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**AUDITORS IN THE ECONOMY: THE IMPACT OF STANDARDS,
RENT-SEEKING BEHAVIOR AND PUNISHMENT**

A MASTER'S THESIS

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ABBREVIATIONS

SEC	:	Securities and Exchange Commission
IFRS	:	International Financial Reporting Standards
ISAs	:	International Standards on Auditing
GAAS	:	Generally Accepted Auditing Standards
OLG	:	Overlapping Generations Model

LIST OF SYMBOLS

Chapter 2:

β	: Level of positive externality created by high quality financial reporting
$\pi_G, \pi_B, \pi_S, \pi_H$: Utility of agents in the economy
x	: Proportion of entrepreneurs reporting high quality information
p	: Proportion of self-interested auditors
n	: Proportion of entrepreneurs in the economy
τ	: Penalty amount for entrepreneurs publishing low quality information
q	: The probability of detection of self-interested auditors
c, d	: Parameters of the linear function of q
e	: Cost of publishing high quality financial information for entrepreneurs
s	: Subsidy amount for entrepreneurs publishing high quality information
σ	: The proportion of τ and s auditors can take as bribes from entrepreneurs
v_1, v_2, v_3	: Agents pace of changing their strategies over time
w	: Competitive service fee for an audit

Chapter 3:

C	: Penalty amount for auditors with substandard effort
f	: Uniform probability density of auditors choosing an effort below a certain level
w'	: Competitive fee for an audit service
w	: Competitive fee for services other than audit

- e_R : Minimum level of effort required by the audited companies
 e_S : Minimum level of effort required by the auditing standards
 p : Probability of detection for auditors with substandard performance
 a, b : Parameters for the linear function of p
 L_t : Proportion of auditors with substandard performance
 $T_{1,i}$: Moral cost threshold level for young auditor i at time t
 $T_{2,i}$: Moral cost threshold level for old auditor i at time t
 $F(T_{1,i})$: Fraction of young auditors who choose an effort below the standards, and use $T_{1,i}$ as a threshold.
 $F(\overline{T_{1,i}})$: Fraction of young auditors who choose an effort below the standards, and use $\overline{T_{1,i}}$ as a threshold.
 $F(T_{2,i})$: Fraction of old auditors who choose an effort below the standards, and use $T_{2,i}$ as a threshold.

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RÉSUMÉ

Dans ce travail, l'effet des auditeurs, leur honnêteté et les facteurs affectant leur choix de stratégies individuelles sont analysés en utilisant des méthodes de modélisation dynamique. Etant donné que l'étude est basée sur des modèles théoriques, nous n'avons pas de résultat empirique. Au lieu, l'étude donne un aperçu significatif sur la façon dont les différentes variables paramétriques et des stratégies individuelles peuvent provoquer des équilibres stationnaires à émerger dans l'économie. Pour analyser ces questions avec une perspective analytique, j'ai utilisé deux modèles dynamiques inspirés par les modèles d'Acemoglu et Verdier (2000) et Lui (1986).

Le modèle que j'étudie dans le chapitre 2 considère le recours aux auditeurs pour surveiller la qualité de l'information financière. Les investisseurs, les créanciers et les gouvernements ont besoin d'information financière pour évaluer la performance d'une entreprise parce qu'ils prennent leurs décisions en fonction de leurs conceptions de cette information financière. Mais il est très essentiel pour les parties prenantes que l'information soit de haute qualité et fiable.

Dans l'existence d'externalités, il y a toujours la possibilité que les actions égoïstes des individus dans une économie aboutissent finalement à une défaillance du marché. Dans le cadre de cette recherche, un tel exemple serait d'une économie où toutes les entreprises publiques soumettent des informations financières manipulées, tirant de gains provenant de la performance exagérée au détriment de l'intérêt public. De toute évidence, nous ne pouvons pas espérer trouver une allocation efficace du capital dans telles circonstances.

Une contribution importante du secteur de l'audit est son rôle d'empêcher les investisseurs de prendre des décisions fondées sur des informations inexacts et d'améliorer ainsi la répartition efficace du capital dans l'économie. Toutefois, le secteur apporte ses coûts et ses avantages. Dans la recherche d'Acemoglu et Verdier (2000), les coûts de l'introduction des agents dans l'économie pour auditer l'information sont simplement classés en deux catégories: i. le coût du retrait des individus (agents) de la production vers la surveillance, ii. les coûts résultant d'un comportement malhonnête des agents dans la poursuite de gains individuels.

Les auditeurs sont en mesure d'utiliser une information supérieure pour extraire des rentes supplémentaires de l'économie. Il peut y avoir deux circonstances qui peuvent leur permettre de le faire. Tout d'abord, ils sont à des entrepreneurs qui choisissent l'information financière de mauvaise qualité et prennent des pots de vin pour signaler

que celle-ci est élevée. Deuxièmement, ils peuvent travailler avec des entrepreneurs utilisant l'information financière de haute qualité et prendre des pots de vin pour ne pas signaler que la qualité est faible.

Bien sûr, un comportement malhonnête des auditeurs ne sera pas toléré par la société car elle mine son intention d'encourager l'utilisation des rapports de haute qualité. Si un auditeur rapporte fidèlement le choix de la qualité de l'entrepreneur qu'il avait inspecté, il reçoit rien d'autre que les frais de service d'audit concurrentiel. Si l'auditeur exige des loyers de l'entrepreneur inspecté, il peut être détecté par l'autorité avec une certaine probabilité, et perd ses frais de service. Sinon l'auditeur reçoit à la fois les frais de service et un loyer, sans être détecté par l'autorité.

Ce contexte permet un environnement plus réaliste où l'on peut considérer des auditeurs indépendants maximisant leur intérêt personnel. Il leur est possible d'exiger des frais supplémentaires des clients qui ont des informations financières inexactes, et à son tour, de donner l'assurance pour celle-ci. Cependant, ils devraient le faire en risquant d'être détecté. Par exemple, pour un auditeur risque-neutre, la valeur espérée de prendre un frais supplémentaire pour donner l'assurance sur une déclaration de faible qualité diminue quand il y a une forte probabilité d'être puni pour cette action.

Les résultats de la version statique du modèle suggèrent qu'avoir les auditeurs dans l'économie est efficace afin que la société puisse maximiser le surplus social à condition que l'externalité positive vaille supporter le coût d'opportunité de l'allocation des auditeurs hors du secteur de production.

L'analyse est ensuite étendue à couvrir la dynamique des changements de stratégie entre les différents acteurs, en introduisant un cadre évolutionniste dans lequel les agents hétérogènes de différentes professions sont capables de changer leurs stratégies au fil du temps, en fonction de leurs évaluations de l'utilité de leurs stratégies par rapport à l'utilité des autres agents et celle de l'économie globale moyenne. L'analyse des états stationnaires des équations dynamiques montre qu'il y a six allocations triviales où tous les agents choisissent une des deux stratégies. En outre, nous pouvons avoir une population mixte ou certains choisissent une stratégie et certains une autre. La condition de stabilité est définie.

Après la conclusion du chapitre 2 que le comportement égoïste des auditeurs peut entraîner des échecs du gouvernement dans plusieurs circonstances, j'analyse comment les sociétés tentent d'éviter de telles défaillances à travers des normes, des sanctions et de sensibilisation avec un modèle dynamique.

Pour que le secteur de l'audit puisse avoir une valeur dans l'économie, les auditeurs doivent effectuer leur travail de manière à satisfaire les besoins de la société. Ils devraient être en mesure de recueillir des preuves suffisantes et appropriées afin de donner une assurance raisonnable que l'information financière fournie par la direction de l'entreprise audité reflète ses performances réelles. En d'autres termes, les auditeurs sont censés fournir un certain niveau de qualité de l'audit, qui exige directement une certaine quantité d'effort de l'audit. A cet effet, certaines normes d'audit ont été établies dans le

monde entier pour spécifier le minimum de soins et d'effort qui devrait être appliqué pour chaque procédure d'audit.

Bien que les directives générales pour les efforts d'audit nécessaires soient fournis par les normes, les auditeurs peuvent choisir de ne pas suivre ces lignes directrices, et d'exercer un effort au-dessous du niveau requis par les normes. La raison pour laquelle un auditeur fait cela pourrait être la nécessité d'utilisation des ressources écrasantes pour atteindre ce niveau d'effort, ou le coût d'opportunité d'allouer ses ressources à l'audit au lieu de services plus rentables, ou les deux. Ce comportement axé sur la maximisation d'utilité au détriment du bien-être de la société apporte la nécessité de suivre les choix de l'effort des auditeurs et la mise en œuvre des peines en conséquence.

En effet, le suivi des efforts des auditeurs est une tâche très difficile pour la société, parce que la plupart des échecs d'audits ne sont pas révélés jusqu'à ce que les entreprises auditées déclarent faillites, et les ressources des gouvernements sont souvent insuffisantes pour détecter tous les échecs d'audit. Les investisseurs et les créanciers font confiance aux auditeurs d'être assurés qu'ils transfèrent leurs fonds à des entreprises, sur la base des indicateurs réels de la performance financière. Mais, quand ils subissent des pertes en raison de l'information financière inexacte, ils ont recours à des mécanismes de contentieux afin d'être indemnisés. Alors que les autorités judiciaires enquêtent sur le cas de trouver les parties responsables pour les pertes, ils comptent sur les normes d'audit au moment de décider si l'auditeur a déployé des efforts d'audit suffisants.

Le modèle OGM que je considère dans le chapitre 3, étudie l'impact des normes et des systèmes de dissuasion sur les niveaux observés de performance en dessous des standards dans le marché de l'audit et donne des résultats très significatifs. Le premier constat du modèle suggère qu'il est possible de trouver des équilibres multiples dans le secteur de l'audit, dont certains peuvent être stables.

Comme nous avons vérifié les intervalles où les équilibres existent, il nous a conduit au deuxième constat que la pénalisation est un instrument très utile pour les sociétés pour réduire la fraction des auditeurs avec les niveaux d'effort inférieurs aux normes de l'économie, et de maintenir ce niveau perpétuellement. Dans l'exemple fourni, avec des paramètres donnés de l'environnement économique, le niveau de punition est avéré avoir un impact énorme sur la création et la résiliation des équilibres. Nous déduisons des chiffres que si le gouvernement devient plus tolérant et réduit les pénalités, il est possible de voir une grande augmentation soudaine de faible rendement au fur et à mesure que les équilibres de niveau inférieur disparaissent. En outre, lorsque l'économie s'installe dans un équilibre stable défavorable, les efforts pour la relever, par exemple par le biais d'augmenter la peine à son niveau précédent, seront inefficaces. Cela signifie également qu'il peut exister des économies avec différents niveaux de faible rendement, même si les valeurs des paramètres sont les mêmes pour les deux. Cependant, les résultats montrent également que si les peines se font tellement durcir, cela pourrait susciter que l'économie piège en même temps dans un équilibre défavorable de rendement inférieur persévérant.

Ensuite, nous avons introduit une variable supplémentaire au modèle pour voir quel impact ferait-il si les entrepreneurs audités avaient une demande consciente pour un

audit décent. Dans un tel environnement, les auditeurs sont obligés d'exercer un effort au moins à un niveau fixé par un marché plein d'avantages économiques entrepreneurs axés sur le long terme. La nouvelle variable se révèle d'avoir un impact similaire aux niveaux d'équilibre. Cependant, il est important de noter qu'une société puisse développer une telle prise de conscience quant à la qualité d'audit au lieu d'utiliser des sanctions pour la dissuasion va très certainement conduire l'économie à un meilleur état dans le long terme. Dans un environnement avec un tel développement structurel, il est prévu que les entrepreneurs finissent par exiger le niveau d'effort standard à partir de l'organe de révision qui permettrait de réduire la nécessité des auditeurs d'inspection et aussi les coûts écrasants liés à ces inspections. Une autre constatation importante du modèle est que la prise de conscience des entrepreneurs auditée a également un impact important et négatif sur le rendement inférieur total dans le secteur de l'audit.



ABSTRACT

In this thesis, the impact of auditors' presence, their honest and self-interested behavior in the economy, and the factor affecting their choice of individual strategies are analyzed by using dynamic modelling methods. Since the study relies on theoretical models, it does not yield any empirical result. Instead, the study yields significant insights on how various parametric variables and individual strategies may cause steady-state equilibria to emerge in the economy. In order to analyze these issues with an analytical perspective, we employed two dynamic models inspired by the models of Acemoglu and Verdier (2000) and Lui (1986).

The model we covered in Chapter 2 investigated first, the use of auditors for monitoring the financial reporting quality. Investors, creditors and governments require financial information to evaluate a company's performance because they make their economic decisions based on their conceptions over this financial information. But it is very essential for the stakeholders that the information is of high quality and is reliable.

In the existence of externalities, there is always the potential that self-interested actions of individuals in an economy eventually result in market failure. In the context of this research, an example is an economy where all public companies report manipulated financial information, extracting gains through overstated performance in the expense of public interest. Obviously, we cannot expect to find an efficient allocation of capital in such circumstances.

A major contribution of auditing sector is considered to be its role in protecting investors from making decisions based on inaccurate information, and thereby enhancing efficient allocation of capital in the economy. However, the sector brings its costs together with its benefits. In the research of Acemoglu and Verdier (2000), the costs of introducing agents into the economy for auditing the information are simply categorized into two: 1) the cost of withdrawing individuals (agents) from production to use them in monitoring, 2) the costs resulting from dishonest behavior of rent-seeking agents.

Auditors are able to use their superior information for extracting additional rents from the economy. There can be two circumstances which enable them to do that. First, they match with entrepreneurs choosing low quality financial reporting and take bribes to

report that the quality is high. Second, they match with entrepreneurs using high quality financial reporting and take bribes not to report that the quality is low.

Of course, dishonest behavior of auditors will not be tolerated by the society since it undermines its intention to foster the use of high quality reporting. If an auditor truthfully reports the quality choice of the entrepreneur he had inspected, he will receive nothing but the competitive audit service fee. If the auditor demands rents from the inspected entrepreneur, he gets detected by the authority with probability q , and loses his service fee. On the other hand, with probability $1 - q$, the auditor receives both the service fee and a rent, without being detected by the authority.

This setting allows for a more realistic environment where we can consider independent auditors as self-interest maximizers. It is possible for them to demand extra fees from clients they found out to report inaccurate financial information, and in turn, giving assurance for this inaccurate information. However, they should do it taking the possibility of detection into account. That is for instance, for a risk-neutral auditor, the expected value of taking an extra fee for giving assurance over a low quality reporting decreases when there is high probability of being punished for that action.

The findings of the model's static version suggested that having auditors in the economy are effective for the society to maximize the social surplus only if the positive externality being promoted is worth bearing the opportunity cost of allocating auditors out of the productive sector.

The analysis is then extended to capture the dynamics of the strategy changes among different actors, by introducing an evolutionary framework in which the heterogeneous agents of different occupations are able to change their strategies over time, based on their evaluations of their strategies' utility compared to mean utility of other agents and that of the overall economy. Steady state equilibrium analysis of the dynamic equations shows that there are six trivial rest points where all agents select one of two strategies. Furthermore, there are mixed rest points for p and n . The stability is checked for these equilibria but however they did not turn out to be stable levels, at least within the limitations of this specific framework.

After concluding in Chapter 2 that the self-interested behavior of auditors may result in government failures in several circumstances, we analyze how societies attempt to avoid such failures through standard-setting, penalties and raising awareness with a dynamic model.

For audit sector to have a value in the economy, the auditors should perform their jobs in a manner satisfying the needs of the society. They should be able to gather

sufficient and appropriate evidence in order to give a reasonable assurance that the financial information provided by the management of the audited company reflects its actual performance. In other words, auditors are expected to provide a certain level of audit quality, which directly requires a certain amount of audit effort. For this purpose, some standards for auditing have been established throughout the world for specifying the minimum care and effort that should be applied for each and every audit procedure.

Although general guidelines for required audit efforts are provided by the standards, auditors may choose not to follow these guidelines, and exert an effort below the level required by the standards. The reason an auditor does this might be the overwhelming resource requirements to reach that level of effort, or the opportunity cost of allocating his resources to audit instead of more profitable services, or both. This utility maximizing behavior in the expense of society welfare brings the necessity of monitoring auditors' effort choices and implementing punishments accordingly.

As a matter of fact, monitoring audit effort is a very difficult task for the society, because most audit failures are not revealed until the audited companies declare bankruptcy, and governments' resources are often insufficient to detect all audit failures. Investors and creditors trust auditors to be assured that they are transferring their funds to companies, based on actual financial performance indicators. But, when they incur losses because of inaccurate financial information, they resort to litigation mechanisms in order to be compensated. While the judicial authorities investigate the case to find out the parties responsible for the losses, they rely on auditing standards when deciding whether the auditor has exerted sufficient audit effort or not.

The OGM model we covered in Chapter 3 investigated the impact of standards and deterrence schemes on the prevailing levels of substandard performance of auditors in the audit market and it yielded very significant results. The first finding of the model suggests that it is possible to find multiple equilibria in the audit sector, some of which may be stable. We show this by introducing an example that had three equilibrium points, two of them being stable.

As we checked the ranges where the equilibria exist, it led us to the second finding that the punishment is a very useful instrument for societies to lower the fraction of auditors with substandard effort levels in the economy, and to sustain that level perpetually. In the example provided, with given parameters of the economic environment, the punishment level turned out to have a huge impact on the creation and termination of the equilibria. We realize from the figures that if the government becomes more tolerant and reduces the penalties, it is possible to see a sudden large increase in substandard performance as the lower level equilibria vanishes. Moreover, when the economy settles in an unfavorable stable equilibrium, the efforts to bring it back, for instance by increasing penalty to its previous level, will be ineffective. This also means that there may exist economies at different equilibrium levels of substandard performance

even if the values of parameters are the same for both. However, the results also show that if the penalties are increased so much, it might cause the economy to trap in an unfavorable equilibrium of persistent substandard performance as well.

Then we introduced an additional variable to the model to see what impact would it make if the audited entrepreneurs had a conscious demand for a decent audit. In such an environment, auditors are compelled to exert an effort at least at a level set by a market full of long-term economic benefit oriented entrepreneurs. The new variable resulted to have a somehow similar impact to the equilibrium levels. However, it is important to note that for a society to develop such an awareness regarding the audit quality instead of using penalties for deterrence would most certainly lead the economy to a better state in the long-run. In an environment with such a structural development, it is expected that the entrepreneurs will eventually demand the standard effort level from the auditors which would reduce the necessity of inspecting auditors and the overwhelming costs related with these inspections. Another important finding of the model is that the awareness of the entrepreneurs being audited also has a big and downside impact on the overall substandard performance in the audit sector.

ÖZET

Bu tezde denetimin ekonomideki etkisi, denetçilerin kişisel çıkarlarını takip eden ve etmeyen kişiler olmalarının nasıl sonuçlar yarattığı, bireysel kararların değişiminde nelerin etkili olduğu dinamik modelleme yöntemleriyle incelenmiştir. Çalışma, teorik modellere dayalı olduğundan ampirik sonuçlar elde edilmemiş, ancak farklı parametrik değişkenlerin ve bireysel stratejilerin ekonomide durağan dengeler yaratma konusundaki etkilerini görmemizi sağlayan önemli bulgulara ulaşılmıştır. Analitik bir bakış açısı ile bu konuları analiz edebilmek için, Acemoğlu ve Verdier (2000) ile Lui'nin (1986) modellerinden esinlenerek iki dinamik model kullanılmıştır.

İlk olarak 2. Bölümde işlediğim modelde finansal raporlama kalitesinin kontrol edilmesi için, denetçilerin kullanımını araştırdık. Yatırımcılar, kredi kurumları ve devletler iktisadi karar verecekleri zaman şirketlerin performansını değerlendirebilmek için finansal bilgiye ihtiyaç duyarlar. Ancak kullandıkları finansal bilginin kaliteli ve güvenilir olması onlar için çok önemlidir.

Dışsallıkların mevcut olduğu durumlarda, bir ekonomide bireylerin kendi çıkarlarını gözetken eylemleri sonucunda piyasa başarısızlıklarının oluşma potansiyeli her zaman vardır. Bu araştırma bağlamında, tüm kamu yararını ilgilendiren şirketlerinin mali tablolarını manipüle ederek yüksek performans göstergeleri yaratıp, bu sayede kâr elde ettiği bir ekonomi örnek olarak gösterilebilir. Bu tür bir durumda sermayenin etkin dağıtımından söz etmek mümkün değildir.

Denetim sektörünün önemli bir rolünün yatırımcıları yanlış bilgilere dayalı kararlar almaktan korumak ve böylece ekonomide sermayenin etkin dağıtımını güçlendirmek olduğu düşünülmektedir. Ancak, denetim sektörü yararları ile birlikte bazı maliyetleri de beraberinde getirmektedir. Acemoğlu ve Verdier (2000) araştırmasında, bilginin denetimi için ekonomide bürokratlara yer verilmesinin maliyeti iki kategoriye ayrılmıştır: 1) bireylerin denetçi olmasalar üretim sektöründe olacak olmalarından kaynaklanan fırsat maliyeti, 2) denetçilerin bireysel çıkarlarını önde tutmalarından kaynaklanan maliyetler.

Denetçiler, denetim sürecinde kamu yararını ilgilendiren kuruluşların mali pozisyonları ve performansları hakkında bilgi üstünlüğüne sahip olurlar. Bu bilgi üstünlüğünün yukarıda belirtildiği üzere toplumsal faydayı koruyacak şekilde kullanmaları beklenirken, denetçiler asimetrik bilgi koşullarını fırsata çevirip ekonomide ekstra rant elde edebilirler. Bunu iki farklı şekilde yapabilirler. Birincisi, düşük kaliteli finansal raporlama seçen girişimcilerle eşleştiklerinde, bilgi kalitelerinin yüksek olduğunu raporlamak için rüşvet almak. İkincisi ise yüksek kaliteli finansal raporlama kullanan girişimciler ile eşleştiklerinde kalitelerinin düşük olduğunu bildirmemek için rüşvet almak.

Denetçilerin dürüst olmayan davranışları toplum tarafından hoşgörülmecektir. Eğer bir denetçi dürüst bir şekilde girişimcilerin kalite seçimini raporlarsa, sadece denetim ücretini alacaktır. Ancak eğer denetçi denetlediği girişimlerden rüşvet alma yoluna giderse, belli bir olasılıkla devlet tarafından yakalanacak ve cezalandırılacaktır. Yakalanmadığı takdirde hem denetim ücretine hem de girişimciden aldığı rüşvete sahip olacaktır.

Modelin bu şekilde düzenlenmesi, denetçilerin bireysel çıkarlarını gözettikleri durumun da incelenmesi bakımından daha gerçekçi bir ekonomik ortam sunar. Denetçilerin yanlış bilgi sunumu yaptığını farkettilerinden ekstra ücret talep etmesi ve karşılığında bu yanlış bilgiler için güvence vermesi mümkündür. Ancak bunu yaparken, yakalanma olasılığını da dikkate almaları gerekir. Yani, risk-nötral bir denetçinin düşük kaliteli finansal bilgiler için güvence vererek elde edeceği faydanın beklenen değeri, bu eylemi için ceza alma ihtimali ve alacağı cezanın miktarı arttıkça azalır.

Modelin statik versiyonundaki bulgular gösteriyor ki denetçiler, sosyal faydanın maksimizasyonu için sadece gözetilen pozitif dışsallık onları üretim sektörünün dışında tutmaya degecek kadar büyükse efektif bir rol oynamaktadırlar.

Bu statik analizin değerlendirmesinin ardından, değişik mesleklerden heterojen oyuncuların zaman içinde stratejilerini, getirilerini diğer oyuncuların getirisiyle ve ekonomideki ortalama getiriyle karşılaştırarak değiştirebildikleri bir evrimsel çerçeve oluşturduk. Bu çerçeve denetçilerin ve girişimcilerin strateji değiştirme dinamiklerini gözlemleyebileceğimiz bir analize imkan sağlamaktadır. Dinamik eşitliklerin denge analizini yaptığımızda, oyuncuların stratejilerden yalnızca birini veya ötekini seçtikleri altı adet sıradan denge ile, bireysel çıkar odaklı denetçi oranı ve ekonomideki girişimci oranı için birer adet karma dengeye ulaşılabilir. Bu dengelerin durağanlık analizi yapıldığında ise çizilen çerçevenin limitleri dahilinde durağan bir denge olmadığı saptanmıştır.

2. Bölümde denetçilerin bireysel çıkar odaklı davranışlarının devlet başarısızlıklarına sebep olabileceği sonucuna varıldıktan sonra 3. Bölümde, toplumların bu tip başarısızlıkları standartlar, cezalar koyarak ve girişimcilerde farkındalık yaratarak nasıl önlemeye çalıştıkları bir dinamik model ile incelenmektedir.

Denetim sektörünün ekonomi için bir değeri olması ancak, denetçilerin işlerini toplumun ihtiyaçlarını karşılayacak şekilde yapmalarıyla mümkündür. Yeterli ve uygun denetim kanıtı toplayarak denetledikleri şirketlerin yayınladıkları finansal bilgilerin, şirketin gerçek performansını yansıtıp yansıtmadığını hakkında makul güvence vermelidirler. Bir diğer deyişle, denetçilerin işlerinde belli bir kalite seviyesini sağlamaları beklenmektedir, bu da doğrudan doğruya belli bir denetim eforu gerektirmektedir. Bu amaçla, dünya genelinde denetim standartları geliştirilmiş ve çeşitli ülkelerde zorunlu hale getirilmiştir. Bu standartlar denetçilerin denetim hizmetlerinin her aşamasında göstermeleri gereken minimum efor seviyelerini tanımlamaktadır.

Standartlar denetçilere göstermeleri gereken efor seviyeleri konusunda rehberlik yapsa da, denetçiler kendilerini bu rehberlere uymak zorunda hissetmeyebilir ve bu seviyelerin altında efor sarfetmeyi seçebilirler. Denetçilerin böyle davranmasının sebebi standart seviyesine ulaşmanın katlanması zor maliyetleri olması veya kaynaklarını denetim yerine daha kârlı hizmetlere tahsis etmek istemesi olabilir. Bu fayda odaklı davranışın toplumsal faydayı zedelemesi, denetçilerin efor tercihlerinin gözlenmesi ve standart altı efor tercihinin cezalandırılması gerekliliğini ortaya koymaktadır.

Ancak denetim eforunun kontrol edilmesi toplum için çok zor bir görevdir, çünkü çoğu denetim başarısızlığı, denetlenen firma iflas etmedikçe ortaya çıkmamaktadır ve devletin kaynakları tüm denetim başarısızlıklarını tespit etmek için yeterli değildir. Yatırımcılar ve kredi kuruluşları kaynaklarının şirketlere gerçek finansal performans göstergelerine dayanarak aktarıldığından emin olmak için denetçilere güvenir. Eğer yanlış finansal bilgi sebebiyle zarar ederse, bu zararını tazmin etmek için hukuki yollara başvurur. Adli kurumlar vakaları incelerken, zararlardan kimlerin sorumluğu olduğunu tespit etmek için denetim standartlarına başvurur ve denetçinin bu zararı öngörmek adına yeteri kadar efor sarf edip sarf etmediğine bu şekilde karar verir.

3. Bölümde işlenen OGM modeli standartların ve cezai yaptırımların denetim sektöründeki standart altı efor gösteren denetçi oranı seviyelerini nasıl etkilediğini araştırmaktadır ve önemli bulgular sağlamaktadır. Modelin ilk bulgusu, bahsedilen seviyelerde çoklu denge olma ihtimalini göstermiştir. Hatta bu dengelerden bazıları durağan olabilmektedir. Bu bulgu, ikisi durağan olan üç dengenin var olduğu bir örnek ile gösterilmiştir.

Dengelerin var olduğu aralıklar incelendiğinde, ikinci bulgu kendini göstermiştir. Modelden anlaşıldığı üzere ceza seviyelerinin dengeler üzerinde önemli bir etkisi vardır.

Örnekte ele alından parametreler çerçevesinde, cezanın toplumun standart altı efora karşı toleransının yüksek olduğu bazı seviyeleri için üç dengeden düşük olan ikisinin kaybolduğu, kalan tek dengenin yüksek standart altı efor gösteren denetçi oranına denk gelen denge olduğu görülmektedir. Tüm bunların ötesinde, ekonomi kötü bir dengede hapsoldüğünde, parametrelerin eski haline getirilmesi ve cezanın yükseltilmesinin denetçiler üzerindeki etkisinin ciddi şekilde azaldığı görülmektedir. Öte yandan cezanın çok fazla yükseltilmesi de benzer şekilde ekonominin yüksek dengeye yönelme riskini artırmaktadır. Bu bağlamda cezalar, toplumun denetim kalitesini iyileştirmek ve sürekli bir şekilde kontrol altında tutması için önemli bir enstrüman olarak ortaya çıkmaktadır. Bu da şu anlama gelmektedir: Tamamen aynı parametrelere sahip iki denk ekonomiyi farklı duran dengelerde konumlanmış olarak görmek mümkündür.

Son olarak, modele yeni bir değişken ekleyerek, denetlenen şirketlerin bilinçli bir şekilde denetçilerden işlerini düzgün şekilde yapmalarını beklemelerinin nasıl bir etkisi olacağı incelendi. Böyle bir ekonomik çevrede denetçiler, ne olursa olsun belli bir miktar denetim eforu sergilemek zorunda kalmaktadırlar. Bu efor seviyesi piyasadaki tüm girişimcilerin uzun vadeli ekonomik faydalarını ön planda tutmalarıyla gerçekleşebilmektedir. Yapılan analiz sonucunda yeni değişkenin etkisinin ceza değişkeninin etkisine benzer olduğu görülmüştür. Ancak şunu belirtmek gerekir ki, böyle bir yapısal gelişimin ekonomiye katkısı, denetçileri ceza ile korkutmanın etkisinden çok daha fazla olacaktır. Ayrıca böyle bir çevrede, şirketler tarafından talep edilen eforun zamanla standart efora yakınsaması beklenmektedir. Böylece denetçilerin bireysel çıkar odaklı davranışlarının cezalandırılmasına gerek kalmadığı gibi bununla ilgili maliyetlerden de kaçınılmış olacaktır.

CHAPTER 1: INTRODUCTION

Investors, creditors and governments require financial information to evaluate a company's performance because they make their economic decisions based on their conceptions over this financial information. But it is very essential for the stakeholders that the information is of high quality and is reliable.

Today's competitive market conditions put a great pressure on companies' managements to meet their investors' expectations. Due to this pressure, they are avoiding the costs of providing high quality accounting information and some companies even become much more inclined to manipulate their financial statements (Carruth, 2011). World has experienced significant losses because of investments based on inaccurate financial information, as in the cases of Enron and WorldCom. These experiences have highlighted the importance of obtaining reliable attestation over financial statements.

In the existence of externalities, there is always the potential that self-interested actions of individuals in an economy eventually result in market failure. In the context of this research, an example is an economy where all public companies report manipulated financial information, extracting gains through overstated performance in the expense of public interest. Obviously, we cannot expect to find an efficient allocation of capital in such circumstances.

Market failures are often intended to be solved by the intervention of public authorities (i.e. governments). This is mostly done through the use of agents (or

bureaucrats) with relevant expertise and skills for collecting required information. However, this process inevitably creates room for another potential disease for the economy: government failures due to inefficient allocation of individuals, information asymmetry and principal-agent problem. Thus, there is a trade-off between market failures and government failures.

The independent auditors are considered to be the “watchdogs” of public interest. Their existence in the economy is for ensuring that all information published by companies, which are subject to public interest, are accurately stated, so that the investors and creditors supply their funds and capital to companies, conditional on their actual performance. It would not be feasible, if possible, for individuals with capital and funds in the economy to inspect all financial information regarding the performance of companies in the market, without the professional intermediacy of auditors who possess the required expertise and skills. Therefore, the auditors have an important role for achieving a higher output for the society through a more efficient allocation of funds.

As a matter of fact, there is also some evidence that their existence causes a downside impact on the output through waste of resources, let alone helping to achieve a better one.¹ For example, many banks and investors have lost billions of dollars due to the accounting scandal of Enron in 2002. It was a huge energy company audited by one of the largest audit firms in the world. However, the auditors failed to reveal Enron’s fraudulent financial information, and investors’ trust for their assurance caused them to wastefully transfer their capital in a company in the edge of bankruptcy.

Such failures basically result from the fact that there is a conflict of interest between the society and the auditors. There are various ways that auditors may pursue their self-interest in the expense of public interest. An auditor, for instance, may gain from being more cost averse. It means that he can reduce his costs by performing an audit

¹ Many of these evidence and their reasons are investigated in recent research such as (Agrawal & Chadha, 2005) and (Moore, Tetlock, Tanlu, & Bazerman, 2006).

with lower effort or by decreasing the size of its engagement teams, both of which would certainly decrease the quality of the audit. Auditors' overall effort levels in the audit sector and how they are affected by deterrence policies are examined in Chapter 3.

An auditor may also gain from seeking additional rents from the clients he audits, that is, he can charge extra fees for reporting an opinion favorable to his client. Impact of such activities to the economy is analyzed in Chapter 2. But it is convenient to claim that all these behavioral problems would damage the public interest by creating an inefficient capital allocation environment.

In this research we will introduce two models for analyzing the audit sector, auditors' impact in the economy and the dynamics emerging out of their presence in the economy. We first begin with a model inspired by Acemoglu and Verdier (2000) to examine the evolutionary dynamics of the agents' strategy choices in the economy. Then, we will introduce another model, inspired by Lui (1986), to see how substandard effort of auditors are affected by the standards and deterrence schemes set by the society.

CHAPTER 2: AUDITING, PUBLIC INTEREST AND HONESTY

The public demand for auditing basically arises from the need for verified information. Using their professional skills and going through an exhaustive investigation process, the auditors gather sufficient evidence to conclude whether the company's financial statements reflect the truth or not. This evidence provides the auditor a superior information regarding the financial position of the companies that are subject to public interest. It is expected from an auditor to use this superior information to report on any material misstatements by the company's management that may influence the investors' decisions. However, auditors, like all other actors in the economy, are self-interested. Thus, they might have incentives to diverge from acting in accordance with public expectations.

In this chapter, the benefits and costs of the existence of auditors in the economy -with and without dishonest behavior- are analyzed. In addition to this analysis, an evolutionary interpretation is made with an attempt to observe the dynamics of strategy choices of agents in the economy.

2.1. Literature Review

In one of his speeches, Lynn Turner, a former chief accountant of the SEC, addresses the importance reliable and high quality financial information by stating that the success of capital markets of the USA derived from people's willingness to invest more capital there since they receive higher quality financial information than is available in any other place in the world (Turner, 2001). So, if the information does not reflect the

company's financial position and performance fairly, there emerges a risk for investors and creditors that they invest in underperforming or insolvent companies due to misleading inaccurate financial information.

A major contribution of auditing sector is considered to be its role in protecting investors from making decisions based on inaccurate information, and thereby enhancing efficient allocation of capital in the economy (Doty, 2013; Zimmerman, 2015). This relationship is best observed in countries where International Financial Reporting Standards (IFRS) have been adopted. While financial reporting in accordance with IFRS provides higher quality financial information and comparability among financial statements, it also requires reasonable assurance from auditors since the statements involve managers' judgment. Thus, by all means, adoption of IFRS is viewed as a big step forward to reliable financial information of companies.² The positive impact of IFRS adoption on capital markets and national economies is supported by empirical evidence in many researches.³

However, the sector brings its costs together with its benefits. In a model developed by Acemoglu and Verdier (2000), the costs of introducing agents into the economy for auditing the information are simply categorized into two: 1) the cost of withdrawing individuals (agents) from production to use them in monitoring, 2) the costs resulting from dishonest behavior of rent-seeking agents.⁴

An auditor may gain from seeking additional rents from the clients he audits, that is, he can charge extra fees for reporting an opinion favorable to his client. Such behavioral

² See Yi Lin Chua, Chee Seng Cheong, and Gould (2012).

³ See, for example, Armstrong, Barth, Jagolinzer, and Riedl (2010); Li (2010).

⁴ In fact, the model of Acemoglu and Verdier (2000) investigates the case where governments need bureaucrats to monitor entrepreneurs' choice of technology (good or bad) and implement policies accordingly. Our interpretation of it provides insight and basis to understand the impact of auditing sector and rent-seeking behavior of auditors in the economy.

problems would damage the public interest by creating an inefficient capital allocation environment.

The conflict of interests mentioned above clearly shows that there is a trade-off for the public authorities to consider while deciding whether to use auditors for monitoring the financial information accuracy in the market. The main questions we are trying to answer in this chapter are: What is the optimal and evolutionary stable size of the auditing sector in an economy? Should auditors exist in the economy at all? And if so, what are the conditions for that when they are acting in accordance with their self-interests or public-interest? And lastly, might there be certain levels of different proportion of agents with different strategies that stays stable over time in the economy?

The model we cover in this chapter is inspired by Acemoglu and Verdier (2000) and investigates the evolutionarily stable allocation of auditors and entrepreneurs in an economy.

2.2. The Model

The economy is considered to have risk-neutral individuals and their mass is normalized to 1. The individuals can become entrepreneurs or auditors. The fraction of entrepreneurs is denoted by n , and they have a uniform production of y . Entrepreneurs choose between two types of financial reporting: high quality financial reporting which accurately reflects the company's performance and low quality financial reporting which is likely to include inaccurate information regarding the company's performance. The fraction of those choosing high quality financial reporting will be denoted by xn . There is an additional cost of providing high quality financial information, $0 < e < y$, for the entrepreneurs making it. However, the choice of high quality financial reporting provides all individuals in the economy, irrespective of their job and type of financial reporting

choice, $\beta > e$ units of positive externality for each entrepreneur using good technology, that is βxn . Consequently, the social surplus is:

$$SS = ny + (\beta - e)nx. \quad (1)$$

In the case of a decentralized economy, where there are no auditors and where all individuals are entrepreneurs ($n = 1$) and their technology choices are unknown to public, those making a high quality financial reporting and low quality financial reporting will face the following payoffs:

$$\pi_g = y + \beta xn - e \quad (2)$$

$$\pi_b = y + \beta xn \quad (3)$$

It is evident that there is only one equilibrium here, which is $n = 1$ and $x = 0$. The simple reason is that the individuals are self-interested and they do not take into account whether they contribute to payoffs of other individuals in the economy. This equilibrium yields a social surplus of $SS = n \cdot y$. It is important to note that the setting considers the production with high quality financial reporting creating a positive externality instead of the one which may use a low quality financial reporting creating a negative externality. But this does not affect the model's findings since the reasoning goes both ways. This equilibrium implies that no enterprise would be willing to report fairly in the absence of auditors as their integrity brings them to a disadvantaged position in the competitive market.

We will now introduce the honest auditors into this economy and analyze what impact would they have with regard to utilization of positive externalities for reaching a better equilibrium. In this case, society uses auditors to monitor the quality choices of

entrepreneurs and implement policies accordingly. The entrepreneurs using low quality financial reporting are punished with a penalty of $\tau < y$, and those using high quality financial reporting are rewarded with a subsidy of s , both being applicable in the case of inspection.

The probability of detection, $p(n)$, depends on the fraction of auditors. We can simply calculate $p(n) = \min\{\frac{(1-n)}{n}, 1\}$. So the probability of being inspected by an auditor is $\frac{(1-n)}{n}$, unless there are more auditors than entrepreneurs.⁵

Now, there are incentives, imposed by society, for actors in the production sector to diverge from undesired behavior towards desired behavior and this shift is inspected by auditors. Investors and creditors do this by being more inclined to transfer their funds to those who were able to acquire assurance from auditors for their financial statements, rather than those who were not. In fact, those companies, statements of which have been detected to include inaccurate information are either asked to make the necessary corrections, often causing them to bear additional costs, or they end up in court trials being subject to high amounts of fine payments.

Taking several constraints into account, there occurs a feasible set of (x, n) , a region providing highest utility levels for the economy either at points on $x = n$ or $(0,1)$, depending on the level of β . In other words, until now, the model assumes that the cost of introducing auditors in the economy to monitor quality choices is simply the opportunity cost of withdrawing them from the productive sector, and the result implies that in a setting where auditors are completely honest, the optimality of their presence in the economy depends on the level of unit contribution to output that can be achieved through fair reporting. If the positive externality is higher than a certain threshold, then it is worth

⁵ We will ignore the case where there are more public agents than entrepreneurs ($n < 1/2$) since it is obviously not an optimal allocation.

employing auditors to impose incentives towards the creation of that externality. The model, on the other hand, suggests that if the damage caused by low quality (or inaccurate) financial information to the economy is low enough, the society is better off when all individuals operate in the production sector, bearing no costs for providing high quality financial information, and none of them withdrawn to monitor others for promoting higher quality information.

Auditors, on the other hand, are able to use their superior information for extracting additional rents from the economy. There can be two circumstances which enable them to do that. First, they match with entrepreneurs choosing low quality financial reporting and take bribes to report that the quality is high. Second, they match with entrepreneurs using high quality financial reporting and take bribes not to report that the quality is low. In both circumstances, the amount of rents they receive can be no more than τ and s , because otherwise, it would not be feasible for the entrepreneurs to give bribes to the auditors. The proportion of τ and s auditors can take as bribes is denoted with σ .

Of course, dishonest behavior of auditors will not be tolerated by the society since it undermines its intention to foster the use of high quality reporting. If an auditor truthfully reports the quality choice of the entrepreneur he had inspected, he will receive nothing but the competitive audit service fee, w . If the auditor demands rents from the inspected entrepreneur, he gets detected by the authority with probability q , and loses his service fee. On the other hand, with probability $1 - q$, the auditor receives both the service fee and a rent of $\sigma\tau$ or σs , without being detected by the authority. Note that with an absolute detection with probability $q = 1$, the risk-neutral auditors would not dare to demand rents and the optimum solution would be the same as that of the case with no dishonest behavior.

This setting allows for a more realistic environment where we can consider independent auditors as self-interest maximizers. It is possible for them to demand extra fees from clients they found out to report inaccurate financial information, and in turn, giving assurance for this inaccurate information. However, they should do it taking the possibility of detection into account. That is for instance, for a risk-neutral auditor, the expected value of taking an extra fee for giving assurance over a low quality reporting decreases when there is high probability of being punished for that action.

The competitive fee plays an important role in this new framework since if the fee for the audit service is too low, it is understandable that auditors become prone to seek additional rents for compensation. Since these rents are in the expense of public interest, the society should set a competitive fee so that the auditors do not diverge from doing what is expected of them, and their inspections continue to be useful for the promotion of high quality reporting.

The utility of an entrepreneur choosing low quality financial reporting and high quality financial reporting are denoted by π_b and π_g respectively and in this new setting with the auditors involved, they are given by the following equations:

$$\pi_G = y + \beta xn - e + \frac{(1-n)}{n} s(1-p\sigma) \quad (4)$$

$$\pi_B = y + \beta xn - \frac{(1-n)}{n} \tau(1-p\sigma) \quad (5)$$

In the auditor population, the proportion of self-interested auditors is denoted as p , and the rest of this population is honest. The utilities of these auditors are defined as:

$$\pi_H = w + \beta xn \quad (6)$$

$$\pi_S = (1-q) \left[w + \beta xn + \frac{1-n}{n} \sigma(xns - (1-x)nt) \right] \quad (7)$$

It is clear that the probability of detection is important for determination of self-interested auditor's utility π_S . However, it is essential to know how the probability itself is determined. In order for an auditor to be punished for being dishonest, there should be an occasion, which will reveal that the auditor had been unable to detect a material misstatement. In addition to that, judicial authorities should gather sufficient evidence that this failure is related with auditor's negligent or fraudulent behavior, which requires substantial amount of physical and human resource. As the proportion of auditors choosing to pursue their self-interests increase in the economy, the government resources assignable for each case decreases. The less resource is assigned for detecting self-interested auditors, the less likely it is to spot and punish them. Thus, we can say that there is an inverse relationship between q and p , but we do not know the degree of this relationship. So, we will assume that the relationship is linear and we will assign parameters c and d representing the variables affecting the degree of the relationship between the two.

$$q = c - dp \quad (8)$$

where $0 < d < c < 1$. When this equation is substituted into the utility of self-interested auditor, it can be redefined as:

$$\pi_S = (1 - (c - dp)) \left[w + \beta xn + \frac{1-n}{n} \sigma(xns - (1-x)nt) \right] \quad (9)$$

The static model's results' implication would be that when the auditors pursue their self-interest and are homogenous with respect to honesty, they make an expected value comparison to decide whether to act in line with public expectations or not. This comparison involves many factors such as detection possibility and the competitive fee they are receiving for their service. Society can impact this decision by changing the levels of these variables and restrain their behavior. If the society fails to establish these market conditions, there can still be a value of using auditors to monitor information quality in the market depending on the degree of benefit the society gets from high quality information. However, this time it will yield a lower output when compared to the case where all auditors act in line with public interest.

2.3. Evolutionary Framework

The above model can be considered as a normal form game as there is a strategic interaction between the agents in the economy. Acemoglu and Verdier (2000) propose a standard analysis of this framework using a fixed probability of detection of dishonest behavior. Fully rational agents play exactly once this game knowing all the details of the game including the preferences of the other agents. An evolutionary interpretation, on the other hand, will allow for all behaviors or strategies in the population of agents (we can say that each agent will start to play the game initially with a specific strategy) and assume that an evolutionary process operates over time on this initial distribution of behaviors.

An evolutionary process can be generally described by two elements: a *mutation mechanism* and a *selection mechanism*. The first mechanism introduces variety in the population and the second mechanism ensures that the better performing varieties are selected. The replicator dynamics is a set of ordinary differential equations describing the selection mechanism and in the standard version that we will use, no mutation is involved. The mutation is introduced via the dynamic stability concept. The dynamic stability is a test of robustness against mutations.

In other words, each population has a set of available strategies out of which their members are able to select. Thus, in this dynamic setting, agents' decision rules to choose a strategy does not depend on the expected utility evaluation based on probabilities, and rather depends on the strategy's expected utility assessment compared to the mean utility of the population, which is directly related to the fraction of population using it. The mean utility levels of different populations, and the overall population can be calculated as:

$$\bar{\pi}_1 = p\pi_S + (1 - p)\pi_H. \quad (10)$$

$$\bar{\pi}_2 = x\pi_G + (1 - x)\pi_B. \quad (11)$$

$$\bar{\pi}_3 = n\bar{\pi}_1 + (1 - n)\bar{\pi}_2. \quad (12)$$

However, agents of different occupations change their decisions at different paces. For instance, we know that an auditor may become more easily corrupt than an entrepreneur choosing to change the information quality, since the latter involves additional processes and costs. We denote the strategy revision pace of an auditor and an entrepreneur as v_1 and v_2 respectively. We also introduce the variable v_3 for denoting the pace that an individual changes his decision of being an entrepreneur or an auditor. Furthermore, we assume that the level of paces are compared as: $v_1 > v_2 > v_3$.

Now, we define the dynamic equations for changes in fractions of the two populations, and the aggregate population.

$$\frac{\dot{p}}{p} = v_1(\pi_S - \bar{\pi}_1). \quad (13)$$

$$\frac{\dot{x}}{x} = v_2(\pi_G - \bar{\pi}_2). \quad (14)$$

$$\frac{\dot{n}}{n} = v_3(\pi_E - \bar{\pi}_3). \quad (15)$$

When the mean utilities are substituted into these equations, we get:

$$\dot{p} = v_1 p(1-p)(\pi_S - \pi_H). \quad (16)$$

$$\dot{x} = v_2 x(1-x)(\pi_G - \pi_B). \quad (17)$$

$$\dot{n} = v_3 n(1-n)[(x\pi_G + (1-x)\pi_B) - (p\pi_S + (1-p)\pi_H)]. \quad (18)$$

We can easily see that there are trivial rest points for these equations, at which the economy would be in equilibrium. These are the points where all the members of a population choose one strategy or the other (i.e. $p = 0, p = 1, x = 0, x = 1, n = 0, n = 1$). In addition to these, it is possible to find mixed population states for;

- any p satisfying $\pi_S - \pi_H = 0$, or
- any x satisfying $\pi_B - \pi_G = 0$, or
- any n satisfying $\pi_E - \pi_A = 0$

subject to the constraint $p, x, n \in (0,1)$ where the expected payoff of an auditor is $\pi_A = p\pi_S + (1-p)\pi_H$. However, since the term $\pi_B - \pi_G$ does not depend on x , $\pi_B - \pi_G = 0$ does not have a real root for x in the specified range. Thus, the steady state of the second dynamics x^* can either be 0 or 1. On the other hand, the mixed steady state of the first dynamics as a function of x is given as follows:

$$p^*(x) = \frac{c(w + \beta nx) - (1-c)(1-n)\sigma(sx + (1-x)t)}{d(w + \beta nx + (1-n)\sigma(sx + t(1-x)))} \quad (19)$$

For $x = 0$, this steady state will be

$$p^*(0) = \frac{(1-c)(1-n)\sigma t + cw}{d(\sigma t(1-n) + w)} \quad (20)$$

and for $x = 1$, it will be

$$p^*(1) = \frac{c(w + \beta n) - (1-c)(1-n)\sigma s}{d(w + \beta n + \sigma s(1-n))} \quad (21)$$

There exists a steady state of the evolutionary system $p^*(x)$ such that $0 < p^*(x) < 1$ if $\frac{1-c}{c} < \frac{w + \beta nx}{(1-n)\sigma(sx + (1-x)t)} < \frac{1-c+d}{c-d}$. In this case, there is a steady state of the population of auditors where some are honest and some are corrupt.

Note that this condition relates the proportion of the income of an honest auditor over the bribe that a corrupt auditor will extract from the entrepreneurs with the parameters of the probability of getting caught.

A steady state allocation of the economy to entrepreneurs and auditors is given by the root of $(x\pi_G + (1-x)\pi_B) - (p\pi_S + (1-p)\pi_H) = 0$. We will not give explicitly the values of $n^*(x)$.

2.4. Evolutionary Stability

We will start with the stability of the pure states where agents choose one strategy or behavior over the other.

For $x^* = 0$ or $x^* = 1$, we can check the stability of the dynamics of x .

$$\dot{x} = v_2 x(1-x) \left(-e + \frac{(1-n)}{n} (s+t)(1-p\sigma) \right). \quad (22)$$

$$x^* = 0 \text{ is stable if } \frac{1-p^*(0)\sigma}{n^*(0)} + n^*(0)\sigma < \frac{e+s+t}{s+t}. \quad x^* = 1 \text{ is stable if } \frac{1-p^*(1)\sigma}{n^*(1)} + n^*(1)\sigma < \frac{e+s+t}{s+t}.$$

We see that policy variables such as subsidies and penalties have an important impact on the stability of a bad quality financial reporting and good quality financial reporting as well as the level of bribes affecting the level of entrepreneurs and bureaucrats in the economy. We have made simulations of this dynamic system to provide an example on the stability of good quality financial reporting as a standard and bad quality financial reporting as a standard. Figure 2.1 is computed using the following values of the parameters: for the first row $(e,s,t,\sigma) = (0.5,1,1.1,0.2)$ and for the second row $(e,s,t,\sigma) = (0.5,1,0.2,0.2)$. The only difference is the value of the tax penalty. We see that the penalty is a crucial instrument for an economy providing good quality financial reporting. Note that providing subsidies, as an incentive to increase good quality financial reporting will not be enough to create this incentive, the authorities shall also discourage bad quality financial reporting by penalties.

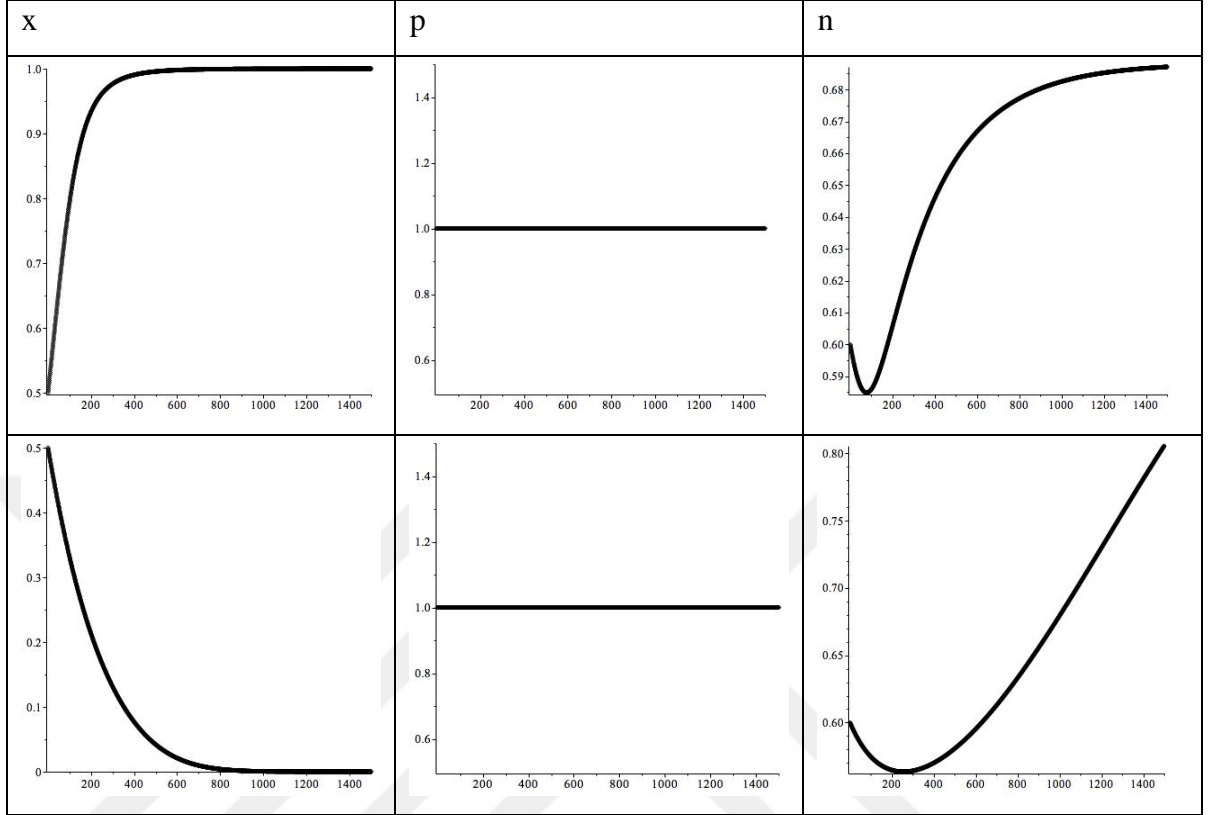


Figure 2.1 : Simulation results for dynamics of x , p and n

$p = 0$ is stable if $-cw - (1 - c)(1 - n^*(0))\sigma t < 0$ when $x=0$ and $-c(w + \beta n^*(0)) + (1 - c)(1 - n^*(0))\sigma s < 0$ when $x=1$. $p = 1$ is stable if $-(c - d)w - (1 - (c - d))(1 - n^*(0))\sigma t > 0$ when $x=0$ and $-(c - d)(w + \beta n^*(0)) + (1 - (c - d))(1 - n^*(0))\sigma s > 0$ when $x=1$.

For the stability of $p = 0$ we see that the first constraint (when $x = 0$) is always satisfied. The second constraint can be written as $(1 - n^*(0))\sigma s - c(w + \beta n^*(0)) + (1 - n^*(0))\sigma s < 0$ and will likely to be satisfied when the level of subsidies would be below the level of wages with positive externalities i.e. $(1 - c)(1 - n^*(0))\sigma s < c(w + \beta n^*(0))$.

For the stability of $p = 1$ we see that the first constraint (when $x=0$) is always satisfied. The second constraint can be written as $(1 - n^*(0))\sigma s - (c - d)(w + \beta n^*(0)) +$

$(1 - n^*(0))\sigma s) < 0$ and will likely to be satisfied when the level of subsidies would be below the level of wages with positive externalities i.e. $(1 - (c - d))(1 - n^*(0))\sigma s > (c - d)(w + \beta n^*(0))$. Note that if the second condition of stability for $p = 1$ is satisfied, we will most likely have the stability of $p = 0$ as well. The computations we have conducted above illustrate this as we have found the same graphs for x and n with $p=1$. This shows that the level of corruption in the auditing sector may not have an impact on the subsistence of low quality financial reporting in the economy.

We can check the stability of the rest points by evaluating the Jacobian of the system of equations at these rest points and computing the eigenvalues of the matrix. The rest points are asymptotically stable if all the eigenvalues of the matrix are negative or have negative real parts. Jacobian matrix of the first and third equations is obtained as:

$$J = \begin{bmatrix} \frac{\partial(\pi_S - \pi_H)}{\partial p} & \frac{\partial(\pi_S - \pi_H)}{\partial n} \\ \frac{\partial[\pi_E - \pi_A]}{\partial p} & \frac{\partial[\pi_E - \pi_A]}{\partial n} \end{bmatrix} \quad (23)$$

We will evaluate the Jacobian matrix at $x = 0$ and $x = 1$.

$$J|_{x=0} = \begin{bmatrix} \left(\begin{array}{c} d(\sigma(1 - n^*(0))t + w)v_1 \\ \frac{\sigma(1 - n^*(0))t}{n^*(0)} + w \\ -(1 - c + 2dp^*(0))(\sigma(1 - n^*(0))t + w) \end{array} \right) v_3 & \begin{array}{c} -\sigma(1 - c + dp^*(0))tv_1 \\ \left(\sigma p^*(0)(1 - c + dp^*(0)) + \frac{(1 - \sigma p^*(0))}{n^*(0)^2} \right) tv_3 \end{array} \end{bmatrix} \quad (24)$$

$$J|_{x=1} = \begin{bmatrix} \left(\begin{array}{c} d(\beta n^*(1) + \sigma(1 - n^*(1))s + w)v_1 \\ \beta n^*(1) - \frac{\sigma(1 - n^*(1))s}{n^*(1)} + w \\ -(1 - c + 2dp^*(1))(\beta n^*(1) + \sigma(1 - n^*(1))s + w) \end{array} \right) v_3 & \begin{array}{c} (-\beta + (1 - c + dp^*(1))(\beta - \sigma s))v_1 \\ \left(\beta p^*(1) - \frac{(1 - \sigma p^*(1))s}{n^*(1)^2} + w \right) v_3 \\ -p^*(1)(1 - c + dp^*(1))(\beta - \sigma s) \end{array} \end{bmatrix} \quad (25)$$

We will illustrate the stability of an interior rest point. For the parameter set $(\beta, e, s, t, w, \sigma, c, d, y, x) = (2, 1, 1, 1, 1, 0.2, 0.6, 0.6, 2, 0)$, the rest points of the system of dynamic equations are $p^* = 0.84$ and $n^* = 0.45$. When we evaluate the eigenvalues at these rest points, we find that both are positive. They are not stable. For the parameter set $(\beta, e, s, t, w, \sigma, c, d, y, x) = (2, 1, 1, 1, 1.2, 0.2, 0.6, 0.6, 2, 1)$, the rest points of the system of

dynamic equations are $p^* = 0.98$ and $n^* = 0.80$. When we evaluate the eigenvalues at these rest points, we find that both are positive. They are not stable.

2.5. Discussion

In this chapter, we first made interpretations of the static model of Acemoglu and Verdier (2000) with respect to the relationship of auditors and entrepreneurs, in order to analyze the impact of auditors' existence in the economy as monitoring agents. The results suggest that having auditors in the economy are feasible only if the positive externality being promoted is worth bearing the opportunity cost of allocating auditors in the production sector.

Then we extended my analysis into an evolutionary framework in which the heterogeneous agents of different occupations are able to change their strategies over time, based on their evaluations of their strategies' utility compared to mean utility of other agents and the overall economy. Steady state equilibrium analysis of the dynamic equations shows that there are six trivial rest points where all agents select one of two strategies, some of which being stable depending on the parameter set. Furthermore, there are mixed rest points for p and n . However, we could not find a range where any of these equilibria are stable.

CHAPTER 3: THE IMPACT OF STANDARDS AND PUNISHMENT ON THE OVERALL PERFORMANCE OF AUDITORS

In the previous chapter, we examined the economic feasibility of having auditors to monitor the entrepreneurs' financial reporting quality, in the presence of an externality, and concluded that the self-interested behavior of auditors may result in government failures in several circumstances. In this chapter, we analyze how societies attempt to avoid such failures through standard-setting, penalties and raising awareness with a dynamic model.

3.1. Literature Review

For audit sector to have a value in the economy, the auditors should perform their jobs in a manner satisfying the needs of the society. They should be able to gather sufficient and appropriate evidence in order to give a reasonable assurance that the financial information provided by the management of the audited company reflects its actual performance. In other words, auditors are expected to provide a certain level of audit quality, which directly requires a certain amount of audit effort. For this purpose, some standards for auditing, such as International Standards on Auditing (ISAs) and Generally Accepted Auditing Standards (GAAS), have been established throughout the world for specifying the minimum care and effort that should be applied for each and every audit procedure.

Although general guidelines for required audit efforts are provided by the standards, auditors may choose not to follow these guidelines, and exert an effort below the level required by the standards. The reason an auditor does this might be the overwhelming resource requirements to reach that level of effort, or the opportunity cost of allocating his resources to audit instead of more profitable services, or both. This utility maximizing behavior in the expense of society welfare brings the necessity of monitoring auditors' effort choices and implementing punishments accordingly (Zhang, 2007).

As a matter of fact, monitoring audit effort is a very difficult task for the society, because most audit failures are not revealed until the audited companies declare bankruptcy, and governments' resources are often insufficient to detect all audit failures (Francis, 2011).

Investors and creditors trust auditors to be assured that they are transferring their funds to companies, based on actual financial performance indicators. But, when they incur losses because of inaccurate financial information, they resort to litigation mechanisms in order to be compensated. While the judicial authorities investigate the case to find out the parties responsible for the losses, they rely on auditing standards when deciding whether the auditor has exerted sufficient audit effort or not.

The impact of litigation exposure on auditors' effort and audit quality has also been investigated by many researchers (Bonner, Palmrose, & Young, 1998; Palmrose, 1987, 1988; Reffett, 2010; Venkataraman, Weber, & Willenborg, 2008). The findings highlight the importance of the severity of punishments for audit failures with respect to their effects in the auditing sector.

However, few research analyzes the effects of enforcing auditor standards.⁶ Ye and Simunic (2013) investigated the impact of standard effort levels on audit effort, and found that the impact heavily depends on the characteristics of the legal systems.

Next, inspired by the model developed by Lui (1986), we will introduce a model to analyze the dynamics of auditing sector with auditors choosing substandard effort.

3.2. The Model

3.2.1. The Dynamic Model Design

As in a typical overlapping-generations model, actors in the economy live for two periods. In this case, two groups of independent auditors (young and old) exist in the audit market in a specific period (t). Let's assume that the auditors spend part of their time for the audits, and spend the rest of their time providing management advisory or tax consultancy services.⁷ They are paid competitive fees, w' and w , for an audit and for other services, respectively. In my analysis, w' is left out from the auditors' utility functions since it does not affect the findings of the model.⁸ Thus from now on, without loss of generality, we will only use w .

In each period, every auditor matches with a client and independently chooses an audit effort level, e_i . If an auditor performs the audit in accordance with the standards, then his effort will be $e_i = e_s$. If he performs a substandard audit, then his effort will be

⁶ See, for example, (Okeefe, King, & Gaver, 1994).

⁷ Another interpretation of this could be the case of allocating human resources between engagement teams of different service departments, which is more appropriate for big audit firms.

⁸ The original utility function is:
$$u_{2,i} = \begin{cases} w' + w - m_i - p_t C & \text{if } e_i = 0 \\ w' + w(1 - e_s) & \text{if } e_i = e_s \end{cases}$$

However, when comparing the utilities for these two different levels of effort, w' is cancelled out. The reason why w' does not affect the model's findings is that the auditors' decide on an audit effort level based on their assessment of whether the marginal utility contribution of providing other services is attractive enough.

$e_i = 0$; and in this case, he will be charged a penalty of C with probability, p , which is the probability of being detected by authorities.

If the auditor is detected for the second time due to a substandard audit, the punishment cost increases to C' , which we assume is a cost any previously punished auditor would not risk to bear.⁹

The probability of punishment, p , depends on regulator's resources to detect whether there is an audit failure. Determination of the level of p is explained later in this chapter.

We assume that same number of auditors join the market each period, having independent levels of professional care (i.e. moral cost of substandard performance), m_i , which is uniformly distributed between 0 and $\frac{1}{f}$. So, the fraction of auditors exerting an effort below m^* is fm^* .

$$\text{uniform probability density} = \frac{1}{\frac{1}{f} - 0} = f \quad (26)$$

$$\int_0^{e_s} F(m^*) de = fm^* \quad (27)$$

We will now define and derive the utilities of the young and old auditors in different periods.

⁹ This kind of punishment may involve suspension or termination of professional licence. In some jurisdictions, imprisonment is also applicable for auditors approving false statements. Such a cost would offset all possible gains from exerting low effort.

For Old Auditor at Time t

$$u_{2,i} = \begin{cases} w - m_i - p_t C & \text{if } e_i = 0 \\ w(1 - e_s) & \text{if } e_i = e_s \end{cases} \quad (28)$$

Auditor will either choose an effort level equal to e_s or he will exert no effort at all, since effort levels below e_s provides the same utility to him. As a risk-neutral agent, his effort choice will be based on the expected utility comparison. We can simplify this comparison into two possible cases:

$$1) \quad we_s - m_i - p_t C > 0 \quad \text{or} \quad m_i < we_s - p_t C \quad (29)$$

In this case the auditor has a level of moral cost which enables the expected utility of exerting an effort below the standards to exceed the payoff of exerting an effort level required by the standards. Thus, the auditor would take the risk of being punished and choose the effort level of $e_i = 0$.

$$2) \quad we_s - m_i - p_t C < 0 \quad \text{or} \quad m_i > we_s - p_t C \quad (30)$$

If the moral cost of the auditor is at a level which makes the expected utility of performing below the standards lower than the payoff of choosing the standard effort, it means that the auditor will not take the risk of being punished and choose the effort level of $e_i = e_s$. So we can say that there is a threshold of moral cost for old auditors in order to decide what level of effort they will choose, which is:

$$T_{2,i}(t) = we_s - p_t C$$

For Young Auditor at Time t

$$u_{1,i} = \begin{cases} w - m_i - p_t(C + \max(we_s - m_i - p_{t+1}^e C, 0)) & \text{if } e_i = 0 \\ w(1 - e_s) & \text{if } e_i = e_s \end{cases} \quad (31)$$

p_{t+1}^e is the expected probability of being detected in the next period. The max function part included in the upper expected utility function represents the decision the young auditor will make next period. It also affects his decision in the current period because if he is punished this period, he will not seize the option to choose between effort levels next period, and will have to bear the opportunity cost of that period's additional expected utility for a substandard effort, if any.

The threshold a young auditor expects to face next period is:

$$T_{2,i}(t+1) = we_s - p_{t+1}^e C \quad (32)$$

So, there exist two different thresholds for the young auditor to consider this period, depending on his expected choice next period.

- 1) If the young auditor has a moral cost $m_i < T_{2,i}(t+1)$, then he knows that he will choose substandard effort in the next period. In that case, his threshold this period is:

$$\overline{T}_{1,i}(t) = we_s - p_t \frac{(1 - p_{t+1}^e)C}{(1 - p_t)} \quad (33)$$

- 2) If the young auditor has a moral cost $m_i \geq T_{2,i}(t+1)$, then he knows that he will not take the risk and choose the effort level required by standards in the next period. In that case, his threshold this period is:

$$T_{1,i}(t) = we_s - p_t C \quad (34)$$

We can compare these two thresholds separately for an increasing p and a decreasing p .

$$T_{2,i}(t+1) - T_{1,i}(t) = (p_t - p_{t+1}^e)C \quad (35)$$

$$T_{1,i}(t) - \overline{T_{1,i}}(t) = p_t C \frac{p_t - p_{t+1}^e}{1 - p_t} \quad (36)$$

- 1) If $p_{t+1}^e < p_t$, then $\overline{T_{1,i}}(t) < T_{1,i}(t) < T_{2,i}(t+1)$. Therefore, with a decreasing probability of being detected, the young auditor will make the effort choice by comparing his m_i with $\overline{T_{1,i}}(t)$. Because if it falls below this threshold, then it is already lower than the other thresholds, and if it exceeds $\overline{T_{1,i}}(t)$, he will choose the standard effort level regardless of his m_i being higher or lower than $T_{1,i}(t)$. When the auditors expect the probability of detection to decrease next period, the proportion of young auditors choosing the substandard effort level would be $F(\overline{T_{1,i}}(t))$.
- 2) If $p_{t+1}^e \geq p_t$, then $\overline{T_{1,i}}(t) \geq T_{1,i}(t) \geq T_{2,i}(t+1)$. Therefore, with an increasing probability of being detected, the young auditor will make the effort choice by comparing his m_i with $T_{1,i}(t)$ this time, with similar reasons described above. When the auditors expect the probability of detection to increase next period, the proportion of young auditors choosing the substandard effort level would be $F(T_{1,i}(t))$.

The same logic is applicable for the other periods as well. For instance, let's take the period $t - 1$:

If $p_t^e < p_{t-1}$, then the fraction of young auditors with substandard effort at time $t - 1$ is

$$F(\overline{T_{1,i}}(t-1))$$

If $p_t^e \geq p_{t-1}$, then the fraction of young auditors with substandard effort at time $t - 1$ is

$$F(T_{1,i}(t-1))$$

We will assume in the rest of this chapter that the auditor's expectations for the detection probability's direction of change are always correct:

$$p_t^e \geq p_{t-1} \Leftrightarrow p_t \geq p_{t-1} \quad (37)$$

We want to find the proportion of auditors with substandard effort level in a specific time period. We have found this proportion for young auditors, now we should find it for old auditors. For that, it is important to leave out the old auditors who were detected and punished when they were young, since we assume that they cannot choose a substandard effort again.

If $p_t^e \geq p_{t-1}$, then the fraction of old auditors with substandard effort at time t is

$$(1 - p_{t-1})F(T_{1,i}(t))$$

If $p_t^e < p_{t-1}$, then the fraction of old auditors with substandard effort at time t is

$$F(T_{2,i}(t)) - p_{t-1}F(\overline{T}_{1,i}(t-1))$$

I will denote the overall proportion of auditors choosing a substandard effort level at time t , as L_t . As a matter of fact, since we assumed that the size of young and old auditors are the same, L_t can be calculated as the average of the proportions of young and old auditors with substandard performance.

There are four different cases of expected detection probability dynamics affecting the calculation of L_t .

1) $p_t^e \geq p_{t-1}$ and $p_{t+1}^e \geq p_t$ (continuously increasing)

$$L_t = \frac{1}{2} (F(T_{1,i}(t)) + (1 - p_{t-1}) F(T_{2,i}(t))) \quad (38)$$

2) $p_t^e < p_{t-1}$ and $p_{t+1}^e < p_t$ (continuously decreasing)

$$L_t = \frac{1}{2} (F(\overline{T}_{1,i}(t)) + F(T_{2,i}(t)) - p_{t-1} F(\overline{T}_{1,i}(t-1))) \quad (39)$$

3) $p_t^e < p_{t-1}$ and $p_{t+1}^e \geq p_t$ (first decreasing, then increasing)

$$L_t = \frac{1}{2} (F(T_{1,i}(t)) + F(T_{2,i}(t)) - p_{t-1} F(\overline{T}_{1,i}(t-1))) \quad (40)$$

4) $p_t^e \geq p_{t-1}$ and $p_{t+1}^e < p_t$ (first increasing, then decreasing)

$$L_t = \frac{1}{2} (F(\overline{T}_{1,i}(t)) + (1 - p_{t-1}) F(T_{2,i}(t))) \quad (41)$$

As it was described in the beginning of the model, F is assumed to be a uniform probability distribution function, and the uniform probability density is f . We can summarize the cases above with a single function:

$$L_t = \frac{f}{2} (2 - p_{t-1})(we_s - p_t C - J_1 + J_2) \quad (42)$$

where

$$J_1 = \begin{cases} p_t C \frac{p_t - p_{t+1}^e}{1 - p_t} & \text{if } p_{t+1}^e < p_t \\ 0 & \text{if } p_{t+1}^e \geq p_t \end{cases} \quad (43)$$

$$J_2 = \begin{cases} p_{t-1}^2 C \frac{1 - p_t^e}{1 - p_{t-1}} & \text{if } p_t^e < p_{t-1} \\ 0 & \text{if } p_t^e \geq p_{t-1} \end{cases} \quad (44)$$

Again, it is essential to know how the probability itself is determined. In order for an auditor to be punished for substandard performance, there should be an incidence of public loss due to an audit failure and judicial authorities should be able to determine if the auditor's effort is below the standards, which requires substantial amount of physical and human resource. Thus, we will once more assume that there is a negative linear

relationship between p and L , and we will assign parameters a and b representing the variables affecting the degree of the relationship between the two.

$$p_t = a - bL_t \quad (45)$$

3.2.2. Parametric Restrictions

1) p_t cannot be negative.

$$a > b > 0. \quad (46)$$

2) p_t has to be a real number between 0 and 1. Since the range of L_t is $1 > L_t > 0$, it can have values up to $p_t = a$. So,

$$1 > a. \quad (47)$$

3) Since moral costs have values between 0 and $\frac{1}{f}$. Any threshold below 0 means that no auditors would choose a level below standards. And any threshold above 1 means that all auditors would choose a level below standards.

$$1 > we_s - p_t C > 0. \quad (48)$$

The sufficient conditions for this restriction are

$$we_s - aC > 0 \quad (49)$$

$$1 > we_s - (a - b)C \quad (50)$$

4) Utility of choosing the effort level required by the standards cannot be negative.

$$w(1 - e_s) > 0 \quad (51)$$

Since the competitive fee, w , is positive; the constraint can be reduced to:

$$1 > e_s > 0 \quad (52)$$

- 5) f should have a value so that the maximum value of moral cost, $\frac{1}{f}$, falls between 0 and 1.

$$f > 1 \quad (53)$$

The summary of the parametric restrictions:

$$1 > a > b > 0 \quad (54)$$

$$1 > e_s > 0 \quad (55)$$

$$1 + (a - b)C > we_s > aC > 0 \quad (56)$$

$$f > 1 \quad (57)$$

Let's focus on the first case where probability of detection is continuously increasing. In that case,

$$F(T_{2,i}(t)) = F(T_{1,i}(t)) = f(we_s - p_t C) \quad \text{when} \quad f(we_s - p_t C) \leq 1 \quad (58)$$

$$F(T_{2,i}(t)) = F(T_{1,i}(t)) = 1 \quad \text{when} \quad f(we_s - p_t C) > 1 \quad (59)$$

and the proportion of auditors choosing substandard effort levels at time t can be written as:

$$L_t = \begin{cases} \frac{f}{2}(2 - p_{t-1})(we_s - p_t C) & \text{if} \quad f(we_s - p_t C) \leq 1 \\ 1 - \frac{p_{t-1}}{2} & \text{if} \quad f(we_s - p_t C) > 1 \end{cases} \quad (60)$$

When we substitute $p_t = a - bL_t$ into these equations, we get

$$L_t = \frac{f}{2}(2 - (a - bL_{t-1}))(we_s - (a - bL_t)C) \quad (61)$$

and

$$L_t = 1 - \frac{a - bL_{t-1}}{2} \quad (62)$$

Thereby, we obtain two steady state levels of L when we take $L_t = L_{t-1} = L^*$

$$L^* = \frac{f}{2}(2 - (a - bL^*))(we_s - (a - bL^*)C) \quad (63)$$

and

$$L^* = \frac{2 - a}{2 - b} \quad (64)$$

First equation might not have real roots for L^* in certain intervals of other variables. However, as it is illustrated in Figure 3.1, three steady state equilibrium points are found for certain values of parameters (i.e. $a = 0.8, b = 0.7, C = 1.2, f = 1.2, w = 1.5, e_s = 0.7$), two of which belongs the this quadratic equation. This proves that there are real solutions for L^* .¹⁰ The equilibria are shown as the intersection points of L_t functions with the 45° line, colored in green.

¹⁰ See (Cule & Fulton, 2009) for another model where multiple equilibria is found for the corruption level in the economy.

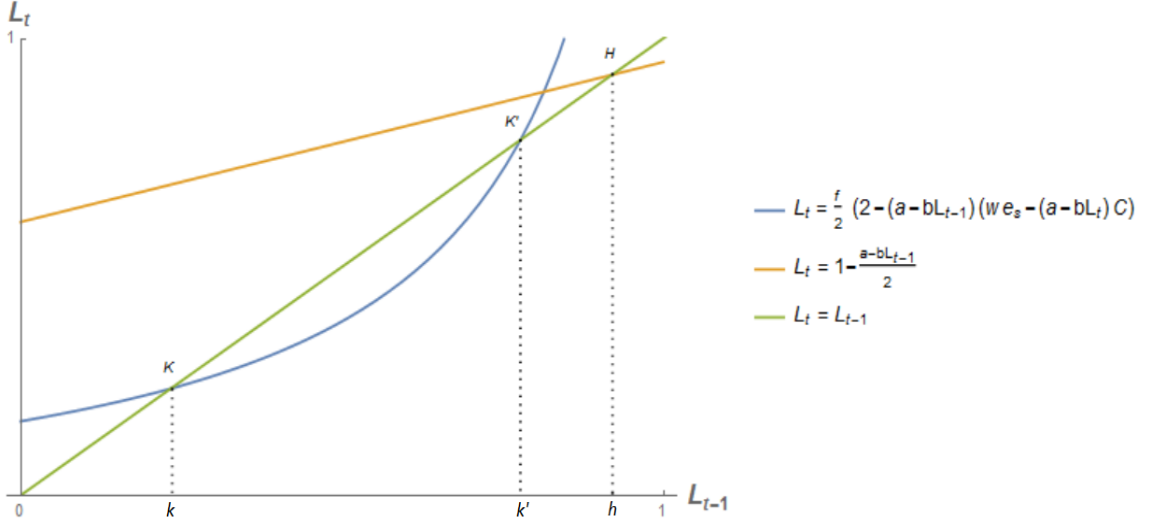


Figure 3.1: Dynamic equilibria of substandard effort in the audit sector.

For any $L_t > \frac{a}{b} - \frac{we_s f - 1}{b f C}$, we know that $f(we_s - p_t C) > 1$. Thus, we use the function $L_t = 1 - \frac{p_{t-1}}{2}$, which is represented with the orange line, for those values of L_t . If $L_t \leq \frac{a}{b} - \frac{we_s f - 1}{b f C}$, then we know that $f(we_s - p_t C) \leq 1$, and use the function $L_t = \frac{f}{2}(2 - p_{t-1})(we_s - p_t C)$, which is represented by the blue curve in the figure.

Since we analyze the case where probability is continuously rising, with constant levels of a and b , L_t should not be higher than L_{t-1} . So we will ignore the upper region of 45° line, where $L_t > L_{t-1}$.

Among the three equilibria, K and H are stable, while K' is not. Consequently, for levels of L_{t-1} between k and k' , L_t will converge to the stable steady state equilibrium, K . On the other hand, if L_{t-1} is higher than h , then L_t will eventually settle on the equilibrium H .

Now, let's see how the penalty level impacts these steady state equilibria levels. When we increase the marginal cost of punishment, C , from 1.2 to 1.25, which corresponds to an approximately 4% increase, the new steady state levels created by the quadratic function of L_t becomes more distant from each other. As a matter of fact, such a change in the punishment level seems to shift the economy into a dynamic environment where there is a wider range of values of L_{t-1} that can converge to a better stable equilibrium, which is represented by point D in Figure (3.2).

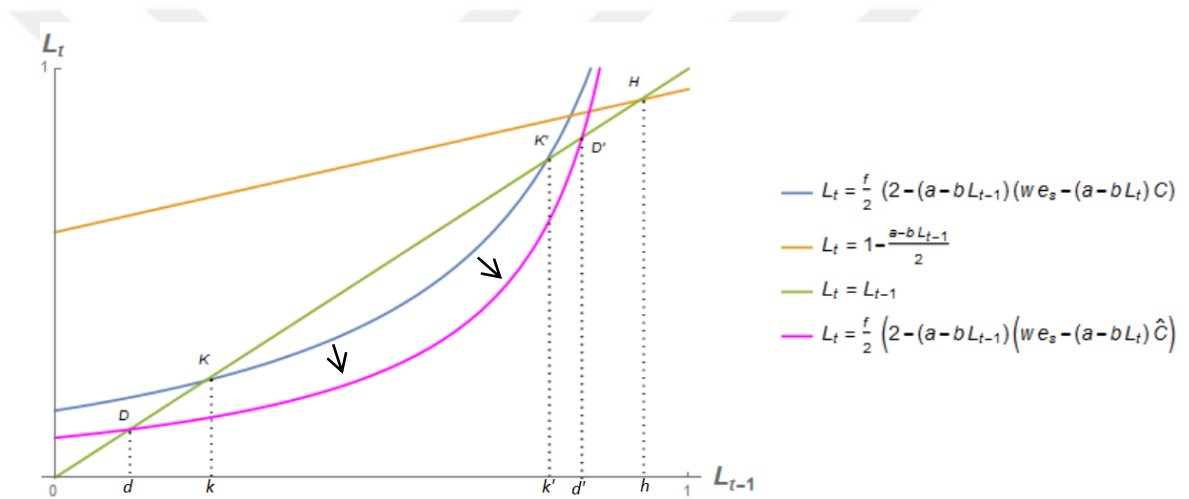


Figure 3.2: Dynamic equilibria of substandard effort in the audit sector with an increased penalty level.

Notice that if C is decreased enough, for instance to $C = 1$, the quadratic function of L_t will shift upwards and no longer intersect the 45° line, leaving H the only stable steady state level that may exist. Conversely, if C increases too much, it is possible that the larger root of the quadratic function of L_t exceeds h . Nevertheless, it is convenient to acknowledge that the governments may aim to reach a steady state equilibrium with a lower proportion of substandard auditors, by increasing the penalty levels.

3.2.3. When Exerting No Effort Is Not An Option

As explained in Chapter 2, auditing is not only a service that supports investors and governments to make profitable and effective decisions, but also an information

validity mechanism that has a highly significant impact on the efficiency of capital markets. Being aware of its importance for creating long-term benefits in the overall economy, entrepreneurs being audited may also demand from auditors a decent audit as well.¹¹ However, the enforceability extent of this demand would not be equivalent to that of government due to the complexity of the audit process, inadequate monitoring resources of entrepreneurs. In addition to these, they do not have the authority to charge fine payments from auditors on behalf of the society. But they can avoid working with auditors that they know to exert zero effort. we will assume that all entrepreneurs in the economy have a similar degree of awareness, and require the same level of effort from auditors to have them audit themselves.

In this section, we will include a new effort level, $e_R < e_S$ to the model, which signifies the effort level required by the companies being audited. Such a model design describes an economy where all the entrepreneurs in the economy do not let auditors to exert zero effort and expect them to work, if not as hard as it is required by the standards. Otherwise, they do not accept to give the competitive fee, w' , for the audit service. But still, an effort level between e_R and e_S is still subject to punishment with a penalty amount of C , since substandard effort is always discouraged by the government.

The new utility functions of old auditors are as follows:

For Old Auditor at Time t

$$u_{2,i} = \begin{cases} w(1 - e_R) - m_i - p_t C & \text{if } e_i = e_R \\ w(1 - e_S) & \text{if } e_i = e_S \end{cases} \quad (65)$$

¹¹ Obviously, that would not be the case for companies publishing manipulated financial information. However, for the rest, the entrepreneurs often do not realize that the information they are publishing is of low quality and inaccurate, until they are audited by an expert. Thus, it is plausible to assume that entrepreneurs may come to acknowledge the long-term benefits of being audited.

With these new utility functions, auditors cannot obtain all of the marginal utility contribution provided by other services, even when they choose to perform below the standards. An auditor will either choose an effort level equal to e_s or e_R . The expected utility comparison of risk-neutral auditors can be simplified into:

$$1) \quad w(e_s - e_R) - m_i - p_t C > 0 \quad \text{or} \quad m_i < w(e_s - e_R) - p_t C \quad (66)$$

In this case the auditor would take the risk of being punished and choose the effort level of $e_i = e_R$.

$$2) \quad w(e_s - e_R) - m_i - p_t C < 0 \quad \text{or} \quad m_i > w(e_s - e_R) - p_t C \quad (67)$$

If the moral cost of the auditor is at a level making the expected utility of performing below the standards lower than the payoff of choosing the standard effort, it means that the auditor will not take the risk of being punished and choose the effort level of $e_i = e_s$.

So the threshold of moral cost for old auditors to decide what level of effort they will choose is:

$$T_{2,i}(t) = w(e_s - e_R) - p_t C \quad (68)$$

For Young Auditor at Time t

$$u_{1,i} = \begin{cases} w(1 - e_R) - m_i - p_t(C + \max(w(e_s - e_R) - m_i - p_{t+1}^e C, 0)) & \text{if } e_i = e_R \\ w(1 - e_s) & \text{if } e_i = e_s \end{cases} \quad (69)$$

The threshold a young auditor expects to face next period is:

$$T_{2,i}(t + 1) = w(e_s - e_R) - p_{t+1}^e C \quad (70)$$

So again, there exist two different thresholds for the young auditor to consider this period, depending on his expected choice next period.

- 1) If the young auditor has a moral cost $m_i < T_{2,i}(t + 1)$, then he knows that he will choose substandard effort in the next period. In that case, his threshold this period is:

$$\overline{T}_{1,i}(t) = w_2(e_s - e_R) - p_t \frac{(1 - p_{t+1}^e)C}{(1 - p_t)} \quad (71)$$

- 2) If the young auditor has a moral cost $m_i \geq T_{2,i}(t + 1)$, then he knows that he will not take the risk and choose the effort level required by standards in the next period. In that case, his threshold this period is:

$$T_{1,i}(t) = w_2(e_s - e_R) - p_t C \quad (72)$$

The comparison of these two thresholds for an increasing p and a decreasing p are the same as those of the previous section.

- 1) If $p_{t+1}^e < p_t$, then $\overline{T}_{1,i}(t) < T_{1,i}(t) < T_{2,i}(t + 1)$. When the auditors expect the probability of detection to decrease next period, the proportion of young auditors choosing the substandard effort level would be $F(\overline{T}_{1,i}(t))$.
- 2) If $p_{t+1}^e \geq p_t$, then $\overline{T}_{1,i}(t) \geq T_{1,i}(t) \geq T_{2,i}(t + 1)$. When the auditors expect the probability of detection to increase next period, the proportion of young auditors choosing the substandard effort level would be $F(T_{1,i}(t))$.

The same comparison is applicable for the previous periods as well.

If $p_t^e \geq p_{t-1}$, then the fraction of old auditors with substandard effort at time t is

$$(1 - p_{t-1})F(T_{1,i}(t))$$

If $p_t^e < p_{t-1}$, then the fraction of old auditors with substandard effort at time t is

$$F(T_{2,i}(t)) - p_{t-1}F(\overline{T}_{1,i}(t-1))$$

Again, there are four different cases of expected detection probability dynamics affecting the calculation of L_t . Assuming an equal mass of young and old auditors, the four possible functions of L_t are summarized below.

$$L_t = \frac{f}{2}(2 - p_{t-1})(w(e_s - e_R) - p_t C - J_1 + J_2) \quad (73)$$

where

$$J_1 = \begin{cases} p_t C \frac{p_t - p_{t+1}^e}{1 - p_t} & \text{if } p_{t+1}^e < p_t \\ 0 & \text{if } p_{t+1}^e \geq p_t \end{cases} \quad (74)$$

$$J_2 = \begin{cases} p_{t-1}^2 C \frac{1 - p_t^e}{1 - p_{t-1}} & \text{if } p_t^e < p_{t-1} \\ 0 & \text{if } p_t^e \geq p_{t-1} \end{cases} \quad (75)$$

Leaving the determination of p_t the same, $p_t = a - bL_t$, we complete the introduction of this new model design. However, since there is a new variable in this modified setting, we have to make the necessary adjustments to the parametric restrictions introduced in the previous section.

1) p_t cannot be negative.

$$a > b > 0 \quad (76)$$

2) p_t has to be a real number between 0 and 1. It can have values up to $p_t = a$. So,

$$1 > a \quad (77)$$

3) Since moral costs have values between 0 and $\frac{1}{f}$. Any threshold below 0 means that no auditors would choose a level below standards. And any threshold above 1 means that all auditors would choose a level below standards.

$$1 > w(e_s - e_R) - p_t C > 0 \quad (78)$$

The sufficient conditions for this restriction are

$$w(e_s - e_R) - aC > 0 \quad \text{and} \quad 1 > w(e_s - e_R) - (a - b)C \quad (79)$$

4) Utility of choosing the effort level required by the standards cannot be negative

$$w(1 - e_s) > 0 \quad (80)$$

Since the competitive fee, w , is positive; the constraint can be reduced to:

$$1 > e_s > 0 \quad (81)$$

5) f should have a value so that the maximum value of moral cost, $\frac{1}{f}$, falls between 0 and 1.

$$f > 1 \quad (82)$$

The summary of the parametric restrictions:

$$1 > e_s > e_R > 0 \quad (83)$$

$$1 > a > b > 0 \quad (84)$$

$$1 + (a - b)C > w(e_s - e_R) > aC \quad (85)$$

$$f > 1 \quad (86)$$

$$C > 0 \quad (87)$$

We will again focus on the first case where probability of detection is continuously increasing. In that case,

$$F(T_{2,i}(t)) = F(T_{1,i}(t)) = f(w(e_s - e_R) - p_t C) \text{ when } f(w(e_s - e_R) - p_t C) \leq 1 \quad (88)$$

$$F(T_{2,i}(t)) = F(T_{1,i}(t)) = 1 \text{ when } f(w(e_s - e_R) - p_t C) > 1 \quad (89)$$

and the proportion of auditors choosing substandard effort levels at time t can be written as:

$$L_t = \begin{cases} \frac{f}{2}(2 - p_{t-1})(w(e_s - e_R) - p_t C) & \text{if } f(w(e_s - e_R) - p_t C) \leq 1 \\ 1 - \frac{p_{t-1}}{2} & \text{if } f(w(e_s - e_R) - p_t C) > 1 \end{cases} \quad (90)$$

When we substitute $p_t = a - bL_t$ into these equations, we get

$$L_t = \frac{f}{2}(2 - (a - bL_{t-1}))(w(e_s - e_R) - (a - bL_t)C) \quad (91)$$

and

$$L_t = 1 - \frac{a - bL_{t-1}}{2} \quad (92)$$

Thereby, we obtain two steady state levels of L when we take $L_t = L_{t-1} = L^*$

$$L^* = \frac{f}{2} (2 - (a - bL^*)) (w(e_s - e_R) - (a - bL^*)C) \quad (93)$$

and

$$L^* = \frac{2 - a}{2 - b} \quad (94)$$

Now, we add a new red colored curve to Figure 3.3, representing the new function of L_t applicable when $f(w(e_s - e_R) - p_t C) \leq 1$. The other function of L_t , which is applicable when $f(w(e_s - e_R) - p_t C) > 1$ stays the same as it is not affected by the new variable, e_R .

Again, it is possible to find three steady state equilibrium points for some values of parameters. we keep all the parameters at the same level as before, so that the effect of e_R can be observed easily. It is clear that if $e_R = 0$, then the new function overlaps with the old function. But when the level of e_R is increased by a small amount ($e_R = 0.01$), decreasing the marginal benefits extractable from providing other services by %1, the quadratic function of L_t shifts downwards, and the distance between the steady state equilibria widens.

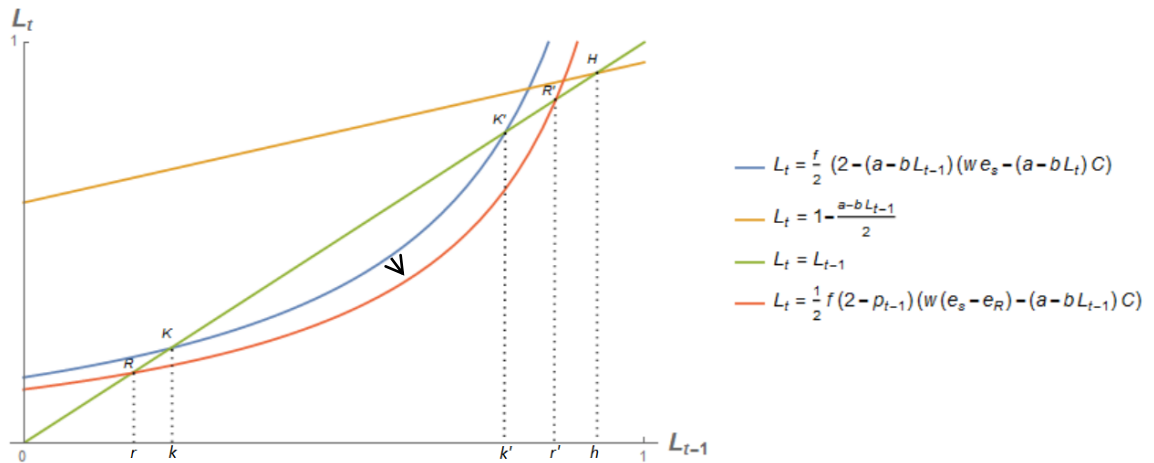


Figure 3.3: Dynamic equilibria of substandard effort in the audit sector with required effort.

Apparently, changes in e_R and C have similar impacts on the equilibria. However, the magnitudes of the impacts differ between the two. A lower level of steady state equilibrium can be reached through a minor increase in e_R .¹²

3.3. Discussion

The first finding we obtain from the analysis of this overlapping generations model is that there can be multiple equilibria in the auditing sector where the level of substandard performance stays the same over time. Our specific example yielded three equilibria, two of them being stable.

As we checked the ranges where the equilibria exist, it led us to the second significant finding that the punishment is a very useful instrument for societies to lower the fraction of auditors with substandard effort levels in the economy, and to sustain that level perpetually. We realize from the figures that if the government becomes more tolerant and reduces the penalties, it is possible to see a sudden large increase in substandard performance as the lower level equilibria vanishes. Moreover, when the economy settles in an unfavorable stable equilibrium, like point H in our example, the efforts to bring it back, for instance by increasing penalty to its previous level, will be ineffective. This also means that there may exist economies at different equilibrium levels of substandard performance even if the values of parameters are the same for both. However, the results also show that if the penalties are increased so much, it might cause the economy to trap in an unfavorable equilibrium of persistent substandard performance as well.

Then we introduced an additional variable to the model to see what impact would it make if the audited entrepreneurs had a conscious demand for a decent audit. In such an

¹² The quadratic function of L_t 's derivatives with respect to e_R and C are compared and the results show that, all other parameters being fixed, e_R 's impact is slightly higher than that of C .

environment, auditors are compelled to exert an effort at least at a level set by a market full of long-term economic benefit oriented entrepreneurs. The new variable resulted to have a somehow similar impact to the equilibrium levels. However, it is important to note that for a society to develop such an awareness regarding the audit quality instead of using penalties for deterrence would most certainly lead the economy to a better state in the long-run. In an environment with such a structural development, it is expected that the entrepreneurs will eventually demand the standard effort level from the auditors which would reduce the necessity of inspecting auditors and the overwhelming costs related with these inspections.



CHAPTER 4: CONCLUSIONS

In this research, we have analyzed the essence of having auditors in the economy, impact of their presence –with honest and self-interested behavior- and how their substandard effort persistence is affected by different punishment schemes or by a long-term benefit oriented market environment.

In order to analyze these issues with an analytical perspective, we employed two dynamic models inspired by the models of Acemoglu and Verdier (2000) and Lui (1986). The model we covered in Chapter 2 investigated first, the use of auditors for monitoring the financial reporting quality. The findings of the model's static version suggested that the auditors are effective agents for society to maximize the social surplus, when there is a significant externality present in the economy.

The analysis is then extended to capture the dynamics of the strategy changes among different actors, by introducing an evolutionary framework to the model. There occurred trivial and mixed rest points for strategy choices of the actors. The stability is checked for these equilibria however they did not turn out to be stable levels, at least within the limitations of this specific framework.

The OLG model we used in Chapter 3 yielded very significant results for the analysis of substandard effort levels in the audit sector. The findings of the model show that it is possible to find multiple equilibria in the audit sector, some of which may be stable. The example we illustrated in figures had three equilibria and had such an

economic environment where the punishment level has a huge impact on the creation and termination of the equilibria. Another important finding of the model is that the awareness of the entrepreneurs being audited also has a big and downside impact on the overall substandard performance in the audit sector.



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