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BUREAUCRACY INTERMEDIARIES, CORRUPTION AND RED TAPE

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Bureaucracy intermediaries, corruption and red tape[☆]

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Abstract

Intermediaries helping individuals and firms with the government bureaucracy are common in developing countries. Although such bureaucracy intermediaries are, anecdotally, linked with corruption and welfare losses, few formal analyses exist.

In our model, a government license can benefit individuals. We study individuals net gain when acquiring the license through the regular procedure, through bribing or through intermediaries. For a given procedure, individuals using intermediaries are better off than if intermediaries and corruption had not existed. Intermediaries grease the wheels. We then study incentives of corrupt bureaucrats to create red tape. When free to choose levels of red tape, bureaucrats implement more red tape and individuals are unambiguously worse off in a setting with intermediaries than with direct corruption only.

Intermediaries can thus improve access to the bureaucracy, but also strengthen incentives to create red tape - a potential explanation why license procedures tend to be long in developing countries.

Keywords: Bureaucracy, Corruption, Intermediaries, Red tape
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1. Introduction

Intermediaries that help individuals and firms with the government bureaucracy are present throughout the developing world. Yet, there is a limited understanding of what such bureaucracy intermediaries do. Although the prevalence of intermediaries is, anecdotally, linked with corruption in the government bureaucracy and a welfare loss, there are few formal analyses of the topic. On the empirical side, there is an almost complete lack of studies involving bureaucracy intermediaries.

This paper aims at filling a gap in the theoretical literature on bureaucracy intermediaries. In a model where individuals can get a benefit by going through a license procedure at the government bureaucracy, we study how individuals' net gain from the license is affected when the license can also be acquired through intermediaries. We study how the incentives of government bureaucrats to create red tape are affected when there are intermediaries, and what effects such "endogenous red tape" has on individuals' gain from the license. We also endogenize the existence of the intermediary sector itself.

The study focuses on one specific aspect of what intermediaries can offer individuals and firms - time saving. Individuals can acquire the license through the regular procedure, or by bribing corrupt bureaucrats to get a speedier treatment, or from an intermediary, which allows for even more time saving. From individuals' choice of how to acquire the license, we derive several interesting and novel results.

We first show that, ceteris paribus, individuals acquiring licenses through either corrupt bureaucrats or intermediaries are better off than if corruption and intermediaries had not existed. Second, and importantly, we show that the incentives of bureaucrats to complicate license procedures and add red tape differ in models with intermediaries. Bureaucrats find it optimal to create more red tape when there are intermediaries. Third, we show that, when corrupt bureaucrats can choose their "optimal" level of complication of the government bureaucracy, individuals' net gain is unambiguously lower in a model with intermediaries than in a model with "direct" corruption only.

An additional contribution of the paper is that we endogenize the existence of the intermediary sector. Whether the sector arises or not, the degree of competition within the sector, the effect on individuals' gain from licensing, and bureaucrats' "optimal" choice of the amount of red tape is analyzed in a model with endogenous entry and oligopolistic competition between intermediaries. We show that as long as entry costs into intermediation are not too high and when bureaucrats are free to choose the level of red tape, the intermediary sector exists, license procedures are longer and individuals are unambiguously worse off, than without intermediaries.

In order for citizens to acquire a license from the government bureaucracy, a number of steps typically have to be completed, involving visits to several offices, standing in line, making different payments, etc. As long as the costs to acquire the license are smaller than the benefit obtained, individuals will optimally choose to get the license. The lower the cost, the better off individuals will be. Importantly, any reduction of license costs will make available a surplus that would otherwise be lost, for instance in queuing, waiting, going between different offices, etc., as well as on the extensive margin where some individuals possibly switch from "informality", into getting the license.[1]

[1] In section 2, we document evidence on the prevalence of bureaucracy intermediaries in different parts

Consider bureaucrats that are interested in capturing the surplus associated with reducing individuals' license costs. Apart from legitimate license fees, individuals face other costs, such as monetary costs for transport, and time costs of queuing, waiting and going to the offices. It is bureaucrats' removal of these time costs, against payments from individuals, that is the focus in this paper. The model is inspired by the fact, especially true in developing countries, that individuals and firms getting licenses typically have to spend considerable amounts of time in completing license procedures, including visiting multiple government offices at different locations and at different points in time.[2] We refer to the reduction in such time costs as "speed money corruption" for which individuals pay "bribes" to bureaucrats. We take the principal-agent relationship between bureaucrats and the government as given, assume that bureaucrats can pocket the bribes charged, and focus on bureaucrats' optimal choice of such bribes.

The time costs can be broadly categorized as either one of the following two types: those that bureaucrats directly control and can affect, such as waiting times in lines and processing times of applications within the office, and those that bureaucrats cannot directly control, such as the time that individuals spend in transporting themselves between different offices of the bureaucracy.

Paying a bribe to a bureaucrat to speed up the handling of the procedure, is a typical example of the first category. In a Brazilian survey of entrepreneurs' costs and experiences to register a firm in the garment industry, 40 percent of firms affirm that "speeding up" the registration procedure is possible (Zylbersztajn et al. [49]). In a related paper, Zylbersztajn and Graça find evidence of firms' "exposure to bribes solicited to accelerate the process" [50, p. 14]. Gancheva [18] discusses similar practices at firm start-up in Bulgaria. Queuing times inside the office is another time cost that bureaucrats can affect, by accepting bribes to let individuals jump queues. Even when paying for such "services", the license applicant typically has to complete the same steps as a regular applicant. What the intermediary function does however, is to also reduce costs that bureaucrats cannot directly control, further shorten the time individuals spend in licensing and to eliminate steps that the individual has to undertake. This may include handing in- and picking up the application at the different offices of the bureaucracy, undertake the necessary payments, assisting when the applicant fills in application forms, take care of paperwork, and deliver the completed license/certificate to the applicant. The applicant saves on transportation costs, both the monetary cost and the time involved, and also economizes on time spent to find out exactly how the procedure works.

An individual can thus bribe corrupt bureaucrats to avoid some time costs, or use an intermediary (that in turn pays bureaucrats), avoiding a larger fraction of time costs.

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of the world. Both individuals and firms use such intermediaries. The specific model in this paper is one of individuals' demand for intermediaries, a demand derived from time saving aspects. However, the model can be broadly interpreted to concern also firm demand for intermediaries.

[2] de Soto [14] reported that starting a firm in Peru involved 11 different steps at 7 different government authorities. The procedure to obtain legal authorization to build a house on state-owned land involved 15 different steps at 6 different authorities, which in turn consisted of a total of 207 sub-steps at approximately 50 (sub-) offices/counters/desks. As reported in de Soto [15], the formalization of property, or similar procedures, involved 168 steps in the Philippines, 77 in Egypt and 111 in Haiti. Since the writings of de Soto, the Doing Business project at the World Bank has documented procedures for starting firms, registering property, getting credit etc., in a large number of countries. For the very same procedure, the number of offices to be visited, monetary costs, as well as time costs, tend to be significantly higher in the developing world, compared to developed countries (Djankov et al. [16], World Bank [47]).

We introduce, in section 3, a model with three players: individuals, bureaucrats and intermediaries. Individuals can acquire a government license in three ways: through the regular procedure, by "direct" bribing, which eliminates some time costs, or through intermediaries, which eliminates all time costs. Intermediaries, which in turn pay "indirect" bribes to bureaucrats, maximize profits from license fees, and bureaucrats maximize profits from direct and indirect bribes.

We first use the model to study the effect of bribing and intermediaries on individuals' license gain for an exogenously specified license procedure. Because we study endogenous intermediary entry and emergence of the sector itself, the paper provides new insights into when such services can be expected to exist.

Many authors, e.g. Lui [32], de Soto [14], Rosenn [38], Tanzi [43] and La Porta et al. [28], have hypothesized that bureaucrats deliberately create extra bureaucratic hurdles, or red tape, in order to extract bribes and, in addition, some have argued that such proceeds are channeled through intermediaries (Bertrand et al. [5]). As expressed by Rosenn, citing a typical Brazilian complaint regarding civil servants and the need to go through time consuming red tape; "êles criam dificuldades para vender facilidades (they create difficulties in order to sell facilities)" (Rosenn [38, p. 535], translation from original). In actual license procedures, we often observe that a multitude of offices have to be visited, documents should be stamped and certified, individuals have to visit the same bureaucrat several times and have to deliver and pick up papers at an office on different days and times with varying opening hours, etc.

Inspired by such evidence, we then let bureaucrats choose not only the level of the bribe but also the length/complexity of the license procedure. We thus have in mind corrupt bureaucrats that either have discretion over the actual license procedure implementation, or that lobby against legislators with such influence, or that channel corruption proceeds to supervisors in order to influence the procedure complexity. In doing this analysis, we assume "centralized corruption" (Shleifer and Vishny [39]). All corrupt bureaucrats take one joint decision on bribe levels (and the length of the procedure). In our central result concerning red tape (proposition 5, a special case of which is corollary 2), we show that there is more red tape and that individuals are unambiguously worse off when the intermediary sector exists, than when there is "direct corruption" only.

The paper proceeds as follows: Section 1.1 discusses related literature and section 2 presents stylized facts about bureaucracy intermediaries. Section 3 presents the model. Section 4 discusses the results. Proofs to section 3 are in the appendix.

1.1. Relation to literature on corruption and intermediaries

In this paper, corruption means "speed money". The modeling choice is different from many recent papers in the corruption literature. In this literature, a typical question is how the existence of corruption - which arises from a principal/agent relationship - affects the allocation of (scarce) government benefits/licenses/permits, and where the social benefit of allocating the permit to some (deserving) individuals is higher than allocating it to other (undeserving) individuals. In such settings, corruption means accepting bribes to let undeserving/unqualified individuals obtain benefits. Banerjee et al. [3] provide a framework for studying the effects of corruption and the emergence of red tape in such settings. Bertrand et al. [5] document that in Delhi, India, using an intermediary/agent is the way to get a driving license without actually learning how to drive. The papers by Hasker and Okten [20] and Bose and Gangopadhyay [7] provide a theoretical framework for the role of intermediaries as observed by Bertrand et al. [5].[3] The result from this type of corruption is individuals with driving licenses but without proper driving skills. It involves a social cost which is not present in, and not the purpose of, the analysis in this paper.

In our model, all applicants are "deserving". The cost involved in the allocation of licenses is instead time costs at the bureaucracy. Bureaucrats always do their job, in terms of making sure that individuals fulfill the necessary regulation. This is similar to what was termed "corruption without theft" by Shleifer and Vishny [39]. However, outright extortion is ruled out. Extortion refers to the case when bureaucrats charge for doing their job at all and an individual has to pay an illegal fee in order to get a document that he/she is legally entitled to. Differently, in the case of "speed money", the option to stand in line the regular way still exists and the individual thus has the choice to not bribe. This differentiates "speed money" from "corruption without theft".[4]

This paper extends the results of Lui [32], who analyses the "Myrdal hypothesis", i.e. if bureaucrats have an incentive to slow down service [34]. In Lui's model, the bureaucrat awards a license in a one-step procedure. The bureaucrat chooses a speed of service, i.e. how fast he works with each application, that is neither too fast - which would leave individuals queuing with too much surplus, nor too slow - which would make individuals choose to not queue (and bribe) at all. In our model, bureaucrats do not choose a speed of service but can instead affect the procedure length, and we add intermediaries to the analysis. The important additional insight from our analysis of endogenous red tape is that, with intermediaries, procedures are unambiguously longer and individuals are unambiguously worse off, compared to a model with "direct" bribing only.

2. Stylized facts about bureaucracy intermediaries

Different types of intermediaries assisting with bureaucratic contacts are common throughout the developing world. Myrdal [34] documents their existence in India and Oldenburg [35] goes further with a more formal account of the role of intermediaries in a land consolidation program in Uttar Pradesh. Oldenburg identifies different roles of intermediaries within and outside the bureaucracy and details the functions of "brokers", "touts", "scribes", "consolidators", "helpers" and "barkers" within the land consolidation program. Levine [29] documents the existence of intermediaries in the interface between the Ghanaian bureaucracy and firms and individuals.

[3] Hasker and Okten [20] analyze the impact from intermediaries on the degree of socially beneficial regulation that is followed, when some bureaucrats accept bribes to reduce regulation for individuals. Similarly, Bose and Gangopadhyay [7] analyze the effects of intermediaries on the amount of undeserving applicants that obtain licenses. In these models, the intermediary has an informational advantage over individuals, in that he knows which bureaucrats are willing to bend the rules (or accept undeserving individuals). This provides a clear rationale for individuals to use intermediaries. Hasker and Okten [20] find that traditional means of combating corruption are less effective, and can even be counterproductive, when there are intermediaries. Bose and Gangopadhyay [7] find, unsurprisingly, that the amount of undeserving applicants increases when there are intermediaries. In addition, in their model with endogenous queue lengths at counters, under certain conditions, not only undeserving but also deserving individuals will find the service of an intermediary valuable, in locating corrupt (honest) bureaucrats.

[4] It should be noted, however, that the difference between the two becomes less distinct when we introduce endogenous red tape, as this is a means to make procedures more complicated for applicants.

The prevalence of despachantes, used in bureaucratic contacts in Brazil, is documented by Rosenn [38] and, from a sociological and anthropological viewpoint, by DaMatta [12, 13]. Lawyer and legal thriller author John Grisham describes the Brazilian despachante as a "facilitator extraordinaire" that "is an integral part of Brazilian life" [19, p. 376]. In a comprehensive study entitled "Brazil is not for amateurs", Castor describes the despachante (or "dispatcher") as "a popular mediator of the relationships between the population and the state" [8, p. 79]. When studying the formalization of firms, Stone et al. [41], Zylbersztajn and Graça [49] and Zylbersztajn et al. [50] provide evidence that using intermediaries is the most common way to formalize a firm in Brazil. Husted [21] describes how "coyotes" help individuals obtain drivers' licenses in Mexico. Such coyotes are an example of "tramitadores", a more general and widely used term for (mostly) informal intermediaries present in most of (Spanish-speaking) Latin America, assisting individuals and firms with bureaucratic procedures ("tramites"). Proética [37] documents, for Peru, the degree of individuals' usage of tramitadores in different bureaucratic contacts. Lambsdorff [27] refers to tramitadores helping out with the bureaucracy in El Salvador. Examples of reports documenting the use of such intermediaries by firms, at formalization are CIET [10, 11] and IFC [23] for Bolivia, CIEN [9] for Guatemala, IFC [24] for Honduras and IFC [22] for Peru.[5] Gancheva [18] and Yakovlev and Zhuravskaya [48] document the use of intermediaries by firms in Bulgaria and Russia, respectively.

Although none of the papers above, with the possible exception of Oldenburg [35], is a specific study of intermediaries, they point at the different functions performed. In some settings, the main reason why individuals use bureaucracy intermediaries seems to be the intermediary's knowledge of how license procedures actually work. In many countries with large and non-transparent bureaucracies, actually finding out what is required in order to get, say, a passport, is a challenge in itself. Rosenn writes: "The despachante functions effectively because he knows how to fill out the bewildering variety of forms, to whom the copies should be delivered, and what documentation will be required" [38, p. 537]. Honduran firms claim that they use tramitadores, at formalization, because of lack of unified information from the authorities regarding the procedure (IFC [24]). The same holds in a small sample of micro-enterprises in Guatemala (CIEN [9]). For Bulgarian firms obtaining an operations permit, "the procedures are not clear, nor are they easily accessible to potential licenses applicants" (Gancheva [18, p. 22]).

Time-saving in license procedures is a related reason why individuals and firms use intermediaries. The World Bank Enterprise Surveys on senior management time spent in handling government regulation requirements confirm that there is a large variation between different parts of the world. Whereas the high-income OECD average is 4.2% of a work week, the world average is 9.8% and the Latin American/Caribbean average is 12.7% [46]. Another World Bank report, studying a few Latin American countries, showed similar values [45]. The numbers confirm earlier work by de Soto [14].

By frequent interactions, bureaucracy intermediaries learn how to handle the procedures at the government offices and can solve matters faster than a particular individual or firm. The processing of many applications at the same time and having personal relations with bureaucrats are additional reasons why intermediaries possess a "superior technology". As a result, the intermediary's cost for acquiring licenses is lower.

[5] Another generic name, used in some parts of (Spanish-speaking) Latin America, is "gestor".

Furthermore, Stone et al. [41] and Zylbersztajn and Graça [50] indicate that firms use intermediaries to become formal because these act much like "one stop shops". The time-saving achieved by using intermediaries thus consists of two parts: for intermediaries at the bureaucracy itself and for firms by eliminating the need to visit multiple offices. These two time-saving components are made explicit in the model in this paper.[6]

Before proceeding with the formal analysis, and to better understand bureaucrats' incentives to create red tape, we need to discuss the bureaucrat-intermediary interaction and why bureaucrats are able to capture all or some of the rents of intermediaries. An intermediary handles applications at the government bureaucracy, representing license applicants and acting on their behalf. It typically handles several applications from different applicants at the same time. These two features make the intermediary easily identifiable as an intermediary proper. Think of an intermediary that represents individuals applying for personal documents or entrepreneurs registering their business, where the intermediary will carry the IDs and other documents of the applicants, at the bureaucracy. If it is at the discretion of the bureaucrat to decide whether and how to handle intermediaries' applications, this means that the bureaucrat possesses bargaining power vis--vis the intermediary and can capture part of the surplus associated with the intermediation activity. As this activity is typically informal, neither illegal nor strictly regulated, bureaucrats will have some discretion in their transactions with intermediaries. Even if the intermediary function were completely legal and formalized, which is not the standard case, there would be some scope for bureaucrats to decide how many intermediary applications to accept, and how promptly to go about in handling them.[7]

An example of bureaucrat-intermediary interaction is from Brazil in general, and the State Department of Transit (DETRAN) in São Paulo in particular. At these offices, "despachantes" (bureaucracy intermediaries) typically resolve vehicle-related errands for a number of individuals at the same time, representing each one of them in their interaction with the authority. There is abundant anecdotal evidence that such despachantes typically do not stand in lines, about the hand-over of "gifts" to bureaucrats, but also that there are systems in place that enable despachantes to achieve time saving not available to individuals. More specifically, despachantes have access to some of the information systems and computerized registries of the bureaucracy. Whereas an individual has to undertake one extra step, e.g. go to an office to get a register excerpt, the despachante can handle the same step from its office without going physically to the bureaucracy. With

[6]From the supply side, a possible argument for the existence of bureaucracy intermediaries is that the government allows them to exist as a means of helping individuals and firms going through bureaucratic procedures. Such intermediaries then become a "second best" option in societies where the government can do little to reform its bureaucracy. Another supply-side argument explaining their existence may be that intermediaries are easier to work with for bureaucrats because they "always have their papers in order". That is, the cost of handling applications from intermediaries is lower. Bureaucrats would then be able to serve more customers of the bureaucracy in less time, which would be socially beneficial.

[7]As a theoretical case one could imagine a law stipulating that intermediaries are completely legal and can represent individuals at the bureaucracy, no upper limit on the number of applications that can he brought to the bureaucracy and intermediaries having very low-paid "office boys" standing in lines. This would make it difficult for bureaucrats to capture any of the surplus associated with the intermediation activity. It is interesting to note that the Brazilian bureaucracy reform "Poupatempo", discussed in section 4, not only prohibits intermediaries but also makes it necessary for applicants to get a new appointment number for each new errand [36].

such access, which is the result of a very close cooperation between the bureaucracy and despachantes, these intermediaries possess a true time-saving device.

Overall, there is evidence, also from other countries than Brazil, that intermediaries work in close collaboration with bureaucrats or that intermediaries are even former bureaucrats. Fjeldstad [17] presents evidence that a crack-down on corruption at the tax authority in Tanzania had the effect that fired bureaucrats instead started working as intermediaries, using their previous corruption networks. In Russia, Ankarcrona [1] reports that "customs brokers" are typically former customs employees. Bertrand et al. [6] find evidence that "agents" that help individuals to get a driver's license in India work in collaboration with bureaucrats to circumvent regulation.

3. A model of time-saving, corruption, intermediaries and endogenous red tape in licensing

Consider a government license that brings a benefit of the value g to any individual. Acquiring the license means going through a procedure at the government bureaucracy, consisting of n identical steps. Each step of the procedure consists of one visit to the government bureaucracy, where the individual interacts with a bureaucrat who is a monopolist in this step. The individual pays the official fee and then proceeds to the next step of the procedure. The bureaucracy's cost of completing the procedure for an individual consists of two parts. The first part, constant throughout the paper, is the cost that the bureaucracy faces in undertaking the controls associated with awarding the license, for instance checking relevant criminal and tax records, etc. We can think of it as deducted from individuals' license gain, such that g represents the gain of the license after socially relevant controls have been undertaken. The second cost, p per step of the procedure, is the bureaucracy's administrative cost of handling each application at each office. The monetary cost of the license is thus np, which is also the official license fee.

Each step of the procedure is also associated with a time cost. Individuals, indexed by i, differ in A_i, the (per step) opportunity cost of time. Let A_i, which we will also refer to as "productivity", be uniformly distributed on the unit interval, $(0 \leq A_i \leq 1)$, and let the total measure of individuals be 1.[8] Total license costs to individuals are $np + nA_i$, and the net gain is $g - (np + nA_i)$. If the regular procedure were the only means to acquire the license, all individuals would get it as long as the gain for the $A_i = 1$ -individual is positive (i.e. for $n \leq \frac{g}{p+1}$). Demand would then fall as n grows, and equal zero at $n_{max} = \frac{g}{p}$, which is the maximum procedure length of interest in the model.

As a second option, individuals can acquire the license by bribing. For each of the steps the individual pays a bribe (instead of p), whereby time costs are reduced by a fraction α, with $0 \leq \alpha < 1$. The gain that individuals can realize from bribing is thus proportional to α. We assume that bureaucrats can not price discriminate between individuals with different opportunity costs of time. This is a central assumption, which is maintained throughout the paper. Let the total bribe paid be B, such that the net gain that individuals derive from the license becomes $g - (B + (1 - \alpha)nA_i)$.

The third option to acquire the license is through intermediaries. The intermediary is a "one stop shop", where individuals can obtain the same license as through the regular

[8] In the last section of the appendix, we discuss the validity of the main results for other distributions.

procedure or bribing. We assume that using an intermediary eliminates all bureaucracy-related time costs for individuals, and that there are no time costs in the interaction with the intermediary. Individuals pay intermediaries a fee d, and obtain the license, realizing a net gain of $g - d$. Intermediaries, in turn, acquire the license from the bureaucracy by paying a bribe B_d to bureaucrats (we refer to this as "indirect" bribes). Bureaucrats cannot price discriminate between intermediaries. Apart from B_d, intermediaries have no other costs at the bureaucracy (in particular, no time costs). Intermediaries maximize profits and cannot price discriminate between individuals. Bureaucrats set B and B_d to maximize profits from direct and indirect demand, incurring license costs np. We use the assumption of centralized corruption (Shleifer and Vishny [39]). Bureaucrats take one joint decision on B and B_d and split the revenue equally between them.[9]

The existence and size of the intermediary sector is determined within the model. We use a standard Cournot model of oligopolistic competition between identical intermediaries. This provides us with a setting in which the intermediary fee entails a mark-up over costs B_d, a mark-up that decreases as competition increases. The number of intermediaries, defined as m, is determined by a zero net-profit entry condition.[10] More specifically, the cost to enter is f per step of the license procedure, i.e. a total cost of nf, which is also the profit each intermediary will make. With this specification, entry costs reflect the fact that the longer the procedure, thus involving contacts with more bureaucrats and offices, the more costly it is for a prospective intermediary to learn.[11]

The timing is as follows: Bureaucrats choose, in turn, through which means to accept bribes (direct only, direct and indirect, indirect only), the optimal length of procedures n (in case we study endogenous red tape, else n is fixed), and bribes B and B_d. Given bribes, and if $B_d \neq \emptyset$, a number $m \geq 1$ of intermediaries will simultaneously and symmetrically decide to enter and set a license fee d, determined through Cournot competition, such that each entrant makes zero net profits. Third, individuals, taking B and d as given, choose if and through which means to get the license. A subgame perfect equilibrium is derived by backward induction: direct and indirect license demand is derived, the profit maximization problem of intermediaries is solved, bureaucrats choose B and B_d by solving the profit maximization problem for a given n, the optimal n is derived (in case of endogenous n), and, bureaucrats choose through which means to accept bribes.

In section 3.1 we solve the subgame in which bureaucrats only accept direct bribes. This section brings out the main intuition with respect to time costs, license procedure lengths and individuals' license gain. In section 3.2, the bribe and intermediary subgame is solved and in 3.3 we determine, for each combination of n and f, in which of these subgames bureaucracy profits are largest. This determines allocations, profits in optimum, whether intermediaries exist, and the size of the intermediary sector (if it exists). With more instruments/bribes/choices available to bureaucrats, and as also discussed by Hasker and Okten [20], we should expect the largest profits in the bribe and intermediary case, unless some constraint binds. The third subgame, i.e. the intermediary only case, in which bureaucrats only accept indirect bribes, is optimal only for a very limited parameter space and is placed in the appendix. In section 3.4 we analyze red tape.

[9] Adding a small time cost for individuals when using intermediaries, or for intermediaries at the bureaucracy, would not change the qualitative results of the paper.

[10] To avoid analytic complexity we let m be a continuous variable. Intermediaries exist iff $m \geq 1$.

[11] Constant entry costs, as opposed to nf, are discussed at the end of section 3.3.

3.1. Direct corruption only

Consider the choice of individuals of how to get the license when they can either bribe, or get the license the regular way. Bribing will imply a higher net gain if

$$g - (B + (1-\alpha)nA_i) \geq g - (np + nA_i) \quad \text{i.e. if} \quad A_i \geq \frac{B - np}{\alpha n} \tag{1}$$

Individuals with productivity above this threshold level thus prefer bribing. An additional threshold is relevant if n is large. The official procedure then becomes prohibitively costly, and more so the higher is A_i. The choice for such individuals is instead between bribing and not getting the license at all, i.e. to get the license if the net gain is positive:

$$g - (B + (1-\alpha)nA_i) \geq 0 \quad \text{i.e. if} \quad A_i \leq \frac{g - B}{(1-\alpha)n} \tag{2}$$

Only individuals below this productivity level will choose to get the license at all. This latter condition on A_i thus binds if it is less than 1, the highest productivity level. With A_i uniformly distributed, total license demand, through bribing, is $\text{Min}\{1, \frac{g-B}{(1-\alpha)n}\} - \frac{B-np}{\alpha n}$.

Now consider bureaucrats' optimal choice of B. Taking a joint decision on the bribe level B, and facing total costs of np, bureaucrats maximize bribe profits,

$$\begin{aligned} &\underset{B}{\text{Max}}\ \pi = (B - np) \times (\text{Min}\{1, \frac{g-B}{(1-\alpha)n}\} - \frac{B-np}{\alpha n}) \\ &\text{s.t. } B \leq (1-\alpha)np + \alpha g \end{aligned} \tag{3}$$

The constraint assures that demand for bribing does not become negative. As indicated above, the solution to the problem depends on the length of the procedure n:

$$B^*(n) = \begin{cases} np + \frac{\alpha n}{2} & \text{if } 0 < n \leq n_1^* = \frac{g}{p+1-\frac{\alpha}{2}} \\ g - (1-\alpha)n & \text{if } n_1^* < n \leq n_2^* = \frac{g}{p+1-\frac{\alpha}{2-\alpha}} \\ np + \frac{\alpha(g-np)}{2} & \text{if } n_2^* < n \leq \frac{g}{p} \end{cases} \tag{4}$$

We refer to these cases as small-, middle- and large-n, with profits π_s, π_m and π_l.

- For small values of n, the optimal bribe is such that individuals with productivity above $A_i = 1/2$ choose to bribe (plug in $np + \frac{\alpha n}{2}$ in expression 1). Individuals with lower productivity get the license through the regular procedure. The mark-up over costs np that bureaucrats charge, i.e. $\frac{\alpha n}{2}$, is proportional to individuals' gain from bribing.
- In the middle-range, the optimal bribe is such that the highest-productivity individual ($A_i = 1$) is indifferent between bribing and not getting the license at all, i.e. we have $1 = \frac{g-B}{(1-\alpha)n}$. This implies that the optimal bribe level will decrease as n increases and that also individuals with productivity below $A_i = 1/2$ will bribe.
- For large n, bribes will again increase with n and the mark-up is proportional to $g - np$, the gain of the license minus costs that bureaucrats always incur. High-productivity individuals can no longer afford the license and low-productivity individuals increasingly switch to bribing as n increases. Both the lower- and upper threshold converge to zero as $n \to n_{max}$, a license procedure length at which no individual can afford the license.

3.1.1. License allocations and individuals' gain

In figure 1 the license allocation in the case of bribing (solid lines) is compared to the benchmark case when only the regular procedure exists (dot-dashed line). The graph displays (the upper solid line) the amount of licenses awarded for each n, and through which means it was awarded. For the analysis to follow, define as G the aggregate net license gain that individuals obtain, i.e. the sum of net gains from licenses awarded through the regular procedure, bribing and (for the sections to come) through intermediaries:

Definition 1.
$$G \equiv \int_{Bureaucracy}(g-np-nA_i)\mathrm{d}A_i+\int_{Bribe}(g-B-(1-\alpha)nA_i)\mathrm{d}A_i+\int_{Intermediary}(g-d)\mathrm{d}A_i$$

In these integrals, the integration limits depend on n. In the present section, there is only the first two terms. It is clear from figure 1 that the amount of licenses awarded is greater when the bribe option exists. As some individuals *choose* to bribe, and given that there is always the option to use the regular procedure, G must be larger in the bribing case. This is formalized in proposition 1.

Proposition 1. *The aggregate net license gain G is larger when the option to bribe exists, than if there is only the regular license procedure. No individual is worse off and some individuals are strictly better off. This holds irrespective of parameter values.*

All individuals that bribe, and there will be some such individuals due to bureaucrats' profit maximization, will be better off than when the bribe option did not exist. In addition, the higher productivity an individual has, the larger is the gain from bribing, compared to using the regular procedure (because bureaucrats cannot price discriminate). Proposition 1 thus states that corruption is good: the possibility to pay "speed money" means that (some) individuals get the license at a lower total cost. It is a formalization of the "grease the wheels" view of corruption (see e.g. Bardhan [4] and Svensson [42]).

Intuitively, individuals should have a higher net gain G the higher is α, as they get a fraction of the surplus associated with reducing time costs. As stated in the following proposition this is indeed the case, except in the middle n-range.

Proposition 2. *The aggregate net license gain G increases with the fraction α of time costs that bureaucrats can remove, for license procedure lengths $n < n_1^* = \frac{g}{p+1-\frac{\alpha}{2}}$ and $n > n_2^* = \frac{g}{p+1-\frac{\alpha}{2-\alpha}}$, i.e. $\frac{\partial G}{\partial \alpha} > 0$. For intermediate license procedure lengths, $\frac{\partial G}{\partial \alpha} < 0$.*

Proof. See the appendix. □

For both small and large n, the optimal bribe is such that a constant fraction of the surplus associated with time saving can be captured. This is because bureaucrats cannot price discriminate. An increase in α implies a higher surplus to be divided between bureaucrats and individuals, we thus have $\frac{\partial G}{\partial \alpha} > 0$. In the middle-$n$ region, the individual with $A_i = 1$ will get an additional time saving of $(\Delta\alpha)nA_i = (\Delta\alpha)n$ as α increases. The bribe, $g - (1 - \alpha)n$, is increased accordingly, and bribing individuals with $A_i < 1$ are therefore worse off. In what follows, we return to the α-dependence in detail.

3.1.2. Endogenous red tape and individuals' gain from licensing

Thus far, we have considered the problem that bureaucrats face when maximizing revenue from "speed money", *given* a license procedure. That is, the implementation of the license procedure, i.e. the exact number of checks and controls, documents to be filled in, stamps to be obtained etc., represented by n, has been exogenously determined. However, if bureaucrats can affect the way in which the license procedure is implemented, the analysis changes significantly. As motivated in the introduction, we take the view that corrupt bureaucrats, while still obeying all rules and performing all relevant checks related to awarding the license, are free to choose how the procedure is implemented. That is, bureaucrats choose the number of steps n of the procedure. In making this choice, the administrative costs of handling applications, i.e. np, are incurred.

Figure 2 shows bureaucracy profits π (solid, inverted U) and individuals' gain G (dot-dashed) from the optimal solution in (4). The sum of π, G and aggregate time costs incurred by individuals is also shown (upper solid curve). As long as all individuals get the license, these three terms must sum to $g - np$. The figure suggests that bureaucracy profits are maximized in the middle-n region (indicated between the two adjacent markers on the horizontal axis). To show this formally, we solve the profit maximization problem in (3), the only difference being that n is now a choice variable. Bureaucrats thus solve

$$\begin{aligned} &\underset{B,n}{\text{Max}}\ \pi = (B - np) \times (\text{Min}\{1, \frac{g-B}{(1-\alpha)n}\} - \frac{B-np}{\alpha n}) \\ &\text{s.t. } B \leq np + \alpha(g - np) \end{aligned} \tag{5}$$

The problem has a solution only for $1 = \frac{g-B}{(1-\alpha)n}$, as profits are strictly increasing or decreasing in n, for small- and large n, respectively.[12] We get

$$B^* = g - (1-\alpha)n^*, \quad n^* = \frac{g}{\sqrt{(1+p)(1+p-\alpha)}} \tag{6}$$

The first thing to note about the solution is that not only optimal bureaucracy profits π^* (obtained by plugging in B^* and n^* in expression 5), but also the optimal length of the procedure, n^*, increases in α. This is because bribing individuals can realize higher gains from the license as α increases, which in turn allows bureaucrats to increase the length of the license procedure and thereby the surplus related to time saving that can be extracted from individuals. Thus when corrupt bureaucrats can provide larger reductions in time costs for individuals, it is optimal to make procedures longer. Second, by plugging in (B^*, n^*), and the corresponding threshold between the regular procedure and bribing, in the expression for G in definition 1, we get that the aggregate individual gain at the "optimal" procedure length is decreasing in α. We summarize these results below:

Proposition 3. *Bureaucracy profits π^*, and the license procedure length that maximizes bureaucracy profits, n^*, increase in α, the fraction of time costs bureaucrats can remove. At n^*, individuals' aggregate license gain $G(n^*)$ instead decreases in α, i.e. $\frac{\partial G(n^*)}{\partial \alpha} < 0$.*

Proof. See the appendix. □

[12] The first order condition w.r.t. B is as in (3). We first solve (3), then maximize profits w.r.t. n.

For individuals that do not bribe, it is clear that the increase in n makes them worse off. The result that also bribers are worse off is because, at n^*, the individual with the highest opportunity cost of time is indifferent between bribing and not getting the license at all. As α is increased, this individual gains the most. The subsequent increase in n^* needed to make this individual again indifferent, implies that all other bribing individuals will be worse off, as their initial gain from increasing α was smaller. The result follows from the lack of price discrimination. The result from proposition 1, that introducing "speed money" corruption increased individuals' license gain, is thus unambiguously reversed by proposition 3, i.e. when the license procedure length n is endogenous.

Although we have not yet introduced intermediaries, proposition 3 indicates what the impact will be: There will be more red tape, and individuals will be worse off. Increasing α means more time saving, which is similar to introducing intermediaries.

3.2. Bribe and intermediary model

We now discuss the subgame in which individuals can either bribe or use an intermediary, in addition to the regular procedure. The threshold between the regular procedure and bribing is as in (1). Individuals instead prefer intermediaries over bribing if

$$g - d \geq g - (B + (1-\alpha)nA_i) \quad \text{i.e. if} \quad A_i \geq \frac{d-B}{(1-\alpha)n} \tag{7}$$

As it can never be optimal to have an intermediary fee larger than g, high-productivity individuals will always acquire the license, irrespective of n ($\leq n_{max}$). This is different from the model in section 3.1, and comes from the assumption that there are no remaining time costs (and that we assume that individuals indifferent between informality and getting the license will acquire it). We can thus write the demand for intermediaries as $Q_d = 1 - \frac{d-B}{(1-\alpha)n}$, and the demand for bribing as $Q_B = \frac{d-B}{(1-\alpha)n} - \frac{B-np}{\alpha n}$.

3.2.1. Intermediaries' entry decision and choice of optimal fee

We use Cournot's model of oligopolistic competition to model the intermediary sector. Upon entry, an intermediary makes a quantity choice q, taking the quantity of the other $(m-1)$ intermediaries, defined as $(m-1)\tilde{q}$, as given. With $Q_d = q + (m-1)\tilde{q}$, we can solve for the indirect demand function $d(q)$, which is used in the profit function $q \times (d(q) - B_d)$, to get the individual intermediary's profit maximization problem:

$$\underset{q}{\text{Max}}\ q \times ((1-\alpha)n + B - (1-\alpha)n(q + (m-1)\tilde{q}) - B_d) \tag{8}$$

Solving for q as a function of $\tilde{q}$, then applying symmetry between intermediaries, the optimal q is plugged back into $d(q)$ to get $d(B, B_d, m) = \frac{1}{m+1}((1-\alpha)n + B) + \frac{m}{m+1}(B_d)$. This response function captures the standard feature of Cournot competition, i.e. a mark-up over cost B_d that gradually declines as the number of intermediaries, m, increases. The second condition that determines the intermediary sector response functions is that per-intermediary profits, i.e. $\frac{1}{m}(d - B_d)(1 - \frac{d-B}{(1-\alpha)n})$, should equal entry costs nf. Solving for m and the pricing rule d as functions of the bureaucracy bribe levels, we get:

$$m(B, B_d) = -1 + \frac{n(1-\alpha) - (Bd - B)}{n\sqrt{f(1-\alpha)}},\ d(B_d) = B_d + n\sqrt{f(1-\alpha)} \tag{9}$$

The number of intermediaries, m, increases in the direct bribe B and in $(1-\alpha)$, the additional gain of using an intermediary compared to bribing, and decreases in the indirect bribe B_d and in entry costs f. In addition, m is constant if bribe levels are proportional to n. Similar to the bribe-only solution in (4), we will get such a small-n case also with intermediaries. For larger n, with B_d constrained by the condition that the intermediary fee cannot exceed g, the number of intermediaries will instead increase in n.[13]

3.2.2. Bureaucrats' choice of bribe levels

Bureaucrats choose B and B_d to maximize profits from direct- and indirect demand:

$$\underset{B,B_d}{\text{Max}}\ \Pi = (B-np)\times\left(\frac{d(B_d)-B}{(1-\alpha)n}-\frac{B-np}{\alpha n}\right)+(B_d-np)\times\left(1-\frac{d(B_d)-B}{(1-\alpha)n}\right)$$
$$\text{s.t. } d(B_d)\leq g,\ m(B,B_d)\geq 1,\ B\leq(1-\alpha)np+\alpha d(B_d) \tag{10}$$

The constraints correspond to that intermediary fees can never exceed g, that at least one intermediary enters, and that demand for bribing Q_B does not become negative.

A special case: Free entry into the intermediary sector

To illustrate what the effect from introducing intermediaries will be, we first study the free entry case. We present the results in two corollaries to propositions 1 and 3. With $f=0$, the intermediary sector is large, in fact $m\to\infty$ (from 9). Each intermediary sets a fee $d=B_d$, i.e. there is no mark-up. With $f=0$, the solution to (10) is

$$\begin{cases} B^*(n)=np+\frac{\alpha n}{2}, B_d^*(n)=np+\frac{n}{2} & \text{if } 0\leq n\leq n_1^{**}=\frac{g}{p+\frac{1}{2}} \\ B^*(n)=np+\alpha(g-np), B_d^*(n)=g & \text{if } n_1^{**}\leq n\leq\frac{g}{p}\end{cases} \tag{11}$$

With $f=0$, all bribes are channeled through intermediaries, seen by plugging in $B^*(n)$ and $B_d^*(n)$ in Q_B, which becomes zero. The surplus associated with using intermediaries is larger than when bribing, and there are no "losses" of this surplus due to intermediary sector entry barriers. Similar to expression 4 there is a small-n case, in which individuals and bureaucrats split the surplus related to the time cost reduction. For large n, the regular procedure becomes prohibitively costly and bureaucrats can extract all the surplus from individuals that use intermediaries, by setting $B_d=g$.[14]

The aggregate of individuals is (at least weakly) better off than in the case with the regular procedure only, and no individual can be worse off. For large n, for which $d=g$ binds, individuals are indifferent. We get the following corollary to proposition 1:

[13]It can be inferred from (9) that neither the intermediary sector mark-up, nor per-intermediary demand, depend on the direct bribe level B. The free-entry condition gives that the mark-up $(d-B_d)$ could only increase if demand per intermediary decreased, whereas, with Cournot competition, an increase in the mark-up is instead associated with an increase in per-intermediary demand. The two conditions imply that it is the number of intermediaries that adjusts as B (and total intermediary sector demand) changes, not the demand per intermediary.

[14]For small n, bureaucrats set B and B_d such that the individual with $A_i=1/2$ is indifferent between the regular procedure, bribing, and using an intermediary. Individuals with $A_i<1/2$ thus go through the regular procedure, individuals with $A_i\geq 1/2$ use intermediaries. For large n, bureaucrats "shut down" the direct bribe option by setting a high B, thus channeling all bribers through intermediaries, and set $B_d=g$. Individuals with low A_i get the license through the regular procedure (these are the same individuals as would get the license had only the regular procedure existed), all other individuals use intermediaries and get zero surplus. As n approaches n_{max}, all individuals use intermediaries.

Corollary 1. *The aggregate net license gain G is (weakly) larger when the option to use intermediaries exists, than if the license can only be acquired through the regular procedure. No individual is worse off, and, for short license procedure lengths, some individuals are strictly better off. This holds irrespective of parameter values.*

We also get a corollary to the endogenous red tape result. In fact, we can use proposition 3 also in this section, because profits from (11) are equal to the profits we would get if setting $\alpha = 1$ in (4).[15] As we have already derived that red tape increased and individuals' gain decreased with α, and intermediaries correspond to $\alpha = 1$, we get:

Corollary 2. *There is more red tape, and individuals are unambiguously worse off, in the model with intermediaries, than with direct corruption only.*

Proof. See the proof to proposition 3. □

The more time saving that can be offered - with more time saving being possible when there are bureaucracy intermediaries - the stronger are bureaucrats' incentives to create red tape, the larger is the bureaucracy, and the worse off are individuals. This is a general result, and holds in a variety of settings: when some but not all bureaucrats are corrupt, when entry costs are positive and hence direct and indirect corruption coexist, and for different degrees of intermediary sector competition, as shown below.

The general case

The general solution to (10), given in (A.3) in the appendix, consists of a number of cases, which arise because of the constraints on d, m and Q_B. For small n and f, no constraints bind, and we get a solution where direct- and indirect demand is constant, and where B, B_d and d, as well as bureaucracy- and intermediary sector profits, increase linearly in n. This is similar to the small-n cases in (4) and (11). The intermediary fee will increase as the procedure length n increases, until $d = g$ is reached. As it can never be optimal to charge a higher fee, there will be an n-threshold above which $d = g$ always binds. Increases in f allows fewer intermediaries to enter, such that above a certain f-threshold, the $m = 1$-constraint binds. This entry cost threshold is constant for small n (at $f_1 = \frac{1-\alpha}{9}$), whereas, for longer procedure lengths it is a function of n. For large n and large f, the constraints on d and m both bind. There are thus four cases of the solution, for which direct bribing and intermediaries coexist.

For small n, there is an additional threshold (at $f_2 = \frac{1-\alpha}{4}$), above which only one intermediary can enter, and, in addition, the Q_B-constraint binds. There is no direct bribing, as this would take away demand and profits from the intermediary, which would then not be able to recover entry costs. Bureaucrats thus set B and B_d such that Q_B is exactly zero, there is one intermediary, and no direct bribing. As n increases, the Q_B-constraint is relaxed, and direct- and indirect bribing coexist, also for large f.[16]

A low α implies a big difference in time cost reductions between using an intermediary and bribing, resulting in a large intermediary sector. The opposite holds for high α.

[15] Plugging in $B^*(n)$ and $B_d^*(n)$ in the expressions in (10), we see that the solution does not depend on α (as all corruption is indirect). The solution in (4) holds algebraically also for $\alpha = 1$. It collapses to the small-n and middle-n ranges, with $n_1^* = n_1^{**}$, $n_2^* = \frac{g}{p}$, and B in (4) equals B_d in (11).

[16] Note that for each level of f, profits will be negative for n close enough to $n_{max} = \frac{g}{p}$ (this results from the existence of entry costs). For large enough f, profits will be negative also for small n. However, the solution to (10) will then not apply, because profits from the bribe only model will be larger.

3.3. Bureaucracy profits and existence of intermediaries

The final step in solving the model is to compare profits from sections 3.1 and 3.2. Proposition 4A characterizes the existence conditions of the intermediary sector.[17]

Entry costs f can be thought of as acting like a "loss" from the system, it is therefore the comparison of the extra profits bureaucrats can make when intermediaries exist, due to the larger time saving available to individuals, to the cost of "sustaining" the intermediary sector (through the effect of f on B, B_d and profits), that determines whether the sector exists. There are two entry cost thresholds which are important for the characterization of the existence of intermediaries, f_2 and f_{max}. The former is the threshold above which intermediaries never exist for the smallest n, the latter is the highest entry cost for which intermediaries will ever exist.

Proposition 4A. For f such that

$0 < f \leq f_2$, direct bribing and intermediaries coexist for small procedure lengths (below a threshold-n), and there is direct bribing only, for large n (above the threshold-n);

$f_2 < f \leq f_{max}$, there is direct bribing only, for small n, a lower intermediate range of procedure lengths n where there is intermediaries only, without direct corruption, and coexistence of direct bribing and intermediaries for an upper intermediate range of n. For large n, there is direct bribing only.

where: $f_2 = \frac{1-\alpha}{4}, f_{max} = \frac{8+4(2-\alpha)\sqrt{(1-\alpha)^5}-\alpha(24-\alpha(29-\alpha(17-4\alpha)))}{(8-\alpha(11-4\alpha))^2}$

Proof. See the appendix. □

Figures 3 and 4 display the solution graphically, for "typical" parameter values. In figure 3, three sets of graphs are shown, with a different entry cost f for each set of graphs (and with g, p, α kept constant). The upper panel in each set shows bureaucracy profits in the bribe and intermediary model (solid), and the lower panel shows m, the size of the intermediary sector. In each profit graph the profits from the bribe only model is also shown (this curve, dashed, remains the same in all three panels). In each m-graph the profit comparison is explicitly taken into account in that, for each n, bureaucrats' optimal choice will be whichever of the two settings (bribe and intermediary, or bribe only) that delivers the highest profits. Intermediaries will only exist if profits in the model with intermediaries are higher than in the bribe only case.

For low entry costs, $0 < f \leq f_1 = \frac{1-\alpha}{9}$, as depicted in panels A-B, and as was discussed in section 3.2, the constraint on m never binds and the intermediary sector is large. The size of the sector is constant for small n because increases in n, which always imply larger time saving for individuals when bribing/using intermediaries, result in bureaucracy bribes, an intermediary fee and bureaucracy and intermediary profits that increase linearly in n. As also entry costs increase linearly in n, the size of the intermediary sector is constant. For larger n, where the $d = g$ - constraint binds, the number of intermediaries increases with the length of the license procedure. The mark-up

[17] The intermediary only subgame, which is optimal only for a very limited subset of the parameter space, is placed in AppendixA.3, and its impact on the solution captured by proposition 4B.

in the intermediary sector increases linearly in n, but as d is constrained to equal g, the benefit of using an intermediary, and consequently demand for intermediaries, increases, which allows more intermediaries to enter (from expression 9).

As f increases, with $f_1 < f \leq f_2$, the constraint on m binds for small n, but is then relaxed (panels C-D). For small n, and as in panels A-B, bureaucracy profits are always larger with intermediaries, assuring the existence of the sector. Profits are lower than in panels A-B however, the intermediary sector is smaller and does not exist for as high n.

As f increases further, with $f_2 < f < f_{max}$, large entry costs make the existence of intermediaries too costly for bureaucrats for small n, i.e. setting B_d (and B) such that at least one intermediary can enter is less profitable than operating without intermediaries. There is still a middle-range of n, however, where the bribe and intermediary solution is optimal. As bribing only allows individuals a time saving of a fraction α, it implies that increases in n will make bureaucracy profits start decreasing at a smaller n, as compared to the bribe and intermediary case. As f approaches f_{max}, the range over which there are intermediaries shrinks to zero.

Figure 4 displays the solution in (n, f) - space, for given values of g, p and α. The five areas correspond to the different solutions in (A.3). As discussed above, the intermediary sector exists for small n as long as f is not too large, the $m = 1$ - constraint binds as f becomes high enough and, given f, the sector ceases to exist for large enough n. Furthermore, it is in the middle-range of n that the highest entry costs can be sustained, where individuals' time saving and willingness to pay for bribing/intermediation is high, yet costs np, unavoidable for bureaucrats, are not too high. Finally, for almost the entire parameter space where intermediaries exist, there is also direct bribing.[18]

A final note in this section relates to entry costs. If such costs had been specified as constant, rather than as a function of n, there would never be intermediaries for the smallest n, as entry costs cannot be recovered by intermediaries. For large enough n, we would get one intermediary, and then an increase in m for increasing n, over the range that intermediaries exist. The results with respect to endogenous license lengths and individuals' gain from licensing would not change with this alternative specification.

3.4. Endogenous red tape and individuals' gain from licensing

We now turn to bureaucrats' optimal choice of n. The intermediary only subgame never generates the highest profits when n is endogenous (see proof to proposition 5), the discussion thus concerns the comparison between the bribe only and the bribe and intermediary models. As may be guessed from the profit graphs in figure 3, the procedure length that maximizes profits, n^*, is always larger in the bribe and intermediary model. In this model, profits are always maximized in the region for which $d = g$ binds, and, depending on f, we can have either $m > 1$ or $m = 1$. For large enough f, the bribe only solution is instead optimal. Panel E of figure 3 was constructed such that profits are equal in the two models, hence above the corresponding f-value the bribe only solution is

[18]Other values of α give a similarly small area over which $Q_B = 0$ binds. An increase in α, which implies that the difference in time saving between using an intermediary and bribing goes down, gives a similar-shaped curve as in figure 4, but compressed towards zero, as smaller entry costs can now be sustained in the intermediary sector. A reduction in α gives the opposite effect. Only for small α, and large f, is the intermediary only subgame in AppendixA.3 ever optimal, and then over a very limited parameter space (see proposition 4B and the corresponding proof.)

optimal. Not surprisingly, the intermediary sector is smaller, and hence less competitive, at the profit maximum, the larger is f. Importantly, the aggregate individual gain is always smaller when the bribe and intermediary model determines bureaucrats' optimal choice of n. These assertions are summarized in proposition 5, in which $0 < f^* < f^{**} < f_{max}$ for all $\alpha \in (0,1)$, $p \geq 0$, and illustrated in figure 5.

Proposition 5 The procedure length n^* that maximizes bureaucrats' profits is

$$n^* = \begin{cases} \frac{g}{\sqrt{(p+1)(\sqrt{f(1-\alpha)}+p)-\frac{\alpha f}{4}}} \text{ if } 0 \leq f < f^* \\ \frac{g}{\sqrt{(p+1)(p+1-\alpha-2\sqrt{f(1-\alpha)})+f(1+\alpha)}} \text{ if } f^* \leq f < f^{**} \\ \frac{g}{\sqrt{(1+p)(1+p-\alpha)}} \text{ if } f^{**} \leq f < f_{max} \end{cases}$$

In the first two intervals, i.e. for f such that $0 \leq f < f^{**}$, the optimal choice of n is given by the bribe and intermediary case. Bureaucracy profits are strictly larger, the license procedure n^* is strictly longer and individuals' aggregate gain is strictly lower, than when the bribe only case is optimal, which is the case for $f^{**} \leq f < f_{max}$.

For $0 \leq f < f^*$, increases in entry costs f result in shorter license procedures, $\frac{\partial n^*}{\partial f} < 0$, higher aggregate gain, $\frac{\partial G(n^*)}{\partial f} > 0$, and a smaller intermediary sector $\frac{\partial m(n^*)}{\partial f} < 0$; for $f^* \leq f < f^{**}$ increases in f has an ambiguous effect on n^* and $G(n^*)$, and $m = 1$.

where:
$f^* = \frac{4(1-\alpha)(1+p)(14+18p-5\alpha-6\sqrt{(1+p)(5+9p-5\alpha)})}{(4+5\alpha)^2}$, $f^{**} = \frac{(1-\alpha)(1+p)(2+2p-\alpha-2\sqrt{(1+p)(1+p-\alpha)})}{\alpha^2}$

Proof. See the appendix. □

Proposition 5 states that we get longer license procedures and individuals that are worse off, whenever intermediaries exist. Whereas "direct" corruption incentivizes bureaucrats to complicate license procedures, which makes individuals worse off, intermediaries further strengthen this incentive, with individuals even worse off. The proposition also details the conditions for when this situation arises, which is as long as entry costs into the intermediary sector are not too high. Proposition 5 sends a strong message, in that time saving institutions such as bureaucracy intermediaries, which supposedly benefit individuals facing a complicated bureaucracy, can instead have the opposite effect.

Figure 5 shows optimal bureaucracy profits (panel A), the aggregate individual gain (panel B), the optimal procedure length (panel C) and the size of the intermediary sector (panel D), as a function of f, for constant values of g, p and α (solid lines). The dashed line corresponds to the bribe only model. The figure shows that bureaucracy profits are higher, procedures are longer and individuals are worse off, when the bribe and intermediary solution is optimal. In addition, for $0 \leq f < f^*$, lower entry costs into intermediation results in a larger intermediary sector, higher bureaucracy profits, longer procedures and less gain from licensing.

4. Discussion

This paper suggests a theory of bureaucracy intermediaries, which are common in many developing countries. In a model where the bureaucracy intermediary sector is endogenous and arises, if at all, from bureaucrats maximizing rents from a license procedure, the paper addresses a topic with very few previous studies. A first straightforward result of the analysis is that if entry costs to become an intermediary are low, the intermediary sector is large, competitive, and exists for both short as well as longer license procedures. The evidence provided in section 2 suggests that low entry costs is likely to be the case in both the Indian and Brazilian contexts, where we observe the use of intermediaries for many different types of government services. If entry costs to become an intermediary are instead high, if the intermediation activity is restricted, made more difficult, or is better controlled, the intermediary sector should then only be expected to emerge, if at all, for longer license procedures (as opposed to the shortest ones). A second result is that, for almost all combinations of license procedure lengths and entry costs, bureaucracy intermediaries should be expected to coexist with direct bribing, rather than as the only option to speed up processes and grease the wheels. Figures 3 and 4 capture these predictions of the model.

How should such entry costs be interpreted, however? One straightforward interpretation is that it is costly to learn and understand how a license procedure works, what documents are required at each step, how to fill them in, etc. It may require legal training to understand the intricacies of procedures and different cases that can arise in the handling of applications. If there are different authorities involved in a license procedure, different documents/certificates/stamps required at each step, combined with many exceptions to rules, loopholes and workarounds, it seems reasonable to assume that entry costs are a function of the complexity of procedures. However, it is not a priori clear how such costs would differ between countries with equally long procedures, say.[19]

Another interpretation is that f represents some aspect of policy, perhaps rules and regulations, at the government offices, that restrict the possibilities of intermediaries to represent individuals and firms at the bureaucracy, or more effective corruption controls. If enforcement vis--vis the sector is correlated with (country) income, with high-income countries having more enforcement/regulations/restrictions, we should expect less of bureaucracy intermediaries in richer countries, and if at all, only for longer procedures (as opposed to shorter ones). The reading of the available literature that discusses bureaucracy intermediaries suggests that these are common in many developing countries, and much less common in richer countries.

In many parts of Latin America tramitadores are neither legal nor strictly illegal, but their presence and ability to operate outside and inside many government offices means that there is a de facto acceptance and/or lack of enforcement towards the intermediation activity. This suggests that bureaucrats and tramitadores operate in close connection, and that bureaucrats facilitate the intermediation activity ("f is low").

In Brazil, despachantes are recognized as a professional category, formalized training exists, there are trade unions and despachantes have the right to formally represent citizens and to operate inside some government departments. An example is the above mentioned Department of Transit, DETRAN, in São Paulo, and in other Brazilian states. Traditionally, buying, owning and selling vehicles is something for which citizens in Brazil face a large number of legal requirements, and, consequently, interactions with

[19]In addition, low entry costs for intermediaries, due to clear and transparent procedures, would probably also imply low costs for individuals (which in the present model could be modeled as a compression of the A_i-distribution towards zero).

the government bureaucracy. This is costly, money- and time-wise. However, the existence of despachantes, the recognition of such intermediaries to handle vehicle matters at the bureaucracy, their preferential access at the authorities, and other aspects of the bureaucracy-intermediary interaction, are there to *simplify*.

If we view the license procedure as exogenous, such intermediaries and supporting institutions de facto simplify and make citizens better off, as compared to going through the regular procedure. This is the essence of proposition 1 (and corollary 1). If we instead believe the procedure is endogenously determined, the paper suggests a theory for how an institutional setting, with a large and complicated bureaucracy, many intermediaries, close bureaucracy-intermediary interaction, and the right for intermediaries to represent citizens and preferential access at the bureaucracy, has emerged. Propositions 3 and 5 (and corollary 2) establish the negative effects on individuals' licensing gain from such endogenous red tape.

Proposition 5 predicts that countries that have a sector of bureaucracy intermediaries should have longer license procedures. Due to lack of data on the prevalence of bureaucracy intermediaries in different countries, this prediction is difficult to test. However, the model presents one channel, out of many possible, that can potentially explain the high correlations observed between corruption and the size of bureaucracy. The correlation between the country rankings of "Ease of Doing Business", which is a measure of bureaucratic complexity, from the World Bank, and the "Corruption Perceptions Index", from Transparency International, is around 0.8. Although these indices are, at best, proxies for variables in our model (n and Π, respectively), the following potential channel to create such a correlation is suggested here: Bureaucrats seek to maximize revenue from bribes $\implies$ Bureaucrats seek to be able to reduce time costs at the bureaucracy more effectively, which is facilitated by the presence of intermediaries $\implies$ The more effective the intermediary sector is in reducing time costs at the bureaucracy, the stronger the incentive for bureaucrats to complicate $\implies$ The length of procedures, n, and corruption profits, Π, increase.[20]

The mutually beneficial cooperation between bureaucrats and intermediaries may also involve other professions such as notaries public and potentially accountants, benefiting from a cumbersome regulation. Reforms of the government bureaucracy typically meet fierce resistance from such groups. In Peru, notaries public have opposed and attempted to reverse simplifications in land titling and property rights registration (ILD [25]). As a Brazilian example of such reform resistance, trade unions of despachantes have lobbied vis-a-vis politicians to limit, delay or hinder bureaucracy simplification reforms such as the government "one stop shop" Poupatempo in the state of São Paulo, a reform likely to have reduced the use of despachante services over the past decade (Lima [30, 31]).[21] The

[20] It should also be noted here that both large bureaucracies and the extent of corruption are highly (negatively) correlated with country income: the correlation coefficients between either of the two indices above, with GDP/capita, is around 0.75 in absolute value. These facts underline the development aspect of addressing issues related to bureaucracy and corruption. The data sources are World Bank [47], Transparency International [44] and IMF [26]. There are 172 countries with Doing Business, Corruption and GDP/capita data, which were used to calculate the correlation coefficients. The Corruption Perceptions Index, which runs from 1 to 10, was converted into a simple ranking of countries, with the least corrupt country ranked first. For GDP/capita, countries were ranked from low to high income.

[21] For details on Poupatempo, see Annenberg [2] and Paulics [36]. The magazine "Despachante em foco" (Despachante in focus) from the trade union of "Despachantes documentalistas" in São Paulo state

following citation from Castor [8] further illustrates the mechanisms studied in this paper. The author discusses various waves of Brazilian bureaucracy reforms, from the 1930's until the 1990's, the citation concerns the reform efforts by the head of the "Extraordinary Ministry for De-Bureaucratization", Helio Beltrão, in the early 1980's (pp. 171-172):

> Beltrão's approach was basically to concentrate the efforts of his team on the simplification of the day-to-day life of the population and of business through the elimination of hundreds of unnecessary or redundant documents in bidding procedures, the financing and mortgaging of houses, the issuance of personal documents such as driver licenses, and similar everyday transactions. Even if some of the "simplifications" of Beltrão survived and were incorporated in the administrative *praxis*, a large number of his innovations were quietly eliminated by the actions of bureaucrats who had lost their power to complicate others' lives. They were helped by groups of professionals like "dispatchers" and public notaries who had lost a substantial part of their business due to the reduction in requirements for documentation, signatures and stamps.

In this paper, some evidence of the mode of operation of the intermediary sector in Latin America, and in Brazil in particular, is presented, and several of the papers cited provide insights from India. These are two countries where intermediaries are common and where procedures at the government bureaucracy are long (Brazil ranks 130th and India 132nd in the overall Doing Business ranking [47]). However, data collection and empirical studies on the prevalence of bureaucracy intermediaries in different countries, for which government authorities/license procedures/services intermediaries are most common, how they typically operate, and if and how the phenomenon decreases with development, is needed to provide basic data about the intermediary sector. This could potentially also allow for a validation of the endogenous red tape argument presented.

The model predicts that individuals increasingly resort to intermediaries when procedures at the government bureaucracy get complex. Better data on intermediary usage could therefore complement studies such as the Doing Business study, in that de facto procedures that citizens follow may differ largely from de jure procedures (de Soto [14]).

Reforms such as Poupatempo, which physically co-locate many government authorities, provide a possibility to test the relevance of the theory of intermediaries presented in this paper. As opposed to recent papers on bureaucracy intermediaries (Hasken and Okten [20], Bose and Gangopadhyay [7]), which focus on intermediaries' role in facilitating rule-breaking, this paper stresses the time-saving aspect. In the Poupatempo example, citizens can access the different authorities required to get a license, at the same physical location. Care has also been taken so that the citizen should be able to

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discusses issues of concern to the bureaucracy intermediary sector. Topics discussed include efforts to get access to the computerized registries of the transport authorities, technical changes to this system, the opening of a "Central de atendimento ao despachante" (Despachante service desk) in conjunction with a DETRAN building, to change the classification of the profession in the Brazilian Occupation Classification and to revoke a law that makes control of the profession a state- (and not a federal) matter [40]. It should be mentioned that, at present, DETRAN in São Paulo is being reformed, one aim being to provide a more transparent bureaucracy, another to reduce citizens' dependence on intermediaries.

visit the different authorities within the same day. The procedure to get the license per se however, i.e. the rules and regulations that the individual has to fulfill, have not changed. They are the same as if the citizen uses the traditional procedure (which still exists). Ceteris paribus the reform thus reduces the incentives to use an intermediary for time saving purposes, but for individuals that cannot fulfill rules and regulations, the incentives to use an intermediary do not change. With data on intermediary usage pre- and post reform, for treatment and control groups, reforms such as Poupatempo present a possibility to address which functions intermediaries primarily perform.

This paper aims at providing a contribution to the literature on bureaucracy intermediaries. It is worth mentioning the work of Brazilian anthropologist Roberto DaMatta, with studies of the Brazilian social hierarchy [12, 13]. The importance of personal contacts with bureaucrats in order to get things accomplished can be interpreted as a potential determinant of entry costs to become an intermediary. Intermediaries need to cultivate such contacts in order to be able to effectively handle license applications on behalf of individuals. In societies where the bureaucracy is characterized by a rules-based treatment and impersonal contacts between users of the bureaucracy (individuals, firms) and neutral officials, it is probably more difficult for a sector of intermediaries to emerge. This description would correspond to a "high f". Obviously, there may be deeper underlying explanatory factors for the importance of personal contacts and the prevalence of bureaucracy intermediaries. Notwithstanding, and as discussed in section 2, it is interesting to note that Latin America, the region of the world where senior management of firms spends most time with government regulation, a proxy for the amount of contact with bureaucrats, is also a region where bureaucracy intermediaries are common.

In his characterization of citizens' contact with public authorities in Brazil, Roberto DaMatta describes the citizen-bureaucrat interaction, much different from the "Weberian" case [13]. In brief, simplifying a comprehensive account but still following the author closely: A citizen arriving at the government bureaucracy is "someone who is no-one" (*alguém que é ninguém*), or just "some individual" (*indivíduo qualquer*), and solving his errand is "not possible" (*não pode*). However, it might be that a personal link between the bureaucrat and the individual is discovered (having studied at the same institution, being from the same city, having the same favorite team, having religion in common, etc.), which might facilitate a "fix" (*jeitinho*) in order to solve the errand. Such personal ties are not always there however, and the citizen may resort to a despachante. This intermediary, which has arisen as a result of the mismatch between the law and daily life, is the specialist in entering in contacts with the public offices, in resolving issues and in obtaining a *jeitinho* from the authorities. DaMatta thus argues that personal ties are important, and even though some or most citizens do not have them, there is room for specialists in such personal ties to bureaucrats to develop, which will then act as mediators in the hierarchy between the law/bureaucracy and ordinary citizens.

4.1. Policy interventions to reduce red tape

As a final section, we discuss some possible policy interventions to reduce red tape. In the model presented, bureaucrats accept bribes in order to reduce individuals' time cost at the bureaucracy, either directly, or through intermediaries. We have taken as given the principal-agent relationship between bureaucrats and the authorities/the government, and assumed that bureaucrats can affect the complexity of license procedures and that bureaucrats can pocket the bribes charged. Continuing with these assumptions, and focusing on the effects of indirect corruption and intermediaries (think of the intermediary only subgame), what policies exist to reduce such intermediary-induced red tape?

Consider first competition in the intermediary sector. For an exogenous license procedure, more competition increases individuals' license gain, for an endogenous procedure the gain instead decreases. Less competition in the intermediary sector (through a more regulated entry) thus implies that citizens are better off in the endogenous-n outcome, but it comes at the price of a higher intermediary mark-up, reducing the benefit of having intermediaries, for any given n. A penalty on bureaucrats for handling applications from intermediaries has a similar effect. It will increase the indirect bribe B_d and the intermediary fee d. Procedures will be shorter and individuals will be better off in the endogenous-n outcome, but again at the price of less intermediary competition.

The origin of the intermediary-induced red tape is the time costs that (only) intermediaries can remove, such as the time costs of going between different bureaucracy offices. These time costs increase when steps are added, the willingness to pay for intermediary services increases, and individuals get less license gain. Consider the effects of a reform such as Poupatempo, which effectively establishes a parallel license procedure. That is, individuals can get the license in either the "old"- or the "new" bureaucracy. Intermediaries are prohibited at Poupatempo, and, from the currently available evidence, no corruption stories have emerged at Poupatempo. That is, assume there is no corruption in the new bureaucracy. Assume a license procedure has a socially optimal length of n_s, i.e. n_s is the number of steps necessary to undertake all socially relevant controls to award a license. Let g and p be the same in the old- and the new bureaucracy. Any increase in the license procedure length at the old bureaucracy, above n_s, will shift all demand from individuals going through the regular procedure to the new bureaucracy. The old bureaucracy then handles applications only through intermediaries. Importantly, the threshold in (A.4) changes to $\frac{d-n_s p}{n_s}$. This implies that old bureaucracy bribe profits decrease for $n > n_s$, i.e. profits peak at n_s. There is thus no incentive to create red tape. Interestingly, the new bureaucracy now handles all individuals with a low opportunity cost of time, the old bureaucracy all individuals with a high opportunity cost.[22]

Assume implementing a parallel procedure has a cost proportional to the license procedure length n_s, i.e. $C_1 \times n_s$. The benefit to individuals comes from removing red tape, equaling $G(n^*) - G(n_s)$, which decreases in n_s. Reform costs are thus less than the gain to individuals if

$$C_1 \times n_s < G(n^*) - G(n_s) \tag{12}$$

That is, the implementation of a parallel procedure is beneficial for license procedure lengths (n_s) that are "short enough". For license procedures for which more checks and controls are socially motivated, there is less to gain from reducing lengths from the endogenous-n outcome and the implementation of the parallel procedure is more costly.

The Poupatempo reform does more than put up a parallel procedure however. It also co-locates different government authorities at the same physical location, plus establishes opening hours and other institutional features such that the individual is typically able to

[22]Anecdotally, this corresponds with experiences at Poupatempo, which has been argued to be "pro-poor" (individuals with less income have lower opportunity cost of time).

resolve the errand in one single visit. With one visit only, the threshold in (A.4) changes to $\frac{d-n_s p}{1}$. This effectively increases the gain from the license reform, as the outside option for individuals using the old bureaucracy has further improved. It should be noted however, that although the new bureaucracy consists of only one physical location, which should lower costs of establishing parallel services, the coordination required in order to co-locate authorities that have typically worked separately, and establishing a common back-office assuring that individuals get a speedy treatment, is a large challenge. Perhaps a cost function that is quadratic in n, rather than linear, is motivated. On the other hand, reforms such as Poupatempo establish many different license procedures at the same location, meaning that costs are shared. Paulics [36] and Mota Prado and da Matta Chasin [33] discuss challenges of the Poupatempo implementation.

4.2. Conclusion

This paper presents a model of bureaucracy intermediaries, where the sector arises endogenously as a result of bureaucrats' maximization of rents from a license procedure, and evidence on the mode of operation of such intermediaries. The paper provides one explanation why license procedures tend to be long in developing countries. An empirical study that can potentially distinguish the theory presented, from other theories of intermediaries, as well as effects from policies aimed at reducing red tape, are discussed.

AppendixA.

AppendixA.1. Proofs to bribe-only model in section 3.1

Proof of Proposition 2. Using the solution in (4) and definition 1, we get $G(n)$ and $\frac{\partial G(n)}{\partial \alpha}$:

$$G(n), \frac{\partial G(n)}{\partial \alpha} = \begin{cases} g + \frac{n}{8}(-4 - 8p + \alpha),\ \frac{n}{8} & \text{if } 0 \le n \le n_1^* = \frac{g}{p+1-\frac{\alpha}{2}} \\ \frac{g^2 - 2gn(1+p-\alpha) + n^2((1+p)^2 - \alpha(1+2p))}{2n\alpha},\ -\frac{(g-n-np)^2}{2n\alpha^2} & \text{if } n_1^* \le n \le n_2^* = \frac{g}{p+1-\frac{\alpha}{2-\alpha}} \\ \frac{(g-np)^2(4-3\alpha)}{8n(1-\alpha)},\ \frac{(g-np)^2}{8n(1-\alpha)^2} & \text{if } n_2^* \le n \le \frac{g}{p} \end{cases} \tag{A.1}$$

The derivate is positive for small and large n, and negative in the middle-n region. □

Proof of Proposition 3. n^* lies in the middle-n region, with profits $\pi_m = \frac{(n(p+1)-g)(g-n(p+1-\alpha))}{\alpha n}$, and gain as in (A.1). Plugging in n^*, differentiating w.r.t. α, and simplifying, we get

$$\begin{cases} \frac{\partial \pi_m(n^*)}{\partial \alpha} = \frac{g(1+p)(2(1+p)-\alpha-2\sqrt{(1+p)(1+p-\alpha)})}{\alpha^2\sqrt{(1+p)(1+p-\alpha)}} \\ \frac{\partial G(n^*)}{\partial \alpha} = -g(1+p)\left(\frac{4(1+p)^3 - 6\alpha(1+p)^2 + \alpha^2(2+3p) - 4(1+p)(1+p-\alpha)\sqrt{(1+p)(1+p-\alpha)}}{4\alpha^2\sqrt{((1+p)(1+p-\alpha))^3}}\right) \end{cases} \tag{A.2}$$

$\frac{\partial \pi_m(n^*)}{\partial \alpha}$ is always > 0, seen by using the Arithmetic Mean - Geometric Mean inequality (AM-GM), i.e. $\frac{(1+p)+(1+p-\alpha)}{2} \ge \sqrt{(1+p)(1+p-\alpha)}$. The denominator in the large parenthesis in $\frac{\partial G(n^*)}{\partial \alpha}$ is always > 0. The numerator is also always > 0, seen by using AM-GM again, i.e. replacing $\sqrt{(1+p)(1+p-\alpha)}$ with $\frac{(1+p)+(1+p-\alpha)}{2}$. It simplifies to $p\alpha^2$, which is > 0, yet smaller than the original numerator. $\frac{\partial G(n^*)}{\partial \alpha}$ is thus always < 0. □

AppendixA.2. Solution to bribe and intermediary model in (10)

There are five distinct solutions, depending on which of the constraints that bind. There is an (n, f)-parameter space over which each solution holds, as indicated for each case.

$$\begin{cases}
\text{no constraints bind} \\
f \leq f_1,\ 0 \leq n < n_{d=g} \\
B = np + \frac{\alpha n}{2},\ B_d = d - n\sqrt{f(1-\alpha)} \\
d = np + \frac{n}{2} + \frac{n\sqrt{f(1-\alpha)}}{2},\ m = \sqrt{\frac{1-\alpha}{4f}} - \frac{1}{2} \\
\\
d = g \text{ binds} \\
f \leq f_1,\ n_{d=g} \leq n < n_{max};\ f_1 < f \leq f_2,\ n_{m=1} \leq n < n_{max} \text{ and } f > f_2,\ \text{Min}\{n_{m=1}, n_{max}\} \leq n < n_{max} \\
B = np + \alpha(g - np) - \frac{n\alpha\sqrt{f(1-\alpha)}}{2},\ B_d = g - n\sqrt{f(1-\alpha)} \\
d = g,\ m = (1 + p - \frac{g}{n})\sqrt{\frac{1-\alpha}{f}} - \frac{\alpha}{2} \\
\\
m = 1 \text{ binds} \\
f_1 < f \leq f_2,\ 0 \leq n < n'_{d=g} \\
B = np + \frac{n\alpha}{2},\ B_d = d - n\sqrt{f(1-\alpha)} \\
d = np + n - \frac{n\alpha}{2} - n\sqrt{f(1-\alpha)},\ m = 1 \\
\\
d = g \text{ and } m = 1 \text{ bind} \\
f_1 < f \leq f_2,\ n'_{d=g} \leq n < n_{m=1} \text{ and } f > f_2,\ n''_{d=g} \leq n < n_{m=1} \\
B = g - n(1-\alpha) + n\sqrt{f(1-\alpha)},\ B_d = g - n\sqrt{f(1-\alpha)} \\
d = g,\ m = 1 \\
\\
m = 1 \text{ and } Q_B = 0 \text{ bind} \\
f > f_2,\ 0 \leq n < n''_{d=g} \\
B = (1-\alpha)np + \alpha d,\ B_d = d - n\sqrt{f(1-\alpha)} \\
d = np + n - n\sqrt{\frac{f}{1-\alpha}},\ m = 1 \\
\\
\text{where:} \\
f_1 = \frac{1-\alpha}{9},\ f_2 = \frac{1-\alpha}{4} \\
(f\text{-thresholds, for small } n \text{, above which } m = 1 \text{, and } (m = 1,\ Q_B = 0) \text{, respectively, bind}) \\
n_{d=g} = \frac{g}{p + \frac{1}{2} + \frac{1}{2}\sqrt{f(1-\alpha)}},\ n'_{d=g} = \frac{g}{p + 1 - \frac{\alpha}{2} - \sqrt{f(1-\alpha)}},\ n''_{d=g} = \frac{g}{p + 1 - \sqrt{\frac{f}{1-\alpha}}} \\
(n\text{-thresholds, for different levels of } f \text{, above which } d = g \text{ binds}) \\
n_{m=1} = \frac{g}{p + 1 - (2+\alpha)\sqrt{\frac{f}{4(1-\alpha)}}} \\
(n\text{-threshold, below which } m = 1 \text{ binds})
\end{cases} \tag{A.3}$$

The solution is displayed in figure 4, in which each area corresponds to one of the solutions above. The comparison with bribe-only profits has been taken into account in that, above the upper curve, the optimal solution is the bribe only case (see main text).

AppendixA.3. Intermediary only model

When bureaucrats accept only indirect bribes, the set-up follows the same logic as in the other subgames. Individuals prefer intermediaries over the regular procedure if

$$g - d \geq g - (np - nA_i) \quad \text{i.e. if} \quad A_i \geq \frac{d - np}{n} \tag{A.4}$$

such that demand for intermediaries is $1 - \frac{d-np}{n}$. Using the same reasoning as in section 3.2.1, the expressions that determine m and the pricing rule d become:

$$m(B, B_d) = -1 + \frac{n - (Bd - np)}{n\sqrt{f}}, \; d(B_d) = B_d + n\sqrt{f} \tag{A.5}$$

Finally, bureaucrats maximize profits Π^I from indirect bribes (where index I indicates the intermediary only case) subject to the constraints on m and d, hence solving

$$\underset{B_d}{\text{Max}} \; \Pi^I = (B_d - np) \times \left(1 - \frac{d(B_d) - np}{n}\right) \; \text{ s.t. } \; d(B_d) \leq g, \; m(B, B_d) \geq 1 \tag{A.6}$$

The solution to (A.6) is given below. Similar to the bribe and intermediary solution, there are distinct solutions, depending on which constraint that binds. There is an (n, f)-parameter space over which each solution holds, as indicated for each case.

$$\begin{cases} \text{no constraints bind} \\ f \leq \frac{1}{9}, \; 0 \leq n < \frac{g}{p+\frac{1}{2}(1+\sqrt{f})} \\ B_d = d - n\sqrt{f} \\ d = np + \frac{n}{2} + \frac{n\sqrt{f}}{2}, \; m = \sqrt{\frac{1}{4f}} - \frac{1}{2} \\ \\ d = g \text{ binds} \\ f \leq \frac{1}{9}, \; \frac{g}{p+\frac{1}{2}(1+\sqrt{f})} \leq n < n_{max} \text{ and } f > \frac{1}{9}, \; \frac{g}{p+1-\sqrt{f}} \leq n < n_{max} \\ B_d = g - n\sqrt{f} \\ d = g, \; m = (1 + p - \frac{g}{n})\sqrt{\frac{1}{f}} \\ \\ m = 1 \text{ binds} \\ f > \frac{1}{9}, \; 0 \leq n < \frac{g}{p+1-\sqrt{f}} \\ d = np + n - n\sqrt{f}, \; m = 1 \\ B_d = d - n\sqrt{f} \end{cases} \tag{A.7}$$

AppendixA.4. Proposition 4B and proofs of Propositions 4 and 5

There is a narrow sub-set of entry costs, in the $(f_2, \, f_{max})$-interval, combined with small α, for which we get an additional n-range with intermediaries only. This is due to the optimality of the solution with $m = 1$, from (A.7). In the $(f, \, \alpha)$-interval indicated below, the intermediary only solution is optimal (just) below the n-range where we have $m = 1, Q_B = 0$, from (A.3), and we get a larger profit because the indirect bribe can be set without consideration of the $Q_B = 0$-constraint. For somewhat larger n, however, intermediary only profits start decreasing. Proposition 4B, where $f_2 < \tilde{f} < \bar{\bar{f}} < f_{max}$ and $\bar{\alpha} \approx 0.42$, completes the characterization of intermediary existence, for small α:

Proposition 4B. For f and α such that

$\tilde{f} < f < \bar{\bar{f}}$, $0 < \alpha \leq \bar{\alpha}$, the lower intermediate range of procedure lengths where there is intermediaries only (from the second part of Proposition 4A) is discontinuous, with a narrow n-range in between, for which the bureaucracy only solution is optimal.

Proof of Propositions 4A and 4B. We use the solutions in expressions 4 (bribe only), A.3 (bribe and intermediaries) and A.7 (intermediary only). We first establish, in the first three paragraphs below, the comparison between the solutions in (4) and (A.3). The n-thresholds referred to, but not stated, are given below the text.[23]

For small n, profits in the bribe only case is $\pi_s = \frac{n\alpha}{4}$. With bribes and intermediaries, profits are $\Pi_s = \frac{n}{4}(1 + f - 2\sqrt{f(1-\alpha)})$ for $f \leq f_1 = \frac{1-\alpha}{9}$ and $\Pi_{s,m=1} = n(\frac{\alpha}{4} - 2f + \sqrt{f(1-\alpha)})$ for $f_1 \leq f < f_2 = \frac{1-\alpha}{4}$. Both are larger than π_s in their respective f-ranges. The bureaucracy and intermediary large-n solution for $f < f_1$ has profits $\Pi_l = \frac{(g-np)(n+np-g)}{n} + \frac{\alpha nf}{4} - (n + np - g)\sqrt{f(1-\alpha)}$ which equal large-n profits with bribes only, $\pi_l = \frac{\alpha(g-np)^2}{4(1-\alpha)n}$, at $n = n_{(\pi_l=\Pi_l)}$, which is thus the upper intersection between the profit curves. In the $[f_1, f_2)$-interval the crossing between $\Pi_{l,m=1}$ (large-n profits when $m = 1$ binds) and Π_l is always at $n < n_{(\pi_l=\Pi_l)}$, which implies that $n_{(\pi_l=\Pi_l)}$ is the threshold between bribe only and bribe and intermediary profits, also for $[f_1, f_2)$.

For $f \geq f_2$, profits are $\Pi_{s,m=1,Q_B=0} = n(\sqrt{\frac{f}{1-\alpha}} - \frac{2-\alpha}{1-\alpha}f)$ in the bribe and intermediary model (up to $n''_{d=g}$, from A.3). This is less than π_s (which holds up to n_1^*, from 4), and, in addition, $n_1^* < n''_{d=g}$. For $n \leq n_1^*$ we thus always have the bribe only solution when $f \geq f_2$. There will be an n-interval however, above n_1^*, with the bribe and intermediary solution. The lower intersection can fall in the region of middle-n or large-n profits from the bribe only solution (from 4). In the middle-n region, the lower intersection is at $n_{(\pi_m=\Pi_{s,m=1,Q_B=0})}$ for $f_2 \leq f < \frac{(1-\alpha)(-2+\alpha(3-2\alpha)-\sqrt{(2-\alpha)(2+\alpha(-5+4\alpha))})}{2(-2+\alpha)^3}$ and, above n_2^* (from 4), for larger f (up to $f_{max} = \frac{8+4(2-\alpha)\sqrt{(1-\alpha)^5-\alpha(24-\alpha(29-\alpha(17-4\alpha)))}}{(8-\alpha(11-4\alpha))^2}$), at $n_{(\pi_l=\Pi_{s,m=1,Q_B=0})}$. For $f < \frac{4(1-\alpha)}{(4-\alpha)^2}$, which lies in the (f_2, f_{max})-interval, the upper intersection is $n_{(\pi_l=\Pi_l)}$, from above. For $f \geq \frac{4(1-\alpha)}{(4-\alpha)^2}$ the upper intersection is where $m = 1$ binds. We have $\Pi_{l,m=1} = \frac{(g-n(1-\alpha+p))(n+np-g)}{\alpha n} + \frac{2\sqrt{f(1-\alpha)}(n+np-g)}{\alpha} - \frac{nf(1+\alpha)}{\alpha}$, and the intersection is $n_{(\pi_l=\Pi_{l,m=1})}$. f_{max} solves $n_{(\pi_l=\Pi_{s,m=1,Q_B=0})} = n_{(\pi_l=\Pi_{l,m=1})}$.

In sum, for $f < f_2$, we have bribe and intermediaries for $0 \leq n < n_{(\pi_l=\Pi_l)}$ and the bribe only solution for $n_{(\pi_l=\Pi_l)} \leq n < n_{max} = \frac{g}{p}$. For $f_2 \leq f < f_{max}$, we have bribe and intermediaries for an intermediate-n range. In this range, the constraint on no direct bribing ($Q_B = 0$) first binds, but is relaxed, as n increases. This is proposition 4A.

[23]The sub-index on bribe only profits π indicate whether it is the small-, middle-, or large-n solution. The first sub-index on bribe and intermediary profits, and intermediary only profits, indicate whether it is the small- or large-n solution ($d < g$ for small n and $d = g$ for large n). The other sub-indices, $m = 1$ and $m = 1$, $Q_B = 0$, respectively, indicate binding constraints.

We now compare with the intermediary only case (in A.7), first proving that it will never apply for small n. For $f < \frac{1}{9}$, profits are $\Pi_s^I = \frac{n}{4}(1 + f - 2\sqrt{f})$, and for $f \geq \frac{1}{9}$, profits are $\Pi_{s,m=1}^I = n(\sqrt{f} - 2f)$. We compare these with the above established Π_s and $\Pi_{s,m=1}$, for $f \leq f_1$ and $f_1 \leq f < f_2$, respectively. The (f, α) parameter space where the intermediary only profits are largest always fall outside the applicable parameter space, and the n-thresholds below which these solutions apply are smaller for the intermediary only case. Comparing with bribe only profits π_s, for $f < \frac{1}{9}$, gives $\Pi_s^I > \pi_s$ only in a parameter space where the bribe and intermediary solution applies and has a larger profit, comparing $\Pi_{s,m=1}^I$ and π_s for $f \geq \frac{1}{9}$ yields the same result. The intermediary only case thus never applies for small n (below n_1^*). We next show, however, that $\Pi_{s,m=1}^I$ is the optimal solution for somewhat larger n, for a subset of the (f,α) parameter space.

We have $\Pi_{s,m=1}^I > \Pi_{s,m=1,Q_B=0}$ for $f > \bar{f} = \frac{2-2\sqrt{(1-\alpha)^3}-\alpha(3-\alpha)}{\alpha^2}$, where $f_2 < \bar{f} < f_{max}$, and $\Pi_{s,m=1}^I > \pi_l$, for $n > n_{(\Pi_{s,m=1}^I=\pi_l)}$. This is the lower intersection of the n-range for which $\Pi_{s,m=1}^I$ is optimal. This threshold must be smaller than $\frac{g}{p+1-\sqrt{f}}$ (from A.7), in order for $\Pi_{s,m=1}^I$ to apply. Equality gives that f can be no larger than $\bar{\bar{f}} = \frac{8-16\alpha+9\alpha^2+4(2-\alpha)\sqrt{(1-\alpha)(1-2\alpha)}}{(8-7\alpha)^2}$ (where $\bar{\bar{f}} < f_{max}$). This threshold is, in turn, only larger than $\bar{f}$ for $\alpha < \bar{\alpha} = \frac{5}{6} - \frac{(53-6\sqrt{78})^{\frac{1}{3}}+(53-6\sqrt{78})^{-\frac{1}{3}}}{12} \approx 0.42$, which is the largest α for which the intermediary only solution ever applies. The upper intersection depends on the profit curve curvatures. There are two cases. For $\bar{f} \leq f < \tilde{f}$ we have that $\Pi_{s,m=1}^I$ is optimal between $n_{(\Pi_{s,m=1}^I=\pi_l)}$ and $n_{(\Pi_l^I=\Pi_{s,m=1,Q_B=0})}$, where the latter threshold solves $\Pi_l^I = \Pi_{s,m=1,Q_B=0}$. For $\tilde{f} \leq f < \bar{\bar{f}}$ the intermediary only solution holds between $n_{(\Pi_{s,m=1}^I=\pi_l)}$ and $n_{(\Pi_l^I=\pi_l)}$, which solves $\Pi_l^I = \pi_l$. The profit curves never intersect in the large-n region of the bribe and intermediary case. The threshold $\tilde{f}$ solves $n_{(\Pi_l^I=\Pi_{s,m=1,Q_B=0})} = n_{(\Pi_l^I=\pi_l)}$.

To sum up, for $\alpha < \bar{\alpha}$, there is an f-range, $\bar{f} \leq f < \bar{\bar{f}}$, with $f_2 < \bar{f} < \bar{\bar{f}} < f_{max}$, for which intermediary only profits are largest in an intermediate-n range. There are two cases. With $\bar{f} \leq f < \tilde{f}$, for increasing n, we get bribe only, intermediary only, bribe and intermediary with $Q_B = 0$, bribe and intermediary, then bribe only up to n_{max}. Because the intermediary only model and the solution with $Q_B = 0$ from the bribe and intermediary model are the same w.r.t. intermediary existence, this solution is the same solution as displayed in figure 4 and as captured by proposition 4A. With $\tilde{f} \leq f < \bar{\bar{f}}$, for increasing n, we get bribe only, intermediary only, bribe only, bribe and intermediary with $Q_B = 0$, bribe and intermediary, then bribe only up to n_{max}. The n-interval for which there is intermediaries only is thus discontinuous, which is proposition 4B.

The n-thresholds used in the proof are

$$n_{(\pi_l=\Pi_l)} = \frac{(4-3\alpha)g}{p+\sqrt{1-\alpha}(2(1-\alpha)\sqrt{f}+(2+3p)\sqrt{1-\alpha}-\sqrt{-4(2-\alpha)\sqrt{f(1-\alpha)}+\alpha^2 f+4(1-\alpha)(1+f)})}$$

$$n_{(\pi_m=\Pi_{s,m=1,Q_B=0})} = \frac{2(1-\alpha)g}{(1-\alpha)(2(1+p)-\alpha)-\sqrt{(-1+\alpha)\alpha(\alpha(-1+\alpha+4f-4\sqrt{\frac{f}{1-\alpha}})+4(-2f+\sqrt{\frac{f}{1-\alpha}}))}}$$

$$n_{(\pi_l=\Pi_{s,m=1,Q_B=0})} = \frac{\alpha g}{\alpha p+2\sqrt{\alpha((-2+\alpha)f+\sqrt{f(1-\alpha)})}}$$

$$n_{(\pi_l=\Pi_{l,m=1})} = \frac{(2-\alpha)^2 g/4}{(1-\frac{\alpha}{2})((1+p)-\alpha(1+\frac{p}{2}))-\sqrt{f(1-\alpha)^3}-\sqrt{\frac{\alpha}{4}(1-\alpha)(((7-\alpha)\alpha-8)f+2(2-\alpha)\sqrt{f(1-\alpha)})}}$$

$$n_{(\Pi^I_{s,m=1}=\pi_l)} = \frac{g}{p+2\sqrt{(1-\alpha)(\sqrt{f}-2f)/\alpha}}$$

$$n_{(\Pi^I_l=\Pi_{s,m=1,Q_B=0})} = \frac{2g}{1+2p+\sqrt{f}+\sqrt{(1-2\sqrt{f})+(9-5\alpha)f/(1-\alpha)-4\sqrt{f/(1-\alpha)}}}$$

$$n_{(\Pi^I_l=\pi_l)} = \frac{g(2(1-\alpha)(1+\sqrt{f})+(4-3\alpha)p+2\sqrt{(1-\alpha)((1-\alpha)(1+f)-(2-\alpha)\sqrt{f})})}{4(1-\alpha)(1+p)\sqrt{f}+p(4(1+p)-\alpha(4+3p))}$$ □

Proof of Proposition 5. First note that the intermediary only solution will not be a part of the endogenous n-solution. Maximal profits, over the range that this solution applies, is at $n = \frac{g}{p+1-\sqrt{f}}$ (from A.7). For this n, over the applicable (f, α) parameter space, profits $\Pi^I_{s,m=1}$ are always less than maximum profits in the bribe only model.

Maximizing bribe and intermediary (large-n) profits, Π_l and $\Pi_{l,m=1}$, gives

$$\frac{\partial \Pi_l}{\partial n} \implies n^* = \frac{g}{\sqrt{(p+1)(\sqrt{f(1-\alpha)}+p)-\frac{\alpha f}{4}}} \tag{A.8}$$

$$\frac{\partial \Pi_{l,m=1}}{\partial n} \implies n^* = \frac{g}{\sqrt{(p+1)(p+1-\alpha-2\sqrt{f(1-\alpha)})+f(1+\alpha)}} \tag{A.9}$$

The former solution is feasible up to the n where $m = 1$ starts binding, i.e. at $n_{m=1}$ (from A.3). Solving for equality gives that the unconstrained optimum in (A.8) holds for $f < f^*$, above which (A.9) applies. (A.9) is optimal as long as profits are larger than endogenous-n profits in the bribe only case (from 6). Equating profits from (6), with profits from (A.9), gives $f = f^{**}$, and we get the f-thresholds and n^* in proposition 5.

It is straightforward to check that n^* with either $0 \leq f < f^*$ or $f^* \leq f < f^{**}$ is strictly greater than when the bribe only solution applies (solve for equality w.r.t. f and check that the solution falls outside its permitted interval). Next compare, for the respective parameter spaces that (A.8) and (A.9) apply, the aggregate gain of individuals using intermediaries, individuals bribing, and individuals using the regular procedure, to the gain for the corresponding individuals in the bribe only model. Because $d = g$, individuals using intermediaries have zero net gain, which is less than in the bribe only model. As for individuals bribing, one can show that B (from A.3) is always larger than in the bribe only model. Individuals do not switch to the regular procedure, however. The A_i-threshold ($\frac{B(n)-np}{\alpha n}$) is instead lower, i.e. fewer individuals use the regular procedure. This is because, for larger n, also the regular procedure implies less gain. All three groups are thus worse off in the bribe and intermediary model.

The derivative $\frac{\partial n^*}{\partial f}$ is always negative for $0 \leq f < f^*$, but can change sign in the middle interval, depending on (p,α). The aggregate individual gain for the solution with $d = g, m > 1$, is $G = \frac{\alpha n f}{8} + \frac{(g-np)^2}{2n}$ (using definition 1), which gives $\frac{\partial G(n^*)}{\partial f} > 0$ over the relevant interval. Finally, $\frac{\partial m(n^*)}{\partial f}$ is always negative when $0 \leq f < f^*$.[24] □

[24] The negative derivative, $\frac{\partial n^*}{\partial f} < 0$, over $0 \leq f < f^*$, can be understood as follows. The bribe level,

AppendixA.5. Other distributions of A_i.

The model solved has some general properties, that hold for other A_i-distributions. In the subgame solutions (i.e. 4, A.3 and A.7), for small n, when no constraints bind, bribes (and intermediary fees) are linear in n. The intermediary mark-up is linear in n. The linearity implies constant demand and profits linearly increasing in n. The result arises because the gain of bribing/using an intermediary is proportional to n, and costs np are transferred to individuals, therefore the optimal bribes/fees are also linear in n. This is always the case, irrespective of the A_i-distribution. Taking the model in AppendixA.3 as example, one can use the substitution $x = \frac{B_d - np}{n}$, where, after solving for $d(B_d)$, also $\frac{d-B_d}{n}$ can be written as a function of x. Solving w.r.t. x, we get $B_d = n + xn$. Profits thus increase linearly in n for small n and are instead maximized for large n (where $d = g$).

We next illustrate, for the original uniform-, and two linear distributions, that the result that intermediaries decrease G, when n is endogenous, still holds. More specifically, we investigate whether larger m, i.e. more intermediary competition, leads to longer procedures and less license gain. The distributions, $h(A_i)$, are uniform, linearly decreasing, and linearly increasing in A_i. In the region where $d = g$, we get:

$$\begin{cases} h(A_i) = 1 \implies \Pi^I_{d=g} = \frac{(g-n-np)(n(1+p+mp)-g(1+m))}{mn} \implies n^* = \frac{g\sqrt{1+m}}{\sqrt{(1+p)(1+p+mp)}} \\ h(A_i) = 2(1-A_i) \implies \Pi^I_{d=g} = \frac{(g-n-np)(n(1+p+2mp)-g(1+2m))}{2mn} \implies n^* = \frac{g\sqrt{1+2m}}{\sqrt{(1+p)(1+p+2mp)}} \\ h(A_i) = 2A_i \implies \Pi^I_{d=g} = \frac{(g-n-np)(n^2-(1+2m)(g-np))}{2mn(g-np)} \implies \underbrace{1 = \frac{n^2(-g^2+2gn(1+p)-n^2p(1+p))}{(g^2-n^2p(1+p))(g-np)^2(1+2m)}}_{\text{at } n=n^*} \end{cases}$$

In the first two cases it is direct to show that $\frac{\partial n^*}{\partial m} > 0$, in the last case an increase in m must be accompanied by an increase in n, for the first order condition (shown) to hold. We thus have that entry of more intermediaries makes procedures longer, in all three cases. Because $d = g$, individuals using intermediaries are indifferent. Individuals using the regular procedure are worse off, i.e. the aggregate is worse off.

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for the large-n case with $d = g, m > 1$, is $B = np + \alpha(g - np) - \frac{n\alpha\sqrt{f(1-\alpha)}}{2}$, i.e. decreasing in f. As bureaucrats are bound by $B_d = g - n\sqrt{f(1-\alpha)}$, a larger f has a direct negative effect on indirect bribe profits. This affects the optimal B, which is reduced, to channel individuals to direct bribing instead. A larger fraction of profits now stems from direct bribes, giving individuals a time saving of α. The possibility to raise n is reduced, as the time-saving offered is less valuable to the aggregate of individuals.

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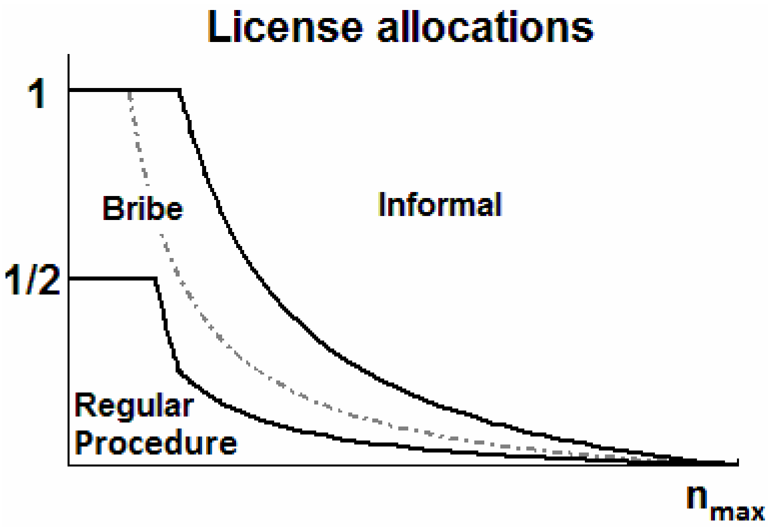

Figure 1. Solution as a function of n. The graph displays, for each procedure length n, the amount of licenses awarded (upper solid line), and the distribution of individuals that get the license through the regular procedure, bribe, or that do not get the license at all. The dot-dashed line is the productivity level below which individuals get the license when only the option of the regular procedure is available.

g=1, p=0.1, alfa=2/3

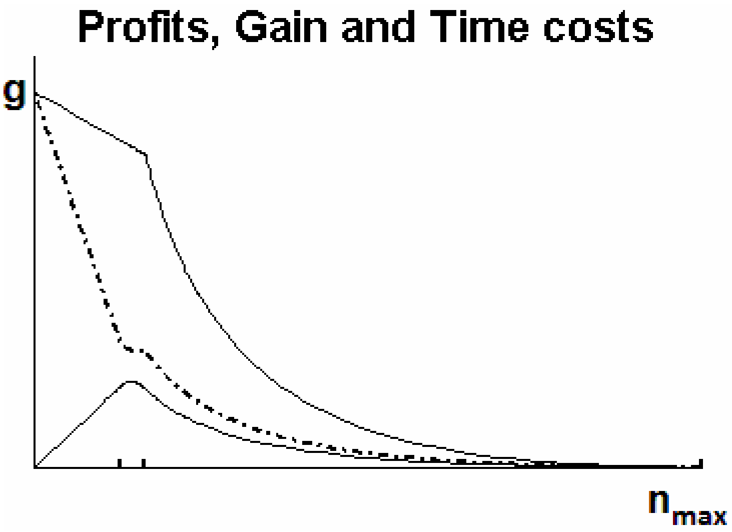

Figure 2. Bureaucracy profits (solid, inverted U), individuals' aggregate gain (dot-dashed) and sum of profits, gain and time costs (upper solid curve), as functions of n.

g=1, p=0.1, alfa=2/3

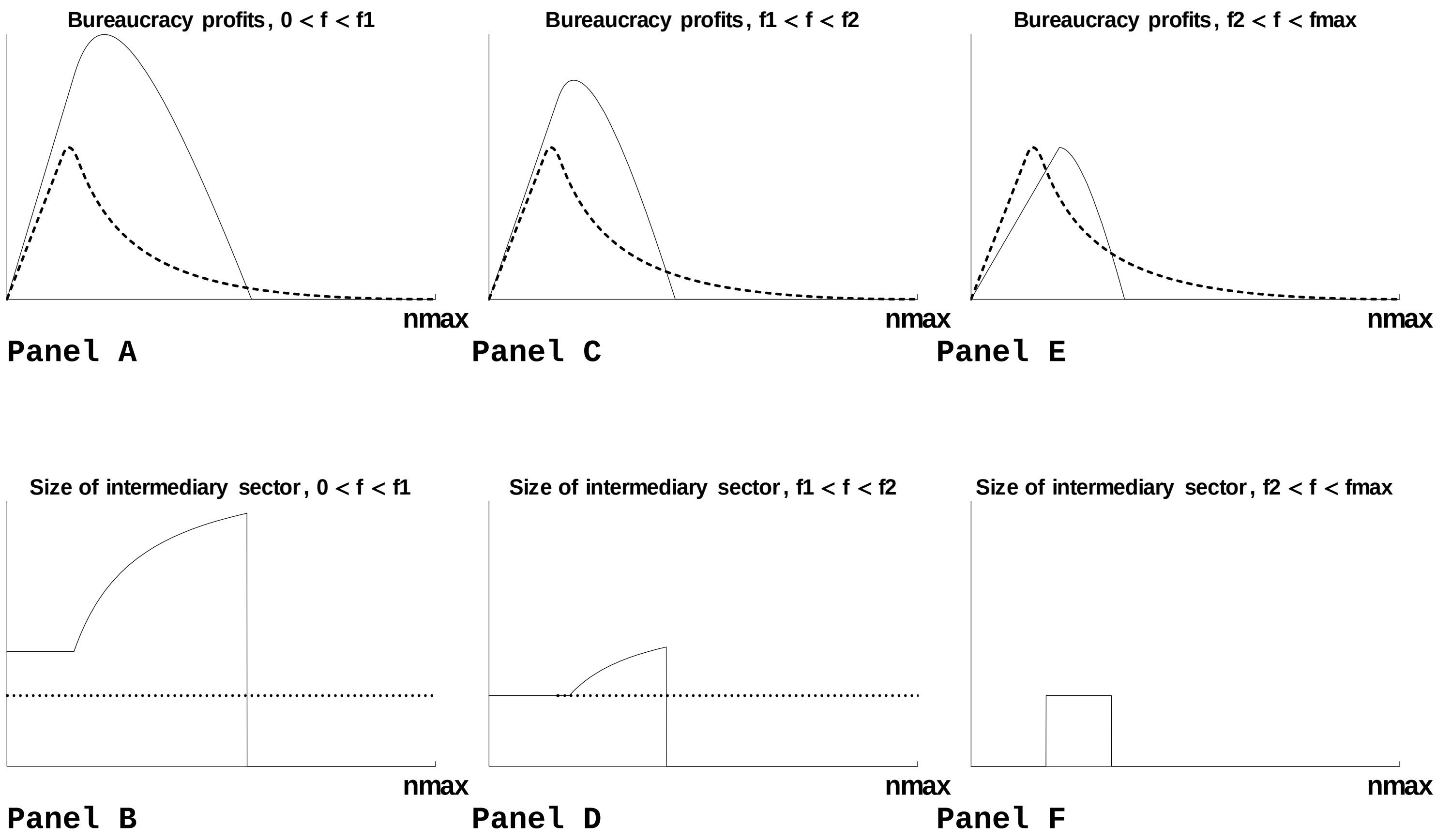

Figure 3. Solution as a function of n, for three different entry costs f. Bureaucracy profits (panels A, C, E) and size of the intermediary sector (panels B, D, F). In each profit graph the profits from the bribe and intermediary model (solid), and from the bribe only model is shown (the latter curve, dashed, remains the same in all three panels). The dotted line in panels B and D is m=1.

g=1, p=0.1, alfa=2/3

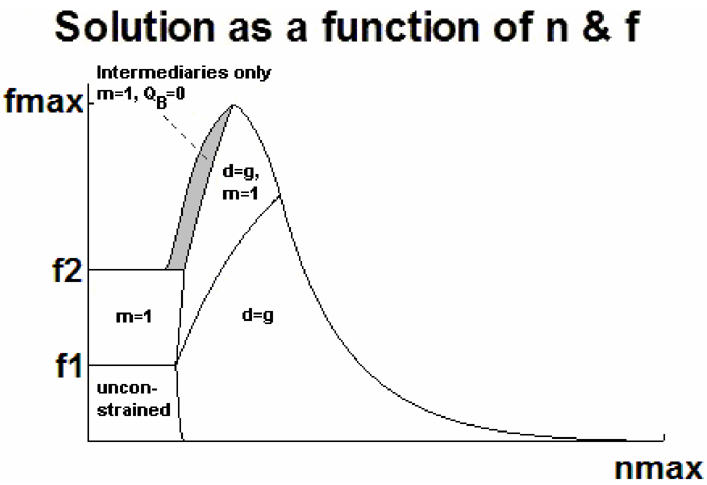

Figure 4. Solution in (n, f)–space. The five areas in the graph correspond to the (n, f)-parameter space for which each of the solutions to the bribe and intermediary model apply (see expression A.3). Direct bribing and intermediaries coexist for four of the five different solutions. The area marked in gray is where intermediaries exist without direct corruption (Q_B=0 binds). Outside of the five areas, i.e. above the upper curve, the optimal solution is the bribe only solution, i.e. m=0.

g=1, p=0.1, alfa=2/3

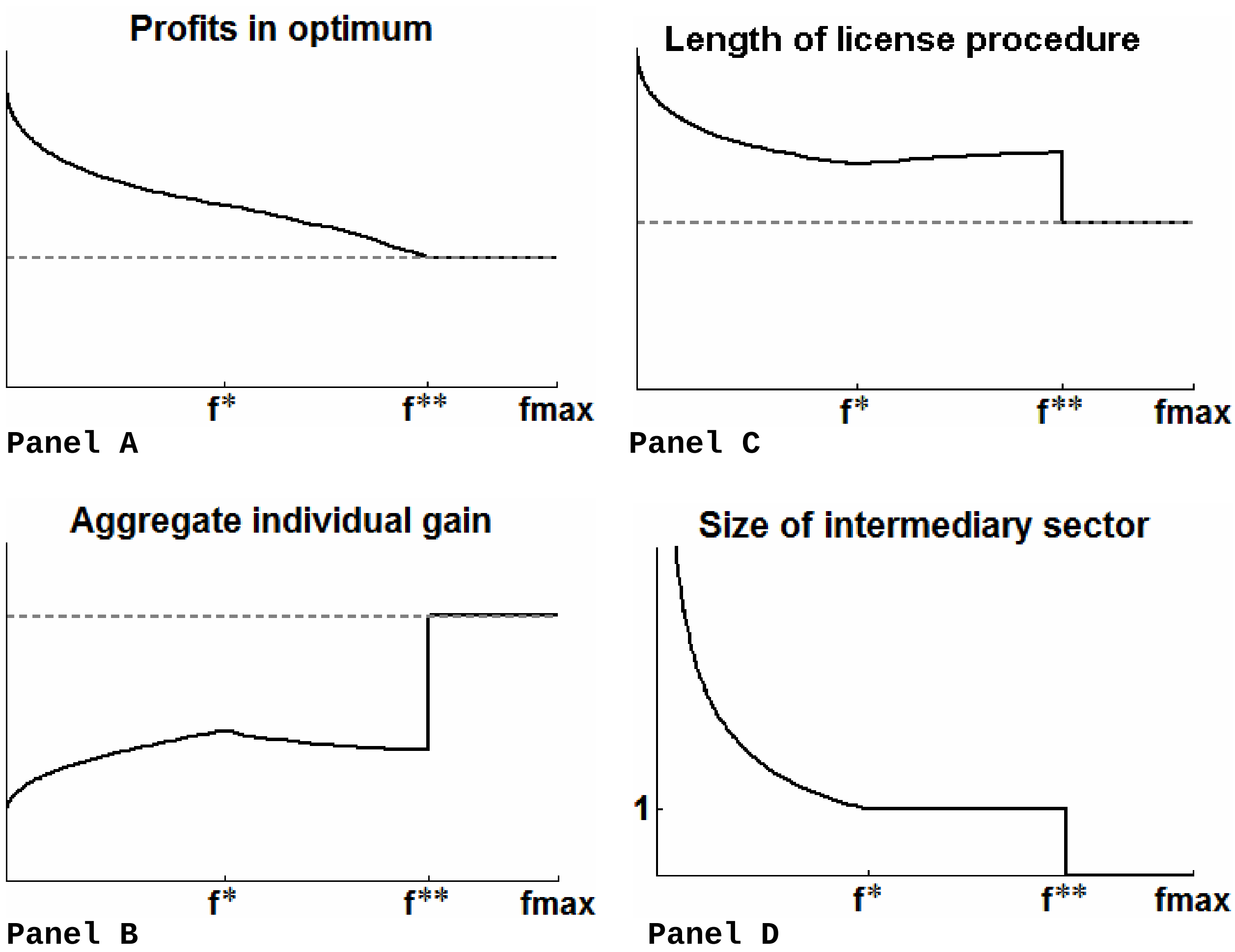

Figure 5. Solution when n is endogenous, as a function of the entry cost f (solid line). Bureaucracy profits (panel A), aggregate individual gain (B), length of license procedure (C) and size of the intermediary sector (D). The dashed line shows profits, gain and length of the procedure for the bribe only solution. The figure shows that bureaucracy profits are higher, procedures are longer and individuals are worse off, when the bribe and intermediary solution is optimal.

g=1, p=0.1, alfa=2/3