Employee Inside Debt and Firm Risk-Taking: Evidence from Employee Deposit Programs in Japan[#]

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Abstract

Using a sample of 2104 Japanese firms, we investigate the effect of employee deposits – a form of employee inside debt – on firms' risk-taking behavior. Our identification strategy utilizes a new law in 2003 that changed the priority of employee deposits in bankruptcy and led to large scale withdrawals of employee deposits. Our results indicate that firms with higher levels of employee deposits have lower total risk, systematic risk, and idiosyncratic risk, engage in less risk-taking investment, and have higher leverage. Our findings suggest that the holding of the company's debt by its employees can reduce the agency costs of debt.

Keywords: inside debt; risk-taking; employee deposits; agency costs of debt.

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1. Introduction

The agency cost of debt (Jensen and Meckling (1976); Galai and Masulis (1976)) remains one of the most important research topics in modern financial economics. Due to the divergent payoff structures of debt and equity, shareholders may have the incentive to allow managers to take risk-increasing projects, whereas creditors prefer borrowers to manage the firm more conservatively. This risk-shifting problem has drawn continuous attention and many papers have sought to identify mechanisms that can mitigate this problem. Jensen and Meckling (1976) suggest implementing an optimal incentive structure under which the manager's personal holdings of the firm's debt and equity should be designed in a ratio that mimics the firm's overall capital structure. More recently, Edmans and Liu (2011) formally model this idea of "inside debt" as part of managerial compensation and confirm it to be an effective remedy to the agency costs of debt.

In line with the theoretical development, recent empirical evidence shows that inside debt, usually in the form of pensions and deferred compensation, causes CEOs to manage their firms conservatively (Sundaram and Yermack (2007)), and even transfer value from shareholders to debtholders (Wei and Yermack (2011)). These types of inside debt are appealing to the company's lenders, and hence firms whose managers hold more inside debt face less stringent contracts and lower cost of borrowing (Chen, Dou, and Wang (2010); Wang, Xie and Xin (2010)). These studies all suggest that inside debt aligns managers' interest closely with that of creditors by increasing their exposure to the firm's bankruptcy risk.

While previous studies focus exclusively on managerial inside debt, we examine another form of inside debt, namely, in-company employee deposits.[1] In Japan, these

[1] A recent paper by Chang, Kang and Zhang (2012) looks at the monitoring incentives of employees of companies with pension deficits in the context of the company's M&A activities. The authors find that

in-company savings are under the Employee Deposit Programs (EDP, *Shanai-yokin seido*), which allow participating employees to deposit their money in their firm at a favorable interest rate.[2] By lending money to their employer, employees are exposed to risk of bankruptcy, which is likely to be costly if their deposits are not fully secured. This is true irrespective of the priority or seniority of employee deposits, as long as they are impaired in bankruptcy or liquidation.[3] They may, however, be in a position to monitor the firm's risk-taking behavior more effectively than outside lenders, which could translate into lower cost of borrowing from employees, relative to outside lenders. In addition, if employee monitoring mitigates risk-taking, this also benefits other lenders, and the firm is able to borrow at lower cost from the market.

Can employee inside debt be another way to resolve the risk-shifting problem? In this paper, we utilize data on EDPs of listed firms in Japan to provide the first empirical evidence on the effect of employee deposits on firm's risk-taking behavior. We find that firms that offer EDP or firms that have a higher level of employee deposits (ED) – measured by deposits per employee and deposits to asset ratio – have lower levels of total risk, systematic risk, and idiosyncratic risk.[4] This effect is consistent with what has been documented for managerial inside debt by Sundaram and Yermack (2007). Furthermore, using keiretsu affiliation as a proxy for the strength of banking relationship, we find that the risk-reducing effect of EDP is only concentrated among non-keiretsu firms, suggesting that the discipline from employee inside debt is reduced when firms are closely monitored or insured by banks. We further test the impact of employee deposits on firm's capital investment. Eisdorfer (2008) argues that risk-shifting incentives may result in a positive relation between

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companies with larger pension deficits pay lower merger premia, have higher merger announcement returns, and are less likely to engage in diversifying mergers.

[2] The U.S. and most other countries do not have such explicit forms of employee inside debt.

[3] Change in the law about the seniority of the employee deposits plays an important role in our DID analysis, as discussed below.

[4] Our results are robust to an alternative measure of risk –i.e., the expected default probability as in the KMV model, as discussed later.

investment and market volatility and a consequent decrease in debt value. Following his empirical approach, we find that the firms with a higher level of employee deposits have lower investment sensitivity to expected market volatility. Finally, we find that the level of employee deposits can positively predict the level of firm's leverage ratio (excluding employee deposits in calculating total debt), implying that larger balance of employee deposits is associated with lower cost of borrowing due to better alignment of incentive between insiders and outside creditors. These results all suggest an effective role played by EDP in mitigating the agency costs of debt.

There are several alternative, but not mutually exclusive, explanations for these results, apart from the idea that employee monitoring is the main mechanism that induces firms with EDPs to reduce risk. One such explanation, which is plausible especially in Japan's institutional context, is based on the notion that EDPs were put in place to improve mutual trust, bonding or loyalty vis-à-vis employees, or even as a form of employee benefit, rather than to provide a cheaper source of finance.[5] Employers motivated by such concerns would then reduce the riskiness of their companies, so that the savings remain safe and breach of trust does not occur. Risk-reduction and cheaper borrowing cost in this case are consequences of companies trying to promote employee loyalty, welfare and productivity, rather than obtaining cheaper finance. Whether such "trust" or reputational costs to employers (and consequent effects on worker morale or productivity) can be effective in reducing the agency costs of debt in other institutional contexts is an issue that goes beyond the scope of the present paper.

A third potential explanation for our results is reverse causality or endogeneity: it is possible that our results are driven by the fact that some firms are inherently less

[5] EDPs in Japan go back to the 19th century. They were regulated only after 1952, and fall under the purview of the Ministry of Labor and Welfare. The popularity of EDPs in the post-war period until the mid-1970s may also have been due to the lack of alternative opportunities for workers to park their savings.

risky, and attract more employee deposits. It is also possible that some unobserved factors negatively affect firm risk and are meanwhile positively related employees' willingness to participate. Some degree of bi-directional causality will undoubtedly exist, since if employees are successful in monitoring and reducing risk, it is likely that more employees will be willing to deposit their savings with the company. While this is not the direction we want to pursue in this paper, the willingness of informed employees to deposit savings with the company can signal to outsiders the riskiness of the company, and can potentially be a monitoring mechanism for outsiders as well, similar to arguments that a part of banks' liabilities should consist of subordinated debt whose spreads can provide information on bank riskiness. [6]

We address endogeneity and establish a direction of causality from deposits to company risk in several ways. First, we follow standard approaches and control for firm fixed effect in addition to a broad range of firm characteristics, attenuating the omitted variable concern, as certain firm characteristics that are omitted from the model might affect employer's decision to offer employee deposits. Second, we control for observed heterogeneity between firms with and without EDPs via a propensity score matching algorithm (originally developed by Rosenbaum and Rubin (1983)). By matching firms on their propensity scores in offering EDP, the EDP and non-EDP firms can be treated as randomly assigned. This approach also helps to overcome potential model misspecification problem arising from linear regressions. Third, we estimate a Heckman selection model, in which variables such as employees over total assets and labor expenses over sales, which reflect the importance of employees in the organization but are not directly related to company risk, are used as instruments. All approaches yield very consistent results.

[6] See, for example, Berger, Davies and Flannery (2000) or Flannery and Sorescu (1996).

Our main empirical approach is a difference-in-difference (DID) methodology. Specifically, we identify an exogenous shock to EDP caused by the new regulation on employee deposits in 2003 (called the New Corporate Reorganization Law – henceforth CoRoL), and apply the DID approach to examine the changes in firm risk in response to this shock. Publicly listed companies in Japan typically file for reorganization under CoRoL. Prior to the law change in 2003, employee deposits under reorganization law were regarded as "kyoeki-saiken" (common benefit claim) and were guaranteed the right of preferential treatment. However, the new law of 2003 put a maximum limit on the amount of deposits that could be claimed, so that any excess amount would have the same status as any other junior debt claims. This greatly reduced employee deposits, and many firms abolished EDPs. Applying DID analysis to the regime shift helps to mitigate the reverse causality concern as the reduction in the balance of employee deposits is mainly attributed to changes in regulation rather than to firm risk or unobserved firm characteristics. We show that firms that had EDP at the beginning of 2003 became relatively more risky in comparison to firms that did not have EDP after the law change, and the risk gap becomes smaller.[7]

To our knowledge, we are the first to directly examine the effect of *employees'* inside debt holdings on firm risk and the cost of debt. We contribute to the literature on the agency costs of debt by documenting another effective mechanism that can mitigate the risk-shifting problem. We also add to the inside debt literature by showing that not only do the debt holdings of top executives matter, those of rank and file employees also have an important impact. Moreover, while existing studies exclusively

[7] One could ask whether firms might respond by increasing ESOPs when EDPs have to be withdrawn, and whether this could explain the increase in risk-taking. Existing evidence for the US, however, suggests that ESOPs reduce firm risk (Bova et al. (2012)). This is consistent with the view that employees have incentives to monitor firms and reduce risk since they are risk averse and have their human capital tied closely to the company's fortunes.

use CEO pension data as a noisy proxy for CEO inside debt, we directly look at the real debt holdings of employees.[8]

Furthermore, our study contributes to the literature on the role of employees as a stakeholder of the firm. Existing studies find that junior employees may have considerable amount of relevant information about the firm (Huddart and Lang (2003), Babenko and Sen (2011), Chang, Kang and Zhang (2012), Bova, Kolev, Thomas and Zhang (2012)). In this study, we further show that rank and file employees can effectively influence the firm's risk-taking behavior.

Our paper is also related to the literature on deposit insurance and risk-taking. This stream of studies focuses on the drawback of deposit insurance in terms of moral hazard. In particular, due to deposit insurance, banks are free from the threat of runs, and thus have less incentive to behave prudently, as depositors no longer have incentives to monitor banks (e.g. Ioannidou and Penas (2010)). Using the data of EDPs in which employees are depositors and firms are debtors, we find supporting evidence by showing that the risk-reducing effect of employee deposits is weakened for firms where employee deposits are implicitly guaranteed by external parties such as main banks.

The rest of this paper is structured as follows. Section 2 describes the background of Employee Deposit Programs in Japan. We develop our hypotheses in Section 3. Section 4 and 5 present our data and empirical results. Section 6 concludes with a summary.

[8] CEO pensions are often subject to managerial horizon problems. For example, CEOs may engage in earnings management during the pre-retirement period to grant themselves more performance -contingent pensions (Kalyta (2009)). In this case, we cannot fully rule out the possibility that near-retirement CEOs increase their pensions and decrease firm risk at the same time, as they might prefer a quiet life immediately before retirement.

2. Background

An Employee Deposit Program (EDP) or in-company savings scheme in Japan is a company-run program that allows participating employees to deposit their money in the company as an interest-bearing asset.[9] Most programs, until recently, have paid much higher interest rates than regular banks. Historically, EDP has been considered as part of firms' employee welfare programs,[10] and accordingly, has been regulated by the Ministry of Labor and Welfare (Ministry of Labor until 2001) since its introduction in 1952.[11] For a firm to introduce the EDP, an agreement has to be reached between the employer and the representatives of employees under the framework of labor law. The employer manages the account entrusted by the workers who typically deposit through payroll deductions. Typically a written approval for withdrawal is required for the worker, in response to which the employer has the legal obligation to return the savings to the worker upon request without delay. Thus, the EDP can actually be viewed as an internal bank providing saving services. However, while bank deposits would be secured by government up to 10 million yen by the deposit insurance program, employee deposits are not insured and bear the credit risk of the corresponding employer. In other words, the value of employee deposits is contingent on both the incidence of bankruptcy and the liquidation value in bankruptcy.

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[9] There has been almost no research regarding Employee Deposit Programs in Japan. The only exception is an article: Junji Narita (1997) "The role of in-corporate deposit system during the high economic growth period," Financial Review, June, 1-19 (in Japanese). The annual publication by the Ministry of (Welfare and) Labor, the ministry's website (http://www.mhlw.go.jp/new-info/kobetu/roudou/gyousei/kantoku/dl/040324-2a.pdf) as well as the websites of various Prefectural Governments also provides useful information on EDPs.

[10] Some employers introduced EDP for the purpose of promoting the spirit of bonding or trust among their employees.

[11] EDP existed since late 19th century. When EDP was not regulated by the government, employers often forced their employees to deposit their wages and sometimes refused the withdrawal of deposits to prevent workers from leaving the company. The Labor Standards Law drafted after the World War II banned such forced savings by the employees. In the 1950s and 1960s during the high-growth period of the Japanese economy, when many corporations needed more funds for growth, EDPs played an important role not only in providing stable funds for corporations but also in complementing bank deposits for employees. See Narita (1997).

As insiders, employees are likely to have at their disposal various channels for collecting information about the use of the company's assets. Thus, the employees participating in EDP have the incentive to monitor the firm's management and discourage risk-taking behavior. One important channel through which employees participating in EDPs can monitor is the threat of "walking with their feet", i.e., withdrawing deposits if the company engages in excessive risk taking. Withdrawals of deposits can therefore signal to the market that company risk has increased, thereby increasing the cost of borrowing for the company.

Bankruptcy or reorganizations may result in conflicts of interest between employees who participate in the EDP and other creditors such as banks or bondholders. Although the Ministry of Labor and Welfare stipulated mechanisms for the employers to secure *all deposits* by obtaining bank guarantees, securing collateral and setting up a committee to oversee the deposits, there was only a very small penal charge of 300,000 yen (about USD 3000) for firms that failed to make arrangements to secure the full amount of the deposits. Therefore, when bankruptcy liquidation cases were brought to court, employees of the bankrupt firms filed claims to recover their deposits. These court cases were often contentious – the focal point of the disputes being whether to interpret employee deposits as part of unpaid wages, i.e., as senior debt which should be paid with priority. [12]

The New Corporate Reorganization Law of 2003, effective from April, 2003, was aimed at streamlining corporate reorganizations and making the process more efficient. The new law, however, also effectively reduced the seniority of employee deposits in reorganization. Consequently, many companies dropped their EDPs and the outstanding deposits of firms reduced dramatically after 2003. Therefore, the

[12] For example, in a Sapporo High Court ruling on December 17, 1998, a firm's employee claimed that employee deposits were a senior debt of the firm that should be paid with priority upon bankruptcy. However, the court decided against this claim and argued that employee deposits were already secured by labor law under which only the "forced" part of the deposits should be paid back as unpaid wages in case of bankruptcy.

passage of this new regulation provides an ideal laboratory for us to examine the casual relationship between employee deposits and firm risk: the change in EDP balance is caused by an exogenous regulatory shock rather than any unobservable firm characteristics.

We summarize below how the new CoRoL of 2003 affected the seniority of EDs. [13] We provide further details of the laws and regulations related to EDP in Appendix B by directly translating the content from the Ministry of Labor and Welfare's official website:

1. Before 2003, all Employee Deposits (EDs) under EDPs were treated as "kyoeki-saiken" and were guaranteed the right of preferential treatment () under the Corporate Reorganization Law (former Corporate Reorganization Law Article 119). Thus, under the former law, it did not matter whether the courts regarded the EDs as forced or discretionary.
2. However, outside CoRoL, EDs have no "general lien" or the status of "ippan-sakidori-tokken (IST) unless the court decided it represents "forced savings". General lien (or IST) is determined under the Civil Code (Article 306 No.2, Article 308). For example, in bankruptcy liquidation cases, it was possible for the court to rule that EDs were not forced savings, in which case, employees might lose substantial amounts of the deposits. This is what happened in the Sapporo High Court ruling on December 17, 1998 referred to above.
3. The 2003 Law limited the maximum amount of EDs under CoRoL that could receive preferential treatment as 'kyoeki-saiken.' (Corporate Reorganization Law, Article 130 No. 5). This maximum was the higher of 1/3rd of the deposits or past six months' salary. Amounts in excess of this maximum had lower seniority. But it could be made senior, if the court decided that it was forced

[13] We are very grateful to Professor Hishashi Ikeda for patiently answering many questions that greatly helped us understand the legal status of employee deposits.

savings (Civil Code Article 306 No.2, Article 308). However, even in this case, the seniority would be just below 'kyoeki-saiken.' Therefore, the treatment of the remaining amount would be subject to interpretation of whether it was deemed forced saving or not.

4. Nothing changed vis-a-vis other types of court settlements. Here, for EDs to be treated as senior claims, general lien (or IST) has to be recognized under the Civil Code (or under former Commercial Code until 2003).

3. Hypotheses development

Managerial ownership of debt has received considerable attention in recent literature because it aligns insiders' incentives with creditors' interest and is therefore viewed as a remedy for the risk-shifting problem associated with the concave payoff structure of debt (Jensen and Meckling (1976); Edmans and Liu (2011); Bolton, Mehran, and Shapiro (2011)). The empirical literature in this area focuses exclusively on the ownership of debt by top corporate executives, in the form of pension balance and deferred compensation that are required to be reported after 2007. However, we know very little about the ownership of debt by rank and file employees. Japan's Employee Deposit Program provides a unique opportunity and detailed data for us to study this issue.

The argument that rank and file employees can play an important role in corporate operations has received support in recent literature. For example, junior employees may have relevant information about the firm (Huddart and Lang (2003); Babenko and Sen (2011)); they could also influence firm's capital structure decisions through collective bargaining (Matsa (2010)). Therefore, it is also sensible to believe that employees, as insiders of the firm, are able to acquire advantageous information, make their voice heard, and find channels to align firm's actions with their collective

interest. There could be various channels, for example, controlling operations within the range of their mandates, voicing concern to supervisors about employee morale which could then be relayed to senior management, or influencing the firm's management via workers' bodies and labor unions. The latter is especially relevant in the context of Japan because the decision making process in Japanese firms, called the "Ringi" system, is known to involve lower level managers and rank-and-file employees.[14] As long as the EDPs offer net benefits to the employees, and such monitoring restrains managerial risk-taking, employees benefit from participating in the programs.

An important issue in this context is the incremental role of employee deposits vis-à-vis other forms of employee benefits, including wages. It could be argued that workers have a natural incentive to monitor management since, in bankruptcy, wages or employment may not be protected. However, even if employee deposits had the same priority as wages in bankruptcy, there is an important monitoring advantage to employee deposits. Since employees have the right to withdraw deposits any time, informed employees, aware of risky company strategies, could cause a "run" by asking to withdraw their deposits. The consequence of such a run could be costly for the firm as it would signal the employees' information to the market and make it very costly for the firm to raise capital. Such a threat of "walking with ones feet" is clearly less feasible if only wages are at stake. In addition, if deposits are not fully insured and there is a possibility that courts would not fully protect deposits in bankruptcy (as was the case with many bankruptcy outcomes in Japan), workers have additional incentives to monitor the firm when their deposits with the firm are at stake.

Clearly, the EDPs have also to be consistent with managerial or shareholder objectives. Since external sources of debt would be more likely associated with greater

[14] Mohammed Ala and William Cordeiro (1999) extensively discuss how lower level managers generate proposals and specific recommendations which are then voted on by upper level management. See also (http://en.wikipedia.org/wiki/Japanese_management_culture).

information asymmetry compared with EDPs where employees can monitor more effectively, it is possible that both the firm and employees benefit from an interest rate on EDPs that is above what would prevail in frictionless markets and below what the market is willing to lend at. More importantly, employee monitoring can convey significant externalities by reducing the riskiness of the firm's strategies, which would reduce the cost of borrowing from other sources as well.[15]

Managers may also want to offer employee deposit programs to create greater bonding, loyalty, or trust, which can be beneficial for employee productivity. The attractiveness of EDPs to employees may well stem from the fact that employees trust the managers of their firms more than other parties, a possibility that seems especially relevant in the institutional context of Japan (Dolan and Worden (1994)). If this is the case, and workers are more willing to work for an organization they trust, breach of trust is costly for shareholders/management, and therefore EDPs would be associated with lower risk-taking.[16] Also plausible in Japan's institutional context, managers may simply care about workers, and employee welfare is a part of the managers' objective function. In fact, in many Japanese companies, the incentive of corporate directors (CEO, chairman, board members) is well aligned with that of employees, because many directors are former rank and file employees that climbed up the management ladder to become directors, while other board members could come from group companies, main banks, and government (Aoki (1988)).

In summary, employees have an incentive to mitigate the firm's risk-taking behavior through various means when they participate in EDPs, and managers may themselves reduce risk-taking to either improve employee productivity by promoting loyalty and trust, or because they consider employee welfare an objective in itself.

[15] In fact, if this externality is sufficiently important, firms would commit to being monitored, by being more accessible to employees and receptive to their concerns. This is one element of the argument that bonding with employees can create shareholder value, discussed next.

[16] Again, since the company is supposed to keep the deposits secure, breach of trust could be more severe if the less senior status of deposits did not allow the company to pay it back fully.

More importantly, such incentives will be aligned with those of external creditors when employees participate in EDPs. Therefore, as long as the deposits are not fully guaranteed,[17] we expect employee deposits to have an impact that discourages risk-taking, which will lead to a negative relation between the presence or the level of employee deposits and firm risk. Moreover, the regime shift in 2003 that caused an exogenous variation in the level of employee deposit guarantee and consequent withdrawal of deposits provides an ideal experiment to address reverse causality and endogeneity issues.[18] Therefore, our main hypothesis consists of two parts:

Hypothesis 1a: *Firms that offer EDP or firms that have a higher level of employee deposits (measured by ED per employee and ED to asset ratio) are associated with lower level of total risk, systematic risk, and idiosyncratic risk.*

Under the New Corporate Reorganization Law of 2003, only a part of EDs (the higher of 1/3rd of deposits or past six months' salary) could be given the status of "kyoeki-saiken" and be given the guarantee of preferential treatment. As we document later, this was accompanied by a number of firms cancelling their EDPs, and consequent reduction in ED levels for firms that had EDPs immediately before the law change. This is most likely to be the result of a perception that the employees were less likely to get back the full value of their deposits after the law change.

It could be asked why the reduced seniority of the EDs should not cause employees to monitor firms' risk-taking behavior even more intensively, thereby mitigating risk and allowing employees to keep their deposits. Indeed, it has been argued (Fama (1990)) that when the debt is junior, the debt holders (here, the employees) have an

[17]As mentioned earlier, the priority of employee deposits if a firm entered bankruptcy liquidation was not guaranteed.

[18]Employee monitoring in the presence of deposits is effective, in part, because of their ability to withdraw and walk with their feet when they get timely information about risky strategies being pursued by the company. However, to the extent that they do not get such information in a timely manner, the new law would have increased the likelihood that the deposits would be impaired. This, and the fact that the deposits are also exposed to risks that the firm could not control, is likely to have made deposits less attractive after the law change.

even stronger incentive to monitor, so that monitoring effort would increase after the passage of the new Law. However, this might not be the case for two reasons. First, if employees monitor more intensively, then they would need compensation for the cost of that monitoring, which would have to be borne by the firm in the form of higher interest payments on the deposits to retain the marginal depositor. This may prove to be too costly for the firm. Second, even if they monitor more intensively and prevent risk-shifting, as long as default is possible, the expected payoff in default to the depositor could be lower because their claims are now junior. As Park (2000) points out, junior lenders may have little incentive to monitor and bring about the timely liquidation of bad projects (e.g., risky negative NPV projects that are taken only because they benefit equity holders at the expense of debt holders) if they get nothing in liquidation. Thus, with the junior status of employee debt clearly spelt out by the new Law, employees were only willing to keep an amount with the company that would be guaranteed to be repaid. Since their deposits would become essentially risk-free if they withdraw the non-guaranteed portion, employees would have little incentive to monitor in the post-2003 period.

This leads to the following hypothesis:

Hypothesis 1b: *After the passage of the New Corporate Reorganization Law, there is an increase in firm risk (total risk, systematic risk, and idiosyncratic risk) among firms with EDP prior to the passage of the Law, relative to other firms.*

Finally, note that the nature of the new law meant that only firms with a significant fraction of employees with deposits in excess of the past six months' salary would experience significant loss of deposits (possibly through the cancellation of the EDP) and thus experience increased risk-taking. Thus, we should expect:

Hypothesis 1c: *The increase in firm risk (total risk, systematic risk, and idiosyncratic risk) among firms with EDP prior to the passage of the Law, relative to other firms, should be most pronounced for firms with the ratio ED per employee to annual salary per employee in excess of 0.5 prior to the law change.*

One key reason that inside debt mitigates risk taking lies in the fact that these debts/deposits are not fully insured. In order to reduce the riskiness of their deposits, employees have the incentive to influence firm risk-taking, and managers may also be motivated to protect their employees and manage the firm prudently. It is natural to ask: what if these deposits are guaranteed by other parties such as external banks? The banking literature shows that any form of liability insurance (e.g. deposit insurance, government bailout) would worsen the debtors' incentive to behave prudently as depositors no longer have the incentive to monitor them (e.g. Ioannidou and Penas (2010)). Similarly, if employee deposits are guaranteed or insured by external parties, neither employees nor debtors (firms, in our case) would worry about the possibility of runs on their deposits. Thus, it is likely that the risk-reducing effect of EDP on firm risk-taking would be reduced if the deposits are implicitly or explicitly insured.

In fact, main banks or *keiretsu* groups do provide certain types of guarantees for their member firms' financial stability (Campbell and Hamao (1993)).[19] Hoshi, Kashyap, and Scharfstein (1990) find that when main banks' client firms become financially distressed, main banks orchestrate bailouts and assume disproportionate responsibility for bad debts. This propping up role may lead main banks to monitor

[19] According to Schaede (2006), "The core of this [Japanese] industrial architecture were the so-called six horizontal keiretsu (inter-market business groups), whose preferential trade relations were cemented through cross-shareholdings anchored by a main bank that fulfilled three important functions: to provide smooth access to finance even to the most highly leveraged firms (by providing loans, and by acting as a delegated monitor, thus inviting loans from other banks as well); to monitor management based on superior insights into the company's operations; and to structure a coordinated workout should a company encounter serious trouble, so as to avoid bankruptcy and ensure the company's longevity (and thereby maintaining the competitive hierarchy)."

client firms closely and the costs of financial distress are much lower in firms connected with main banks or firms belonging to organized groups such as *keiretsu*. Kaplan and Minton (1993) further show that main banks tend to intervene in the appointment of board of directors in related firms which are in financial distress. Thus, a main bank-centered governance system would provide an implicit guarantee of financial stability via bailouts or timely intervention, thereby creating insurance for the employee deposits. In this scenario, the incentive for employees to monitor or influence firm's risk-taking would be greatly reduced as they are less concerned about the riskiness of their deposits. This leads to our second hypothesis.

Hypothesis 2a: *The risk-reducing effect of employee deposits is weaker for firms which are closely connected with main banks.*

Hypothesis 2b: *The increase in firm risk (total risk, systematic risk, and idiosyncratic risk) for firms with EDP prior to the passage of the Law, relative to other firms, should be most pronounced for firms no main bank connections.*

Previous studies find that if the manager holds inside debt, there is a value transfer away from shareholders to debtholders due to the reduced risk-shifting incentives of the manager (Wei and Yermack (2011)). Eisdorfer (2008) shows that distressed firms tend to shift risk by increasing investment in risky projects and documents that such risk-shifting behavior is associated with a decline in the debt value of the firm. EDP is a direct form of inside debt holding and represents another potential method of reducing the agency costs of debt in a levered firm. Therefore, we expect EDP holdings to reduce the firm's risk-taking behavior by discouraging risky investment, which in turn increases the debt value. This is our third hypothesis:

Hypothesis 3: *Employee deposits can reduce risk-shifting investment when expected volatility is high.*

Finally, we examine the relationship between EDP holdings and firms' cost of borrowing. Managerial debt ownership is documented to have the effect of lowering the cost of borrowing. For example, Chen et al. (2010) show that a higher level of the CEO's inside debt holdings is associated with less restrictive debt covenants and lower interest rates charged by public debtholders. Employees' ownership of debt could have a similar effect if it helps resolve the agency costs of debt. We examine this hypothesis by looking at the relation between EDP holdings and the leverage ratio of the firm. We expect that, if EDPs can reduce the cost of borrowing, an increase in employee deposits will lead to a subsequent rise in the debt ratio of the firm. This yields our fourth hypothesis:

Hypothesis 4a: *Employee deposits are positively associated with the leverage ratio.*

Hypothesis 4b: *After the passage of the New Corporate Reorganization Law, there is a decrease in leverage ratio among firms with EDP prior to the passage of the Act, relative to other firms.*

4. Data and summary statistics

Our sample consists of Japanese firms whose accounting and stock data are available on NEEDS Corporate Financial Data and PACAP database, respectively. Financial firms and utilities are excluded since these firms are often subject to heavy regulations. We also match the sample to Kigyo-Keiretsu Soran data for information on Keiretsu membership, and to NEEDS Bank Loan Data for information on banking relationships. The sample period is from 1998 through 2007.[20] All variables are

[20] The Employee Deposit Program saw a number of major regulatory changes in the early to mid-1990s. In particular, the government lowered the minimum interest on EDP from 6% to 3% in 1995, 1% in 1997, and 0.5% in 1999. Yet, the minimum required rate was generally higher than the bank deposit rate. While many firms experienced reductions in employee deposits as a result of these changes, others adopted them, as the required interest payments became more affordable. Many of these late adopters subsequently again moved out of EDPs. Since the distinction of EDP and non-EDP firms becomes somewhat unclear during this period, we focus on the period after 1997. Further, because we mainly rely on the regime shift

winsorized at the 1% level in both tails. The final sample has 2104 Japanese firms.

4.1 Definition of variables

Our main dependent variable is the total risk of the firm. Following Low (2009), we use the variance of daily stock returns over the fiscal year as the proxy for firm risk.[21] The variance is annualized before taking a natural logarithmic transformation. Further, we decompose total risk into systematic risk and unsystematic risk by using the market model, with PACAP value-weighted market portfolio as our proxy for the market portfolio. We adjust for nonsynchronous trading by adding five leads and five lags of market returns (Dimson (1979)). Systematic risk is measured by the variance of the product of the firm beta times the market daily returns. We use the summation of predicted portions of stock return regressions, since we include leads and lags of market portfolio returns. Similar to total risk, we annualize the variance before taking a natural logarithmic transformation. Idiosyncratic risk is measured as the natural logarithm of the annualized variance of the residuals from the market model. All risk measures are calculated with at least 60 days of returns data.

The main independent variable is employee deposits. We use several measures of employee deposits: deposits per employee (ED/Employee), deposits to asset ratio (ED/TA), and a dummy variable (EDP Dum) that equals one if the firm offers EDP and zero otherwise. Additionally, we use total book assets at the beginning of the year to control for firm size (Size), lagged Tobin's q to control for investment opportunities, and lagged return on asset (ROA) to control for profitability. We also control for corporate policy variables that can affect firm risk, including book leverage (BKLeverage), capital expenditures (Netcapex), and research and development expenditures (RD). Pension per employee (Pension/employee) is further controlled for

on EDP in 2003 to design our empirical test, it is prudent to avoid using a longer sample for the pre-shift period than the post-shift period.

[21] Although yearly cash flow volatility could be used in estimating firm risk, Shin and Stulz (2000) argue against using the measure.

to make sure that the effect of EDs is net of the incentive from employees' pension holding. Other control variables include tangibility (Tangibility), sales growth rate (SaleGrow), and directors' total ownership of shares.

To investigate the interaction between the bank relationship and the effect of employee deposit, we proxy for a firm's banking system by its keiretsu incorporation. Keiretsu is a type of main-bank centered business group, in which the main bank and reciprocal holdings among business firms (and between industries) enable member firms' financing and disciplining within the group. We argue that the effect of EDP is negligible among firms with strong banking guarantors, such as those that are keiretsu members.[22]

In the section on investment analysis, we need to estimate market expected volatility and market value of debt. Following Eisdorfer (2008), we measure the conditional expected market volatility using generalized autoregressive conditional heteroscedasticity (GARCH) model. More specifically, we apply a GARCH (1,1) model to monthly returns of the market index from 1980 to 2007. This yields time-series observations of *k*-step-ahead expected volatility for each month during that period. Then, for each fiscal year, the expected volatility is measured by the 12-month-ahead forecasted volatility conditional on information available in the last month of the year before.[23] To estimate the market value of debt, we first estimate the market value of the firm's total assets using a two-equation system (Merton (1974)), and then measure the debt value by the difference between asset value and equity value. The Appendix

[22] In an earlier version of the paper, we also considered an alternative measure of the potential for bank bailout, namely, whether a firm's largest outstanding loan share is from one of the 18 major city, trust, and long-term credit banks in Japan, constituting the "main bank" system (Campbell and Hamao (1993)), and obtained qualitatively similar results as the keiretsu classification.

[23] The forecasted variance for time $t+k$ in time t for the GARCH(1,1) is given by $E_t[\sigma_{t+k}^2] = (\alpha_1 + \beta_1)^{k-1}[\sigma_{t+1}^2 - \alpha_0/(1-\alpha_1-\beta_1)] + \alpha_0/(1-\alpha_1-\beta_1)$,where the mean equation is $R_t = \gamma + \varepsilon_t$, R is monthly return, $\varepsilon_t \sim N(0, \sigma_t^2)$ and $\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$. The expected variance in period t for the following year is given by adding the 12-step-ahead variance forecasts, that is,

$$E_t[\sigma_{t,k}^2] = \sum_{k=1}^{12} E_t[\sigma_{t+k}^2] = \sum_{k=1}^{12}(\alpha_1 + \beta_1)^{k-1}[\sigma_{t+1}^2 - \alpha_0/(1-\alpha_1-\beta_1)] + \alpha_0/(1-\alpha_1-\beta_1).$$

This equation shows that the expected annual variance is a linear function of the expected variance for the next month, σ_{t+1}^2. To examine the impact of expected annual volatility on the firm's investment in a given year, it is sufficient to regress annual investment on expected volatility for the last month of the year.

describes the construction of variables in more detail.

4.2 Summary statistics

Table 1 provides summary statistics regarding employee deposits and other labor benefits from the late 1970s to the early 2000s when the New Corporate Reorganization Law came into effect. The statistics pertain to firms with employee deposit programs only. Noticeably, the importance of employee deposits (e.g. as a percentage of total assets) declined over this time period; the decline was especially rapid in the late 1990s as the government-regulated minimum interest was gradually brought down. Nonetheless, the mean levels of the ratio of employee deposits to total loans (short-term loans) remained above 19% (25%).

Of particular relevance is the level of per-employee deposits. We do not have data on participation rates in EDPs; if we assume a participation rate of 50%, deposits per participating employee would be around $15,000 over the period.[24] This would appear to be a sizable magnitude given that in 2012, Japan's average net disposable household income was $23,000 and net household financial wealth was $75,000.[25]

Table 1 presents additional information on employee pension benefits and rough estimates of "salary" per employee. The Needs database, which is the source of our information on employee deposits and other firm characteristics of Japanese firms, does not provide information on employee salaries but provides information on labor expenses, which includes employees' salary, bonus, retirement allowance, employee welfare expenses, retirement annuity premium, and contributions to reserve for bonus and retirement allowance. Using an "upper bound" estimate of salary as labor expenses less bonus and pension contributions (the latter is only available post-2000), and assuming 100% participation in EDP, the mean (median) ratio of per employee

[24] If labor unionization rates are be considered a benchmark, employee deposits per participating employee would be even higher. The unionization rate has averaged below 30% in the last three decades in Japan, and was 19% in 2010.

[25] See http://www.oecdbetterlifeindex.org/topics/income/.

deposits to salary immediately prior to the law change was 45% (10%). This statistic is relevant because the new law in 2003 stipulated that the amount of deposits that would be guaranteed in the event of bankruptcy would be the maximum of six months' salary or a third of the deposits. Even given our conservative estimate of salary and EDP participation, we find that the ratio of employee deposits to six months' salary would exceed unity for a third of the firms that had EDP programs in 2002.

Table 2 presents comparisons of firms that offer EDP (EDP firms) and firms that do not (non-EDP firms) over our sample period of 1998-2007. In general, EDP firms are older (37 years vs. 28 years), have larger asset in place (264 billion yen vs.182 billion yen), and have higher proportion of tangible asset to total assets (0.30 vs. 0.26). Moreover, they tend to have higher risk, especially in terms of systematic risk. Thus, firms that offer EDPs tend to be large, mature firms with more tangible assets but higher bankruptcy risk. In the next section we proceed to testing the hypotheses formally.

[Insert Table 1 and Table 2 here]

5. Empirical results

We begin by investigating the association between the employee deposits and firm risk using a variety of strategies aimed at addressing concerns about endogeneity and reverse causality. First, we report results from pooled OLS regressions incorporating firm fixed effects. Incorporating firm fixed effects controls for unobserved time-invariant heterogeneity that might be correlated with firm risk as well as employee deposits. For example, if the differences in monitoring costs of employees lead to endogenous relations between employee deposits and firm risk, the firm fixed effects should control for such relationships. Second, we report results corresponding to a propensity-score-matching procedure which controls for observed heterogeneity that could affect the likelihood of treatment. In this approach, treatment (EDP) and

propensity-score-matched control (non-EDP) firms are assumed to be randomly assigned to their respective groups. Third, we use variables such as labor expenses over total sales and the number of employees over total assets, which represent the importance of employees in the firm, to instrument for EDP in a Heckman selection model. Finally, we use the passage of the New Corporate Reorganization Law in 2003 as a natural experiment to address possible reverse causality problems.

To strengthen our argument, we examine the impact of banking relationship on the role of employee deposits. Then we proceed to provide evidence of the negative association between employee deposits and the risk-taking investment. Finally we investigate the relation between the debt ratio and employee deposits.

5.1 Employee deposits and firm risk

We employ the following regression model to investigate the association between the employee deposits and firm risk:

$$FirmRisk_{it} = \alpha_t + \beta_i + \gamma\ ED\ measures_{it} + \delta X_{it} + \varepsilon_{it}, \qquad (1)$$

where i indexes firm and t indexes time, α_t and β_i are year and firm fixed effects. *ED measures*$_{it}$ can be either the EDP dummy, which takes the value of one if firm i offers EDP in fiscal year t (and zero otherwise), ED/Employee, which is defined as total employee deposits divided by the total number of employees for firm i at the end of year t, or ED/TA(%) which is the percentage ratio of total employee deposits to total assets for firm i at the end of year t. X_{it} is a vector of control variables. The dependent variable *Firm risk*$_{it}$ includes total risk, systematic risk, and idiosyncratic risk. Empirical results are reported in Table 3. The coefficients on *ED measures* are negative and significant for all risk measures. Specifically, coefficients of ED/Employee for total risk, systematic risk, and idiosyncratic risk are -0.15, -0.12, and -0.15, respectively. The interpretation is that a one-million yen increase in per employee

deposits will lead to a 15%, 12%, and 15% decrease in total, systematic, and unsystematic risk, respectively. Economically this is a very large effect. The coefficients on ED/TA (EDP dummy) are relatively smaller but still economically significant: -0.08 (-0.07), -0.09 (-0.04) and -0.06 (-0.07) for total, systematic, and idiosyncratic risk, respectively, which are all statistically significant except the coefficient on EDP dummy for systematic risk. These negative and significant coefficients are consistent with our *Hypothesis 1a* that employee deposit, either its presence or its level, has a strong risk-reducing effect.

Signs for most of the control variables are consistent with conventional predictions and previous literature. Firm size is negatively related to total risk and idiosyncratic risk. Firm with more growth opportunities (higher Tobin's *q* and Sales growth) and high leverage are associated with higher risk. The negative and significant coefficients on ROA suggest that profitable firms, or firms with more cash flow, are less risky. The coefficients on both per employee pension and directors' ownership of shares are not significant.

[Insert Table 3 here]

5.1.1 Propensity Score matching

Pooled OLS regression may suffer from model misspecification as it assumes a linear relation between the response variable and control variables. Moreover, it is sensitive to the distribution of covariates. To overcome these potential issues, and also address the self-selection issue associated with observable firm characteristics (the selection into EDP might be related to outcome variables), we employ propensity score matching methodology proposed by Rosenbaum and Rubin (1983) to test for the effect of employee deposits on firm risk. Specifically, for each observation in our treatment group (i.e., EDP firms), we find a nearest-neighborhood match from the control group (i.e., non-EDP firms), based on the propensity score that is defined as the probability of

receiving treatment conditional on the covariates. The covariates on which we estimate the propensity score include: firm size, Tobin's *q*, ROA, tangibility, R&D, net capital expenditure, book leverage, LBREX/sales, employee/TA, and industry and year fixed effects. Results are presented in Panel B of Table 3. The estimates of the average treatment effect for the treated (ATT) are negative and significant for total risk and idiosyncratic risk, with both values equal to -0.06. This implies that the EDP firms will have a 6% reduction in their total risk and idiosyncratic risk relative to non-EDP firms.

We also conduct a multivariate regression analysis using the PS-matched samples. Specifically, instead of univariate comparison of risk measures between EDP and PS-matched non-EDP firms, we regress risk measures on both EDP Dum and continuous measures such as ED/employee and ED/TA, along with other controls and fixed effects. In Panel C, the result consistently shows that coefficients on the employee deposits measures are negative and statistically significant (except for EDP Dum), with the economic magnitude slightly smaller than those in the regressions using the entire sample. Specifically, a one-million yen increase in per employee deposits will lead to a 9.9%, 8%, and 12.3% decrease in total, systematic, and unsystematic risk, respectively. The corresponding numbers for ED/TA (EDP dummy) are: -4.3% (-2.1%), -6.2% (-2.9%) and -4.4% (-2.1%), respectively. Therefore, results from propensity-score matching are highly consistent with the results from the pooled-OLS regressions.

5.1.2 Selection bias

Summary statistics show that EDP firms and non-EDP firms are different in many dimensions. Although we control for most of these dimensions in our baseline model and propensity-score matching analyses, selection bias could still arise if there are unmeasured variables that predict selection into the EDP sample and affect firm's

risk-taking as well. In other words, the selection into the EDP sample may not be random and the factor causing this may not be observed. To address this concern, we use maximum likelihood method described by Heckman (1979) to control for potential selection bias. Specifically, Heckman characterizes the sample selection problem as a special case of the omitted variable problem in which the inverse Mill's ratio (*IML*) is the omitted variable in the OLS regression. Using the two-step Heckman procedure allows us to obtain consistent estimates for determinants of firm risk. The first step uses a probit model to estimate the *IML*. The dependent variable equals one if the firm offers EDP in a certain fiscal year and zero otherwise, and variables which reflect the importance of employees in the organization but are not directly related to company risk (such as employees over total assets and labor expenses over sales), are used as instruments. The second step of the Heckman procedure is to simply estimate the OLS regression with the *IML* as an explanatory variable, using the sample of EDP firms.

Results for both the binomial probit and OLS regressions are reported in Table 4. The probit regressions provide evidence on the predictors of EDP provision. LBREX/sales has a negative and significant coefficient, implying that labor expenses and deposits are substitutes as the employee deposits can act as a form of employee benefit. The coefficient on employee over sales is positive and significant, consistent with the notion that when employees are more important to the firm, it is more likely for the firm to offer EDP. In the second-step OLS regression, *IML* obtained from the first step is included along with all the other controls. In all of the OLS regressions shown in Table 4, the estimated coefficients of employee deposits measures are negative and significant, supporting our hypothesis that employee deposits cause the firm to reduce risk. Note that as a robustness check, we not only use ED/employee and ED/TA, but also include employee deposits over equity value and employee deposits over total labor expenses as alternative measures, and find consistent result.

[Insert Table 4 here]

5.1.3 Reverse causality and DID analysis

Reverse causality is an important concern for our results that requires particular attention. Specifically, the negative association between EDs and firm risk could be driven by the fact that employees are attracted to EDPs precisely when firm risk is lower. To address this issue, we take advantage of an exogenous policy change that made EDP participation less attractive to employees, but is unlikely to have directly affected firm risk.

The passage of the New Corporate Reorganization Law in 2003 imposed limits on the maximum extent to which employee deposits would be protected in the event of bankruptcy. Specifically, the new Law stipulated that if a firm files for reorganization under the new law, only the larger of the past six months' salary before the reorganization date or 1/3 of the existing deposits would be given preferential treatment in repayment, whereas under the existing law, the entire amount of the deposits would qualify for preferential treatment. This new regulation therefore reduced the ex ante payoff from deposits in excess of the stipulated minimum amount that would be repaid for participating employees as long as there was a positive probability that the firm would enter bankruptcy. Thus, we expect that employees would withdraw their deposits after the passage of new regulation and cause a sharp decline on both the balance of deposits and number of firms that offer EDP. Figure 1(a) shows that the percentage of firms that dropped the EDP program increased to almost 20% (compared to a pre-law change average of around 12%) in the year immediately after the law change.[26] To check the validity of our difference-in-differences analysis, we look at the medians and means of several employee deposit measures among the treatment group (i.e. EDP firms in 2002) before and after the regulation shift. Figure

[26] There were 295 firms with EDP programs in 1997 and 124 firms in 2007 – an attrition rate of about 8.5% per year. This rate is lower than the average in Figure 1(a) because some new firms entered the program.

1(b) plots the results. In 2003, there is an obvious reduction in the relative amount of employee deposits (in terms of EDs per employee, ED/equity, ED/total assets, and ED/total sales) among the treatment firms, which continues in the post law-change period. Moreover, for 71% of the treated firms, the average ED/employee in 2004-2007 is lower than the average ED/employee in 1998-2003, and for 85% of the treated firms the average ED/TA in 2004-2007 is lower than the average ED/TA in 1998-2003. This supply shock is mainly attributable to the regulation change, and it directly impacted the participants of EDP but not the firm risk[27]; as such, it provides an ideal experiment to address the causal relationship between employee deposits and firm risk.

[Insert Figure 1 here]

Besides the exogeneity of the shock, another key requirement for the DID approach is the validity of the "parallel trends" assumption. Namely, we require that in the absence of treatment, the average change in the firm risk would have been the same for both the EDP firms and non-EDP firms. Without parallel trends, DID estimates may generate inconclusive or erroneous inferences. Figure 2 illustrates the validity of this assumption by plotting the average treatment and control response functions in terms of firm risk during pre- and post-treatment periods. We find that the realized average firm risks of treatment firms and control firms are both trending down at the same rate during the pre-treatment period, with the treatment firms having lower risk than the control firms. Moreover, after the law change, all measures of risk for the treatment and control firms come closer together, consistent with the idea that the loss of EDPs caused the risk profile of the treatment firms to be more like that of the control firms, supporting a causal link from EDP to risk reduction.

[Insert Figure 2 here]

In the presence of exogenous shock to the employee deposits and parallel trends of

[27] In fact, as we shall see below, total risk and unsystematic risk for both groups decrease after the law change, and systematic risk first decreases and then reverts to pre law-change levels, making it unlikely that EDP participation or levels reduce for the treatment group in anticipation of higher risk.

firm risks between treatment and control groups, we are able to utilize the DID analysis. Specifically, we argue that firms that offer EDP at the end of 2002 (beginning of 2003) will be affected by the new regulation, and use the following regression in our empirical tests.

$$Firm\ risk_{it} = \alpha_t + \beta_i + \lambda EDP02_i \times AFT + \delta X_{it} + \varepsilon_{it}, \quad (2)$$

where *EDP02* is a dummy variable which equals one if firm offered EDP at the end of year 2002 and zero otherwise. *AFT* is an indicator variable that equals one for the period after 2003 and zero otherwise. Control variables are the same as those in previous regressions. Note that since the specification includes year and firm fixed effects, there is no need to include the non-interacted *AFT* and *EDP02* variables. We cluster the standard errors at the firm level. The coefficient of interest is λ, which yields the percentage of risk differential that can be attributed to the regulation change. If employee deposits have a risk-reducing effect, we expect the passage of the New Corporate Reorganization Law to reduce such an effect, and hence the coefficient on the interaction term *EDP02*×*AFT* should be positive.

Results are presented in Table 5. In all regressions, the coefficients on the interacted term are positive and significant. Overall, the results suggest that after the passage of the New Corporate Reorganization Law, the impact of EDP over firm risk is significantly reduced, supporting *Hypothesis 1b*. Further, the DID analysis also addresses a potential concern that the New CoRoL might itself have encouraged firms to take on more risk by streamlining the reorganization process. Treatment and control groups should be similarly affected in terms of risk if this had been the case. Further, we see from Figure 2 that the riskiness of both types of firms to actually decline in the post-law change period. While not inconsistent with this argument (which is about ex ante rather than realized risk), such a finding makes this possibility less likely.

[Insert Table 5 here]

The New Corporate reorganization Law stipulated that only deposits not in excess of the maximum of past six months' salary and a third of the deposits prior to the filing would be paid with priority and granted the status of "kyoeki-saiken". As discussed earlier, we can compute a lower bound estimate of the firm-level ratio of per-employee EDP over annual salary from the Needs data. Firms for which this ratio exceeds 0.5 in the year 2002 (that is, the ratio of deposits per employee to six months' salary per employee exceeds unity) are therefore most likely to be affected by the law change. Unreported results show that this group comprises about a third of the firms with EDP programs in 2002, and this fraction falls to about a quarter in 2007, indicating that firms continue to lose deposits and fall below the 0.5 threshold. Figure 3 and Figure 4 indicates that firms that were in this category in 2002 experience a sharp drop in EDP programs in the year immediately after the law change. In Panel B of Table 5, we replicate the DID estimation for the "above 0.5" group only (EDP02 is restricted to "above 0.5" EDP firms, and "below 0.5" EDP firms are excluded from the sample). Consistent with *Hypothesis 1c*, the coefficients on the interaction term in all regressions are significant and more than twice as large in magnitude as those reported in Panel A of Table 5. Thus, the effect of the law change is coming from the group most likely to be affected by the law change.

To check the robustness of our DID results, we conduct additional tests. First, we conduct a "placebo" test by picking the year 1999 as a transition year, and defining all firms with an EDP program in 1999 as the treatment group and remaining firms as the control group. We consider the period 1996-1998 as the pre-period, and the period 2000-2002 as the post-period. In results not reported in a table, we find that the DID coefficients are insignificant in specifications similar to those in Panel A of Table 5. This result confirms that while there was a general trend during our sample period for firms to shed EDPs, the law change in 2003 had a much more substantial impact on

the level of employee deposits and the continuation of the programs. In particular, the test alleviates concern that our results could be attributable to a time trend in a declining likelihood of bank bailouts. If firms with stronger relationships with main banks need to rely less on EDs (and thus belong primarily to the control group in the DID test), and reduce risk over time as the prospect of bank bailout decreases, our DID test could be picking up such an effect. However, the lack of evidence in the placebo test suggests this is unlikely to be the case. In section 5.2, we conduct the DID test after partitioning firms on the basis of keiretsu membership. Our results only exist for non-keiretsu firms, who do not have strong bank ties.

Second, we conduct tests that closely follow Lemmon and Roberts (2010), who use DID analysis to compare the behavior of below-investment-grade firms with that of a propensity-score-matched sample of unrated firms. Specifically, we require that the treatment firms (control firms) always have (no) EDP during the consecutive three years before the policy change (2001-2003), and then match the control firms to the treatment firms based on a nearest neighbor matching of propensity scores. The matching begins with a probit regression at the firm level of a binary variable (indicating whether a particular firm offers employee deposits or not) on a host of firm characteristics. In particular, we include averages over the pre-shock era (i.e., pre-2003) of characteristic variables that are expected to be determinants of EDP participation choices. These variables are: log (assets), M/B, ROA, tangibility, R&D, Netcapex, book leverage, LBREX/sales, and employee/TA. We also incorporate industry indicator variables in an effort to absorb any time-invariant differences not captured by the firm characteristics.

Panel C in Table 5 presents the results of the DID estimation using the matched sample. The treatment group difference is computed by first calculating the average risk from 2001 to 2003 and then subtracting the average risk from 2004 to 2007 for

each firm. This difference is then averaged over treatment (EDP) firms. A similar procedure is performed for the matched non-EDP firms. The DID estimate is the difference between these two differences, and is presented at the bottom of the table, together with the corresponding *t* statistic of the null hypothesis that this estimate is 0. We see that in response to the reduction in EDP, total risk, systematic risk, and idiosyncratic risk of EDP firms increased 9%, 6%, and 9%, respectively, relative to the change experienced by similar non-EDP firms. The estimates for total risk and idiosyncratic risk are statistically significant and economically meaningful. The result suggests that the contraction in employee deposits had a significant effect on the risk-taking behavior of EDP firms.

In Panel D, we complement the above univariate DID analysis using a regression approach for the propensity-score-matched sample. Specifically, we regress risk measures on the main independent variable of interest, *EDP02*AFT*, other controls, and firm and year fixed effects. The estimated coefficients are 0.098, 0.155, and 0.096 for total, systematic, and unsystematic risk, respectively, and statistically significant. The economic magnitude of these estimates is close to those from the univariate approach, but greater than those in the whole-sample regressions (0.061, 0.078, and 0.051). Therefore, results from propensity-score matching reinforce our argument that the incentive provided by inside debt can effectively reduce firm risk-taking.

In a final set of tests, we redo the DID analysis (as well as those based on keiretsu affiliation) after dropping years 2000-2002 as part of the pre-period. Such a test is motivated by the possibility that the enactment of New Civil Rehabilitation Law of 1999 (CvRhL) may also have reduced the seniority of EDs by encouraging firms to file under this law for a brief period (EDs did not have the preferential status if the firm filed for corporate rehabilitation under the previous Composition Law or the new

CvRhL).[28] The sharp upward increase in the number of firms with ED over salary in excess of 0.5 as a fraction of all firms with ED in Figure 4 from 2000-2002 is consistent with this possibility, since this indicates that some of the firms with smaller amounts of ED as a fraction of salary dropped their EDP programs. Our DID results still hold, though in some cases, we find significant effects only for the sample of firms with ED over salary in excess of 0.5.

5.1.4 Additional robustness checks

We conduct several additional robustness checks for the risk-reducing effect of employee deposits. First, we use the percentage ratio of employee deposits to market value of equity, ED/Equity (%), as a measure of employee deposits. This measure captures the relative importance of ED to equity, or debt incentive over equity incentive. Second, we use the percentage ratio of employee deposits to total labor expenses, ED/LBREX (%), as an alternative measure of employee deposits. This variable measures the relative importance of ED to employee wage and welfare, and thus can act as a useful proxy for employees' incentives. Panel A of Table 6 reports the results. The coefficients on both ED/Equity and ED/LBREX are negative and significant for all risk measures. Specifically, a one-percent increase in employee deposits scaled by equity will lead to 2%, 3.7%, and 1.6% decrease in total, systematic, and unsystematic risk. These numbers on ED/LBREX are smaller due to the much larger magnitude of employee deposits relative to labor expenses. A one-percent increase in employee deposits scaled by labor expenses will reduce the total, systematic, and unsystematic risk by 0.3%, 0.3%, and 0.2%, respectively. For brevity, the coefficients on other control variables (the same as in Panel A of Table 3) are not reported.

[28] The New Civil Rehabilitation Law (CvRhL), enacted in 1999, replaced the previous Composition Law ("Wagi-Law"). However, listed firms seldom chose to file under Composition Law since the latter law was primarily aimed at SMEs. There was a brief period from 2000-2002 during which some large companies like Mycal and Sogo filed for rehabilitation under the new CvRhL.

[Insert Table 6 here]

Further, in the DID analysis, one might argue that firms anticipating increase in risk might deliberately chose to offer EDP right before 2003 in order to take advantage of their employees since they do not have to repay fully in case reorganization was necessary. This alternative interpretation is also consistent with the results documented. However, in 2002, employee deposits constituted a relatively small fraction of total debt and total assets, therefore, the benefit from exploiting the employees by taking on EDP was limited. To confirm that this potential selection bias does not drive the DID results, we use alternative proxies for treatment effect that are less affected by the selection bias, for example, firms that offered EDP in 1999 or in 2000. Since EDP provision, for firms with a large outstanding balance of EDs, is very persistent overtime, a large fraction of "above 0.5" firms that offered EDP in previous years also offered it at the end of 2002. Importantly, the choice of taking on EDP in previous years is less affected by the risk status after 2003 as firms would not anticipate the policy change in 2003. Therefore, the EDP provision several years before 2002 would be a good instrument for the treatment in 2003. In Panel B of Table 6, we rerun the DID regression using EDP99 dummy that equals one for EDP firms in 1999. The results are consistent with the previous DID analyses. All coefficients on the interacted terms are positive and significant. According to the coefficients, relative to non-EDP firms, the risk increase for EDP firms is around 5%, 6%, and 4% for total, systematic, and unsystematic risk, respectively. The control variable specification is the same as in Panel A of Table 5 and hereby omitted.

Finally, we use the expected default probability popularized by the KMV (Kealhofer, Merton and Vasicek) model as an alternative measure of firm risk to test the impact of ED on firm's riskiness. We define the Probability of Default as the probability that the market value of the firm's assets is less than the book value of the

firm's liabilities by the time the debt matures. Following Sundaram (2001) and Eisdorfer (2008), we assume that the book value of liability equals the sum of book value of short term debt plus half of the book value of long term debt. The firm's market value is estimated by solving the following two equations.

$$V_E = V_A N(d_1) - FVe^{-rT} N(d_2) \quad (3)$$

$$\sigma_E = \frac{V_A N(d_1)\sigma_A}{V_E} \quad (4)$$

We use estimates of V_E, σ_E, FV, T, and r to calculate the unobservable V_A and σ_A. V_E is the market value of firm equity and V_A is the firm value (market value of asset), $N(.)$ is the cumulative function of standard normal distribution, $d_1 = [\ln(V_A/FV) + (r + \sigma_A^2/2)T]/[\sigma_A\sqrt{T}]$, $d_2 = d_1 - \sigma_A\sqrt{T}$, σ_A^2 is the asset volatility, FV is the face value of debt, which is estimated as (short term debt +0.5*long term debt), r is the risk-free rate, and T is the time to maturity of debt. Then we can define Probability of Default in terms of the cumulative normal distribution (μ is an estimate of the expected annual return of the firm's assets):

$$Prob_t = N\left[-\frac{\ln(V_A/FV) + (\mu - \sigma_A^2/2)T}{\sigma_A\sqrt{T}}\right] \quad (5)$$

The results in Panel C of Table 6 show that, using Probability of Default as the dependent variable, coefficients on three different EDP measures are all negative and significant (except the one on per employee deposits controlling for firm fixed effects). According to the coefficients, relative to non-EDP firms, the reduction in default probability for EDP firms is around 0.76%. This result is consistent with Sundaram and Yermack (2007) who find that manager's ownership of debt leads to larger distance to default, i.e., lower probability of debt default. We further conduct DID analysis using this alternative measure of firm risk. Panel D of Table 6 shows that, after the passage of the New Corporate Reorganization Law, the default probability of treatment firms increases significantly compared to before vis-à-vis the control group.

Overall, the evidence from these robustness checks confirms the risk-reducing effect of employee deposits, and hence is consistent with *Hypothesis 1*.

5.2 Bank bailout and EDP discipline

The banking literature emphasizes the important role of bank relationships in corporate governance. Bank relationships not only enable firms to raise capital, but also allow banks to obtain information through interactions with firms that can be useful in monitoring borrowers (Diamond (1991)) and bringing about timely intervention that reduce the likelihood of default. In Japan, banks had often intervened to orchestrate bailouts when their client firms became financially distressed and assume disproportionate responsibility for bad debts (Hoshi et al. (1990)), especially when such firm-bank nexus was particularly strong, as in a keiretsu system. Such a system is likely to implicitly provide insurance for employee deposits, thereby reducing the effects of employee deposits on firm's risk-taking behavior.

In order to test this conjecture, we use a keiretsu dummy to proxy for the certification/insurance effect from the main bank, and stratify our sample into firms that are keiretsu incorporated and firms that are not. Then, we estimate Equation (1) and (2) for each subsample. Table 7 and Table 8 present the results.

In Table 7, coefficients on both ED/Employee and ED/TA are negative and significant only for the subsample of non-keiretsu firms. The coefficients of ED/Employee for total risk, systematic risk, and idiosyncratic risk are -0.16, -0.11, and -0.17, respectively, and coefficients of ED/TA for total risk, systematic risk and idiosyncratic risk are -0.086, -0.09 and -0.078, respectively. This evidence supports our prediction that the risk-reducing effect of ED is absent for firms which have been propped up or closely monitored by banks.[29]

[29] However, we do not find any difference in the impact of the EDP dummy on firm risk for the two groups: coefficients on the EDP dummy are negative and significant for both subsamples for total risk and idiosyncratic risk, although they are all only marginally significant.

[Insert Tables 7 and 8 here]

In Table 8, we examine the effect keiretsu incorporation using a DID analysis in the setting of law change. In Panel A treated firms are defined as EDP firms in the year end of 2002, and Panel B defines treated firms as EDP firms with ED/salary greater than 50% (to proxy for firms with average ED balance greater than 6-month salary) and exclude the remaining EDP firms in 2002. For firms with a keiretsu incorporation, all coefficients on EDP02×AFT are insignificant, suggesting that the risk increase resulted from the withdrawal of ED is absent when firms are guaranteed by main-bank system. To the contrary, for firms without a keiretsu incorporation, all coefficients on EDP02×AFT are positive and significant. Overall, the evidence from Tables 7 and 8 is consistent with *Hypothesis 2* that the risk-reducing effect of employee deposits is significantly reduced when employee deposits become implicitly insured by main banks. The evidence is also supportive of a possible substitution effect between outsider monitoring and insiders monitoring (Wang et al. (2010)). That is, as both banks and EDP participating employees are debtholders and have common interest, we expect the bank monitoring effect to substitute for the risk-reducing effect of EDs when the firm has a tighter bank relationship.

5.3 Employee deposits and risk-taking investment

We have documented a negative and significant relationship between firm risk (total risk, systematic risk, and idiosyncratic risk) and measures of employee deposits. In this section, we identify one mechanism through which employees with deposits at stake can mitigate risk taking that decreases the value of debt in place. Specifically, we first show that, in environments where the expected return volatility is higher, corporate investment does not contribute to debt value, and in fact reduces debtholders' welfare by significantly increasing the default probability. We then show that higher level of employee deposits are associated with lower investment-response to increase in

expected volatility. Further, we find that such a mitigation effect is stronger when the firm has higher leverage, consistent with EDP taking effect in the presence of equity-holders' risk-shifting incentives.

Investment in risky projects may result in a value transfer from *existing* bondholders to shareholders. Inside ownership of debt can reduce firms' risk-taking incentives and thus positively affect the debt value and negatively impacts the equity value (Wei and Yermack (2011)). We expect EDs to have a similar effect. In this section, following Eisdorfer's (2008) work for U.S. firms, we create two subsamples of firms characterized by low (below-median) and high (above-median) expected volatilities, where expected volatility corresponds to the overall stock-market volatility estimated from a GARCH (1, 1) model using the monthly market return data from 1980 to 2007.[30] We use expected volatility at fiscal year-end month as the annual measure of expected volatility (as mentioned earlier, this is equivalent to obtaining the 12-month-ahead volatility for each fiscal year). We then estimate the sensitivity of debt value to investment in each subsample in terms of the slope coefficient of the following regression:

$$\%\Delta Debt_{it} = \beta_i + \mu_1 Invest_{it} + \mu_2 Other\ controls + \varepsilon_{it}, \qquad (6)$$

where $Debt_{it}$ is the firm's debt value, measured by the difference between asset value (estimated by solving equations (3) and (4)) and equity value. If the risk-shifting investment destroys debt value, μ_1 will be negative. Furthermore, we also examine the impact of risky investment on firm's default probability.

Table 9 shows the results. The left panel shows that when expected future market volatility is high, the coefficient on investment is negative, suggesting a negative effect on the value of debt. Although the coefficient is insignificant, it is generally consistent with Eisdorfer's (2008)'s finding. When expected future volatility is low, however, the

[30] We use market volatility because firm-level volatility could be affected by the firm's investment decisions.

coefficient μ_1 is 0.43 and statistically significant. Thus, our results suggest that investment in high-volatility regime might bear excessive risk, incurring costs to debtholders that may outweigh the benefits stemming from the investment. In the right panel, the dependent variable is default probability. The evidence confirms that risky investment indeed increases the probability of default in the overall sample and the high expected volatility subsample, thus potentially impairing debtholders' value.[31]

[Insert Table 9 here]

Therefore, our results suggest that overinvesting in high-volatility regimes will shift the risk from equityholders to debtholders, thereby transferring wealth from the latter to the former. The intuition here is very similar to that in the seminal paper by Brander and Lewis (1986), who show that in the presence of debt, shareholders can commit to a more aggressive output strategy when there is uncertainty about future demand or cost. The reason is that if the state turns out to be favorable, then producing higher output increases profits and benefits equityholders. On the other hand, if the state is unfavorable, producing the higher output correspondingly reduces profits; however, the cost in the low states is borne by debtholders. Thus, given limited liability, it is optimal to increase output when there is debt.

If inside debtholders monitor the firm, then they would restrain risky investment when uncertainty in the environment is high. To see if this is indeed the case for employee deposits, we again follow the methodology by Eisdorfer (2008) and estimate the following regression model:

$$Investment_{it} = \alpha_t + \delta_1 Exp.Volatility_{it} \times ED\ Measures_{it} + \delta_2 TobinQ_{it-1} \times ED\ Measures_{it} + \delta_3 Cash\ Flow_{it} \times ED\ Measures_{it} + \delta_4 ED\ Measures_{it} + \delta_5 Cash\ Flow_{it} + \delta_6 TobinQ_{it-1} + \delta_7 Exp.Volatility_{it} + \delta_8 X_{it} + \varepsilon_{it}. \quad (7)$$

[31] The coefficient on Size is positive and significant, which may seem counterintuitive. However, when we remove firm fixed effects from the regression, the coefficient becomes negative and significant at any conventional levels, suggesting that in the cross-section, larger firms have lower default risk.

We expect δ_1 to be negative and significant if employee deposits have the effect of reducing the risk-taking investment (over-investment).

[Insert Table 10 here]

Panel A in Table 10 reports the results for this investment sensitivity analysis. All coefficients on expected volatility are negative and statistically significant, indicating a general negative effect of volatility on investment activities. In the first three columns, the negative and significant coefficients on *Exp. Volatility × ED/Employee* and *Exp. Volatility × ED/TA* imply that employee deposits intensify the negative effect of market volatility on investment. *Exp. Volatility × EDP Dum* also has a negative coefficient but not statistically significant. In the last three columns, however, after controlling for interaction terms between deposit measures and *q* and cash flow, δ_1 becomes negative and significant for all employee deposit measures. This is consistent with our *Hypothesis 3*, suggesting that employee deposits can reduce firm's risk-shifting investment.

Since the risk-shifting incentives of equityholders are expected to be the strongest when the firm is highly levered, we expect the coefficient δ_1 to be larger for the above-median leverage subsample of firms than the below-median subsample. In Panel B of Table 10, we report the results of estimating equation (3) for these two subsamples. Consistent with our expectation, the coefficient is much larger in magnitude and significant only in the high-leverage subsample.

5.4 Employee deposits and leverage ratio

Several empirical studies present evidence that inside debt can reduce the cost of borrowing. For example, Wang et al. (2010) document that larger managerial inside debt is associated with fewer covenant restrictions and less collateral requirements; Chen et al. (2010) also find similar evidence in terms of debt covenant; they additionally document lower interest rate charged by public debt holders for firms with

higher level of CEO's inside debt. In the case of employee inside debt, the strong risk-reducing effect and the possible substitution for bank monitoring imply reduced agency costs of debt. Therefore, we should expect employee deposits to have a similar effect on the cost of borrowing as other inside debt, and positively affect firms' leverage ratios.

To test this hypothesis, we follow two empirical approaches. First, we regress the firm's leverage ratio on last year's employee deposits. Regressing on lagged value helps us to determine the direction of causality to some extent. Second, we utilize the regime shift in 2003 which imposed an exogenous shock to employee deposits but had no direct effect on leverage, and examine whether the treatment firms (EDP firms at the end of 2002) had lower debt than the control group in the post-2003 period. Causality is much easier to establish using this DID test. We exclude employee deposits from total debt in the calculation of leverage. Table 11 presents the results from the two empirical designs. In Panel A, leverage is positively predicted by the previous year's per capita employee deposit. More specifically, a one-million yen increase in per employee deposits leads to a 0.9% (with firm fixed effect) or 0.8% (without firm fixed effect) increase in leverage ratio in the next year. Results for ED/TA and EDP dummy are also positive, but not significant. In panel B, the DID analysis shows that after the regime shift which caused a reduction in employee deposits, the leverage ratio is significantly lower than before for EDP firms relative to non-EDP firms. To ensure the robustness of our result, we use both EDP02 and EDP99 (firms that offered EDP in 1999) as the treatment group to address the potential selection bias, and the results are very close for the two specifications. The positive association between inside debt and firm leverage is consistent with the evidence documented by Sundaram and Yermack (2007). Overall, results from both empirical designs support our *Hypothesis 4*,

and are consistent with the argument that EDs reduce the agency costs of debt and thus leads to a lower cost of borrowing.

[Insert Table 11 here]

6. Conclusion

Japan's Employee Deposit Program provides a unique opportunity to explore the impact of inside debt on firms' risk-taking. Using this dataset, we provide for the first time evidence that debt holding by a firm's rank-and-file employees can mitigate the agency costs of debt. While our results strongly suggest a role for employee governance or monitoring in reducing agency costs, they are also consistent with management objectives that promote trust, loyalty or bonding with employees, possibly motivated by considerations of improving productivity.

We find that employee deposits are associated with a significant risk-reducing effect, and this effect is mainly concentrated among firms that are not supported by main banks. We use multiple empirical approaches, including a DID analysis based on the passage of New Corporate Reorganization Law in 2003, to overcome endogeneity and reverse causality concerns. Our findings are consistent with studies on inside debt which suggest that the insider holding of debt can help align the incentive of insiders with those of debtholders (Jensen and Meckling (1976); Edmans and Liu (2011); Bolton et al. (2011)). In addition, we document that EDs reduce the risk-taking investment and consequently increase the debt value of the firm, which is consistent with the finding of Wei and Yermack (2011). Finally, we test the implications on firm's leverage ratios, which reflect the impact of EDs on the cost of borrowing. We find that EDs are positively related to leverage, implying that the risk-reducing effect of EDs can help decrease the cost of borrowing. Overall, our results suggest that employee inside debt can be an effective remedy to the agency costs of debt when it is appropriately prioritized.

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Appendix A: Definitions of variables used in study

This appendix defines the variables used in this study. Accounting data is from NEEDS Corporate Financial Affairs Data, stock return data is from PACAP, bank loan data from NEEDS Bank Loan Data, and keiretsu membership data from Kigyo- Keiretsu Soran Data.

Variables	Definition
Independent variables related to employee deposit	
ED/Employee	FB090/FE056
ED/TA	FB090/FB067
ED/Debt	FB090/(FB074+FB075+FB076+FB077+FB015+FB098+FB101+FB102 +FB107)
ED/Cash	FB090/FB003
ED/Equity	FB090/MKTVAL(MKTVAL is extracted from PACAP Monthly Stock Price and Return File: Japan version)
ED/Loan	FB090/(FB052+FB074)
EDP Dum	Dummy variable that takes the value of one for firms with outstanding balance of employee deposits for a year between 2000 and 2007, and zero otherwise.
EDP02 (EDP99)	Dummy variable that takes the value of one for firms with outstanding balance of employee deposits for the year 2002 (1999), and zero otherwise.
Risk Measures	
Total Risk	Log(variance of daily stock returns over firm fiscal year, annualized)
Systematic Risk	Log(variance of the predicted portion of a market model, annualized). The market model takes into account nonsynchronous trading by adding five leads and lags of daily market returns (Dimson, 1979).
Unsystematic Risk	Log(variance of the residual from the market model, annualized).
Expected Volatility	The forecasted variance for time $t+k$ in time t for the GARCH(1,1) is given by $E_t[\sigma_{t+k}^2] = (\alpha_1+\beta_1)^{k-1}[\sigma_{t+1}^2 - \alpha_0/(1-\alpha_1-\beta_1)] + \alpha_0/(1-\alpha_1-\beta_1)$,where the mean equation is $R_t = \gamma + \varepsilon_t$, R is monthly return, $\varepsilon_t \sim N(0,\sigma_t^2)$ and$\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$. Monthly market return data ranging from 1980 to 2007 is used to estimate the expected volatility of each month. We use expected volatility at fiscal year beginning month as the annual measure of expected volatility.
Firm Characteristics	
Size	Log ($FB067_{t-1}$)
ROA	$(FC051/FB067)_{t-1}$
Cash flow	FC029/FB067
Tobin's q, or q	$[(MKTVAL+DEBT+FB123+FE019)/FB067]_{t-1}$
Tangibility	FB031/FB067
SaleGrowth	Sales growth,$(FC001\text{-}FC001_{t-1})/FC001_{t-1}$
LBREX./Employee	Total labor expenses per employee,FE087/FE056
BKLeverage	(FB074+FB075+FB076+FB077+FB015+FB098+FB101+FB102+FB107)/FB067
NetCapex	Net capital expenditure, $(FB031\text{-}FB031_{t-1}+FC046)/FB031_{t-1}$
RD	FE026/FB067
Pension/employee	FB107/FE056
DIROWN	Director Ownership,FF082/FF084
Firm value	The estimation procedure is based on the Merton (1974) model, which views equity as a European call option on the value of the firm's assets. In particular, the firm value is estimated by solving the following two equations. (1) $V_E = V_A N(d_1) - FVe^{-rT}N(d_2)$; (2) $\sigma_E^2 = V_A N(d_1)\sigma_A / V_E$where V_E is the market value of firm equity and V_A is the firm value (market value of asset). $N(.)$ is the cumulative function of standard normal distribution, $d_1 = [\ln(V_A/FV) + (r+\sigma_A^2/2)T]/[\sigma_A^2\sqrt{T}]$, $d_2 = d_1 - \sigma_A^2\sqrt{T}$. σ_A^2 is asset volatility, $FV$is the face value of debt, r is the risk-free rate, and T is the time to maturity of debt , which is estimated by (0.5 short term debt +5 long term debt)/book value of total debt.
Market value of debt	The difference between firm value (estimated as above) and equity value.
Main-bank system	
Keiretsu	Dummy variable that takes the value of one for firms with keiretsu membership for a year between 2000 and 2007.

Appendix B: Appropriate Implementation of Employee Deposits: The Range of Deposit Protection Changed due to the Revision of the *Corporate Reorganization Law*

Translated from the website of the Ministry of Labor and Welfare
http://www.mhlw.go.jp/new-info/kobetu/roudou/gyousei/kantoku/dl/040324-2a.pdf

To implement employee deposits:

1. Employer must establish an agreement with the employees and notify the Commissioner of the Labor Standard Inspection Office in the local jurisdiction. (*Labor Standard Law*, Article 18 Section 2)

   If there is a labor union that consists of more than half of the workers, the employer must prepare in writing an "Agreement in regards to Savings Management" and notify the Commissioner of the Labor Standard Inspection Office in the local jurisdiction. If there is no labor union that consists of more than half of the workers, the employer must establish an agreement with an employee representative that represents more than half of the employees.

2. Employer must establish the provisions for savings management and publicize them, for example, by posting them in the workplace. (*Labor Standard Law*, Article 18 Section 3)
3. Employer must pay interest on deposits. The deposit rate must not be set below the rate specified by the Ministry of Labor and Welfare (i.e., the minimum required rate). (*Labor Standard Law*, Article 18 Section 4)
   a. In case the management and employees agree to set a deposit rate below the minimum required rate, such agreement is deemed invalid. In such cases, the minimum required rate is applied.
   b. The minimum required rate is specified by the Ministerial Ordinance that determines the deposit rate when employer accepts deposits from employees (in accordance with *Labor Standard Law*, Article 18 Section 4). Currently the minimum rate is set as 0.5% per annum.

      The minimum required rate is reviewed at the beginning of each year by taking into account the actual market interest rates. If a revision is necessary, the Ministerial Ordinance is revised and the new rate becomes effective for the following fiscal year (from April 1 to March 31 of the following year). It must be noted that the same deposit rate applies for the entire fiscal year.
   c. In principle, the management and the employees must establish a new agreement when revising the deposit rate. The new agreement must be notified to the Commissioner of the Labor Standard Inspection Office in the local jurisdiction.
4. Employer must return employee's savings without delay when an employee requests withdrawal of savings. (*Labor Standard Law*, Article 18 Section 5)

5. Each year employer must secure the outstanding amount of deposits, as of March 31, for a period of one year. (*Law to Secure Payment of Wages*, Article 3)

   To secure deposits, employer may use one of the following methods; 1) establish a guarantee agreement with a financial institution, 2) establish a trust agreement with a trust firm, 3) establish a pledge or a mortgage, or 4) set up a deposit conservation committee, create savings management account and implement appropriate book-keeping procedures. (*Regulation for Implementing the Law to Secure Payment of Wages*, Article 2 Section 1)

   If the deposit is secured by a deposit conservation committee, the following points must be taken into consideration.

   a. *Simultaneous use of savings management account and payment reserve system*
      For better conservation of deposits, it is desirable to set up a payment reserve system with a savings management account.
   b. *Appropriate management of deposit conservation committee*
      In accordance with the provision of Article 2 Section 2 of the *Regulation for Implementing the Law to Secure the Payment of Wages*, the deposit conservation committee must appropriately manage the composition of committee members, hold quarterly meetings, prepare deposit account reports, notify the results of the meetings, and maintain records.

6. Employer must present a report regarding the state of deposit management for year ending March 31. The report must be submitted to the Commissioner of the Labor Standard Inspection Office in the local jurisdiction by April 30.

When the Corporate Reorganization Law is applied, the total amount of employee deposits has been considered as *common benefit claims* (*kyoeki saiken*) which should be paid back in full without being constrained by the reorganization process. [32]

However, since the revision of the Corporate Reorganization Law that became effective April 1, 2003, the revised Law limits the range of employee deposits that are considered as common benefit claims to the larger of the past 6 month salary before the reorganization date or 1/3 of the existing deposits. Therefore, employer must pay attention to this change as any deposit above the specified amount is treated as *reorganization claims* (*kosei saiken*) for corporate reorganizations submitted after April 1, 2003.[33]

[32] *Kyoeki saiken* are claims, which have seniority over all other claims, for services rendered or obligations incurred during the period after the ruling of corporate reorganization.
[33] *Kosei saiken* are unsecured creditors' claims that have existed prior to the commencement of the reorganization proceedings.

Table 1. Summary of employee deposits and labor benefits, 1977-2002

The table presents the means and medians of employee deposits measures and other labor benefits before the 2003 New Reorganization Law. Financial and utility firms are excluded. Short-term loan is defined as loans, bank over-drafts, and bill loan with repayment term within a year. Salary is total labor expenses minus bonuses (Bonus ex.) and pension contributions (Pension ex.). Since the pension contribution data are only available after 2000, it is set to be zero before 2000. Other variable definitions are in the Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen.

	1977-1980			1981-1990			1991-1999			2000-2002		
	N	Mean	Median	NA	Mean	Median	NA	Mean	Median	N	Mean	Median
Employee Deposits (Mil.Yen)	1584	3771.4	968.15	4446	3580.5	920.7	2891	3335.4	509.49	693	2609.1	326.29
ED/Employee (Mil.Yen)	1584	0.75	0.61	4446	0.70	0.55	2891	0.71	0.48	693	0.68	0.30
ED/TA (%)	1584	1.88	1.57	4446	1.40	1.13	2891	1.01	0.72	693	0.76	0.41
ED/Debt (%)	1584	8.36	4.65	4444	6.25	3.52	2880	4.89	2.27	691	4.34	1.75
ED/Loan (%)	1524	19.92	6.62	4096	19.00	5.57	2604	19.73	4.25	603	17.12	3.07
ED/short-term loan(%)	1259	33.86	15.65	3717	25.01	10.37	2270	25.84	8.04	490	22.53	5.43
ED/salary (%)	1320	89.19	46.89	3960	70.38	33.87	2590	45.81	17.87	561	42.31	10.79
Pension liab./employee (Mil.Yen)	1584	1.59	1.24	4446	1.84	1.46	2891	2.15	1.78	693	3.56	2.98
Pension ex./employee (Mil.Yen)	NA	NA	NA	NA	NA	NA	NA	NA	NA	693	0.23	0.00
Bonus ex./employee (Mil.Yen)	1419	0.56	0.55	4156	0.65	0.64	2703	0.74	0.74	606	0.69	0.68
Salary/employee (Mil.Yen)	1320	1.79	1.15	3960	2.17	1.44	2590	2.89	1.96	561	3.28	2.38
LBREX./employee (Mil.Yen)	1584	2.20	1.62	4446	2.72	2.00	2891	3.52	2.61	693	3.90	2.97

Table 2. Summary statistics of sample firms, 1998-2007

The table presents the means and medians of selected financial data for EDP firms and non-EDP firms from 1998 to 2007. Financial and utility firms are excluded. We obtain the annual accounting data from NEEDS Corporate Financial Affairs Data, and calculate risk measures using data from PACAP. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. We conduct t-tests to test for differences between the means for the EDP and non-EDP firms. The difference-in-means t-tests assume unequal variance across groups when a test of equal variance is rejected at the 10% level. We use the Wilcoxon Rank Sum Test to test for differences in the medians.

	Non-EDP firms			EDP firms		
	N	Mean	Median	N	Mean	Median
Employee Deposits						
Employee Deposits (Mil.Yen)	13315	0.00	0.00	2126	2860***	270.0***
ED/Employee (Mil.Yen)	13307	0.00	0.00	2126	0.60***	0.29***
ED/TA (%)	13315	0.00	0.00	2126	0.70***	0.37***
ED/Debt (%)	12873	0.00	0.00	2114	4.28***	1.60***
ED/Loan (%)	10610	0.00	0.00	1858	10.20***	2.71***
Risk measures						
Total Risk	13315	7.34	7.33	2126	7.37*	7.40**
Systematic Risk	13315	5.62	5.69	2126	5.72***	5.78***
Unsystematic Risk	13315	7.15	7.13	2126	7.17	7.18
Firm Characteristics						
Total Assets (Bil. Yen)	13315	182.08	52.35	2126	264.21***	94.82***
Sales (Bil. Yen)	13315	155.59	46.19	2126	228.13***	80.82***
Sales Growth	13308	0.02	0.01	2126	0.01***	0.00***
Tangibility	13315	0.26	0.24	2126	0.30***	0.27***
Tobin's q	13315	1.05	0.80	2126	0.90***	0.75***
ROA	13315	0.04	0.03	2126	0.03***	0.03***
BKLeverage	13315	0.24	0.22	2126	0.28***	0.27***
R&D	13315	0.01	0.00	2126	0.01	0.00***
NetCapex	13249	0.17	0.09	2123	0.11***	0.08***
Age	13315	28.20	32.00	2126	37.08***	41.00***
LBREX./employee(Mil.Yen)	13305	4.79	3.65	2126	3.99***	3.05***
Pension/employee(Mil.Yen)	13307	2.35	1.52	2126	3.21***	2.50***
Director Ownership (%)	13289	0.66	0.00	2126	0.12***	0.00***

Table 3. Firm risk and employee deposits

This table shows the effect of employee deposits on firm risk. The sample period is 1998-2007. Financial and utility firms are excluded. **Panel A** presents the regression results of firm risk on employee deposit measures (ED/Employee, ED/TA, and EDP Dum). ED/Employee is per employee deposit. ED/TA is the total employee deposits scaled by total book value of assets. EDP Dum takes the value of one for EDP firms, and zero otherwise. Standard errors are clustered by firm and reported in brackets. In **Panel B** we match non-EDP firms to EDP firms based on propensity scores, and compare firm risks of the two samples. Propensity scores are estimated from a probit model that is run at the firm level. The dependent variable equals 1 for treated firms (EDP) and 0 for control firms (non-EDP firms). The covariates included in the regression are: log(assets), M/B, ROA, tangibility, R&D, Netcapex, book leverage, LBREX/sales, employee/TA, and industry and year fixed effects. The matching procedure is a one-to-one nearest neighborhood matching. **Panel C** reruns the regression in Panel A using p-score matched samples. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Regressions

	TotalRisk			SystRisk			UnsysRisk		
ED/Employee	-0.15***			-0.12**			-0.15***		
	[0.034]			[0.053]			[0.034]		
ED/TA		-0.076***			-0.092**			-0.062**	
		[0.025]			[0.036]			[0.025]	
EDP Dum			-0.072***			-0.043			-0.073***
			[0.027]			[0.043]			[0.028]
Size	-0.096***	-0.097***	-0.094***	-0.020	-0.022	-0.019	-0.13***	-0.13***	-0.13***
	[0.033]	[0.033]	[0.033]	[0.042]	[0.042]	[0.042]	[0.033]	[0.033]	[0.033]
Tobin's *q*	0.090***	0.090***	0.091***	0.19***	0.19***	0.19***	0.069***	0.069***	0.070***
	[0.011]	[0.011]	[0.011]	[0.015]	[0.015]	[0.015]	[0.011]	[0.011]	[0.011]
ROA	-0.76***	-0.76***	-0.76***	-0.10	-0.11	-0.11	-1.02***	-1.02***	-1.02***
	[0.18]	[0.18]	[0.18]	[0.25]	[0.25]	[0.25]	[0.20]	[0.20]	[0.20]
Tangibility	-0.036	-0.033	-0.033	-0.13	-0.12	-0.12	-0.031	-0.029	-0.029
	[0.11]	[0.11]	[0.11]	[0.14]	[0.14]	[0.14]	[0.12]	[0.12]	[0.12]
BKLeverage	0.19**	0.19**	0.19**	-0.20*	-0.20*	-0.20*	0.29***	0.29***	0.29***
	[0.083]	[0.083]	[0.083]	[0.11]	[0.11]	[0.11]	[0.086]	[0.086]	[0.086]
SaleGrow	0.043	0.042	0.043	0.14***	0.14***	0.14***	0.006	0.005	0.006
	[0.029]	[0.029]	[0.029]	[0.040]	[0.040]	[0.040]	[0.030]	[0.030]	[0.030]
RD	-0.39	-0.41	-0.38	-0.53	-0.55	-0.53	-0.68	-0.69	-0.67
	[0.79]	[0.79]	[0.79]	[1.26]	[1.26]	[1.25]	[0.83]	[0.83]	[0.83]
Netcapex	-0.053***	-0.053***	-0.053***	-0.067***	-0.068***	-0.068***	-0.051***	-0.051***	-0.051***
	[0.015]	[0.015]	[0.015]	[0.022]	[0.022]	[0.022]	[0.015]	[0.015]	[0.015]
Pension/employee	-0.004	-0.005	-0.005	-0.001	-0.001	-0.001	-0.004	-0.005	-0.005
	[0.004]	[0.004]	[0.004]	[0.005]	[0.005]	[0.005]	[0.004]	[0.004]	[0.004]
DIROWN	-0.007	-0.007	-0.007	-0.008	-0.008	-0.008	-0.006	-0.006	-0.006
	[0.008]	[0.008]	[0.008]	[0.010]	[0.010]	[0.010]	[0.008]	[0.008]	[0.008]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.711	0.710	0.710	0.592	0.592	0.592	0.736	0.736	0.736
N.of Obs.	15331	15331	15331	15331	15331	15331	15331	15331	15331

Panel B. Risk comparison based on propensity score matching

Group	N	Mean		
		TotalRisk	SystRisk	UnsysRisk
Control (Non EDP)	2050	7.42	5.72	7.22
		[0.02]	[0.02]	[0.02]
Treated (EDP)	2050	7.36	5.72	7.16
		[0.02]	[0.03]	[0.03]
Difference		-0.06	-0.003	-0.06
t-Stat: Difference		-2.33**	-0.10	-2.37**

Panel C. Regressions using p-score matched samples

	TotalRisk			SystRisk			UnsysRisk		
ED/Employee	-0.099***			-0.080*			-0.123***		
	[0.030]			[0.046]			[0.030]		
ED/TA		-0.043**			-0.062*			-0.044**	
		[0.021]			[0.032]			[0.021]	
EDP Dum			-0.021			-0.029			-0.021
			[0.037]			[0.060]			[0.037]
Size	0.008	-0.003	0.011	0.137*	0.108	0.128*	-0.061	-0.071	-0.057
	[0.049]	[0.049]	[0.049]	[0.076]	[0.078]	[0.077]	[0.049]	[0.049]	[0.049]
Tobin's *q*	0.171***	0.172***	0.172***	0.298***	0.297***	0.296***	0.136***	0.138***	0.137***
	[0.021]	[0.021]	[0.021]	[0.033]	[0.033]	[0.033]	[0.021]	[0.021]	[0.021]
ROA	-1.900***	-1.909***	-1.899***	-0.916	-1.182**	-1.168**	-2.122***	-2.133***	-2.123***
	[0.389]	[0.388]	[0.389]	[0.563]	[0.568]	[0.566]	[0.404]	[0.403]	[0.404]
Tangibility	0.183	0.199	0.195	-0.080	-0.011	-0.016	0.186	0.205	0.201
	[0.166]	[0.166]	[0.167]	[0.237]	[0.232]	[0.233]	[0.172]	[0.173]	[0.173]
BKLeverage	0.169	0.178	0.193	0.066	-0.087	-0.065	0.262*	0.277**	0.292**
	[0.132]	[0.131]	[0.132]	[0.203]	[0.205]	[0.204]	[0.135]	[0.134]	[0.135]
SaleGrow	-0.007	-0.008	-0.006	0.108	0.162*	0.165*	-0.060	-0.062	-0.059
	[0.062]	[0.062]	[0.062]	[0.091]	[0.095]	[0.095]	[0.062]	[0.062]	[0.063]
RD	-0.944	-0.937	-0.998	1.101	1.476	1.384	-2.119	-2.129	-2.193
	[1.324]	[1.326]	[1.328]	[2.261]	[2.209]	[2.213]	[1.327]	[1.332]	[1.335]
Netcapex	-0.170***	-0.175***	-0.171***	-0.183**	-0.204***	-0.199***	-0.167***	-0.172***	-0.169***
	[0.057]	[0.058]	[0.057]	[0.073]	[0.073]	[0.073]	[0.059]	[0.060]	[0.060]
Pension/employee	-0.004	-0.005	-0.005	-0.004	-0.002	-0.002	-0.004	-0.005	-0.005
	[0.005]	[0.005]	[0.005]	[0.007]	[0.007]	[0.007]	[0.005]	[0.005]	[0.005]
DIROWN	0.003	0.004	0.004	-0.034**	-0.033**	-0.034**	0.013	0.013	0.013
	[0.008]	[0.008]	[0.009]	[0.015]	[0.015]	[0.015]	[0.008]	[0.009]	[0.009]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.794	0.793	0.793	0.698	0.705	0.705	0.814	0.813	0.813
N.of Obs.	4642	4642	4642	4642	4642	4642	4642	4642	4642

Table 4. Heckman regression

This table shows the result from the Heckman two-stage regression. The first stage estimates the firm-level probit regression in which the dependent variable is EDP Dum. The second stage conducts the risk regression by additionally include inverse Mill's ratio estimated from the first stage. ED/Equity (%) is total employee deposits scaled by the market value of equity. ED/LBREX (%) is total employee deposits scaled by total labor expenses of the firm. All covariates in the probit regression are lagged for one period. The sample period is 1998-2007. Financial and utility firms are excluded. Standard errors are clustered by firm and reported in brackets. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Heckman first stage

	EDP DUM
LBREX/sales	-0.538**
	[0.261]
Employee/TA	0.004***
	[0.001]
Size	0.183***
	[0.011]
Tobin's q	-0.065***
	[0.024]
Tangibility	0.649***
	[0.087]
ROA	-1.593***
	[0.328]
RD	-0.707
	[0.900]
NetCapex	-0.082
	[0.054]
Constant	-3.245***
	[0.138]
N.of Obs.	13074

Panel B. Heckman second stage

	TotalRisk				SystRisk				UnsysRisk			
ED/Employee	-0.118***				-0.099***				-0.122***			
	[0.021]				[0.029]				[0.022]			
ED/TA		-0.105***				-0.108***				-0.102***		
		[0.018]				[0.024]				[0.018]		
ED/Equity			-0.011**				-0.019***				-0.009*	
			[0.005]				[0.007]				[0.005]	
ED/LBREX				-0.239***				-0.230***				-0.237***
				[0.052]				[0.070]				[0.053]
Size	-0.147***	-0.197***	-0.194***	-0.197***	0.020	-0.022	-0.018	-0.022	-0.206***	-0.257***	-0.255***	-0.258***
	[0.035]	[0.037]	[0.037]	[0.038]	[0.047]	[0.047]	[0.047]	[0.048]	[0.037]	[0.039]	[0.038]	[0.039]
Tobin's *q*	0.198***	0.207***	0.211***	0.220***	0.319***	0.324***	0.323***	0.337***	0.174***	0.184***	0.190***	0.197***
	[0.030]	[0.032]	[0.031]	[0.032]	[0.039]	[0.040]	[0.040]	[0.040]	[0.031]	[0.033]	[0.033]	[0.034]
ROA	-1.665***	-1.426**	-1.570***	-1.306**	-1.070	-0.845	-1.003	-0.739	-1.747***	-1.508**	-1.644***	-1.386**
	[0.560]	[0.590]	[0.586]	[0.600]	[0.747]	[0.764]	[0.760]	[0.773]	[0.582]	[0.614]	[0.609]	[0.624]
Tangibility	-0.963***	-1.098***	-1.089***	-1.099***	-0.966***	-1.082***	-1.078***	-1.082***	-0.975***	-1.113***	-1.104***	-1.114***
	[0.159]	[0.169]	[0.167]	[0.172]	[0.211]	[0.216]	[0.214]	[0.218]	[0.166]	[0.176]	[0.174]	[0.179]
BKLeverage	1.102***	1.065***	1.126***	1.098***	0.965***	0.924***	0.998***	0.960***	1.109***	1.073***	1.131***	1.106***
	[0.088]	[0.088]	[0.089]	[0.088]	[0.119]	[0.119]	[0.120]	[0.119]	[0.090]	[0.091]	[0.092]	[0.091]
SaleGrow	0.061	0.056	0.059	0.067	0.333**	0.327**	0.324**	0.338**	-0.050	-0.054	-0.051	-0.043
	[0.103]	[0.103]	[0.104]	[0.103]	[0.140]	[0.140]	[0.141]	[0.140]	[0.106]	[0.106]	[0.107]	[0.106]
RD	-3.241***	-2.845**	-2.844**	-2.961**	-3.945***	-3.626**	-3.664**	-3.732**	-3.095***	-2.684**	-2.671**	-2.800**
	[1.100]	[1.156]	[1.148]	[1.173]	[1.465]	[1.496]	[1.490]	[1.509]	[1.142]	[1.203]	[1.194]	[1.220]
NetCapex	-0.043	-0.027	-0.035	-0.022	0.001	0.018	0.016	0.021	-0.056	-0.041	-0.052	-0.037
	[0.069]	[0.069]	[0.069]	[0.069]	[0.093]	[0.093]	[0.094]	[0.094]	[0.071]	[0.071]	[0.072]	[0.071]
Pension/employee	-0.004	-0.008*	-0.009**	-0.007	-0.004	-0.007	-0.008	-0.006	-0.003	-0.007	-0.008*	-0.006
	[0.005]	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.005]	[0.005]	[0.005]
DIROWN	0.027***	0.027***	0.028***	0.028***	0.002	0.002	0.003	0.003	0.034***	0.034***	0.035***	0.035***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.011]	[0.011]	[0.011]	[0.011]	[0.008]	[0.008]	[0.008]	[0.008]
Constant	9.733***	10.727***	10.555***	10.763***	6.686***	7.556***	7.384***	7.576***	10.127***	11.142***	10.972***	11.181***
	[0.776]	[0.823]	[0.811]	[0.838]	[1.025]	[1.044]	[1.034]	[1.055]	[0.808]	[0.859]	[0.847]	[0.874]
Mills lambda	-0.490**	-0.749***	-0.686***	-0.796***	-0.471	-0.701**	-0.638**	-0.742**	-0.548**	-0.812***	-0.750***	-0.859***
	[0.241]	[0.257]	[0.254]	[0.263]	[0.318]	[0.327]	[0.324]	[0.331]	[0.251]	[0.269]	[0.265]	[0.274]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.of Obs.	1774	1774	1774	1774	1774	1774	1774	1774	1774	1774	1774	1774

Table 5. Change in firm risk and employee debt: Difference-in-differences analysis

This table shows the response of firm risk to the regime shift on EDP in 2003, using difference-in-differences analysis (DID). The sample period is 1998-2007. Financial and utility firms are excluded. In **Panel A**, EDP02 takes the value of one for firms having EDP at the end of 2002, and zero otherwise. AFT takes the value of one for period 2004-2007, and zero otherwise. Standard errors are clustered by firm and reported in brackets. In **Panel B**, EDP02 takes the value of one for firms with ED/salary>50% at the end of 2002, and zero otherwise. AFT takes the value of one for period 2004-2007, and zero otherwise. Firms with ED/salary<=50% are excluded from the sample in Panel B. Standard errors are clustered by firm and reported in brackets. **Panel C** presents the results of DID analysis based on propensity score matching. The sample firms in Panel B satisfy four additional criteria: 1) control firms are always non-EDP firms from 2001-2006, 2) Treated firms are always EDP firms from 2000-2002, 3) EDP firms do not change status from non-EDP firms throughout the entire 2001-2006 period, 4) each firm contains at least one observation both before and after 2003. Propensity scores are estimated from a probit model that is run at the firm level. The dependent variable equals 1 for treated firms and 0 for control firms. All covariates included in the regression are averages over the pre-shock era (2000-2002). The covariates in the probit model include: log(assets), M/B, ROA, tangibility, R&D, Netcapex, book leverage, LBREX/sales, employee/TA, and the industry fixed effect. The matching procedure is a one-to-one nearest neighbor matching of propensity scores. **Panel D** re-estimates the regression in Panel A using p-score matched samples. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. DID Regressions

	TotalRisk			SystRisk			UnsysRisk		
EDP02×AFT	0.064**	0.062**	0.061**	0.083**	0.080**	0.078**	0.054**	0.051**	0.051**
	[0.025]	[0.025]	[0.025]	[0.036]	[0.036]	[0.036]	[0.026]	[0.026]	[0.026]
Size	-0.085***	-0.097***	-0.106***	-0.053	-0.053	-0.055	-0.122***	-0.137***	-0.148***
	[0.031]	[0.032]	[0.032]	[0.041]	[0.041]	[0.042]	[0.031]	[0.032]	[0.032]
Tobin's *q*	0.173***	0.177***	0.183***	0.293***	0.301***	0.316***	0.140***	0.143***	0.148***
	[0.016]	[0.016]	[0.016]	[0.025]	[0.025]	[0.023]	[0.016]	[0.016]	[0.016]
SaleGrow	0.031	0.064*	0.057	0.198***	0.228***	0.219***	-0.026	0.009	0.002
	[0.034]	[0.035]	[0.035]	[0.049]	[0.051]	[0.049]	[0.035]	[0.036]	[0.036]
ROA	-1.488***	-1.274***	-1.267***	-0.264	-0.223	-0.344	-1.907***	-1.639***	-1.611***
	[0.203]	[0.204]	[0.200]	[0.284]	[0.301]	[0.292]	[0.209]	[0.210]	[0.207]
Tangibility	-0.04	-0.008	-0.003	-0.126	-0.045	-0.055	-0.05	-0.03	-0.019
	[0.102]	[0.104]	[0.105]	[0.123]	[0.127]	[0.128]	[0.106]	[0.109]	[0.110]
BKLeverage		0.154*	0.206**		-0.106	-0.146		0.227***	0.295***
		[0.079]	[0.080]		[0.105]	[0.108]		[0.084]	[0.084]
RD		-0.947	-0.685		-1.324	-1.222		-1.349	-1.03
		[0.868]	[0.797]		[1.213]	[1.246]		[0.935]	[0.848]
Netcapex		-0.106***	-0.113***		-0.181***	-0.173***		-0.093***	-0.104***
		[0.026]	[0.025]		[0.039]	[0.038]		[0.027]	[0.027]
Pension/employee			-0.005			-0.001			-0.006*
			[0.003]			[0.005]			[0.003]
DIROWN			0.004			-0.001			0.005
			[0.005]			[0.011]			[0.006]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.747	0.747	0.747	0.634	0.635	0.636	0.77	0.771	0.771
N.of Obs.	14100	14070	14039	14100	14070	14039	14100	14070	14039

Panel B. DID Regressions (Treated firms are restricted to those with ED/salary>0.5)

	TotalRisk			SystRisk			UnsysRisk		
EDP02×AFT	0.140***	0.125**	0.126**	0.198***	0.183***	0.182***	0.111**	0.095**	0.096**
	[0.050]	[0.049]	[0.049]	[0.064]	[0.065]	[0.065]	[0.048]	[0.047]	[0.047]
Size	-0.074**	-0.089**	-0.106***	-0.034	-0.029	-0.028	-0.098***	-0.117***	-0.141***
	[0.033]	[0.035]	[0.035]	[0.042]	[0.044]	[0.045]	[0.034]	[0.036]	[0.035]
Tobin's *q*	0.097***	0.100***	0.106***	0.191***	0.196***	0.206***	0.076***	0.079***	0.084***
	[0.013]	[0.013]	[0.013]	[0.019]	[0.018]	[0.017]	[0.012]	[0.012]	[0.013]
SaleGrow	0.018	0.042	0.036	0.125***	0.144***	0.137***	-0.015	0.010	0.002
	[0.030]	[0.032]	[0.032]	[0.043]	[0.047]	[0.046]	[0.031]	[0.033]	[0.033]
ROA	-0.986***	-0.869***	-0.955***	-0.030	-0.117	-0.128	-1.249***	-1.081***	-1.229***
	[0.186]	[0.176]	[0.204]	[0.234]	[0.239]	[0.266]	[0.228]	[0.205]	[0.217]
Tangibility	-0.058	-0.020	-0.025	-0.210	-0.112	-0.121	-0.053	-0.025	-0.029
	[0.109]	[0.111]	[0.112]	[0.134]	[0.140]	[0.143]	[0.112]	[0.114]	[0.115]
BKLeverage		0.143*	0.170*		-0.232**	-0.282**		0.236***	0.275***
		[0.084]	[0.088]		[0.107]	[0.114]		[0.089]	[0.091]
RD		-1.008	-0.705		-1.571	-1.502		-1.271	-0.878
		[0.902]	[0.836]		[1.259]	[1.316]		[0.974]	[0.882]
Netcapex		-0.070***	-0.066***		-0.113***	-0.102***		-0.064***	-0.060***
		[0.019]	[0.018]		[0.031]	[0.029]		[0.019]	[0.018]
Pension/employee			-0.002			0.003			-0.002
			[0.004]			[0.005]			[0.004]
DIROWN			0.005			0.001			0.005
			[0.008]			[0.009]			[0.008]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.750	0.751	0.750	0.636	0.637	0.638	0.775	0.775	0.775
N.of Obs.	12084	12060	12030	12084	12060	12030	12084	12060	12030

Panel C. Propensity score matching (DID)

Group	N	Mean		
		TotalRisk	SystRisk	UnsysRisk
Control (Non EDP)	209	-0.69	-0.59	-0.76
		[0.03]	[0.05]	[0.03]
Treated (EDP)	209	-0.6	-0.53	-0.67
		[0.03]	[0.05]	[0.03]
Difference		0.09	0.06	0.09
t-Stat: Difference		1.90*	0.87	1.85*

Panel D. Regressions (DID) using p-score matched samples

	TotalRisk			SystRisk			UnsysRisk		
Treat×AFT	0.102***	0.097**	0.098**	0.168***	0.159***	0.155***	0.096**	0.093**	0.096**
	[0.038]	[0.038]	[0.038]	[0.058]	[0.057]	[0.057]	[0.038]	[0.039]	[0.039]
Size	-0.040	-0.045	-0.075	-0.110	-0.114	-0.105	-0.030	-0.035	-0.079
	[0.055]	[0.057]	[0.058]	[0.079]	[0.082]	[0.085]	[0.057]	[0.059]	[0.059]
Tobin's *q*	0.070***	0.071***	0.074***	0.136***	0.141***	0.146***	0.053***	0.054***	0.057***
	[0.016]	[0.016]	[0.016]	[0.025]	[0.025]	[0.025]	[0.015]	[0.015]	[0.015]
SaleGrow	-0.031	-0.032	-0.007	0.071	0.098	0.135	-0.086	-0.092	-0.074
	[0.052]	[0.061]	[0.062]	[0.080]	[0.094]	[0.094]	[0.052]	[0.060]	[0.063]
ROA	-0.718***	-0.692***	-0.554	0.326	0.309	0.730	-0.959***	-0.918***	-0.900**
	[0.248]	[0.245]	[0.365]	[0.343]	[0.371]	[0.460]	[0.284]	[0.269]	[0.400]
Tangibility	-0.340	-0.264	-0.294	-0.310	-0.190	-0.224	-0.311	-0.238	-0.246
	[0.220]	[0.214]	[0.225]	[0.295]	[0.311]	[0.321]	[0.218]	[0.211]	[0.226]
BKLeverage		0.029	0.117		-0.097	-0.100		0.076	0.192
		[0.141]	[0.152]		[0.204]	[0.234]		[0.150]	[0.163]
RD		0.128	2.243		-0.103	1.804		-0.347	2.023
		[2.279]	[1.982]		[3.087]	[3.566]		[2.493]	[2.045]
Netcapex		-0.032	-0.039		-0.103**	-0.115**		-0.014	-0.020
		[0.035]	[0.037]		[0.048]	[0.052]		[0.035]	[0.037]
Pension/employee			-0.006			-0.007			-0.004
			[0.006]			[0.009]			[0.006]
DIROWN			-0.015			-0.023*			-0.013
			[0.010]			[0.013]			[0.009]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.765	0.766	0.763	0.641	0.642	0.644	0.795	0.796	0.793
N.of Obs.	3526	3514	3500	3526	3514	3500	3526	3514	3500

Table 6: Robustness checks

This table reports the robustness checks for the risk-reducing effect of employee deposits. The sample period is 1998-2007. Financial and utility firms are excluded. Panel A presents the regression results of firm risk on employee deposit measures (ED/Equity, ED/LBREX). ED/Equity (%) is total employee deposits scaled by the market value of equity. ED/LBREX (%) is total employee deposits scaled by total labor expenses of the firm. Panel B presents the result of DID analysis using EDP firms in 1999 as treatment group. Panel C estimates the regression of probability of default computed using KMV model on employee deposit measures (ED/Employee, ED/TA, and EDP Dum). Panel D reports the result of DID analysis using probability of default as dependent variable. EDP99 (EDP02) takes the value of one for EDP firms in 1999 (2002), and zero otherwise. AFT takes the value of one for period 2004-2007, and zero otherwise. Other controls in Panel A and C are the same as in Panel A of Table 3. Other controls in Panel B are the same as in Panel A of Table 5. Standard errors are clustered by firm and reported in brackets. Definitions of all variables are in Appendix. Variables are winsorized at 1%level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Robustness checks using alternative ED measures

	TotalRisk		SystRisk		UnsysRisk	
ED/Equity	-0.020***		-0.037***		-0.016**	
	[0.006]		[0.007]		[0.006]	
ED/LBREX		-0.003***		-0.003***		-0.002***
		[0.001]		[0.001]		[0.001]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.710	0.711	0.593	0.592	0.736	0.736
N.of Obs.	15331	15329	15331	15329	15331	15329

Panel B. Robustness checks for DID analysis

	TotalRisk			SystRisk			UnsysRisk		
EDP99×AFT	0.050**	0.048**	0.049**	0.064*	0.061*	0.063*	0.042*	0.041*	0.042*
	[0.024]	[0.024]	[0.024]	[0.035]	[0.035]	[0.035]	[0.025]	[0.024]	[0.024]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.743	0.744	0.743	0.629	0.63	0.63	0.769	0.77	0.769
N.of Obs.	12459	12443	12416	12459	12443	12416	12459	12443	12416

Panel C. Robustness checks: probability of default

	Probability of default					
ED/employee	-0.867***			-0.337		
	[0.256]			[0.685]		
ED/TA		-0.970***			-1.298***	
		[0.169]			[0.348]	
EDP Dum			-0.755**			-1.302**
			[0.327]			[0.535]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	Yes	Yes	Yes
Adj R-sq	0.19	0.191	0.19	0.335	0.335	0.335
N of Obs.	12718	12718	12718	12718	12718	12718

Panel D. Robustness checks: probability of default (DID analysis)

	Probability of default		
EDP02×AFT	1.168*	1.258**	1.196**
	[0.602]	[0.588]	[0.585]
Size	8.656***	7.993***	7.857***
	[0.956]	[0.946]	[0.959]
Tobin's *q*	1.054***	1.026***	1.192***
	[0.375]	[0.369]	[0.372]
SaleGrow	-3.307***	-2.396***	-2.316***
	[0.818]	[0.819]	[0.820]
ROA	-65.975***	-53.467***	-53.218***
	[5.697]	[5.858]	[5.861]
Tangibility	4.880*	4.411	3.809
	[2.601]	[2.785]	[2.798]
BKlever		12.729***	13.200***
		[2.228]	[2.151]
RD		-4.714	-4.761
		[15.904]	[16.363]
Netcapex		-0.076	-0.133
		[0.752]	[0.753]
Pension/employee			-0.212***
			[0.067]
DIROWN			-3.805
			[4.667]
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Adj.R-sq	0.417	0.420	0.423
N.of Obs.	12169	12138	12117

Table 7. Keiretsu incorporation, employee deposits and firm risk

Sample period is 1998-2007. Financial and utility firms are excluded. Regressions are run by dividing subsamples into Keiretsu firms (Panel A) and Non-Keiretsu firms (Panel B). Keiretsu firms are defined according to Toyokeizai, Kigyo-Keiretsu Soran. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. Standard errors are clustered by firm and are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Keiretsu	TotalRisk			SystRisk			UnsysRisk		
ED/Employee	-0.099			-0.11			-0.11		
	[0.064]			[0.095]			[0.063]		
ED/TA		-0.038			-0.069			-0.025	
		[0.037]			[0.062]			[0.038]	
EDP Dum			-0.082*			-0.049			-0.084*
			[0.046]			[0.074]			[0.047]
Size	0.045	0.041	0.044	0.096	0.087	0.096	-0.011	-0.013	-0.013
	[0.074]	[0.074]	[0.073]	[0.10]	[0.10]	[0.10]	[0.069]	[0.069]	[0.068]
Tobin's *q*	0.15***	0.15***	0.15***	0.28***	0.29***	0.29***	0.089*	0.092**	0.090**
	[0.035]	[0.035]	[0.035]	[0.059]	[0.060]	[0.059]	[0.046]	[0.037]	[0.037]
ROA	-1.67***	-1.69***	-1.69***	-1.31**	-1.32**	-1.34**	-1.64***	-1.67***	-1.66***
	[0.42]	[0.43]	[0.43]	[0.59]	[0.60]	[0.60]	[0.49]	[0.45]	[0.45]
Tangibility	-0.13	-0.14	-0.13	-0.33	-0.33	-0.33	-0.10	-0.12	-0.098
	[0.24]	[0.25]	[0.25]	[0.30]	[0.31]	[0.32]	[0.27]	[0.25]	[0.25]
BKLeverage	-0.15	-0.16	-0.16	-0.82***	-0.81***	-0.83***	0.12	0.10	0.11
	[0.18]	[0.18]	[0.18]	[0.29]	[0.29]	[0.29]	[0.19]	[0.18]	[0.18]
SaleGrow	0.11	0.11	0.10	0.31***	0.31***	0.30***	0.060	0.053	0.052
	[0.079]	[0.082]	[0.082]	[0.10]	[0.11]	[0.11]	[0.098]	[0.083]	[0.083]
RD	-2.01	-1.92	-1.82	-3.15	-3.10	-2.95	-2.21	-2.08	-2.01
	[1.80]	[1.78]	[1.78]	[2.29]	[2.28]	[2.26]	[1.39]	[1.91]	[1.92]
Netcapex	0.0019	0.00072	0.0013	-0.059	-0.061	-0.060	0.023	0.022	0.022
	[0.033]	[0.033]	[0.033]	[0.049]	[0.050]	[0.050]	[0.042]	[0.035]	[0.035]
Pension/employee	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002
	[0.006]	[0.006]	[0.006]	[0.008]	[0.008]	[0.008]	[0.006]	[0.006]	[0.006]
DIROWN	-1.40	-1.54	-1.53	-2.93	-3.14	-3.05	-1.67	-1.79	-1.81
	[5.83]	[5.86]	[5.83]	[11.1]	[11.1]	[11.1]	[4.19]	[4.58]	[4.54]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.709	0.709	0.709	0.617	0.617	0.616	0.750	0.749	0.750
N.of Obs.	2723	2723	2723	2723	2723	2723	2723	2723	2723
Non-Keiretsu									
ED/Employee	-0.16***			-0.11*			-0.17***		
	[0.036]			[0.061]			[0.036]		
ED/TA		-0.086***			-0.090**			-0.078**	
		[0.030]			[0.043]			[0.030]	
EDP Dum			-0.058*			-0.032			-0.063*
			[0.033]			[0.051]			[0.033]
Size	-0.12***	-0.12***	-0.12***	-0.081	-0.082	-0.080	-0.15***	-0.15***	-0.15***
	[0.039]	[0.039]	[0.039]	[0.051]	[0.052]	[0.051]	[0.040]	[0.040]	[0.040]
Tobin's *q*	0.13***	0.13***	0.13***	0.24***	0.24***	0.24***	0.10***	0.10***	0.10***
	[0.014]	[0.014]	[0.014]	[0.020]	[0.020]	[0.020]	[0.013]	[0.013]	[0.013]
ROA	-1.44***	-1.44***	-1.45***	-0.30	-0.30	-0.30	-1.81***	-1.81***	-1.81***
	[0.229]	[0.229]	[0.229]	[0.346]	[0.346]	[0.345]	[0.237]	[0.237]	[0.237]
Tangibility	0.063	0.070	0.072	0.020	0.023	0.026	0.048	0.054	0.056
	[0.124]	[0.124]	[0.124]	[0.158]	[0.158]	[0.158]	[0.130]	[0.130]	[0.130]
BKLeverage	0.31***	0.31***	0.31***	0.075	0.077	0.072	0.36***	0.36***	0.36***
	[0.091]	[0.091]	[0.091]	[0.126]	[0.126]	[0.126]	[0.094]	[0.094]	[0.095]
SaleGrow	0.0075	0.0078	0.0094	0.16***	0.16***	0.16***	-0.037	-0.036	-0.035
	[0.034]	[0.034]	[0.034]	[0.050]	[0.050]	[0.050]	[0.036]	[0.036]	[0.037]
RD	-0.75	-0.81	-0.83	-1.47	-1.50	-1.52	-1.19	-1.25	-1.27
	[0.928]	[0.929]	[0.929]	[1.506]	[1.504]	[1.507]	[0.997]	[1.000]	[0.998]
Netcapex	-0.10***	-0.10***	-0.10***	-0.15***	-0.15***	-0.15***	-0.099***	-0.100***	-0.100***
	[0.023]	[0.023]	[0.023]	[0.038]	[0.038]	[0.038]	[0.023]	[0.023]	[0.023]
Pension/employee	-0.002	-0.002	-0.002	0.002	0.002	0.001	-0.002	-0.003	-0.003
	[0.004]	[0.004]	[0.004]	[0.006]	[0.006]	[0.006]	[0.004]	[0.004]	[0.004]
DIROWN	-0.002	-0.002	-0.002	-0.057***	-0.057***	-0.057***	0.008***	0.008***	0.008***
	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.718	0.717	0.717	0.584	0.584	0.584	0.742	0.742	0.742
N.of Obs.	10225	10225	10225	10225	10225	10225	10225	10225	10225

Table 8. Keiretsu incorporation, employee deposits and firm risk (Diff-in-Diff analysis)

In Panel A (B), EDP02 takes the value of one for firms having EDP (ED/salary>0.5) at the end of 2002, and zero otherwise. AFT takes the value of one for period 2004-2007, and zero otherwise. *t* statistics based on standard errors adjusted for firm clustering are reported in parentheses. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Treatment firms are EDP firms of 2002

Keiretsu		TotalRisk			SystRisk			UnsysRisk	
EDP02×AFT	0.065	0.059	0.059	0.099	0.075	0.075	0.038	0.037	0.036
	(1.455)	(1.344)	(1.338)	(1.528)	(1.186)	(1.189)	(0.858)	(0.827)	(0.820)
Size	0.044	0.049	0.043	0.076	0.101	0.101	-0.007	-0.004	-0.010
	(0.684)	(0.714)	(0.616)	(0.821)	(1.062)	(1.037)	(-0.108)	(-0.059)	(-0.151)
Tobin's *q*	0.153***	0.153***	0.156***	0.265***	0.282***	0.284***	0.096***	0.092***	0.095***
	(4.371)	(4.485)	(4.509)	(4.083)	(4.968)	(4.989)	(2.764)	(2.652)	(2.696)
SaleGrow	0.119*	0.098	0.100	0.273***	0.208**	0.209**	0.086	0.066	0.067
	(1.769)	(1.241)	(1.266)	(2.938)	(2.061)	(2.072)	(1.270)	(0.814)	(0.839)
ROA	-1.594***	-1.591***	-1.579***	-0.672	-1.539***	-1.530***	-1.768***	-1.583***	-1.570***
	(-4.064)	(-3.832)	(-3.811)	(-1.212)	(-2.618)	(-2.618)	(-4.373)	(-3.669)	(-3.640)
Tangibility	-0.203	-0.124	-0.147	-0.402	-0.370	-0.383	-0.177	-0.081	-0.106
	(-0.869)	(-0.526)	(-0.615)	(-1.561)	(-1.236)	(-1.263)	(-0.739)	(-0.341)	(-0.442)
BKLeverage		-0.063	-0.053		-0.870***	-0.873***		0.104	0.116
		(-0.375)	(-0.303)		(-3.404)	(-3.341)		(0.625)	(0.670)
RD		-1.845	-1.827		-3.544*	-3.419		-1.902	-1.878
		(-1.126)	(-1.103)		(-1.677)	(-1.641)		(-1.048)	(-1.026)
Netcapex		0.001	0.001		-0.052	-0.052		0.021	0.021
		(0.019)	(0.021)		(-1.021)	(-1.008)		(0.617)	(0.620)
Pension/employee			-0.003			-0.001			-0.003
			(-0.530)			(-0.067)			(-0.619)
DIROWN			-1.624			-3.440			-1.862
			(-0.294)			(-0.324)			(-0.435)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.742	0.743	0.742	0.659	0.662	0.662	0.777	0.778	0.778
N.of Obs.	2720	2714	2713	2720	2714	2713	2720	2714	2713
Non-Keiretsu		TotalRisk			SystRisk			UnsysRisk	
EDP02×AFT	0.060*	0.060*	0.060**	0.067	0.068	0.073*	0.059*	0.058*	0.058*
	(1.961)	(1.961)	(1.973)	(1.504)	(1.542)	(1.653)	(1.874)	(1.874)	(1.867)
Size	-0.081**	-0.110***	-0.132***	-0.075	-0.090*	-0.087*	-0.104***	-0.137***	-0.166***
	(-2.197)	(-2.861)	(-3.506)	(-1.636)	(-1.911)	(-1.765)	(-2.638)	(-3.344)	(-4.316)
Tobin's *q*	0.121***	0.125***	0.130***	0.227***	0.233***	0.240***	0.097***	0.101***	0.107***
	(9.210)	(9.793)	(9.926)	(11.921)	(12.471)	(12.938)	(7.570)	(8.084)	(8.450)
SaleGrow	-0.005	0.039	0.037	0.114**	0.159***	0.165***	-0.042	0.003	-0.001
	(-0.150)	(1.220)	(1.119)	(2.552)	(3.349)	(3.470)	(-1.285)	(0.103)	(-0.039)
ROA	-1.338***	-1.133***	-1.232***	-0.343	-0.275	-0.216	-1.617***	-1.375***	-1.567***
	(-5.497)	(-5.609)	(-5.701)	(-1.354)	(-1.046)	(-0.657)	(-5.200)	(-5.387)	(-7.019)
Tangibility	0.091	0.101	0.103	-0.020	0.055	0.039	0.078	0.081	0.086
	(0.801)	(0.869)	(0.868)	(-0.141)	(0.377)	(0.266)	(0.656)	(0.664)	(0.692)
BKLeverage		0.312***	0.364***		0.044	0.004		0.387***	0.451***
		(3.437)	(3.892)		(0.378)	(0.033)		(3.975)	(4.578)
RD		-1.161	-0.650		-1.681	-1.461		-1.658	-1.046
		(-1.117)	(-0.732)		(-1.177)	(-1.005)		(-1.476)	(-1.105)
Netcapex		-0.099***	-0.104***		-0.150***	-0.152***		-0.095***	-0.099***
		(-4.652)	(-4.746)		(-4.317)	(-4.198)		(-4.292)	(-4.389)
Pension/employee			-0.003			0.002			-0.004
			(-0.793)			(0.366)			(-0.959)
DIROWN			-0.002			-0.059***			0.008***
			(-0.896)			(-17.992)			(3.338)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.747	0.749	0.748	0.625	0.627	0.627	0.769	0.771	0.770
N.of Obs.	10027	10017	9991	10027	10017	9991	10027	10017	9991

Panel B. Treatment firms are EDP firms of 2002 with ED/salary > 0.5 (excluding firms with ED/salary < 0.5)

Keiretsu		TotalRisk			SystRisk			UnsysRisk	
EDP02×AFT	0.102	0.085	0.086	0.166	0.137	0.139	0.069	0.055	0.056
	(1.386)	(1.140)	(1.157)	(1.553)	(1.341)	(1.280)	(1.010)	(0.802)	(0.817)
Size	0.060	0.065	0.070	0.106	0.126	0.141	0.003	0.008	0.013
	(0.804)	(0.806)	(0.852)	(1.072)	(1.333)	(1.311)	(0.040)	(0.100)	(0.166)
Tobin's *q*	0.152***	0.153***	0.155***	0.260***	0.277***	0.278***	0.094**	0.090**	0.093**
	(3.520)	(3.664)	(3.742)	(3.259)	(3.692)	(4.051)	(2.310)	(2.239)	(2.300)
SaleGrow	0.172***	0.144**	0.154**	0.232***	0.200*	0.215**	0.161***	0.128*	0.138*
	(3.317)	(2.032)	(2.199)	(3.300)	(1.802)	(2.190)	(2.845)	(1.726)	(1.885)
ROA	-1.322***	-1.365***	-1.376***	-0.160	-1.053	-1.072	-1.548***	-1.400**	-1.410**
	(-2.788)	(-2.718)	(-2.725)	(-0.258)	(-1.530)	(-1.646)	(-2.963)	(-2.519)	(-2.522)
Tangibility	-0.128	-0.028	0.040	-0.275	-0.294	-0.161	-0.102	0.036	0.102
	(-0.672)	(-0.128)	(0.181)	(-1.252)	(-0.794)	(-0.548)	(-0.481)	(0.158)	(0.440)
BKLeverage		-0.089	-0.134		-0.850***	-0.921***		0.075	0.030
		(-0.475)	(-0.696)		(-2.953)	(-3.201)		(0.399)	(0.159)
RD		-0.592	-0.588		-1.021	-0.948		-0.789	-0.770
		(-0.362)	(-0.351)		(-0.458)	(-0.407)		(-0.445)	(-0.426)
Netcapex		0.003	0.002		-0.022	-0.024		0.009	0.008
		(0.146)	(0.105)		(-0.410)	(-0.557)		(0.367)	(0.333)
Pension/employee			0.005**			0.008***			0.005*
			(2.065)			(2.617)			(1.837)
DIROWN			-0.685			-1.646			-1.147
			(-0.129)			(-0.159)			(-0.283)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.738	0.745	0.745	0.650	0.656	0.657	0.779	0.784	0.784
N.of Obs.	2355	2349	2348	2355	2349	2348	2355	2349	2348
Non-Keiretsu		TotalRisk			SystRisk			UnsysRisk	
EDP02×AFT	0.111**	0.107**	0.110**	0.130**	0.131**	0.130**	0.098*	0.092*	0.095*
	(2.604)	(2.452)	(2.497)	(2.443)	(2.471)	(2.459)	(1.987)	(1.844)	(1.914)
Size	-0.087**	-0.107**	-0.125***	-0.066	-0.072	-0.076	-0.110**	-0.133***	-0.154***
	(-2.127)	(-2.523)	(-2.891)	(-1.094)	(-1.150)	(-1.177)	(-2.562)	(-3.009)	(-3.446)
Tobin's *q*	0.060**	0.063***	0.104***	0.132***	0.130***	0.186***	0.041*	0.046*	0.086***
	(2.565)	(2.823)	(6.375)	(4.560)	(4.523)	(7.276)	(1.722)	(1.991)	(5.475)
SaleGrow	0.000	0.009	0.017	0.004	0.046	0.077*	-0.000	-0.005	0.000
	(0.309)	(0.475)	(0.999)	(1.451)	(1.479)	(1.742)	(-0.075)	(-0.244)	(0.000)
ROA	-0.734**	-0.612*	-1.166***	0.635*	0.698**	-0.110	-1.076**	-0.958**	-1.507***
	(-2.165)	(-2.039)	(-3.944)	(1.922)	(2.055)	(-0.274)	(-2.596)	(-2.748)	(-4.867)
Tangibility	0.039	0.003	0.006	-0.009	0.014	-0.018	0.011	-0.027	-0.014
	(0.319)	(0.023)	(0.048)	(-0.064)	(0.101)	(-0.119)	(0.087)	(-0.208)	(-0.101)
BKLeverage		0.229***	0.245**		0.017	-0.141		0.262**	0.311**
		(2.808)	(2.459)		(0.220)	(-1.308)		(2.381)	(2.527)
RD		-1.274	-0.761		-1.707*	-1.604*		-1.584*	-0.943
		(-1.651)	(-0.895)		(-1.967)	(-1.755)		(-1.834)	(-1.011)
Netcapex		-0.021***	-0.021***		-0.030***	-0.026***		-0.023***	-0.023***
		(-2.871)	(-2.871)		(-2.793)	(-2.952)		(-3.027)	(-3.045)
Pension/employee			0.001			0.000			0.002
			(0.468)			(0.059)			(0.644)
DIROWN			-0.007			-0.033			-0.011
			(-0.267)			(-1.076)			(-0.428)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.750	0.753	0.752	0.622	0.627	0.627	0.772	0.775	0.774
N.of Obs.	8694	8684	8658	8694	8684	8658	8694	8684	8658

Table 9. The impact of risky investment on debt value

The table presents the impact of risky investment on debt value and default probability. Financial and utility firms are excluded. Following Eisdorfer (2008), the debt value equals the implied total firm value (estimated by the Merton's (1974) model) minus equity value. Investment is defined as the amount of capital investment scaled by total asset. Exp. Volatility is defined as expected market volatility estimated by GARCH (1, 1) model using monthly market index return from year 1980 to 2007. We use expected volatility at fiscal year-end month as the annual measure of expected volatility. Definitions of other variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. Standard errors are clustered by firm and are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Change in Debt Value			Default probability		
	Whole	Low Vol.	High Vol.	Whole	Low Vol.	High Vol.
Investment	0.155	0.430**	-0.05	0.066***	0.044	0.080**
	[0.106]	[0.181]	[0.116]	[0.021]	[0.028]	[0.033]
Lag(q)	0.114***	0.096***	0.124***	-0.005	-0.002	-0.002
	[0.026]	[0.031]	[0.042]	[0.003]	[0.003]	[0.006]
Exp.Vol.	0.077			1.500***		
	[1.786]			[0.363]		
Lag(CF)	0.040***	0.012	0.041***	-0.003	-0.002	-0.002
	[0.013]	[0.022]	[0.014]	[0.002]	[0.002]	[0.003]
Size	0.275***	0.270***	0.252***	0.033***	0.022**	0.045***
	[0.036]	[0.048]	[0.045]	[0.008]	[0.011]	[0.012]
Leverage	1.314***	1.155***	1.147***	0.203***	0.195***	0.227***
	[0.097]	[0.136]	[0.116]	[0.022]	[0.028]	[0.035]
Constant	-3.571***	-3.491***	-3.272***	-0.472***	-0.289**	-0.436***
	[0.409]	[0.542]	[0.509]	[0.092]	[0.123]	[0.139]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.139	0.178	0.18	0.302	0.295	0.297
N.of Obs.	15714	8136	7578	13779	7163	6616

Table 10. Risky investment and employee deposits: investment sensitivity analysis

This table presents the effect of employee deposits on risk-taking investments during 1998-2007. Panel A uses the whole sample. Panel B divides the sample into low-leveraged firms and high-leveraged firms according to industry median leverages. Financial and utility firms are excluded. Investment is defined as the amount of capital investment scaled by total asset. Exp. Volatility is defined as expected market volatility estimated by GARCH (1, 1) model using monthly market index return from year 1980 to 2007. We use expected volatility at fiscal year-end month as the annual measure of expected volatility. Definitions of other variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. Standard errors are clustered by firm and are reported in brackets. *, ** and ***indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A	Investment					
Exp.Volatility×ED/Employee	-0.447**			-0.465**		
	[0.179]			[0.181]		
Exp.Volatility×ED/TA		-0.137**			-0.194***	
		[0.062]			[0.066]	
Exp.Volatility×EDP			-0.184			-0.228*
			[0.123]			[0.123]
q×ED/Employee				-0.006		
				[0.016]		
q×ED/TA					-0.006	
					[0.007]	
q×EDP						-0.006
						[0.005]
Cashflow×ED/Employee				-0.005		
				[0.004]		
Cashflow×ED/TA					-0.026*	
					[0.014]	
Cashflow×EDP						-0.0004***
						[0.000]
Tobin's q	-0.001	-0.001	-0.001	-0.001	-0.001	0.000
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Cash flow	0.010**	0.010**	0.010*	0.010**	0.010**	0.010*
	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]	[0.005]
Size	0.019	0.018	0.019	0.019	0.018	0.019
	[0.013]	[0.013]	[0.016]	[0.013]	[0.013]	[0.016]
BKLeverage	0.060**	0.059**	0.059**	0.060**	0.059**	0.059**
	[0.029]	[0.029]	[0.024]	[0.029]	[0.029]	[0.024]
Exp.Volatility	-0.410**	-0.435**	-0.416***	-0.410**	-0.425**	-0.414***
	[0.181]	[0.180]	[0.150]	[0.181]	[0.180]	[0.149]
ED/Employee	0.020*			0.026		
	[0.012]			[0.018]		
ED/TA		-0.003			0.006	
		[0.007]			[0.009]	
EDP Dum			-0.003			0.005
			[0.010]			[0.009]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.751	0.752	0.752	0.751	0.753	0.753
N.of Obs.	14434	14442	14442	14434	14442	14442

Panel B	Low leveraged firms			High leveraged firms		
Exp.Volatility*ED/Employee	-0.420			-0.498**		
	[0.291]			[0.232]		
Exp.Volatility*ED/TA		-0.155			-0.219**	
		[0.102]			[0.099]	
Exp.Volatility*EDP Dum			-0.035			-0.409**
			[0.236]			[0.207]
Tobin's q	-0.007	-0.007	-0.006	0.013**	0.012**	0.014***
	[0.005]	[0.005]	[0.006]	[0.005]	[0.005]	[0.005]
Cashflow	0.009	0.010*	0.009	0.003	0.003	0.003
	[0.006]	[0.006]	[0.006]	[0.004]	[0.004]	[0.004]
Size	0.002	0.003	0.003	0.028*	0.027*	0.028*
	[0.022]	[0.022]	[0.022]	[0.015]	[0.015]	[0.015]
Exp.Volatility	-0.431*	-0.447*	-0.459*	-0.18	-0.209	-0.165
	[0.260]	[0.260]	[0.264]	[0.218]	[0.217]	[0.221]
ED/Employee	0.033			0.021		
	[0.026]			[0.031]		
ED/TA		0.014			-0.009	
		[0.013]			[0.009]	
EDP Dum			-0.002			0.032
			[0.018]			[0.024]
Firm FE	YES	YES	YES	YES	YES	YES
Adj.R-sq	0.720	0.722	0.723	0.764	0.770	0.768
N.of Obs.	7080	7080	7080	7354	7362	7362

Table 11. Leverage and employee deposits

Sample period is 1998-2007. Financial and utility firms are excluded. Panel A presents the result of regressing book leverage on lagged EDP variables and other covariates. Panel B presents the result from DID regression. The dependent variable is book leverage. Treat takes the value of one for EDP firms in 2002 (1999). AFT takes the value of one for post-shock era 2004-2007.Standard errors are clustered by firm and are reported in brackets. Definitions of all variables are in Appendix. Variables are winsorized at 1% level in both tails. All yen values are in 2005 yen. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Regress BKLEV on lagged ED variables

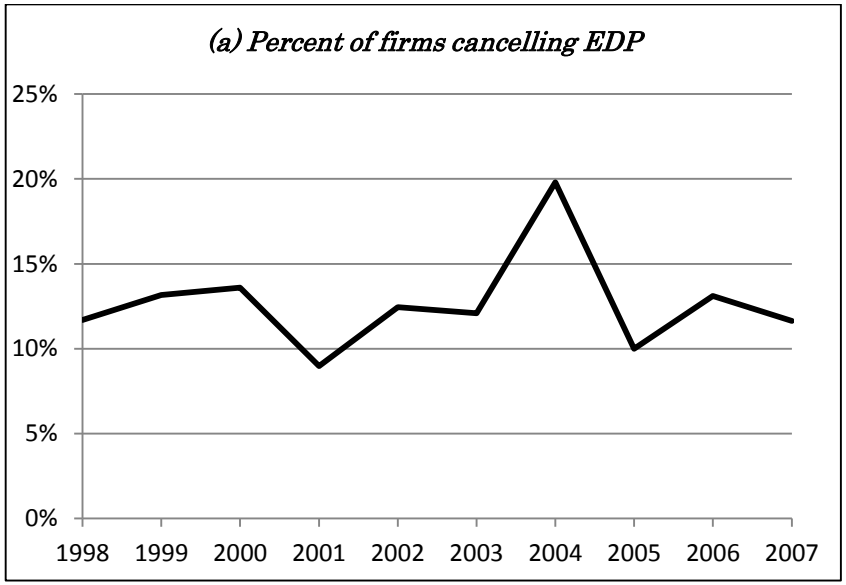
	Book Leverage					
Lag(ED/Employee)	0.009***	0.008**				
	[0.003]	[0.003]				
Lag(ED/TA)			0.003	0.001		
			[0.003]	[0.003]		
Lag(EDPDum)					0.002	0.002
					[0.005]	[0.005]
Size	0.069***	0.031***	0.070***	0.032***	0.069***	0.032***
	[0.008]	[0.004]	[0.008]	[0.004]	[0.008]	[0.004]
Tobin's q	0.002	0.001	0.002	0.001	0.002	0.001
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
ROA	-0.524***	-0.510***	-0.524***	-0.510***	-0.524***	-0.510***
	[0.079]	[0.086]	[0.079]	[0.086]	[0.079]	[0.086]
Tangibility	0.090***	0.105***	0.090***	0.105***	0.090***	0.105***
	[0.029]	[0.023]	[0.029]	[0.023]	[0.029]	[0.023]
Industry Median	0.378***	0.417***	0.378***	0.417***	0.378***	0.417***
	[0.043]	[0.036]	[0.043]	[0.036]	[0.043]	[0.036]
RD	-0.109	-0.315	-0.110	-0.317	-0.111	-0.317
	[0.304]	[0.244]	[0.302]	[0.242]	[0.302]	[0.242]
Netcapex	0.005	0.006	0.005	0.006	0.005	0.006
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Firm FE	Yes	No	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R-sq	0.891	0.248	0.891	0.248	0.891	0.248
N.of Obs.	15365	15365	15372	15372	15372	15372

Panel B. Diff-In-Diffs

	Book Leverage			
	Treat=1 for EDP02		*Treat=1 for EDP99*	
Treat*AFT	-0.009*	-0.010*	-0.012**	-0.012**
	[0.005]	[0.005]	[0.005]	[0.005]
Size	0.063***	0.064***	0.064***	0.065***
	[0.008]	[0.008]	[0.010]	[0.010]
ROA	0.005	0.004	-0.64***	-0.64***
	[0.003]	[0.003]	[0.14]	[0.14]
Tobin's q	-0.772***	-0.771***	-0.002	-0.002
	[0.047]	[0.047]	[0.003]	[0.003]
Tangibility	0.059**	0.078***	0.039	0.046
	[0.027]	[0.028]	[0.034]	[0.034]
Ind. Median	0.402***	0.401***	0.37***	0.37***
	[0.044]	[0.044]	[0.049]	[0.049]
RD		-0.075		-0.19
		[0.342]		[0.37]
NetCapex		0.008		-0.006
		[0.006]		[0.009]
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj.R-sq	0.889	0.889	0.889	0.889
N.of Obs.	14106	14076	11926	11910

Figure 1.Response of employee deposits to regime shift

Figure (1a) shows the percent of EDP firms in our regression sample that cancelled the program each year. Figure (1b) shows the means and medians of employee deposit measures for treated firms (firms offered EDP at the end of 2002) from 1997 through 2007. Definitions of all measures are in Appendix. All variables are winsorized at the 1% level in both tails. The shaded area represents the regime shift in 2003.



(b) Employee deposit measures for treated firms (EDP02)

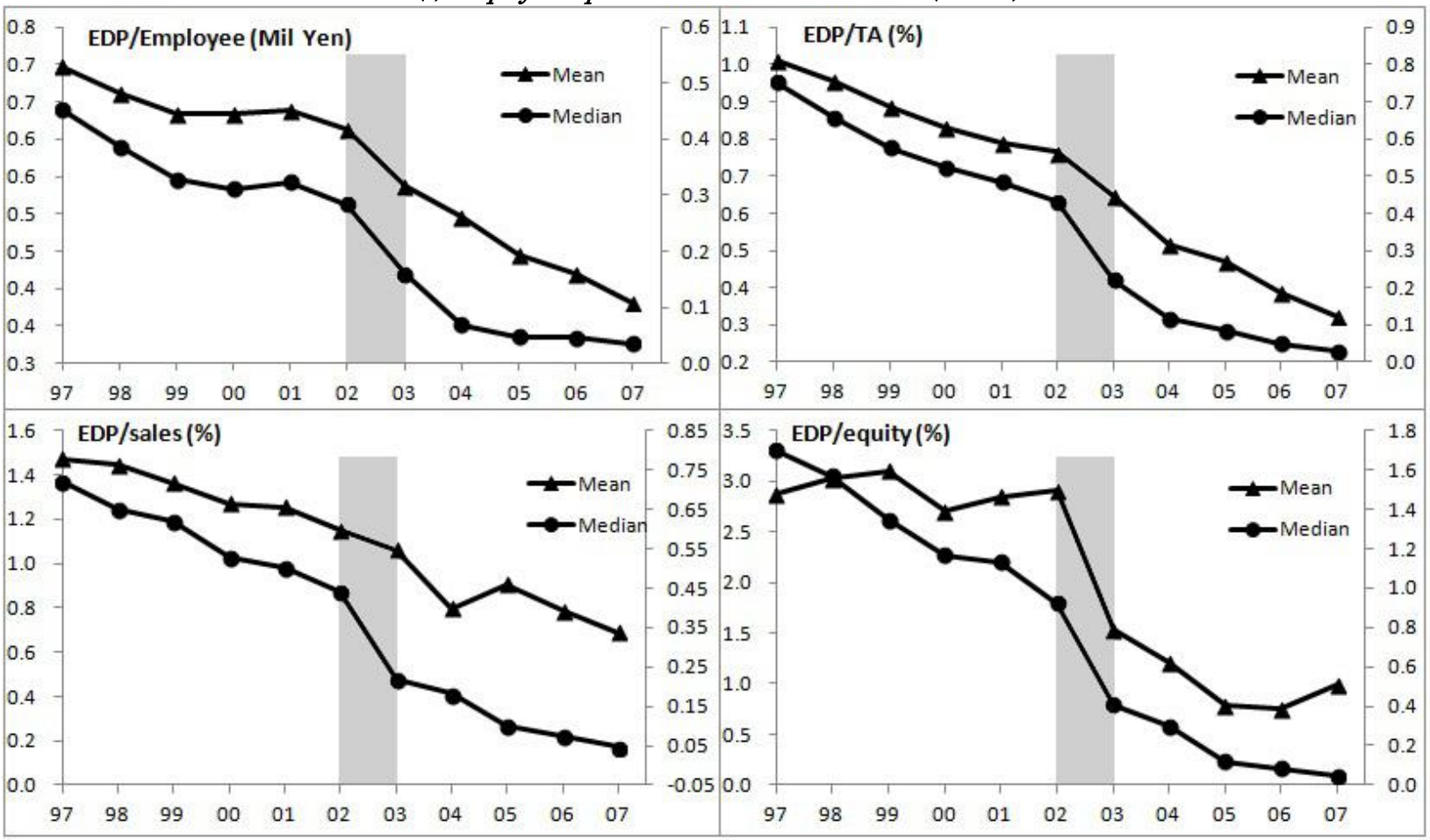


Figure 2. Check for parallel trend assumption

This figure shows the mean values of firm risk measures for both EDP and non-EDP firms from1998 through 2007. EDP refers to firms that offered EDP at the end of 2002, and is represented with solid lines. Non-EDP firms are represented with dotted lines. Definitions of all risk measures are in Appendix. All variables are winsorized at the 1% level in both tails. The shaded area represents the regime shift in 2003.

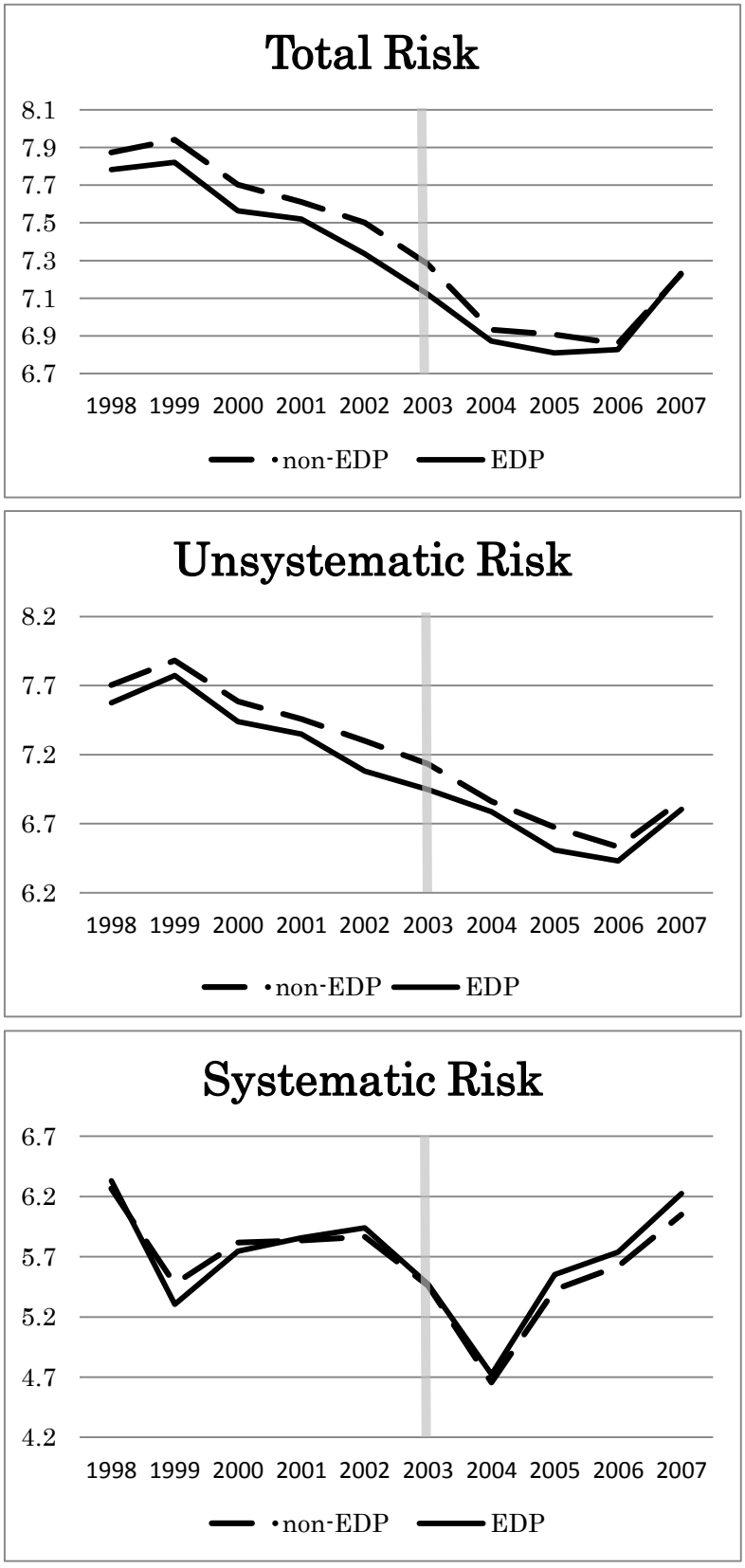


Figure 3. Percent of firms that cancelled employee deposit program (subsamples)

This figure shows the percent of two groups of EDP firms that cancelled the EDP program each year. Blue line with diamond dots are firms with ED/salary>0.5; red line with square dots are firms with ED/salary<0.5.

Figure 4. Percent of firms with ED / salary > 50%

This figure plots the percent of firms with ED / salary >50%. Blue line shows the percentage over EDP firms, and red line shows the percentage over the whole sample.