HOLD-UP PROBLEM IN TURKISH TECHNICAL INSOLVENCY LAW


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**ABSTRACT**

HOLD-UP PROBLEM IN TURKISH TECHNICAL INSOLVENCY LAW

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Turkish Commercial Code prescribes contingent control right shift from the manager to the owner in case shareholder's equity shrinks at some threshold due to the accumulation of net losses in previous years. This study investigates the ex-ante and ex-post impacts of this law on corporate tangible fixed asset investments in Türkiye. Using an extensive firm-level dataset that covers almost all incorporated firms, I first employ the Regression Discontinuity Design setup and show that firms that are positioned just above the threshold cut their tangible fixed asset stocks in the following year compared to similar firms in the just below of the threshold. Following this finding, I further investigate whether this practice of cutting tangible assets is anticipated as a potential ex-ante hold-up threat by managers. Results point to the existence of a managerial underinvestment problem; firms with severe agency conflicts invest less compared to the firms with lower agency conflicts as their initial financial position becomes closer to the threshold imposed by law.

**Keywords**: Hold-up, underinvestment, agency cost, regression discontinuity design

# ÖZ

## TÜRK TEKNİK İFLAS YASASINDA HOLD-UP PROBLEMİ

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Türk Ticaret Kanunu, firmaların özsermayelerinin belli bir kısmını geçmiş yıllar zararları nedeniyle kaybetmeleri durumunda firma üzerindeki bazı kontrol haklarının yöneticilerden firma sahiplerine devredilmesini öngörmektedir. Bu çalışma, yasadaki ilgili maddelerin firmaların ex-ante ve ex-post yatırımlarına etkilerini incelemektedir. Öncelikle Türkiye'deki neredeyse tüm sermaye şirketlerini kapsayan geniş bir veri seti ile geçekleştirilen Regresyon Süreksizlik Tasarımı (RDD) analizi ile yasanın öngördüğü yükümlülüğe tabi olma eşik değerinin hemen üzerinde olan firmaların ve eşik değerin hemen altında kalan ve yükümlülüğe tabi olmayan benzer firmalara göre bir sonraki yılda mevcut maddi duran varlık stoklarını azalttıkları bulgulanmıştır. Bu bulgudan hareket ile, maddi duran varlık stoklarında azalışa gitme eğiliminin henüz yasaya tabi olmayan firmalarda hold-up tehdidi yaratıp yaratmadığı irdelenmiştir. Sonuçlar eksik yatırım davranışının varlığına işaret etmektedir; vekalet maliyetinin daha yoğun olduğu firmalarda diğer firmalara göre kanunun öngördüğü yükümlülük eşik değerlere yaklaştıkça daha az yatırım yapılmaktadır.

**Anahtar Kelimeler**: Hold-up, eksik yatırım, vekalet maliyeti, regresyon süreksizlik tasarımı

*To Nebula*

# ACKNOWLEDGEMENTS

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BoD: Board of Directors

GA: General Assembly

RDD: Regression Discontinuity Design

TCC: Turkish Commercial Code.

TRY: Turkish Lira

**CHAPTER 1**

**INTRODUCTION**

The hold-up problem and its consequences have been one of the central concerns in microeconomic theory. In an economic relationship between two parties where there are no binding contracts, nonrecoverable and relationship-specific investments become vulnerable to ex-post opportunistic behavior of the counterparty if the ex-post bargaining power of the investor is limited. As a natural consequence, foresightful investors refrain from investing, anticipating that they can't obtain the expected return from the investment since the return becomes appropriable by the counterparty. This leads to divergence from the socially desirable investment level and economic efficiency.

Consider a bilateral trade relationship between supplier and customer as an example. Supplier firm produces intermediate inputs only specific to the production of customer firm. In other words, supplier firms' outside option is limited, and the majority of their productions are purchased by the customer firm. One day, the supplier firm considered making cost decreasing investment expecting a higher markup (difference between price and cost) in return for the sunk cost of her investment. However, knowing that her outside options are limited after the investment is made, she anticipates that the customer firm can hold her up and force her to a price cut by threatening to reduce demand. Hence, the surplus arising from investment is shared with respect to ex-post bargaining powers.[1]

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[1] This example is actually based on a true story between General Motors and its supplier Fisher Body. Fisher Body made some investments specific to General Motors automobiles in the 1920s.

Naturally, in this case, the supplier can demand a long-term contract to protect her rights before investing. However, covering every possible contingency in a contract is an unrealistic premise since writing every state of the world is not possible. Not only complex contingencies, incompleteness in contracts may also source from transaction costs, bounded rationality, limited verifiability by third parties such as courts, or inefficiency[2] in the legal system. When the incompleteness is coupled with the opportunistic behavior of the counterparty, inefficient investment levels arise in the economy. Despite there are solution methods proposed in the literature to mitigate the inefficiency arising from ex-post opportunistic behaviors combined with incomplete contracts (Williamson,1975; Klein et al., 1978; Moore and Repullo,1988; Aghion et al., 1994; Nöldeke and Schmidt,1995), the problem is still widespread in practice.

In this study, I examine whether the law on technical insolvency in Turkey, which imposes various obligations on companies regarding loss of capital, causes a hold-up problem between shareholders and managers. Article 376 of the Turkish Commercial Code defines the concept of capital inadequacy and imposes some mandatory measures which lead to distortion on the allocations of control rights in case of bad performance of the firm. If accumulated losses exceed half of the capital of the firm, shareholders obtain the right to consider remedial measures. If accumulated losses exceed two-thirds of capital, then shareholders are the party who must decide on the capital structure of the firm. Both measurements can distort managers' ex-ante investment decisions since investment decision is closely related to the capital structure of the firm and other managerial plans. In other words, the law separates the parties who invest and control that investment in case of bad performance.

In order to empirically test the existence of the potential hold-up problem, analyses are carried out using a large micro-data set at the firm level. Using a large micro-data set containing the financial statements of all capital firms (approximately 1 million firms) in Turkey, the Regression Discontinuity design (RDD) method indicates a decrease in

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[2] As very recent anecdotal evidence on the incompleteness of contracting due to inefficiency in the legal system, residential rent increases have temporarily limited to a maximum % of 25 percent in order to curb inflation in Türkiye in recent years. However, this limit had not enforced by landlords, and rents increased higher than %25 in many cases. The rent contracts become incomplete in a high inflation environment, and parties share a surplus arising from soaring inflation according to their ex-post bargaining power in many cases.

tangible assets in companies that are subject to capital inadequacy threshold. More concretely, the firms whose capital inadequacy ratio is just above the threshold have lower tangible capital stock compared to those just below the threshold. The results imply that when the control rights in the firm shift and the general assembly obtain the right to speak, the physical investments that are made before can be sold off.

In addition to this impact on ex-post investments, panel data analyses revealed some clues to support this possibility. I outline this problem in a mathematical formulation and derive some testable propositions. I show that the firms in which incongruence between managers and shareholders is more serious invest less when the perceived probability of holding up is higher. By proxying incongruence between manager and perceived probability of holding up with agency cost indicators and closeness to the threshold, respectively, I show that the closer to the capital inadequacy threshold, the less investment is made in firms where the agency cost between principal-agent is more evident. This finding is robust to different agency cost proxies and different specifications. Overall, these results emphasize that the content of the technical insolvency law may distort physical investments through the hold-up channel.

The plan of the study is as follows. Section 2 reviews the literature on the hold-up problem; Section 3 summarizes the legislation on capital inadequacy mandatory measurements; Section 4 develops hypotheses by describing the possible channels of influence on firm investments around a simple mathematical formulation; Section 5 describes the dataset and estimation methodology used to test these hypotheses; section 6 presents the estimation results and discuss caveats, future research avenues and solutions to alleviate hold-up problem in Turkey. Finally, section 7 concludes the study.

# CHAPTER 2

# REVIEW OF LITERATURE

Early theoretical studies on the hold-up problem are formulated around the question of the boundaries of the firms. Williamson (1975) and Klein et al. (1978) argue that vertical integration is a solution to avoid transaction costs arising from opportunistic behaviors in the presence of contract incompleteness and hold-up problem. According to this argument, mergers and acquisitions could solve the reluctance of the party that refrains from investment. However, vertical integration has some Weaknesses, in essence. Grossman and Hart (1986) address these costs and benefits. By defining asset ownership as residual control right over an asset and the allocation of asset ownership as the main determinant of bargaining power, they argue that while the integration of two firms increases the owner party, it erodes the incentive of other parties. Thus, the party whose investment decision is more important should obtain the ownership rights of assets.

Following the seminal paper by Grossman and Hart (1986), a wide set of discussions focus on remedies for the hold-up problem through different lenses. It has been argued that designing renegotiation rules can be effective in mitigating hold-up problems. Chung (1991) suggests that simple contracts on revision schemes for renegotiation may induce efficiency. Aghion et al. (1994) show that the combination of assignment of all bargaining power to one party (becoming residual claimant) and ex-ante choice of default point in the case that the renegotiation induces first-best investment. Instead of designing a renegotiation process, Nöldeke and Schmidt (1995) put forward the superiority of conditional ownership over unconditional ownership structures, suggesting that allocating an ex-ante specified buy option contract can sustain first-best efficiency when courts can verify the delivery of goods by the seller. Edlin and

Reichelstein (1993) show that the first-best investment level can be reached when a prespecified performance contract for one party combined with full-bargaining power in the counterparty can induce the first-best. Che and Hausch (1999) defined cooperative investments as mutually beneficial investments for both parties and argued that there is no possibility to reach optimal investment if renegotiation is unavoidable.

Implementation literature points to solving unverifiability problems by designing revelation mechanisms. Moore and Repullo (1988) propose a subgame perfect implementation approach for truthful revelation. Maskin and Tirole (1999) employed Moore-Repullo subgame perfect implementation approach in fill-in contracts where payoffs for all possible contingencies can be written in the contract even if the contingencies can't be described exactly. This mechanism is sufficient to sustain efficiency in investment. However, their model imposes a strong assumption that there is no renegotiation. Aghion et al. (2012) show that subgame perfect implementation in Moore and Repullo (1988) may not induce efficiency when there are small deviations from the perfect information assumption.

On the other hand, a large branch of literature has questioned the observability and symmetric information assumption in the early studies. Rogerson (1992) shows the existence of the first-best solution under different asymmetric information structures, such as completely private information, partially private information, and non-private information. Gibbons (1992) show that even if the investment is not observable, the hold-up problem is an important source of inefficiency. Gul (2001) has considered a similar case with an investment decision that is not observable, but offers are made with arbitrarily small gaps. In this model, an efficient investment level is obtained. Lau (2008) focused on the hold-up problem in the partial information framework instead of binary (full-information or no-information) information structure in observability.

Although the greater part of the literature focus on hold-up problem within an inter-firm structure, such as supplier-customer and outsider investor and entrepreneur, some studies focus on the implications of incomplete contracts at the intra-firm level. Grout (1984) interrelates the specific investment decisions and employment relationships in the absence of a binding contract. Aghion and Tirole (1997) separate formal and real authority concepts in firms depending on the information level. While assigning

formal authority to an agent increases the probability of loss of control for the principal, it also encourages the agent to invest in more information. The final decision of delegation depends on the congruence between the principal and the agent. Along the same line, This study investigates the hold-up problem in Turkish firms between the general assembly (principal) and board of directors (agent) imposed by technical insolvency law.

This study contributes to the empirical literature on the hold-up problem. Despite the abundance of theoretical discussion accumulation, the hold-up problem received little attention in empirical literature based on micro-data. Kaplan and Strömberg (2001) examined financial contracts of 213 venture capital and reported that contracts between venture capital and firms are inherently incomplete. Consistent with theoretical predictions by Williamson (1975) and Klein et al. (1978), Acemoglu et al. (2010) have found a positive relationship between vertical integration and technology-intensive investments, which are usually subject to hold-up problems. Presidente (2021) argue that sunk-cost-intensive industries where labor-friendly institutions are more powerful inclined to automation robot investments since the automation investment increase labor costs and the bargaining power of workers. A notable part of data-driven evidence has come from laboratory experiments in recent years. Hart and Moore (2008) point to the behavioral side of the hold-up problem and show that contracts serve as a reference point. Fehr et al. (2011) confirm the reference point argument in a lab-experiment design. Hoppe and Schmitz (2009) find that option contracts can be effective in mitigating hold-up problems even if renegotiation is allowed.

## CHAPTER 3

## LEGAL BACKGROUND

### 3.1 Technical Insolvency Regulation in Turkey

Article 376 of the Turkish Commercial Code (TCC) describes mandatory measures for joint-stock companies in case they have lost their capital due to accumulated previous years' losses, which is a sign of financial difficulty. The first two clauses of the article elaborate on the actions that firms take depending on the magnitude of capital inadequacy that firms encounter.

> *(i) If it is clear in the last annual balance sheet that half of the sum of the capital and statutory reserves are unsecured due to loss, the Board of Directors shall immediately convoke the General Assembly and submit the remedial measures it considers appropriate.*
>
> *(ii) According to the last annual balance sheet, if two-thirds of the sum of the capital and statutory reserves are unsecured due to loss, unless the General Assembly immediately convoked decides to supplement the capital fully or to be satisfied with one-third of the capital, the company shall automatically terminate. (Turkish Commercial Code, Article no: 376)*

Both of the clauses implies an ambiguity on control right allocation between the Board of Director and the General Assembly, in essence. At first glance, it seems that the first clause aims to warn the company about the risk of losses on capital and encourage it to take action to ameliorate the financial position of the firm. However, on the other side of the coin, this clause contains ex-ante control right uncertainty from the Board of Directors point of view. Under ordinary circumstances, all control rights related to the operational activities of the firm belong to the board of directors. While the Board of Directors is responsible and has all control power, General Assembly has no control right defined by the law during the accounting year, but at the end of the year General

Assembly only has the power to acquit the Board of Directors according to performance. The first clause implies that the Board of Directors, which has authority over all operational activities such as management, and financing, must share its authority with General Assembly.[3]

```
                    ┌─────────────────────────┐
                    │   Turkish Commercial     │
                    │   Code Article 376       │
                    └─────────────────────────┘
                      ↙                     ↘
┌─────────────────────────────────┐  ┌─────────────────────────────┐
│ General Assembly decisions to    │  │ Capital injection decision by│
│ alleviate companies' situation   │  │ General Assembly (clause 2)  │
│ (clause 1)                       │  │                              │
└─────────────────────────────────┘  └─────────────────────────────┘
                  ↘                       ↙
              ┌───────────────────────────────────┐
              │ Shifts in the allocation of control│
              │ rights between the General Assembly│
              │ and the Board of Directors         │
              └───────────────────────────────────┘
                             ↓
                      ┌──────────────┐
                      │  Hold-up     │
                      │  problem     │
                      └──────────────┘
```
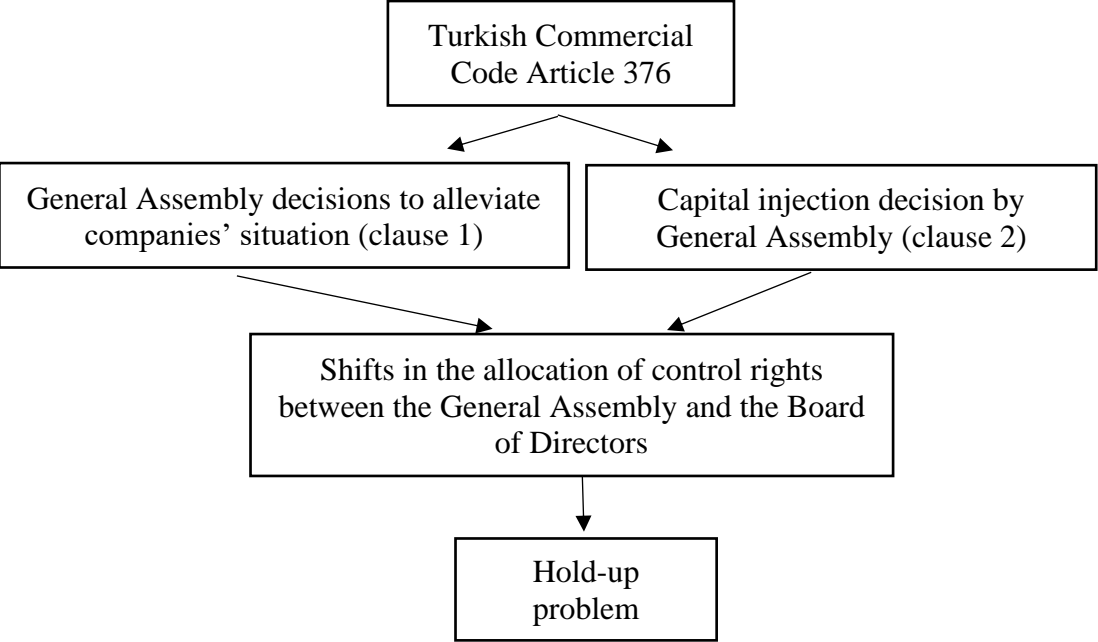
Figure 1: Technical Insolvency Law and Hold-up Problem

On the other hand, the second clause of Article 376 suggests that the party deciding the capital increase should be the general assembly in case of capital inadequacy ratio exceeds 2/3. The shift in the allocation of control rights inheres in this second clause as the first clause. Decisions related to the capital structure (decision to what extent the firm is financed with external debt such as bank loan, equity issuance, or internal finance options such as retained earnings, cash flow, capital injection) of the firm closely related to the management of the firm, especially with corporate investments (Fazzari et al. 1988; Myers, 2001). Hence, it is expected that the managers in firms close but not exceed thresholds consider this possibility when deciding to invest. The

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[3] Confirming this potential shift in control rights, a new communique regarding this article was released in September 2018, prescribing that the General Assembly is able to take any measure needed.

law takes ex-post control power from the Board of Directors, who is the party invested and assigns it to the general assembly.[4] Figure 1 summarizes the hold-up potential of article 376 through two channels. Even though article 376 focuses on joint-stock companies, article 633 of the same code suggests that the same requirements apply to limited liability companies in case of capital inadequacy. The universe of the study consists of joint stock companies and limited liability companies.

**3.2 Measurement of Capital Inadequacy**

Article 376 of the Turkish Commercial Code explains the concept of capital inadequacy as the " *sum of the capital and statutory reserves is unsecured due to loss.* " Based on this definition, the capital inadequacy ratio is derived using the balance sheet items in the dataset of the company financial statements of the Revenue Administration.

$$Capital\ Shortage\ Ratio = \frac{Capital + Legal\ reserves - Owner's\ equity}{Capital + Legal\ reserves}$$

The capital inadequacy ratio formulated above can take any value between minus infinite and plus infinite and shows how much of the capital the firm has lost. As the ratio increases, it shows that the firm has lost its capital by accumulating more losses in the past years, and as it gets smaller, it has strengthened its capital by accumulating more profits in the past years. If the ratio exceeds 1/2 or 2/3, it means that the company will be subject to the obligations of Article 376 of the TCC. Accordingly, a capital inadequacy ratio of 0 means that the sum of capital and legal reserves equals equity; that is, there has been no accumulation of profit or loss in previous years. The fact that the capital inadequacy ratio is 1 means that the equity capital is 0, and therefore, the company has consumed all of its capital and legal reserves due to the losses in the past years.

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[4] There is also another third clause that regulates the case in which the company is in full debt when the firm fully consumes its capital. However, measuring a "fully-debt" situation does not depend on the single score and is based on somewhat subjective reasons. For this reason, it was left out of the scope of this study.

To put it as an example, let the simplified capital structure of firm A be as follows in Table 1. Initially, the firm had 500 TRY capital. The firm also has accumulated 500 TRY losses from previous years and accumulated 250 TRY legal reserves. In this case, the capital inadequacy ratio will be (1000-500)/1000=0.5, and therefore, the firm will be subject to clause 1 of Article 376 in TCC. The Board of Directors must convoke the General Assembly and submit the remedial measures it considers appropriate.

Table 1: Calculation of Capital inadequacy

| | |
|---|---|
| Capital (1) | 750 |
| Legal Reserves (2) | 250 |
| Prior Period Profit or Losses (3) | -500 |
| Owner's equity (1+2 +3) | 500 |

# CHAPTER 4

# HYPOTHESIS DEVELOPMENT

## 4.1 A Simple Illustration

Let a principal-agent relationship has been established between the manager (Board of Directors) and the shareholder (General Assembly) at the beginning of the accounting year. While the shareholder is the sole owner of the company, the manager is responsible for all the usual decision-making processes of the firm, such as borrowing, production, and investment throughout the year. The shareholder does not interfere with the decisions of the manager regarding the company management throughout the year, and she is only concerned with the net profitability at the end of the year. The manager receives a fee from the principal for this work. If she is not satisfied with the performance of the agent, she can fire the agent.

Initially, I assume that both the agent's and the principal's goal is to maximize the profitability of the firm. Therefore, agents do not maximize their own personal profit with the motivation of building their own empire (Jensen,1986), or there is no moral hazard. I also assume that the firm is close enough to the capital inadequacy threshold imposed by the Turkish commercial code. In other words, if the firm has negative profit in the subsequent year, the law is imposed, and the control rights of the agent related to investments are eroded.

As a benchmark case, suppose there is no differentiation in valuations on investments of agent and principal. That means there is no agency cost related to these conflicts. When the agent notices an investment opportunity with an 8-dollar cost and 10-dollar return, he doesn't refrain from investment because even if the firm exceeds the

threshold, the tangible capital investment made by the agent will be protected since the principal has the same valuation as the agent. Consequently, the first-best investment level is attained.

Contrary to this scenario, when the valuations are differentiated between the board of directors and the general assembly (or they cannot observe each other's valuations), underinvestment or overinvestment may occur. Because the agent has to attribute a strictly positive probability for the loss of controls on investments in case of loss beyond expectations since article 376 prescribes a contingency in control rights. BoD knows that there is no guarantee that the GA will continue investments and sustain ex-ante profitability. In this case, the GA has the power to dispose of the investment made by the authority given to it by the law, to implement measures that will prevent efficiency from the investment (for example, to dismiss the worker who understands the machine or to take decisions that may make the financing of the company's production difficult by making a capital increase decision). This raises the possibility of obtaining less than 10 units of expected return for the unit investment of BoD. The extensive form related to the game is depicted below.
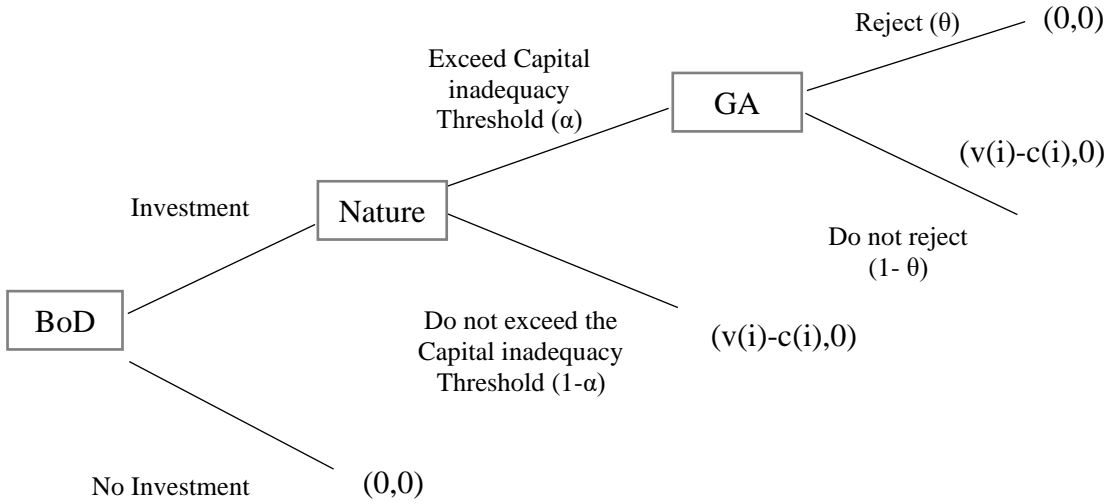


Figure 2: Extensive Form

To put it simply, I suppose that the BoD notices an investment opportunity with 8 dollar cost and 10 dollar return. I also suppose that the probability of the firm being subject to the obligations of the law by exceeding the threshold value is $\alpha=0.5$, and if

the threshold value is exceeded, the probability of the GA taking a decision that may negatively affect the investment (not to adopt the investment) is β=0.5. Therefore, since the expected return of the ex-ante investment will be 7.5 for BoD and this return will be below the expected cost (8), BoD refrains from investing. On the other hand, these expectations may not always be observed. In case the values attributed by the investors to these probabilities deviate, it is possible to dispose of the investments made by the GA.

## 4.2 Assumptions

*Timing:* A principal-agent contract is signed between the owner (General Assembly, GA) and the manager (Board of Directors, BoD) at t=0. Initially, the distance of the firm to the threshold value is α. Between time 0 and time 1, the manager makes investments decision. At the time of t=1, it is revealed whether the firm has exceeded the threshold value according to its profit/loss performance in this period. If the threshold value is exceeded, the provisions of Article 376 are binding for the firm. The manager presents his investment offers to the general assembly in the form of take-it-or-leave-it. The general assembly may cancel and sell the investment or give approval and hold it. If the threshold value is not passed, there is no action on the investments.
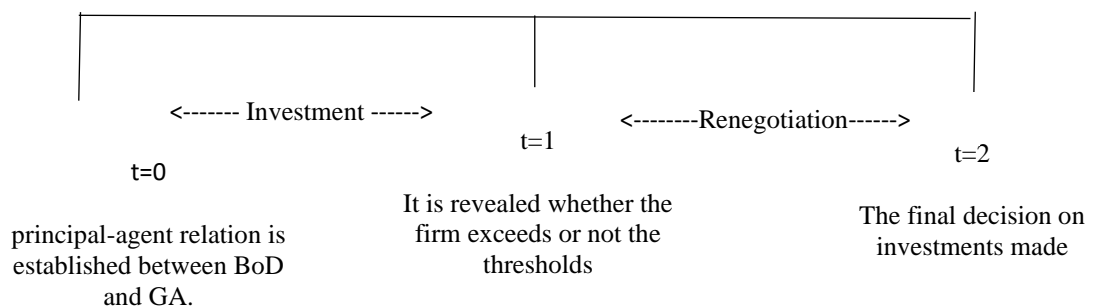


Figure 3: Timing

*Information Structure* The cost of the investments made is known both by BoD and GA. The valuation of the investment for GA is determined at the time t=1 after the investment is made and is known only by GA; that is, it is not observable in terms of courts. Investments can be verified by third parties (parties such as court, and expert);

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however, it is non-contractible because of the leniency and/or lags in the legal system. It is assumed that it is more difficult to make a contract in advance on the investments to be made due to the delays in the implementation of the laws and the costs of the managers and the general assembly taking the case to court. Therefore, since a contract cannot be made between the BoD and GA, the parties are involved in an implicit bargaining process. The bargaining powers are imposed by Article 376th of the commercial code. The current law imposes a bargaining power structure on the model.

*Nature of Investments:* Investments are tangible and observable for each party. Investments are also hybrid, i.e., it increases both the agents and principals (See Che and Hausch (1999) for selfish, cooperative, and hybrid investments. They introduce cooperative investment terms where the investment of the seller increases buyers' valuation). However, the investments can be associated with different valuation increases between the agent and principal. The divergence in valuations can be attributed to different information levels on the investment or the firm. For instance, if the principal knows less about the future benefits of investment, she attributes less valuation than an agent. Another reason can be subjectivity.

*Other assumptions:* The firm has a sole director (BoD) and a sole owner (GA). Both actors are risk neutral. There is no outside option. take-it-or-leave-it bargain. There is no transaction cost in the bargain.

## 4.3 Impact of Law on Manager's Investment Incentives

Within the framework described in subsection 4.1 and 4.2, the optimum investment for the manager in the absence of capital insolvency liabilities is the sum of the investment that maximize the investments of the board of directors and general assembly.

$$i^* \equiv \arg max_i \ v_{BoD}(i) - c_{BoD}(i) \tag{1}$$

In the equation 1, $v_{BoD}(i)$ denotes the valuation of the manager about an investment project, The financial or human capital costs borne by the board of directors is aggregated in $c_{BoD}(i)$. There is no valuation or cost-related to the general assembly. On the other hand, the manager of a firm that is close enough to the capital inadequacy threshold ex-ante optimizes the equation below.

$$i^{BoD} \equiv arg\, max_i\, [\alpha(1-\theta)(v_{BoD}(i) + (1-\alpha)(v_{BoD}(i))] - c_{BoD}(i) \qquad (2)$$

$$i^{BoD} \equiv arg\, max_i\, (1-\alpha\theta)\, [v_{BoD}(i)] - c_{BoD}(i) \qquad (3)$$

The above equation describes the game previously expressed in the extensive form in Figure 2. With $1-\alpha$ probability, the firm will not be subject to capital inadequacy measurements by remaining below the threshold prespecified in the law, and the control right over the investments will remain with the Board of Directors. With the probability of $\alpha$, the firm will be subject to liabilities by exceeding the threshold value. However, the manager cannot completely observe the valuation of the general assembly. $\theta$ denotes the incongruence parameter where $-1 < \theta < 0$. A decrease in $\theta$ means firmer ex-ante belief in the probability of veto of shareholders. When $\theta = 0$, the manager believes that the shareholder thinks the same things about the project. He assigns no probability for ex-post rejection. Therefore, the equation becomes

$$i^{BoD} \equiv arg\, max_i\, (1-\alpha\theta)\, [v_{BoD}(i)] - c_{BoD}(i) \qquad (3)$$

Two simple propositions can be derived from equation 1 and equation 3.

_Proposition 1_: If either $\alpha = 0$ or $\theta = 0$, then $i^* = i^{BoD}$.

Proposition 1 implies that when there is no possibility of capital inadequacy ($\alpha = 0$) or when the manager attributes the same value to the ideas of shareholders even if the threshold value is exceeded ($\theta = 0$) same investment level is obtained.

*Proposition 2*: As the agency cost (incongruence) between manager and shareholder increases and the firm gets closer to the threshold value, the ex-ante investments decrease. In other words, $\frac{\partial^2 i^{BoD}}{\partial \alpha \partial \theta} < 0$.

Proposition 2 suggests that the control structure imposed by the law, which assigns the rights of control on investments to someone other than the investor, may cause ex-ante underinvestment in varying degrees according to relative position to the threshold. The validity of this hypothesis is questioned empirically in section 6.1.
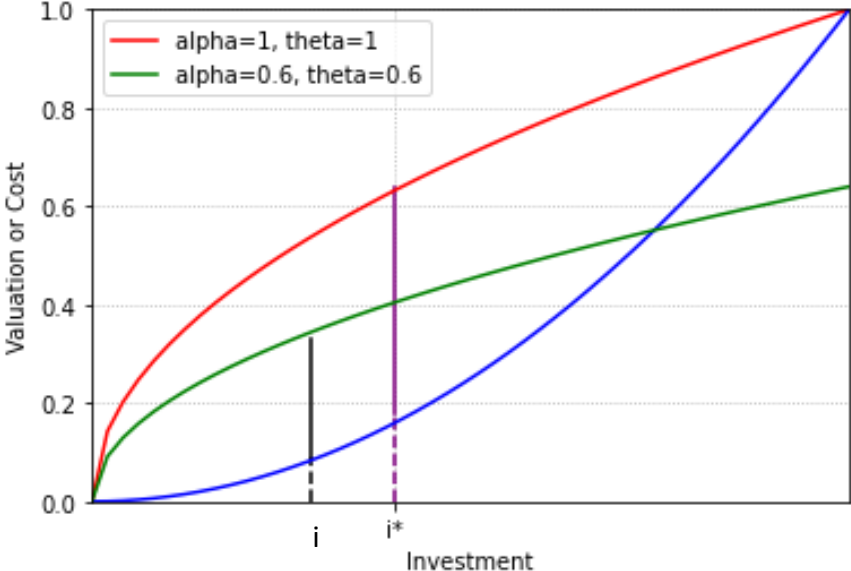


Figure 4: Managerial Underinvestment

On the other hand, overestimation of incongruence parameter $\theta$ and threshold exceeding probability $\alpha$ may lead to ex-post cancellation of investment made. In section 6.1, I investigate whether the shifts in control rights affect the tangible fixed asset stock.

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# CHAPTER 5

# DATA

I use financial statements from Revenue Administration (GIB) by all non-financial corporate companies in Turkey public and private firms. 2009-2021. However, Turkish Commercial Code came into force in 2012, and some breakthrough changes were applied in September 2018. To avoid the impacts of these changes, I set our span for data between 2012 and 2018.

Table 2: Descriptive Statistics

|  | Nr of Obs. | Min | Median | Mean | Max | Sd |
|---|---|---|---|---|---|---|
| Total Asset | 3,097,758 | 0.01 | 0.90 | 9.31 | 58095 | 165.03 |
| Net Sales | 3,097,758 | 0.01 | 0.80 | 8.98 | 89093 | 178.01 |
| Employment | 3,097,758 | 1.00 | 5.00 | 20.32 | 44118 | 156.58 |
| Net Tangible Asset | 3,097,758 | 0.00 | 11.3 | 10.57 | 23.81 | 3.87 |
| Net Tangible Asset Investment | 2,604,448 | -7.66 | 0.00 | 0.19 | 9.3.0 | 1.63 |
| Gross Tangible Asset | 3,097,758 | 0.00 | 11.79 | 11.18 | 24.01 | 3.68 |
| Gross Tangible Asset Investment | 2604448 | -2.93 | 0.02 | 0.26 | 8.61 | 1.20 |
| Leverage | 3,097,758 | 0.00 | 0.00 | 0.11 | 0.82 | 0.18 |
| Profitability | 3,097,758 | -3.07 | 0.03 | -0.05 | 0.71 | 0.47 |
| Liquidity | 3,097,758 | 0.00 | 0.05 | 0.14 | 0.92 | 0.20 |
| General Management Expenses | 3,097,758 | 0.00 | 0.09 | 0.24 | 2.72 | 0.42 |
| Capital Shortage Ratio | 3,097,758 | -43.41 | -0.33 | -1.70 | 18.83 | 7.03 |

Total sales is the logarithm of all assets of the firm. Net sales are total sales minus sales deductions in logarithmic form. A net tangible asset is all tangible fixed assets minus accumulated depreciation. Leverage is total debt to total assets. Profitability is operating profits to net sales. Liquidity is cash and cash equivalent assets to total assets. All variables are winsorized at 1 percentile for each tail.

Since the obligations are binding only on corporate companies, firms other than corporate companies are excluded from the data. In raw data, I have 1 million firms, and approximately %15 of all the firm is a joint stock companies, and the remaining part is limited liability companies. I also exclude firms with paid-in capital, total assets, or net sales of less than one thousand TL from the sample. In order to minimize the effect of outliers in the data, the variables are winsorized at the 1% level from the lower and upper ends. The descriptive statistics related to the dataset are shown above. Our key variable is the tangible fixed assets and tangible fixed asset investments. Our investment variables capture both capital expenditures and acquisitions. There are multiple ways of calculating investment according to tangibility (tangible and non-tangible) and depreciation (gross or net). In our baseline results, I focus on observable and verifiable tangible fixed asset investment, which is defined as a year-on-year log-difference of tangible fixed asset stock. Figure 5 emphasizes the similar trends between aggregated investment derived from microdata with the macro-level gross fixed capital formation variable calculated by Turkstat.
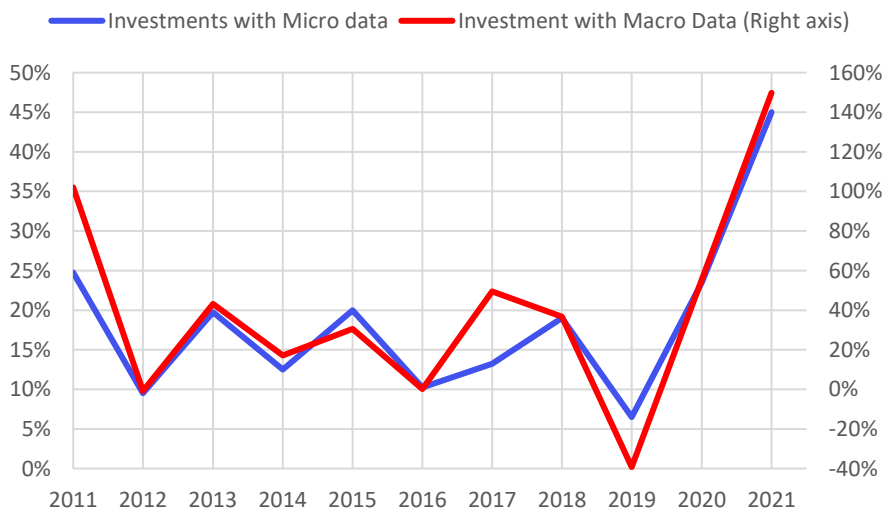


Figure 5: Investment and Gross Fixed Capital Formation

# CHAPTER 6


## EMPIRICAL RESULTS


I present the empirical investigation in this section. In the first subsection, I focus on the net ex-post impact of the law on tangible asset stocks. In the next section, I focus on the testable implication of Proposition 1 in section 4 and investigate the ex-ante impact of capital inadequacy liabilities on managerial investments.

## 6.1 Ex-post Impact on Capital Stock

I first scrutinize the tangible fixed asset stocks of the firms right after they exceed the threshold. More concretely, I ask the question of whether an ex-post impact on tangible fixed asset stock after the shift on control rights from managers to the general assembly. In order to answer this question, I employ the Regression Discontinuity Design methodology, one of the effective methodological devices of causal inference. The RDD assumes that firms just below and just above the threshold are similar to each other and that the process of assigning the effect to these firms occurs randomly. Therefore, analyzing how tangible assets are disrupted (discontinuity) around the threshold value of the capital inadequacy score means making a causal inference. In this way, I can mitigate the endogeneity problem of the traditional econometric methods due to the existence of unobserved omitted variables that affect the relationship between the variables and/or the simultaneous relationship (Roberts and Whited, 2013).

Figure 6 shows the discontinuity of the tangible fixed assets around the points where the capital inadequacy ratio takes the value of 1/2 and 2/3. In the graph, the pooled observation values between 2012 and 2017 are shown; on the horizontal axis, there is the capital loss ratio at (t), and on the vertical axis at (t+1), the average of tangible

fixed assets in logarithmic form for each capital inadequacy ratio group. The observations Ire divided into seven groups according to the capital inadequacy ratio on the right and left of the threshold value and the average of the tangible assets within each group was taken. Figure 6 gives a clue that firms' investments have shown discontinuity, especially around the 2/3 threshold (Calonico et al.2015).
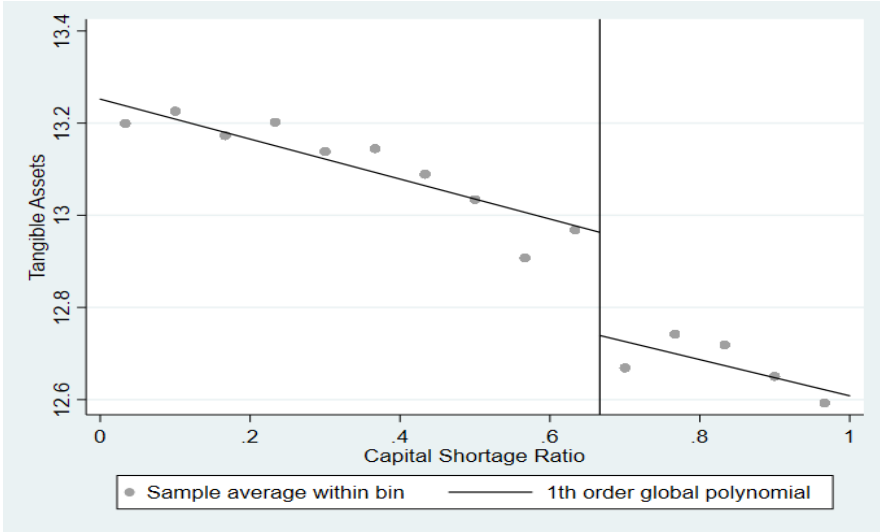


Figure 6: Tangible fixed asset stock around capital inadequacy threshold

The possible effects of the companies that exceed the threshold value compared to the companies that do not pass the threshold value are estimated by the Regression Discontinuity Design method. In order to formal estimation, I estimate the equation below.

$$Tangible_{i,t} = \beta_1 Bind_{i,t-1} + \beta_2 \left( Capital\ shortage_{i,t-1} - cutoff \right)$$
$$+ \beta_3 Bind_{i,t-1}\ x\ \left( Capital\ shortage_{i,t-1} - cutoff \right) + X_{i,t-1} + \varepsilon_{i,t}$$

In the equation above, $Tangible_{i,t}$ refers to the logarithmic of tangible fixed assets of the firm I in year t. The categorical variable $Bind$ takes the value 1 if the capital inadequacy ratio is higher than 2/3 and 0 otherwise at the end of the last year. I centered our force variable $Capital\ shortage_{i,t}$, around the 2/3 cutoff. In order to control the differentiation of the trends of running variables below and above the threshold value, I interact, $Bind_{i,t-1}$ and $Capital\ shortage_{,t} - cutoff$. By this way, our coefficient of interest represents the causal effect of law around the threshold. $X_{i,t-1}$ represents control variables such as leverage, cash, employment, and profitability.

The specification above assumes a linear trend in investments. However, the trend can be in higher polynomial degrees. For this reason, I also apply first and second polynomials. Considering the disadvantages of higher polynomial degrees discussed in Gelman and Imbens (2019), I only employ first and second polynomials. In baseline regressions, I limit our sample within -2.33 and 3.66 capital inadequacy ratios, which means -3 and +3 of the 2/3 threshold imposed by law. I also replicate the regressions for the narrower bandwidths following Angrist and Pischke (2008) and show that the results are compatible with the baseline results.

In addition to the parametric methods described above, non-parametric methods (local polynomial regression) are employed (Calonico et al.,2014). While parametric methods assume a prespecified specification, bandwidths are selected with data-driven methods in non-parametric methods. In this study, I employ mean square error (MSE) by Imbens ve Kalyanaraman (2012) and coverage error rate (CER) optimal bandwidth selection methods (Calonico et al.2020). Prior to starting analyses, I check some assumptions that should be sustained to ensure RDD coefficients are unbiased. One of the main assumptions of the RDD methodology is that the score variable should not be manipulated precisely by firms (Lee and Lemieux,2010). Figure 7 shows the distribution of the capital inadequacy ratio. There is no accumulation on the left of the threshold; visual examination shows smooth decay around the threshold.

In order to test whether the companies are able to manipulate running variables, I apply two formal tests. I first apply McCrary's (2008) formal test, which is based on testing

the smoothness of the marginal density distribution of running variables around the threshold.
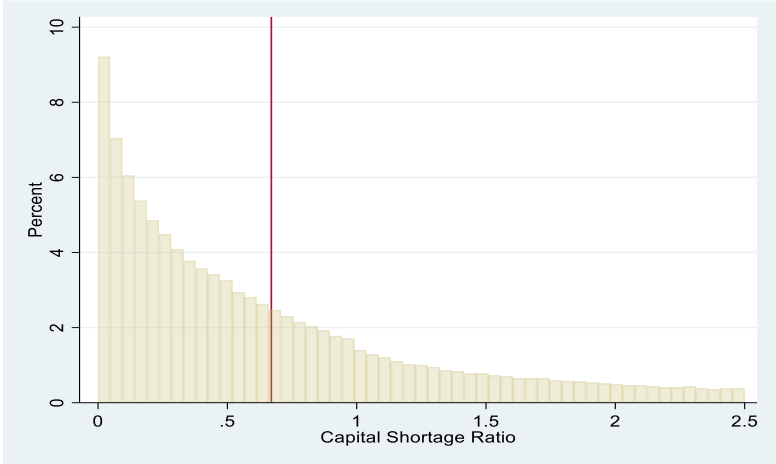


Figure 7: Marginal Density Distribution of Capital Inadequacy Ratio

The statistically insignificant coefficient show that I cannot reject the null hypothesis that the marginal density of the running variable is continuous around the threshold, confirming the visual inspection in Figure 8.
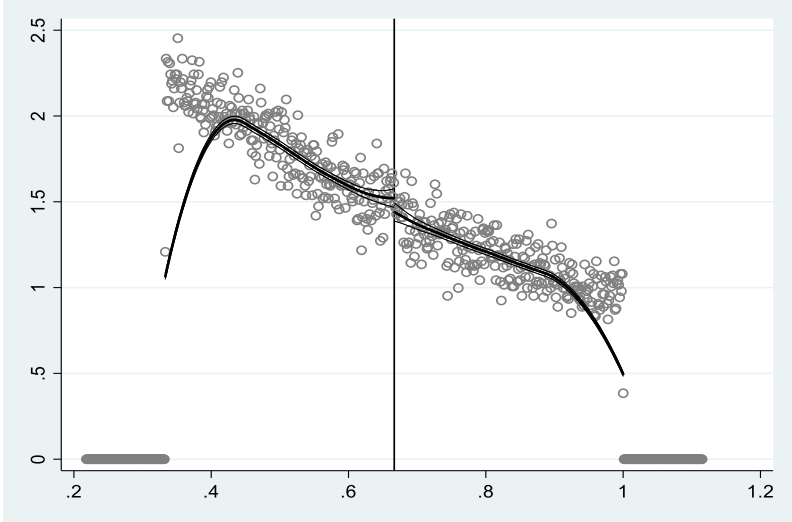


Figure 8: McCrary test for discontinuity check

In addition to the McCrary test, I also apply the non-parametric manipulation check method by Cattaneo et al. (2018). The method is based on a local polynomial density

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estimator in a non-parametric way. The test coefficient is -0.24 with a 0.80 p-value. Hence both of the formal test results corroborate the visual inspection that there is no manipulation in the dataset. Validating that there is no manipulation with precision, I set up a regression discontinuity design. Since the plot imply that the discontinuity arises in the 2/3 value of the capital inadequacy ratio, I focus on this threshold. Table 3 reports the regression results. Parametric regression results have negative and significant coefficients implying that firms just above the capital inadequacy threshold decrease their tangible fixed asset stock by 44 percentage points with respect to just above the threshold (column 1). Despite smaller coefficients, the negative relationship is robust to including fixed effects and control variables (columns 2-3) and to second-order polynomial specification (columns 4-6).

Table 3: The Ex-post Impact on Investment Stock: Parametric Regression Results (-0.5, +0.5)

|  | Gross Fixed Tangible Asset | Gross Fixed Tangible Asset | Gross Fixed Tangible Asset | Gross Fixed Tangible Asset | Gross Fixed Tangible Asset | Gross Fixed Tangible Asset |
|---|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Bind | -0.446*** | -0.352*** | -0.255*** | -0.134*** | -0.101** | -0.054 |
|  | (0.036) | (0.034) | (0.030) | (0.050) | (0.047) | (0.043) |
| Observations | 338,454 | 338,454 | 338,454 | 338,454 | 338,454 | 338,454 |
| R-squared | 0.004 | 0.098 | 0.262 | 0.004 | 0.099 | 0.262 |
| Polynomial | one | one | one | two | two | two |
| Control | no | no | yes | no | no | yes |
| Year FE | no | yes | yes | no | yes | yes |
| Sector FE | no | yes | yes | no | yes | yes |

The dependent variable is the gross fixed tangible asset stock  Bind is the dummy variable that takes 0 for the firms exceeding to the 2/3 threshold imposed by law. Control variables are defined in equation 4. ***, **, * denotes statistical significance at %1, %5, and %10 levels, respectively. Robust standard deviations are in the parentheses

In order to check that our results are not driven by bandwidth selection, I repeat the parametric regression analysis with narrower bandwidths. Our coefficient of interest varies between 8 and 19 percentage points and refers to a significant drop in tangible

fixed asset stock for the firms that are subject to technical insolvency law. The significance of coefficients does not vary much when I include year-fixed effects, sector-fixed effects, and other control variables. The results are also robust to the polynomial degree of the specification. This result is in line with Chava and Roberts (2008), where banks avoid risky investment projects after they take control of firms due to covenant violations.

Table 4: The Ex-post Impact on Investment Stock: Parametric Regression Results (-1,+1)

|  | Gross Fixed Tangible Asset (1) | Gross Fixed Tangible Asset (2) | Gross Fixed Tangible Asset (3) | Gross Fixed Tangible Asset (4) | Gross Fixed Tangible Asset (5) | Gross Fixed Tangible Asset (6) |
|---|---|---|---|---|---|---|
| Bind | -0.140*** | -0.120*** | -0.079** | -0.192*** | -0.167*** | -0.110* |
|  | (0.048) | (0.044) | (0.040) | (0.068) | (0.063) | (0.057) |
|  |  |  |  |  |  |  |
| Observations | 88,562 | 88,562 | 88,562 | 88,562 | 88,562 | 88,562 |
| R-squared | 0.006 | 0.129 | 0.282 | 0.006 | 0.129 | 0.282 |
| Polynomial | one | one | one | two | two | two |
| Control | no | no | yes | no | no | yes |
| Year FE | no | yes | yes | no | yes | yes |
| Sector FE | no | yes | yes | no | yes | yes |

The dependent variable is the gross fixed tangible asset stock. Bind is a dummy variable that takes 0 for the firms to exceed the 2/3 threshold imposed by law. Control variables are defined in equation 4. ***, **, * denotes statistical significance at %1, %5, and %10 levels, respectively. Robust standard deviations are in the parentheses

In addition to parametric regression results, non-parametric results confirm the decreasing tangible fixed asset stock after crossing the line imposed by law. The impact varies between 13 pp. and 22 pp. in different specifications. Overall, these results from regression discontinuity design emphasize a decline in tangible asset stocks. The decline seems more evident in the 2/3 threshold, i.e., when the general assembly should decide on the recapitalization of the firm. Considering these firms are

more constrained in terms of external finance, the increasing need for internal finance for capital increase can be a potential reason behind this decision of decline.

Table 5:The Ex-post Impact on Investment Stock: Non-parametric Regression Results

|  | Gross Fixed Tang. Asset | Gross Fixed Tang. Asset | Gross Fixed Tang. Asset | Gross Fixed Tang. Asset | Gross Fixed Tang. Asset | Gross Fixed Tang. Asset |
|---|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Bind | -0.157* | -0.094 | -0.224*** | -0.064 | -0.220*** | -0.135* |
|  | (0.070) | (0.060) | (0.081) | (0.062) | (0.080) | (0.072) |
| Obs. | 850,778 | 850,778 | 850,778 | 850,778 | 850,778 | 850,778 |
| Eff. Obs. (left) | 500900 | 592480 | 673206 | 405827 | 286053 | 433309 |
| Eff. Obs. (right) | 23718 | 31203 | 28203 | 36320 | 14492 | 20984 |
| Control | no | yes | no | yes | no | yes |
| Polynom. | one | one | two | two | one | one |
| BW (left) | 1.81 | 2.69 | 4.27 | 1.32 | 0.97 | 1.44 |
| BW (right) | 0.38 | 0.61 | 0.51 | 0.79 | 0.21 | 0.32 |
| BW method | mse | mse | mse | mse | cer | cer |

The dependent variable is the gross fixed tangible asset stock  Bind is the dummy variable that takes 0 for the firms exceeding to the 2/3 threshold imposed by law. Control variables are defined in equation 4. ***, **, * denote statistical significance at %1, %5, and %10 levels, respectively. Robust standard deviations are in the parenthesis.

The negative and significant coefficients through Table 3 and Table 5 can't be considered trustworthy unless the other critical assumptions of regression discontinuity design hold. One of the points that I should check is whether the impact is specific to the threshold point or not. To check this assumption, I set a falsification test in which arbitrarily chosen cut-off values are employed. The insignificant coefficient of interest in Table 6 reveals that the discontinuity is specific to the capital inadequacy threshold. There is no significant slump in tangible fixed asset stock around other thresholds.

Table 6: Falsification test with arbitrary thresholds

| Threshold: | -2.333 | -1.333 | -0.333 | 0.666 | 1.667 | 2.667 |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | | | | |
| Bind | -0.027 | -0.023 | -0.008 | -0.079** | 0.116 | 0.065 |
| | (0.040) | (0.027) | (0.016) | (0.040) | (0.075) | (0.116) |
| | | | | | | |
| Observations | 64,729 | 131,445 | 384,855 | 88,508 | 20,518 | 9,749 |
| R-squared | 0.241 | 0.257 | 0.260 | 0.282 | 0.246 | 0.231 |
| Polynomial | One | One | One | One | One | One |
| Control | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes | Yes | Yes |

The dependent variable is the gross fixed tangible asset stock  Bind is the dummy variable that takes 0 for the firms exceeding to the 2/3 threshold imposed by law. Control variables are defined in equation 4. ***, **, * denotes statistical significance at %1, %5, and %10 levels, respectively. Robust standard deviations are in the parentheses

Table 7 : Covariate balance

| | Employment | Liquidity | Total Debt | Profit |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | | | | |
| Bind | -0.036** | 0.001 | -0.007 | -0.009 |
| | (0.017) | (0.002) | (0.005) | (0.006) |
| | | | | |
| Observations | 88,562 | 88,562 | 88,562 | 88,562 |
| R-squared | 0.136 | 0.052 | 0.157 | 0.062 |
| Polynomial | One | One | One | One |
| Control | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Sector FE | Yes | Yes | Yes | Yes |

The dependent variable is the employment, cash, and cash equivalents to an assets, total debt to asset, and net profit to sales.  Bind is a dummy variable that takes 0 for the firms to exceed the 2/3 threshold imposed by law. Control variables are defined in equation 4. ***, **, * denotes statistical significance at %1, %5, and %10 level, respectively. Robust standard deviations are in the parentheses

Furthermore, I check that covariates are continuous around the threshold, which is another Furthermore, I check that covariates are continuous around the threshold, which is another assumption of the regression discontinuity design. Table 7 emphasizes that there is no significant change for liquidity, total debt, and profitability variables around the threshold. In other words, these covariates are continuous around the threshold, excluding employment, which is closely related to fixed asset investments, especially machinery & equipment investments. In addition to regression analysis, I plot the distributions of leverage, cash, and number of employees around the threshold. All plots are in Appendix A.

**6.2 Ex-ante Investment Differentiation**

First, I investigate whether there is a differentiation between firms that are exposed to higher agency costs and lower agency costs as they are close to the threshold. Based on the Proposition 2, the variation in ex-ante investment decisions was estimated with the panel model below.

$$Investment_{i,t} = \beta_1 Closeness_{i,t-1} + \beta_2 Agency\ Cost_{i,t}$$
$$+ \beta_3 Closeness_{i,t-1} x\ Agency\ Cost_{i,t} + X_{i,t-1} + \mu_i + \delta_t + \varepsilon_{i,t}$$

The dependent variable is tangible capital stock in logarithmic form. The distance to the threshold indicates how close the firm is to the capital inadequacy threshold. Agency cost refers to the intensity of agency problems in the company. Although our dataset is extensive in terms of firm numbers and observations, the dataset does not include ownership information. There are different variables in the literature that are used to measure agency cost. In this study, I first employed the share of general administrative expenses in total sales following Ang et al. (2000). Intuitively, it is expected that an owner-managed firm has less general management expenses compared to a similar firm since any additional expense means a loss from its own profit. However, when the manager is different from the owner, the expenses are covered by the firm. For this reason, I expect a positive correlation between higher management expenses and agency costs. Second, because the number of partners and

thus the control right is more dispersed in the companies that are offered to the public, it is expected to see more agency costs in these companies. In this direction, a dummy variable that takes a value of 1 for publicly traded[5] companies and 0 for non-public companies are used. Third, I employed the cash ratio arguing that the firms exposed to higher agency costs accumulate more cash rather than invest (Jensen and Meckling,1976). Fourth, I use the asset utilization ratio, and sales-to-asset ratio as an indicator of how firms use their assets Ang et al.(2000). I use the asset-to-sales ratio in order to interpret the same as the other agency cost proxies. In this way, for all agency cost proxies, the negative values for our coefficient of interest ($\beta_3$) in the regression can be interpreted as the tangible capital stock decreases more for the firms in which the agency problem is more severe as the firms are closer to the threshold. On the other hand, the model includes various control variables $X_{i,t-1}$, including financial liabilities, cash and cash equivalents, operating profit, and sales. I also saturate the model with firm-fixed effects and year-fixed effects in order to control the firm characteristics independent of time and time-variant changes, respectively.

The following regression results are presented to show that ex-ante investment differentiation in companies where agency problems are more prominent. The coefficient of the interaction term is negative and significant, implying that the firms with higher management expenses arising from agency problems have low ex-ante investments when they close to a threshold value (column 1). Incorporating control variables (column 2) and sector-year fixed effects (column 3) has no qualitative effect on the coefficient of interest. Results are compatible when a public firm is employed as the agency cost proxy. Employing control variables and sector-year fixed effects do not vary results much in this specification (column 4-6).

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[5] In order to identify publicly traded firms, I tag the firms with positive balance sheet items of premium on issues of common stock (booking item 520 in Turkish Accounting Standards) in any year

Table 8: Ex-ante Impact of Capital Inadequacy Liabilities on Investments: General Management Expenses and Being Public Firm as Agency Cost

| | Agency Cost: General Management Expenses | | | Agency Cost: Being Public Firm | | |
|---|---|---|---|---|---|---|
| | (1) Gross Fixed Tangible Asset Investment | (2) Gross Fixed Tangible Asset Investment | (3) Gross Fixed Tangible Asset Investment | (4) Gross Fixed Tangible Asset Investment | (5) Gross Fixed Tangible Asset Investment | (6) Gross Fixed Tangible Asset Investment |
| Agency Cost X Closeness | -0.023* | -0.031** | -0.034*** | -0.155*** | -0.166*** | -0.156*** |
| | (0.013) | (0.013) | (0.013) | (0.056) | (0.057) | (0.057) |
| Obs. | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 |
| R-square | 0.520 | 0.522 | 0.523 | 0.520 | 0.522 | 0.523 |
| Controls | no | yes | yes | no | yes | yes |
| Year FE | yes | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes | yes |
| SectorxYear FE | no | no | yes | no | no | yes |

The dependent variable is the gross investment log difference of tangible fixed assets minus depreciation. Closeness is the capital inadequacy ratio which indicates that an increase means the firm is closer to the threshold. Control variables are mentioned in Equation 3 and defined in Table 2. Levels for agency cost and closeness to the threshold are included in the model but not reported. ***, **, * denotes statistical significance at %1, %5, %10 level, respectively. Robust standard deviations are in parentheses.

In addition to general management expenses and being a public firm, table 8 shows that the relationship is similar when I use the assets-to-sales ratio or cash ratio as the proxy for the intensity of agency cost. The negative and significant coefficient of the interaction term indicates that investments decrease in the firms with higher agency cost signals as they close to the threshold.

Despite the differentiation before the 1/2 threshold, I couldn't find any differentiation close to the second threshold. The results are also similar when I use net investments rather than gross investments (see Appendix A). Overall, these results emphasize the role of agency costs in the differentiation of ex-ante underinvestment behavior in the firms.

Table 9: Ex-ante Impact of Capital Inadequacy Liabilities on Investments: Assets-to-sales Ratio and Cash Ratio as Agency Costs

| | Agency Cost: Assets to sales ratio | | | Agency Cost: Cash ratio | | |
|---|---|---|---|---|---|---|
| | (1) Gross Fixed Tangible Asset Investment | (2) Gross Fixed Tangible Asset Investment | (3) Gross Fixed Tangible Asset Investment | (4) Gross Fixed Tangible Asset Investment | (5) Gross Fixed Tangible Asset Investment | (6) Gross Fixed Tangible Asset Investment |
| Agency Cost X Closeness | -0.003*** | -0.002*** | -0.003*** | -0.141*** | -0.136*** | -0.136*** |
| | (0.001) | (0.001) | (0.001) | (0.022) | (0.022) | (0.022) |
| Obs. | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 |
| R-square | 0.520 | 0.522 | 0.523 | 0.521 | 0.522 | 0.523 |
| Controls | no | yes | yes | no | yes | yes |
| Year FE | yes | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes | yes |
| SectorxYear FE | no | no | yes | no | no | yes |

The dependent variable is the gross investment log difference of tangible fixed assets minus depreciation. Closeness is the capital inadequacy ratio which indicates that an increase means the firm is closer to the threshold. Control variables are mentioned in Equation 3 and defined in Table 2. Levels for agency cost and closeness to the threshold are included in the model but not reported. ***, **, * denotes statistical significance at %1, %5, %10 level, respectively. Robust standard deviations are in the parentheses

## 6.3 Robustness and Limitations

I also apply a battery of robustness checks in order to show that our results do not vary much. First, given the minor changes in the middle of the accounting year of 2012, I replicate the analysis excluding the year 2012. Second, I winsorized our key variables 2.5 percent instead of 1 percent in order to show that our results are not driven by outliers. Results are qualitatively in line with our baseline results. Third, I replicate the ex-ante regressions with net tangible asset investments (see appendix) that exclude accumulated depreciations in physical investments. Results are qualitatively and quantitatively similar to our baseline results.

One caveat is that the impact of two different thresholds is investigated mutually. There are advances in the multi-cutoff (Cattaneo et al. 2016). Another caveat that

should be considered is that the measurement of investment is sensitive to revaluation. One other limitation is that our physical investment is aggregated. I can't completely identify whether the firms sell off the management's own investments or the other investments that were made before. The reduction in investment stock may arise from the ex-ante miscalculation of agents as well as the disposing of relatively trivial investments.

# CHAPTER 7

## CONCLUSION

Technical insolvency, or balance sheet insolvency, refers to a position that the assets of the firm are insufficient to cover its debt and is interpreted as a leading indicator of corporate distress. In order to alleviate this distress, the Turkish Commercial Code prescribes some measures to reorganize and recapitalize firms close to technical insolvency. In this study, I empirically investigate whether this law produces physical investment inefficiency due to potential hold-up problems. I first show that physical capital stocks shrink when the firms exceed thresholds imposed by law and control rights shift from the manager to the general assembly. Further analysis shows that the closer to the capital inadequacy threshold, the less investment is made in firms where the agency cost between principal-agent is more evident, implying a hold-up problem for managerial investments.

When it comes to the solution of the hold-up problem in the law, the managerial utility function implies two potential solutions to eliminate the potential managerial underinvestment. The first one is simply abolishment of law ($\alpha = 0$) and assigning control rights to the parties that invest in line with the vertical integration solution by Klein et al. (1978). This solution, however may not be completely inclusive since there should be a right to speak for shareholders when the firm is financially distressed. Another solution is simply minimizing the incongruence between managers and shareholders ($\theta = 0$) so that they attribute the same value to investment even if the firm exceeds the threshold. This solution can be incentivized by encouraging ex-ante

communication between managers and shareholders. Future research may focus on the solution of this hold-up problem in a theoretical manner.

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# A.APPENDICES

## APPENDIX A.1: EX-ANTE INVESTMENTS ON NET TANGIBLE ASSETS

Table A1: Ex-ante Impact of Capital Inadequacy Liabilities on Net Investments

| | Agency Cost: General Management Expenses | | | Agency Cost: Being Public Firm | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment |
| Agency Cost X Closeness | -0.013 | -0.025 | -0.028 | -0.154* | -0.171* | -0.156* |
| | (0.019) | (0.019) | (0.019) | (0.092) | (0.092) | (0.092) |
| Obs. | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 |
| R-square | 0.456 | 0.460 | 0.461 | 0.456 | 0.460 | 0.461 |
| Controls | no | yes | yes | no | yes | yes |
| Year FE | yes | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes | yes |
| SectorxYear FE | no | no | yes | no | no | yes |

The dependent variable is the net investment log difference of tangible fixed assets minus depreciation. Closeness is the capital inadequacy ratio which indicates that an increase means the firm is closer to the threshold. Control variables are mentioned in Equation 3 and defined in Table 2. Levels for agency cost and closeness to the threshold are included in the model but not reported. ***, **, * denotes statistical significance at %1, %5, %10 level, respectively. Robust standard deviations are in the parentheses

Table A2: Ex-ante Impact of Capital Inadequacy Liabilities on Net Investments

| | Agency Cost: Assets to sales ratio | | | Agency Cost: Cash ratio | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment | Net Fixed Tangible Asset Investment |
| Agency Cost X Closeness | -0.004*** | -0.003** | -0.003** | -0.185*** | -0.176*** | -0.176*** |
| | (0.001) | (0.001) | (0.001) | (0.034) | (0.034) | (0.034) |
| Obs. | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 | 1,250,697 |
| R-square | 0.456 | 0.460 | 0.461 | 0.521 | 0.522 | 0.523 |
| Controls | no | yes | yes | no | yes | yes |
| Year FE | yes | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes | yes |
| SectorxYear FE | no | no | yes | no | no | yes |

The dependent variable is the net investment log difference of tangible fixed assets minus depreciation. Closeness is the capital inadequacy ratio which indicates that an increase means the firm is closer to the threshold. Control variables are mentioned in Equation 3 and defined in Table 2. Levels for agency cost and closeness to the threshold are included in the model but not reported. ***, **, * denotes statistical significance at %1, %5, %10 level, respectively. Robust standard deviations are in the parentheses

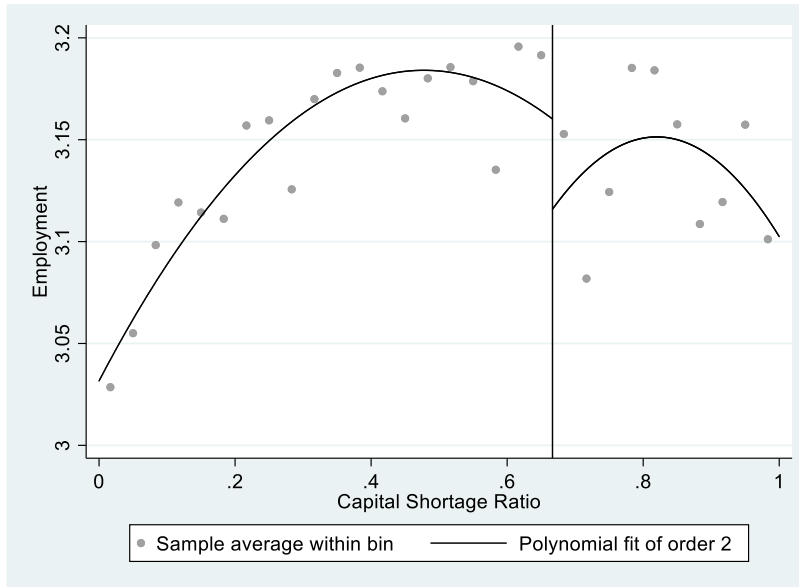**APPENDIX A.2: CONTINUITY OF COVARIATES**

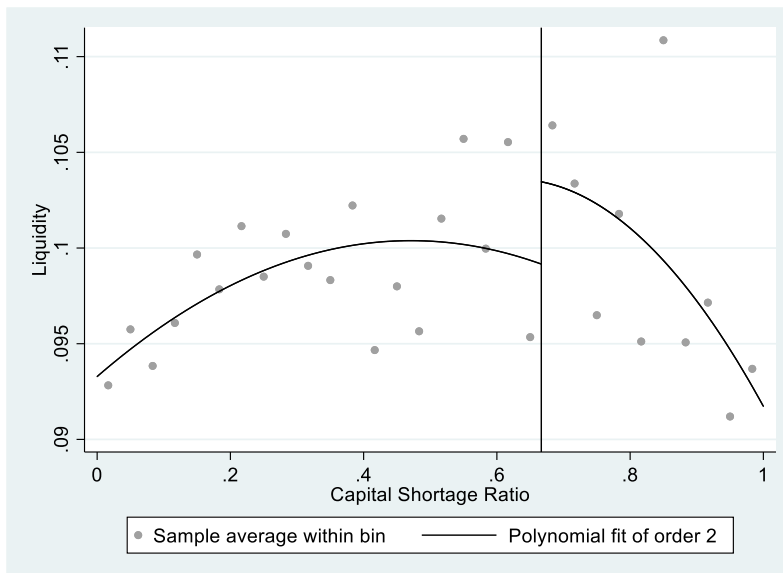

Figure A1: Covariate Balance: Employment
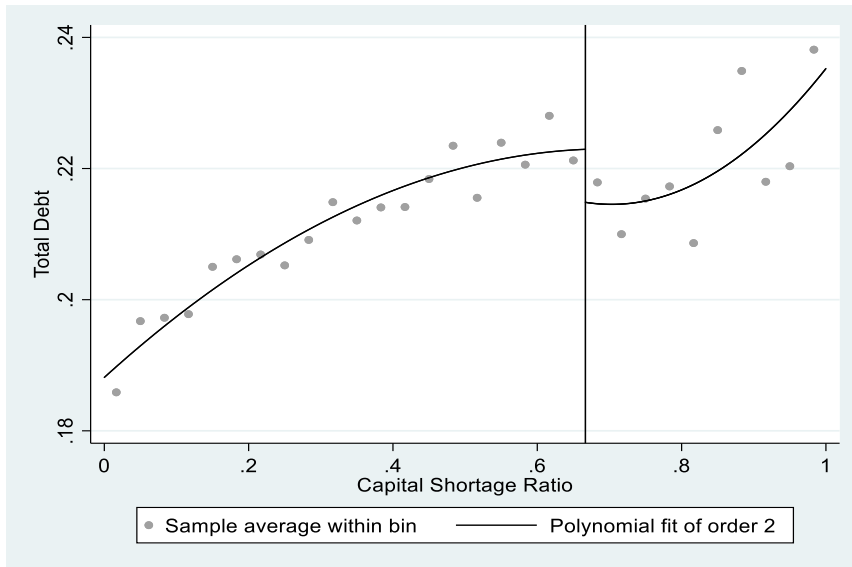


Figure A2: Covariate Balance: Liquidity
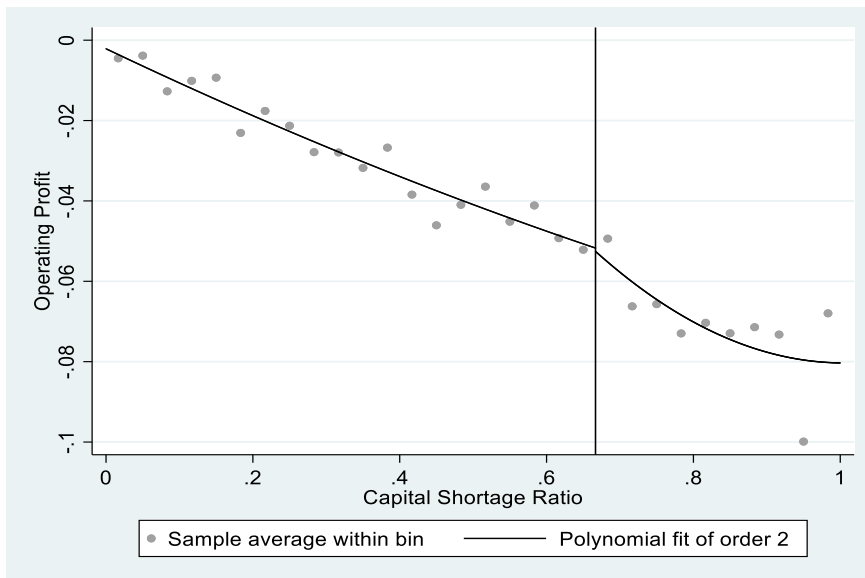
Figure A3: Covariate Balance: Total Debt



Figure A4: Covariate Balance: Operating Profit

## B. TURKISH SUMMARY / TÜRKÇE ÖZET

Hold-up problemi, birbirleri ile ekonomik ilişki içinde olan kişiler arasında tam anlamıyla bağlayıcı ve kapsayıcı kontratlar (complete contracts) yapılamayan durumlarda karşı tarafın yatırım sonrası olası fırsatçı davranışı nedeniyle ilişkiye özgü (relationship-specific) yatırımlardan kaçınılması davranışını ve bu nedenden dolayı ekonomide oluşan etkinsizliği ifade etmektedir.

Örneğin bir tedarikçi-müşteri ilişkisinde üretiminin önemli bir kısmını tek bir müşteriye yapan bir tedarikçi firma maliyetlerini düşürücü ve mark-up oranını artırıcı bir yatırım yapmayı değerlendiriyor olsun. Yatırımı yapan tedarikçi firmanın başka müşteri firmalara satış yapması mümkün değilse (limited outside option), müşteri firma tedarikçi firmanın bu yatırımdan dolayı katlandığı batık maliyetin (sunk-cost) farkında olarak ve elindeki pazarlık gücünü kullanarak, yatırımdan sonra ortaya çıkan toplam rantı (ex-post surplus) paylaşacak şekilde daha düşük fiyat talep edecektir. Bu da yatırımdan doğan rantın pazarlık güçlerine göre paylaşılması anlamına gelmektedir. Dolayısıyla tedarikçi gerçekleştireceği yatırımdan beklediği getiriyi elde edememe ihtimalini yatırımdan önce öngörmekte ve yatırım yapmaktan geri durmaktadır.

Bu noktada, hold-up problemine çözüm olarak tedarikçi firmanın yatırımdan önce müşteri firma ile uzun vadeli bir kontrat yapması doğal bir çözüm olarak görülmektedir. Fakat taraflar arasında kontrat yapmak her zaman mümkün olmayabilmektedir. Gelecekte karşılaşılabilecek olası tüm durumları kapsayıcı (complex-contingent) kontratlar yapmak mümkün olmayabilir, yapılan yatırımlar mahkeme gibi üçüncü kişiler tarafından gözlemlenemeyebilir (unverifiability) ya da hukuki sistemdeki etkinsizlik nedeniyle kontratların uygulanmasında zorluklar olabilir. Tüm bu olası durumlar akademik yazında tamamlanmamış kontratların (incomplete contracts) daha yakından incelenmesine neden olmuş ve hold-up sorununa çeşitli çözüm önerileri getirilmiştir. Firmalar arasında dikey entegrasyonun

sağlanması (Klein,1978), varlıkların kullanım hakkı tahsisinin etkinliği artıracak şekilde gerçekleştirilmesi (Grossman ve Hart,1986),  doğrulanabilirliği sağlayan mekanizmaların tasarlanması (Maskin ve Tirole,1999), çift taraflı fiyat opsiyonlarının yazılması (Nöldeke ve Schmidt, 1995) ve müzakere sürecinin yeniden tasarlanması (Aghion ve diğ. 1994) gibi çeşitli çözüm önerileri literatürde tartışılmıştır. Fakat hold-up problemi bugün hala çözülmesi zor bir problem olarak varlığını sürdürmektedir.

Bu çalışmada ise, Türkiye'de zarar nedeniyle sermaye kaybına dair firmalara çeşitli yükümlülükler getiren yasanın firma yönetimi açısında bir hold-up sorununa neden olup olmadığı incelenmektedir. Türk Ticaret Kanunu'nun 376. maddesi firmaların geçmiş yıllarda yaşadıkları zararları nedeniyle oluşan çeşitli riskleri yönetmek adına Türk Ticaret Kanunu'nun 376.maddesi sermaye kaybı kavramını tanımlamakta ve bazı yükümlülükler getirmektedir. Kanunda,

i. *Son yıllık bilançodan, sermaye ile kanuni yedek akçeler toplamının yarısının zarar sebebiyle karşılıksız kaldığı anlaşılırsa, yönetim kurulu, genel kurulu hemen toplantıya çağırır ve bu genel kurula uygun gördüğü iyileştirici önlemleri sunar.*

ii. *Son yıllık bilançoya göre, sermaye ile kanuni yedek akçeler toplamının üçte ikisinin zarar sebebiyle karşılıksız kaldığı anlaşıldığı takdirde, derhâl toplantıya çağrılan genel kurul, sermayenin üçte biri ile yetinme veya sermayenin tamamlanmasına karar vermediği takdirde şirket kendiliğinden sona erer.*

şeklinde iki fıkra bulunmaktadır. Her iki fıkra da yöneticiler ve genel kurul arasında firmada yapılan yatırımlar üzerinde olası bir yetki devrini ima etmektedir. Birinci fıkrada, olağan zamanlarda firmanın yatırımları ve diğer olağan kararları üzerinde tek yetki sahibi olan yöneticiler sermaye kaybı eşik değerinin geçilmesi durumunda genel kurulu toplantıya çağırarak bazı önlemleri sunmak ve yatırımlar üzerindeki yetkilerine genel kurulu dahil etmek durumundadır. Bu durum firmanın yapılmış yatırımlarının akıbetine dair kararların yatırım yapan kişi dışında biri tarafından verilebilme ihtimalini ima etmektedir. Nitekim 2018 yılında yayınlanan tebliğ ile durum detaylandırılarak "*Genel kurul, sunulan iyileştirici önlemleri aynen kabul edebileceği gibi değiştirerek de kabul edebilir ya da sunulan önlemler dışında başka bir önlemin uygulanmasına karar verebilir*" ibaresi yer almıştır.

İkinci fıkrada ise 2/3 eşik değerinin aşılması halinde yine yönetici yerine genel kurula sermaye yükseltme kararına dair karar verme yükümlülüğü getirmektedir. Firma genel kurulunun sermaye yükseltme kararı vermesi halinde firmalarda finansman kısıtı oluşması son derece doğal bir sonuçtur. Bu durumun önceden yapılan yatırımların getirisini zayıflatması ve hatta sermaye artırımının finansmanı için mevcut yatırımlardan bazılarının satılması ihtimalini ortaya çıkarmaktadır.

Dolayısıyla mevcut yasanın, eşik değeri ihlal etmediği halde eşik değere yakın bir pozisyonda olan, yani eşik değeri ihlal etme tehdidini yakından hisseden bir firmanın yatırım davranışlarında etki oluşturması beklenmektedir. Bir başka deyişle yasanın öngördüğü eşik değere yaklaştıkça hold-up problemine daha fazla maruz kalması beklenen (yasa sonrasında yatırımları üzerinde pazarlık gücünün daha az olması beklenen veya agency cost'u daha az olması beklenen) firmalarda ex-ante yatırımların daha az olması beklenmektedir. Grafik 1, bu bağlamda 376. Maddenin oluşturabileceği hold-up etkilerini şematize etmektedir.
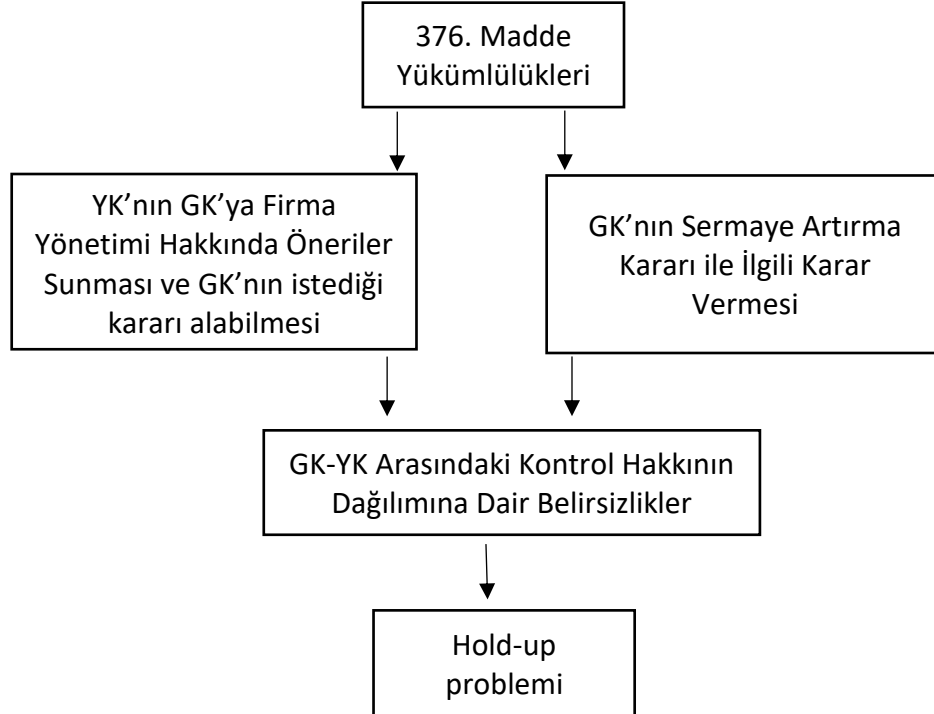


Grafik 1: 376. Madde hükümleri ve Hold-up Sorunu

Yasanın neden olabileceği hold-up sorunu bir örnek ile açıklanabilir. Örneğin, A firmasında 2014 yılı başında YK (Yönetim Kurulu) isimli yönetici (*agent*) ile GK (Genel Kurul) isimli firmanın tek sahibi (*principal*) arasında bir asil-vekil (*principal-agent*) ilişkisi kurmuş olsun. YK kişisi 2014 yılı boyunca firmanın borçlanma, yatırım gibi tüm olağan kararlarından sorumludur ve bu iş için GK'dan ücret almaktadır. GK kişisi YK'nın firma yönetimine dair sene boyunca aldığı kararlara müdahale etmemekte ve sene sonunda net karlılık ile ilgilenmektedir. Hem YK hem de GK'nın nihai amacı firma karlılığını artırmaktır.[6]

YK ile GK arasında yatırımlara ve yönetime dair öznel bakış açısından doğan herhangi bir çatışmanın olmadığı, dolayısıyla firmada herhangi bir *agency cost* olmadığı durum *benchmark case* olarak ele alınsın. Yani ya firma sahibi ile yöneticisi aynı kişi olsun ve dolayısıyla yatırımlara atfettikleri öznel değerleri (*valuation*) tamamen aynı olsun ya da YK ve GK arasında hiçbir uyumsuzluğun olmadığı, her konuda uzlaştıkları bir dünya mevcut olsun. Bu durumda YK 2014 yılı boyunca 10 birimlik beklenen getirisi ve 8 birimlik maliyeti olan bir makine-teçhizat yatırımı fırsatı gördüğünde bir sonraki sene firma eşik değeri geçme ihtimali olsa bile üzerinde herhangi bir kontrol kaybı baskısı hissetmeyeceği için (çünkü GK da yatırımlar hakkında kendisi ile aynı *valuation*'a sahip) bu yatırımı gerçekleştirecek ve *first-best* yatırım seviyesine ulaşılacaktır.

Bu duruma karşıt olarak GK ve YK arasında bir agency cost'un var olduğu bir durumda, yani YK ve GK'nın birbirlerinden ayrı kişiler olduğu ya da yatırımlara atfettikleri değerde (*valuation*) bir ayrışma olduğu ve bu kişisel değerlerin birbirleri tarafından tam olarak gözlemlenemediği varsayıldığında artık *first-best* yatırıma ulaşmak artık mümkün olmayacaktır. Çünkü artık YK *ex-ante* yatırım kararını verirken herhangi bir dış etkenden dolayı 2014 yılı sonunda tahminlerini aşan şekilde bir zarar etmesi durumunda karşılaşacağı 376.madde yükümlülüklerini de önemsemek zorunda kalacaktır. Zira, firma belli bir eşik değerin üstünde zarar ettiğinde yönetim

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[6] Yani aralarındaki ilişkide *moral hazard* veya *empire building* motivasyonları mevcut değildir. Moral hazard'ın mevcut olmadığından kastım hem principal hem de agent'ın amacının firmanın kar maksimizasyonu olduğu ve agent'ın bu kar maksimizasyonu dışında kendi karını maksimize edecek eylemi (hidden action) olmadığı. Bu varsayımın çalışmanın ilerleyen kısımlarında esnetilmesi planlanmaktadır.

ile ilgili bazı kontrol hakları GK'nın eline geçmektedir. GK bu durumda yasanın kendisine verdiği yetkiye dayanarak yapılan yatırımı elden çıkarma, yatırımdan verim almayı engelleyecek önlemleri hayata geçirme (örneğin makineden anlayan işçiyi işten çıkarma ya da sermaye artırımı kararı vererek firmanın üretiminin finansmanını zora sokabilecek kararları alma gibi) gücüne sahip hale gelmektedir. Bu da YK'nın 8 birimlik yatırımına karşılık olarak 10 birimden daha az beklenen getiri elde etme ihtimalini ortaya çıkarmaktadır.

Ortaya konan hold-up sorununun varlığını ampirik olarak test etmek adına firma seviyesinde geniş bir mikro-veri seti kullanılarak analizler gerçekleştirilmiştir. Türkiye'deki tüm sermaye firmalarının (yaklaşık 800 bin firma) mali tablolarının bulunduğu geniş mikro-veri seti kullanılmış ve gerçekleştirilen panel veri analizleri bu ihtimali destekleyen bazı ipuçları ortaya koymuştur. Buna göre, Regression Discontinuity design (RDD) yöntemi ile gerçekleştirilen analizler eşik değeri geçerek yükümlülüğe tabi olan firmalarda da maddi duran varlıklarda bir azalışa işaret etmektedir. Bu durum yöneticilerin yatırım yapmaktan geri durmalarına dair gösterdikleri çekincelerin haksız olmadığını, firma sahiplerinin gerektiğinde daha önceden yapılmış duran varlık yatırımlarını elden çıkarabildiğini göstermektedir.

Yasaya tabi olmanın maddi duran varlık stoku üzerinde oluşturduğu ex-post etkiye ek olarak daha yüksek vekalet maliyetine katlanan firmalarda ex-ante yatırımlarda farklılaşma olup olmadığı da incelenmiştir. Elde edilen regresyon bulguları sermaye kaybı yükümlülüklerine tabi olma ihtimali arttıkça asil-vekil (*principal-agent*) arasındaki uyuşmazlığın (*agency cost)* daha belirgin olduğu firmalarda daha az yatırım yapıldığı görülmektedir. Bu durum, vekalet maliyetinin yüksek olduğu firmalarda yöneticilerin olası bir kontrol hakkı değişimi sonrasında yatırımlardan beklenen getiriyi elde edemeyeceklerini öngörerek yatırımlarını azalttıklarını ima etmektedir. Elde edilen sonuçlar, teorik olarak sıklıkla incelenen bir konu olan hold-up sorununa ampirik bulgular sunmaktadır. Yasanın hold-up sorununun yarattığı etkinsizlikler giderilecek şekilde ele alınmasının yatırımlardaki etkinsizliğin giderilmesi noktasında önemli olduğu düşünülmektedir. Bu bağlamda yatırımda etkinsizliğe yol açmayan yasanın toerik olarak irdelenmesi bir araştırma patikası olarak önem taşımaktadır.

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