them and which distinguish them from other occupations. Put more specifically, counting as professions are all those activities whose performance requires possession of systematic, specialist, and not immediately transferable knowledge, and whose final product the consumer finds difficult to evaluate and which therefore requires a direct trust relationship to be established between the professional and client (Ogus, 1994).

The problem with this kind of definition is that, in reality, there are numerous examples of activities which although they possess the features just

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listed are not professions. Conversely, there are many activities which possess them to a much lesser extent but are nonetheless highly professionalized. In other words, the technological characteristics of the services supplied cannot be taken as the element which defines all the activities regarded as professions in the real world and at the same time excludes all those that are not (Friedson, 1970). Moreover, this definition of profession it is largely incomplete. It fails to explain how a profession becomes such, why there are considerable differences among groups of professions with respect to the monopoly power and social prestige that they possess, and also why a particular profession may enjoy different economic and social 'power' in different countries[1].

Drawing on sociological theory, we shall use a definition of 'profession' which emphasises its dynamic aspects and states that are professional all the activities which have undertaken the 'professionalization process'. The latter is defined as a process set in train by some of the professionals themselves in order to create a market for their services and to gain control over it. It is a project deliberately pursued by the leadership of an occupation in order to acquire, maintain and increase social status and monopoly power.

The focus of this paper is on the process set in motion by professional élites in order to obtain the economic and social power and their effects on the pace of technological innovation. There is a close and reciprocal nexus between professionalism and innovation. First, technological innovations or scientific progress are usually at the ground of the birth and consolidation of a new profession. On the other hand that the manner in which the professionalization process takes place may have significant effects on an economy's propensity to innovate (Mokyr, 1992). The history of the professions provides numerous examples of this linkage. If one considers the rise of the medical profession, for example, one finds that the process by which physicians became professionalized made little progress until the nineteenth century, although university schools of medicine had existed as early as the twelfth and fourteen centuries (Freidson, 1986; Tousijn, 1987). Only in the second half of the nineteenth century and in the early 1900s - a period during which medicine underwent a veritable technical-scientific revolution with the advent of bacteriology and the spread of anaesthetics - did the medical profession (or better its 'scientific' current) begin its ascent. In several countries (including

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[1]An example is provided by lawyers, who in some countries like Germany and France managed to obtain legal recognition for their professional order as early as the nineteenth century and thereby gained a major advantage in terms of monopoly power and social prestige. In other countries, Switzerland for example, they did not achieve legal recognition, or some other form of regulation of their profession, until the first half of the twentieth century, with the consequence that anyone at all could practise as a lawyer (Speranza, 1991).

Italy, the USA, and Great Britain), physicians obtained legal recognition of their professional order, and of the schools in which the dominant paradigm was taught, and thus gained diagnostic and therapeutic exclusiveness.

Several other examples can be cited: that of psychologists, for instance, who arose when Freud's discoveries engendered not only a new scientific discipline but also an occupation distinct from medicine, and in certain respects in competition with it; or engineers, whose professionalization was given considerable impetus by the technological revolution of the second half of the nineteenth century, with the advent of the railways and the industries connected with them (Larson, 1977).

However, although innovation is a necessary condition for the birth of a profession, it is not a sufficient one. Another decisive factor is the recognition by the State, which issues laws and regulations that establish the profession in question as exclusively entitled to supply a particular range of professional services[2]. That intervention by the State is crucial for the success of the so-called 'professional project' is confirmed by the experience of various countries; although one notes marked differences, so that in countries like Germany, Italy and France, State intervention has been more forceful and decisive, while in others, like the USA and Switzerland, it has been less important.

However, besides the acquisition of monopoly power, the professionalization is addressed to achievement of social power. As Larson (1977) affirms, the professionalization process is also a project of collective social mobility, in the sense that professionals as a group usually enjoy higher social status than do other occupational categories.

Yet an increase of social prestige does not come about automatically as a by-product of the professionalization process. It is also a goal deliberately pursued by the professional associations, which implement a strategy designed to secure higher social prestige for their members. Indeed, numerous scholars consider the professionalization process to be a method of social stratification complementary to the system based on wealth.

Once the professional associations have achieved legal recognition, they constantly endeavour to create and reinforce certain characteristics of the profession which ensure high social prestige, such as the control over their own work practices, or the public of the social relevance of their activity.

In almost all the Western countries, the rules regulating the conduct of professional work are laid down by the professionals themselves. Professional

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[2] "[..] a useful concept of profession is the possession of something a monopoly over the exercise of its work. [..] a significant monopoly could not occur until a secure and practical technology of work was developed" (Freidson 1970, p. 21).

work, in fact, is subject to self-regulation or to a system of "peer control" (Powell, 1988) whereby the work and ethical behaviour of professionals can only be judged by their colleagues, who alone are able to assess a professional's preparation, errors and/or malpractice[3].

Moreover, the professional associations often act as pressure groups which form linkages and alliances with other power groups, such as government organizations, courts of justice, political groups, etc., in order to obtain privileges and thus enhance the status of the profession.

Although social mobility is ensured for all those who belong to a profession, this does not mean that all the members of a given profession enjoy the same status. This is because internally to the profession there may be a stratification which, in certain cases, is extremely pronounced. Indeed, according to some authors (Freidson, 1994; Ruschmeyer, 1986) there is currently a tendency towards increasing internal stratification by which the élites - constituted by academics-researchers and managers-administrators - enjoy extremely high power and prestige and manage to secure substantial monopoly rents, while the simple practitioners of the profession are exposed to greater competition and enjoy a markedly inferior status.

In this paper we shall analyse these aspects of professionalism by focusing on the effects that it may have on technological innovation and the allocation of human resources among productive sectors, and via the latter on the growth process. We present a simple extension of Aghion and Howitt's (1992) endogenous growth model which will depict, albeit in highly stylized form, the professionalization process and demonstrate that the effects of professionalization on growth are complex and may operate in opposite directions. On the one hand, the monopoly power of the professions and the status of professional élites favour investment in the acquisition of knowledge and its transfer to the market. On the other, with the passage of time the mechanism by which the practitioners of the profession acquire social prestige increases the advantage of the already-consolidated professions. This may make costly to attract workers in the research sector and discourage the birth of new professions.

2 The model

A class of growth models that can be used to represent the salient features of the professionalization process described in the previous section comprises

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[3]Drawn up for this purpose are the 'codes of ethics' issued by the professional orders which state the rules with which the professional must comply in his/her work.

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so-called neo-Schumpeterian models[4].

2.1   The economy

The economy consists of a continuum of individuals, of measure 1, who can find employment in one of two different types of work activity: one is a professional work which is necessary for the production of the only existing consumption good; the other is suited to the research and development sector. Each individual has an infinite life-span and is endowed with one indivisible unit of labour, the disutility of whose supply is nil. S/he is characterized by one (identical) linear intertemporal utility function in consumption and in a variable which measures the social status accruing from the job performed. The intertemporal preference rate, $\rho > 0$, is constant and, in equilibrium, coincides with the rate of interest at which firms collect savings.

The consumption good, which acts as the numeraire, is produced using the following technology:

$$y_{k_t} = A_k x_{k_t}^{\alpha} \tag{1}$$

with $0 < \alpha < 1$, where x_k denotes the professional services used at time t, and A_k is a technological parameter which measures the productivity of the professional service of type k.

The professional service is instead produced using only labour, and with a linear technology:

$$x_{k_t} = n_{x_{k_t}} \tag{2}$$

where $n_{x_{k_t}}$ denotes the individuals involved in the professional activity k.

Workers who do not find jobs in the professional sector are employed as 'researchers' in the research sector. In accordance with the literature on patents race, we assume that innovations deriving from research activity come about randomly, following a Poisson stochastic process with parameter λn_r, where n_r is the amount of skilled workers employed in the research sector and λ is a positive parameter which indicates the productivity of the research technology.

In this economy, innovation consists in the birth of a new body of knowledge and of a new occupational category, $k+1$, able to provide a professional

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[4]For a thorough survey of the so-called neo-Schumpeterian approach to growth theory see Aghiuon and Howitt (1998).

service which is more productive than that supplied by the previous professional group. For the sake of simplicity, we assume that the increase in productivity brought about by each new professional category is constant and equal to $\gamma > 1$. That is to say, as in Aghion and Howitt (1992), we assume that $A_k = \gamma^k$. Consequently, k denotes not only the type of profession but also the professional era that comes to an end with the introduction of an innovation and the birth of a new profession. Because the parameters that define the economy, and therefore the choices made by agents, remain constant during each professional era, henceforth we can simplify the notation by omitting the temporal index t when it is not indispensable.

2.2 The constitution of the professional market

As said in the Introduction, the birth of a profession moves though two fundamental stages. The first stage is that of innovation, which attests to the importance and efficiency of the practical applications of a certain work activity for current production. The second is that of the formation of market power with the "institutionalization of cognitive exclusivity" and the creation of the orders and associations which regulate access to the profession (Larson, 1977).

The phase during which market power is established is of crucial importance, not only for the birth of the profession but also for the organization and internal stratification of the professional group. Indeed, not all of those who practise a profession possess effective market power: the large majority of them operate in a highly competitive context, and often do so not even as independent professionals[5]. Those who are able to control the market and to ensure themselves monopoly rents constitute the élites of the profession; while those who, although they share the same professional status as the élites, enjoy monopoly rents to a much lesser extent, constitute the group of practitioners.

In order to simplify the analysis we shall assume that the two groups are distinctly different. The élite is formed by those who, having successfully carried out their research and introduced the innovation, induce the State to implement legislation which grants formal recognition to their profession's cognitive exclusivity. The group of practitioners instead consists of those individuals who carry on their professional work as the dependent (professional) employees of the élite.

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[5]The inner stratification of professions has been widely studied in the sociological literature. Some authors consider it to be the most distinctive feature of ongoing professionalization processes: see e.g. Abel (1985), Freidson (1986, 1994) and Ruschemeyer (1986).

After profession has constituted itself and has obtained the cognitive exclusiveness, its élite pursues its lobbying activity in order to obtain an higher social prestige for itself and for the profession as a whole.

To maintain the analogy with Aghion and Howitt's model, we assume that those who belong to the professional élite operate in a monopolistic regime (or one in which the collusion equilibrium can be implemented) by deciding how many practitioners to employ and the amount of resources to invest in the creation of social prestige for the profession. Unlike the investment for obtaining the cognitive exclusiveness, this type of investment has to be carried on constantly for the whole period during which the élite controls the profession. Even if both kinds of investments are lobbying activities, to simplify the analysis we assume that these two forms of investments are completely separeted.

Professionalization process can be represented as a three stages 'course', as described in figure 1, where the duration of research activity and of the period during which a profession is active are uncertain (as indicated by the dotted line), while the race for obtaining the cognitive exclusivennes occurs instantly, when an innovation is devised.

The devising of innovation
and lobbying for acquisition
of cognitive exclusiveness

1 . . . . 2 3

Research activity
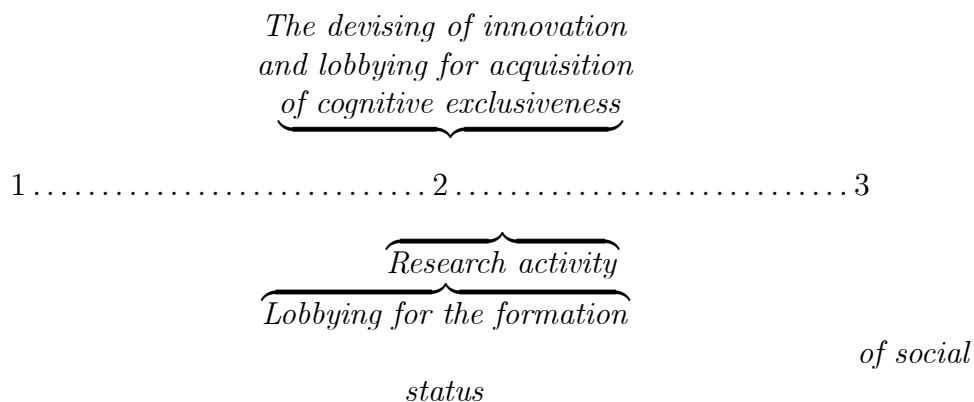*Lobbying for the formation*

of social

status

Figure 1. The professionalization process

Finally, we shall assume that the innovation introduced by each new professional group is drastic, so that, even at the monopoly price, demand for the final good will shift in its entirety to the service supplied by the new professional group.

The benefits of research activity, therefore, are nothing but the benefits that can be obtained by producing the discovered professional service until a new innovation appears and a new professional group takes over. However, once the innovation has been devised, the élites of professional group will seek to preserve its monopoly position by lobbying politicians and administrators

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in order to obtain cognitive exclusiveness for the k+1 type of professional service as well, so that it can absorb the innovation into its profession. The innovation is therefore only a necessary condition for the constitution of a new professional order; also required are the ability to apply pressure on the authorities, and lobbying effort undertaken by the professional group which offers the k-th service.

Assuming free entry to the research sector, and bearing in mind that at every instant the probability of achieving innovation is λn_r, in equilibrium the wage paid in this sector will be:

$$w_{r_k} = q\lambda B_{x_{k+1}} \tag{3}$$

where where q denotes the probability of winning the rent-seeking game and obtaining cognitive exclusiveness and $B_{x_{k+1}}$ is the current value of the total benefits, in terms of utility, that can be obtained by delivering the $k + 1$ professional service. These benefits consist in the monetary income earned from selling the service and from the social prestige obtained from belonging to the profession. For the élite of professionals, therefore, the total benefits expected from undertaking professional activity k are equal to:

$$B_{x_k} = \frac{p_x x_{t,k} - w_{x_k} n_{x_k} + P_{es_k} - C_{es_k}}{\rho + \lambda n_{r_k}} \tag{4}$$

where P_{es_k} and C_{es_k} respectively denote the benefits accruing to the élite from their social status as professionals and the costs of creating that social status, both measured in terms of utility[6].

2.2.1 The attainment of cognitive exclusiveness

In order to set themselves up as a professional group, those who have devised the innovation must first obtain recognition of their cognitive exclusiveness. This will be opposed by the professional group currently active, which, to the extent that it is able to adopt the new technology[7], will seek to appropriate

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[6]Note that (4) is entirely compatible with both the view of the professionalization process as a quest for power and with the Weberian view of a profession as a 'vocation', and according to which the objective function of professionals is different from that of ordinary businessmen because it also comprises ethical aspects which, if pursued, ensure social prestige (Matthews, 1991).

[7]Henceforth, for the sake of simplicity but without altering the substance of the analysis, we shall assume that the élite currently active is able to use the technology devised with the $k + 1$ service just as efficiently as the group that invented it.

the new type of professional service and thereby preserve its monopoly over service x.

This situation can be straightforwardly formalized as a rent-seeking game, where innovator and monopolist compete to obtain cognitive exclusiveness by devoting resources to lobbying activities undertaken to gain the favour of politicians and administrators[8].

Let be e_e and e_x the resources, in terms of effort and time, devoted to lobbying by those who have invented the new type of service x and by the professional group that produces the service x_k. The disutility of lobbying effort coincides with the resources employed. For both groups, the value of obtaining cognitive exclusiveness consists in the monopoly profits obtainable from delivery of the new professional service $B_{x_{k+1}}$.

Let us assume that the probabilities of success assume the traditional logit form introduced by Tullock (1980) but are not perfectly symmetric. More precisely, let us suppose that lobbying activity is at constant returns for both groups, but the marginal productivities are not the same[9]. Hence it follows that the probability that a new professional group can be created and the probability that the $k+1$ service will be absorbed by the old professional group are respectively:

$$q = \frac{e_r}{\sigma e_x + e_r} \tag{5}$$

$$1 - q = \frac{\sigma e_x}{\sigma e_x + e_r} \tag{6}$$

where σ denotes the relative ability of the professional élite currently active to undertake lobbying activities.

Of course, the professional group currently delivering the $k - th$ service has already obtained cognitive exclusiveness on at least one occasion in the past. Since that occasion, the élite has continued its lobbying activity and has had sufficient time to establish further political relations and connections. This has made its contractual bargaining capacity and its ability to apply pressure much greater than that of the group that has devised the $k + 1 - th$ service, Formally, this can be expressed in two ways: by hypothesising that the marginal productivity of lobbying activity is greater for the professional

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[8]Since Tullock's (1980) study, a large body of literature has developed on rent-seeking games. For a recent survey see Nitzan (1994).

[9]This particular form of the success function has been used by Baik (1994).

group currently active (i.e. $\sigma > 1$)[10]; or by assuming that the rent-seeking game is sequential, i.e. that the professional élite has the first-mover advantage and can constrain the innovators to its action[11].

Given the innovator's pay-off function, $u_r = \frac{e_r}{\sigma e_x + e_r} V_{x_{k+1}} - e_r$, its reaction function is:

$$e_r^* = \sqrt{\sigma e_x V_{x_{k+1}}} - \sigma e_x \tag{7}$$

The professional élite therefore makes the effort that maximizes the following pay-off function:

$$u_x = \sqrt{\sigma e_x V_{x_{k+1}}} - e_x \tag{8}$$

that is

$$e_x^* = \frac{\sigma V_{x_{k+1}}}{4} \tag{9}$$

Proposition 1 *The rent-seeking game has a unique equilibrium in pure strategies if and only if $\sigma < 2$. In this case the effort made by the innovator and the probability of constituting a new profession decrease as the increased lobbying capacity of the elite increases.*

Proof. On substituting (9) in (7) it is evident that if $\sigma > 2$, then $e_r^* = 0$. In this case, however, it would be optimal for the élite, too, not to devote effort to lobbying activity, so that $e_r^* = 0$ is a non-optimal action (and so on). Substituting (9) and (7) in (5) shows that the probability of the innovator obtaining cognitive exclusiveness is

$$q = \frac{2 - \sigma}{3 - \sigma} \tag{10}$$

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[10]For greater realism one could hypothesise that the marginal productivity of the élite's lobbying activity depends on the resources that it uses to develop the profession's social status, or on the time that elapses between one innovation and the next. However, this would make the results of comparative statics less easy to interpret, without altering the qualitative results of the model.

[11]For treatment of the rent-seeking game in a model à la Stackelberg, see Dixit (1987) and Perez-Castrillo and Verdier (1992).

hence Proposition 1. ■

Therefore, the better the political and social connections of the professional elite, the fewer the resources that the innovators will invest in lobbying activity, and the lower the probability that they will manage to obtain cognitive exclusiveness and organize a new professional group[12]. For values of σ very close to 2, the ability of the élite professional group to apply pressure would be so high that in practice it would not be in the innovator's interest to engage in the rent-seeking game. The benefits of the innovation would therefore be nil and the economy would be trapped in an equilibrium (if it existed) of almost[13] zero growth.

2.3   The formation of social status

The social status of a profession derives in part from a costly organizational effort consciously pursued by the profession's élite and, as Larson (1977, p. 69) argues, "intended to create social distance between the professionals and the other occupational groups", and in part from the simple passage of time, which enables the group to consolidate as it demonstrates the usefulness of its professional services.

In making their organizational effort in favour of the profession, the élites encourage two different processes of social mobility: one is external, or collective, and enhances the social status of all the members of the profession; the other is internal and is intended to create social distance between the élite and the practitioners.

In order to make the model analytically manageable, we shall assume that the élite enjoy social benefits constantly over time, while the social status of the practitioners tends to increase with the consolidation of the profession. We shall also assume that for both groups social status does not depend on the number of individuals who practise the profession.

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[12]Unlike in Baik (1994, Proposition 2), as σ increases so does the effort of the other competitor (in our case the current professional élite). This is because Baik considers a simultaneous game, whereas it is hypothesised here that the élite has the first-move advantage. And in fact, if in our case we hypothesised a context à la Cournot, the optimal actions would be identical and equal to $\frac{\sigma B_{k+1}}{(1+\sigma)^2}$, while the probability of success would be equal to $\frac{1}{1+\sigma}$. When instead a context à la Stackleberg is hypothesised, the current élite (the leader) is obliged to make a greater effort than would be the case if the lobbying activities were undertaken simultaneously and the innovator (the follower) responded with less effort (Dixit, 1987).

[13]*Almost* because according to Proposition 1 $e_r^* = 0$ for $\sigma = 2$, but in this case, as has been shown, the rent-seeking game does not admit to equilibria in pure strategies (for similar results see Baye et al., 1994; Nti, 1994).

More specifically, when a new profession arises, its social prestige, s_k, is nil. It increases over time until it asymptotically reaches a maximum level which depends on the organizational effort made by the élite, ℓ_k, and on the productivity of the professional service:

$$s_k = A_k \ell_k^\beta (1 - e^{-\theta t}) \tag{11}$$

where $0 < \beta < 1$ indicates the efficacy of the organizational effort in producing status, while θ denotes the rate at which the profession's status increases over time.

The social status obtained by the élite instead derives from the exercise of monopoly power, and it is always higher than the status of the practitioners. More specifically, it is equal to a multiple, $S > 1$, of the maximum level of status achievable by the practitioners. Finally, the costs of the organizational effort are, in terms of utility, proportional to the profession's productivity.

$$P_{es_k} - C_{es_k} = SA_k \ell_k^\beta - cA_k \ell_k = A_k \left(S\ell_k^\beta - c\ell_k \right) \tag{12}$$

Having assumed that the profession's social prestige is unrelated to the number of individuals who practise it, the choices made by the élite with regard to the practitioners to employ on the one hand, and the resources to invest in the formation of social status on the other, can be kept separate. From (2), and from the profit maximization by the firms operating in the sector of the consumption good, the inverse demand function for the professional service is $p_{x_k} = \alpha A_k x_k^{\alpha-1}$. Substituting this expression in (2), the present value of expected profits in the professional sector is maximized when:

$$w_{x_k} = \alpha^2 A_k n_{x_k}^{\alpha-1} \tag{13}$$

The optimal organizational effort undertaken by the élite of the profession is instead that which maximizes (12):

$$\ell_k^* = \left(\frac{S\beta}{c} \right)^{\frac{1}{1-\beta}} \tag{14}$$

Finally, substituting (12), (13) and (14) in (4), the present value of the benefits expected by the professional élite is:

$$B_{x_k} = \frac{\alpha(1-\alpha)A_k n_{x_k}^{\alpha} + cA_k \left(\frac{S\beta}{c}\right)^{\frac{1}{1-\beta}} \left(\frac{1-\beta}{\beta}\right)}{\rho + \lambda n_{r_k}} \qquad (15)$$

The social status of the practitioners instead coincides with the status of the profession, and the benefits expected are:

$$U_{x_k} = \frac{1}{\rho + \lambda n_{r_k}} \left(w_{x_k} + \frac{\theta A_k \ell_k^{\beta*}}{\rho + \lambda n_{r_k} + \theta} \right) \qquad (16)$$

Because individuals can choose, without sustaining costs, to participate either in the labour market as practitioners in the professionalized sector or as researchers in the research sector, in equilibrium the utility yielded by the two types of activity should be the same.

The expected utility derived from research sector is:

$$U_{r,k} = \frac{w_{r,k}}{\rho + \lambda n_{r,k}} \qquad (17)$$

from that we have the following equilibrium condition for labour market:

$$w_{r_k} = w_{x_k} + \frac{\theta A_k \ell_k^{\beta*}}{\rho + \lambda n_{r_k} + \theta} \qquad (18)$$

In equilibrium the monetary income obtainable in the research sector should therefore be greater than that of the practitioners, in order to off-set the return that the latter obtain in terms of social prestige.

3 Equilibrium and long-period growth

Given the structure of the model, production of the final good will only increase from one period to the next if an innovation occurs. The expected average steady-state rate of growth, depends on the number of workers employed in the research, on the productivity of these workers, and on the magnitude of the technological advance brought about by the innovation. In particular, we have[14]:

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[14]Cf. Aghion and Howitt (1992, pp. 336-7).

$$E(g) = E(\ln y_t - \ln y_{t-1}) = \lambda n_r^* \ln \gamma \qquad (19)$$

where n_r^* denotes the amount of labour that in equilibrium is employed in the research sector.

Substituting equations (3), (13) and (15) in (18), and remembering that in equilibrium all individuals find employment, $n_{x_k} + n_{r_k} = 1$, it is possible to obtain the optimal number of individuals who, in equilibrium in the $k-th$ technological era, are employed in the research sector:

$$\frac{q\lambda\gamma \left[\alpha(1-\alpha)(1-n_{r_{k+1}})^\alpha + c(\frac{S\beta}{c})^{\frac{1}{1-\beta}}(\frac{1-\beta}{\beta})\right]}{\rho + \lambda n_{r_{k+1}}} = \alpha^2(1-n_{r_k})^{\alpha-1} + \frac{\theta(\frac{S\beta}{c})^{\frac{\beta}{1-\beta}}}{\rho + \lambda n_{r_k} + \theta} \qquad (20)$$

As in Aghion and Howitt's model, equation (20) enables us to determine the amount of labour employed in the research sector in era k as a function of the labour employed in research in the next technological era. Unlike in Aghion and Howitt's model, however, the relation between n_{r_k} and $n_{r_{k+1}}$ is not univocal. In fact, while the expression on the left side of equation (20) - the marginal benefits deriving from the research activity - are always decreasing in $n_{r_{k+1}}$, the expression on the right - the marginal costs - does not necessarily display a univocal trend with respect to n_{r_k}. An increase in the number of workers employed in the research sector has an ambiguous effect on the wage earned in that sector. In fact, reducing the number of practitioners on the one hand increases the wage earned in the professional sector and, as a consequence that of the researchers, while on the other it reduces the current value of the social prestige deriving from the profession and thus enables the payment of a lower wage to the 'researchers'.

A steady-state equilibrium is defined as a value of n_r^* such that $n_{r_k} = n_{r_{k+1}}$, $\forall k \in (0, \infty)$[15]. From (20) it is straightforward to verify that the marginal benefits deriving from research (the left-hand side, hereafter LHS) are constantly decreasing, while the marginal costs (the right-hand side, hereafter RHS) are instead convex in n_{r_k}, and that $\lim_{n_{r_k} \to 1} RHS = +\infty$. This implies that the marginal costs either monotonically increase with n_{r_k} or initially decrease and then increase with it. If $LHS_{|n_{r_{k+1}}=0} > RHS_{|n_{r_k}=0}$, then in both cases there exists one and only one value of n_{r_k} such that

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[15]The equilibrium is locally stable if $\left|\frac{\partial n_{r,k}}{\partial n_{r,k+1}}\right|$ calculated in n_r^* assumes values less than one.

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$LHS = RHS$. If conversely $LHS_{|n_{r_{k+1}}=0} < RHS_{|n_{r_k}=0}$, then the steady state can exist only if the function of the marginal costs is initially decreasing. In this case, however, because $\lim_{n_{r_k}\to 1} RHS = +\infty$, the steady-state equilibria, if they exist, are necessarily two in number. To summarize, we can state the following:

Proposition 2 *If for $n_r^* = 0$ the marginal benefits are greater than the marginal costs, the steady-state equilibrium exists and is unique. By contrast, if for $n_r^* = 0$ the marginal benefits are less than the marginal costs, either there are two steady-state equilibria or there is no equilibrium at all.*

From eq. (20) we can see that an increase in the efficiency of élite's lobbying activity, by reducing q, reduces also expected net benefits from research activity and resources devoted to this latter, with negative effects on long run growth. As to be expected, the effect of the status variables on the allocation of the labour force and on the economy's average rate of growth is ambiguous. On the one hand, the status variables stimulate research because they increase the expected return for those able to win the innovative competition; on the other, they induce individuals to prefer to work as 'practitioners' rather than 'researchers'. The θ parameter, the rate at which the profession's status increases over time, is the only one to have a certainly negative effect on growth because it alone affects the return on the occupations. As for the rest, S, c and β affect both the benefits deriving from research and its costs.

More specifically, simple comparative statics exercises on (20) yield the following proposition.

Proposition 3 *If the rate at which the profession's social prestige (θ) increases over time is moderate compared to the productivity of research (λ), to the magnitude of a possible technological advance (γ) and to the propability of obtaining the cognitive exclusiveness (q), then an increase in internal social stratification or a diminution in the costs of the organizational effort (c) will have a positive effect on the resources used in the R&D sector and on the average rate of steady-state growth. Vice versa, if the rate at which the profession's social prestige grows is very high, there is very little internal stratification and the probability of winning the rent-seeking game is is very low, then the effect of the status variables on n_r^* and on steady-state growth will be negative. An increase in the efficacy of the organizational effort (β) will instead have a positive effect on n_r^* only if the effect of internal stratification is sufficiently great or if $c < S\beta$*

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Proof. Rewriting (20) as:

$$F = \alpha(1-n_r^*)^\alpha[q\lambda\gamma(1-\alpha)-\alpha\frac{(\rho+\lambda n_r^*)}{(1-n_r^*)}]+(\frac{\beta}{c})^{\frac{\beta}{1-\beta}}S^{\frac{1}{1-\beta}}[\lambda\gamma(1-\beta)-\frac{\theta}{S}\frac{(\rho+\lambda n_r^*)}{(\rho+\lambda n_r^*+\theta)}] = 0,$$

one can easily verify that $F_{n_r^*} < 0$ so that by applying the implicit function theorem, $sign\ \frac{\partial n_r^*}{\partial z} = sign\ F_z$, $z = S, c, \beta$.

From this it follows that:

$\frac{\partial n_r^*}{\partial S} \gtrless 0 \iff S \gtrless \frac{\theta\beta}{\lambda\gamma(1-\beta)}\frac{\rho+\lambda n_r^*}{\rho+\lambda n_r^*+\theta}$;

$\frac{\partial n_r^*}{\partial c} \gtrless 0 \iff S \lessgtr \frac{\theta}{\lambda\gamma(1-\beta)}\frac{\rho+\lambda n_r^*}{\rho+\lambda n_r^*+\theta}$;

$\frac{\partial n_r^*}{\partial \beta} \gtrless 0 \iff \log(\frac{S\beta}{c})[\lambda\gamma - \frac{\theta}{S}\frac{(\rho+\lambda n_r^*)}{(\rho+\lambda n_r^*+\theta)}\frac{1}{(1-\beta)}] - \frac{\theta}{S}\frac{(\rho+\lambda n_r^*)}{(\rho+\lambda n_r^*+\theta)} \gtrless 0$.

Bearing in mind that $S > 1$, if $\theta < q\lambda\gamma(1-\beta)$ it follows that $\frac{\partial n_r^*}{\partial S} > 0$ e $\frac{\partial n_r^*}{\partial c} < 0$. As regards, $\frac{\partial n_r^*}{\partial \beta}$ it follows for the same reason that the expression in the square brackets assumes positive values. Consequently, the effect of β on n_r^* can be positive only if $\frac{S\beta}{c} > 1$. If instead $\theta > q\lambda\gamma\frac{\rho+\lambda}{\beta(\rho+\lambda+\theta)}$, then if S assumes very low values, it is the case that $\frac{\partial n_r^*}{\partial S} < 0$, $\frac{\partial n_r^*}{\partial c} > 0$ and, if $\frac{S\beta}{c} > 1$, $\frac{\partial n_r^*}{\partial \beta} < 0$. ∎

It is evident from proposition 3 that the effects of the professionalization process on research should be evaluated in the light of the manner in which it begins and subsequently evolves. If during the initial stage of the professionalization process its promoters obtain, at low costs, a high level of social prestige (very high parameter S, and parameter c low compared to β), then the professionalization of occupations has a positive effect on innovative activity and on growth. The social reward obtained by the promoters of the professionalization process is added to the monetary reward, and innovative activity is considerably incentivized.

Instead, if the stage in the formation of professional status which assumes greatest importance is that of consolidation of the profession, during which the social status of the 'practitioners' is formed and grows (very high θ parameter), then the effect on growth will be negative. This reductive effect will be heightened if the productivity of the research activity is low, if the technological era during which the profession enjoys monopoly is very long-lasting and the probability to be a winner of the rent-seeking game is low.

It is therefore in more static economies, those in which there is scant innovative capacity and the innovations introduced are marginal, that the professionalization of occupations has a negative effect on the allocation of resources and on growth. In dynamic economies, by contrast, professionalization has exactly the opposite effects, in that it stimulates investments in research undertaken so that the social advantages appropriated on average by professionals can be enjoyed in the future.

4   Conclusions

The paper has analysed the effects of professionalism on the amount of resources that an economy devotes to R&D activity and, through such activity, on growth. The connection between innovation and professionalism is profound and complex, and it works in both directions. A profession, in fact, always springs from an innovative act which engenders a new body of applied knowledge constituting the core of the professional service supplied. Subsequently, a further innovation may eliminate the profession from the market because of the new knowledge and the new professions that it generates. At the same time, however, in order to maintain the dominant positions that they have achieved, the 'elites' of the old professions may obstruct the entry of new professions into the market, and therefore the technological innovation connected with them. Or they may direct research towards complementary innovations which enable them to remain in the market. The latter possibility has not been explored here, however, although it is an aspect of particular interest that may be examined in future works.

A further feature of the innovation/professionalism linkage emphasised here is that the remuneration for innovative activity is both monetary and social in nature, because a large part of the total income of professionals consists of the social prestige that they enjoy. The professionalization process is also a method of social stratification intended to create high social prestige for the members of the professional group (Larson, 1977). As a consequence, the innovation that gives rise to a new profession may be remunerated not only with monopoly profits but also with high social status; and this is therefore a strong incentive for innovative activity. However, the conclusions that we have reached partly conflict with this thesis. Because of the character of status as a public good - which means that it is enjoyed by all the members of the professional group - it does not always incentivize innovative activity, given that it influences the occupational choices of individuals, reducing the number of researchers and increasing the number of those who choose to become professional practitioners, with negative effects on growth.

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