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Managing Capital via Internal Capital Market Transactions: The Case of Life Insurers

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Abstract

The movement of capital within insurance groups is important for understanding insolvency risk management, as well as regulatory policies regarding capital standards and group supervision. Panel data estimates indicate that, on average, a dollar decrease in performance (net income plus unrealized capital gains) when performance is negative is associated with a $0.26 increase in capital contributions to life insurers from other entities in the group, and that a dollar increase in performance when performance is positive is associated with a $0.56 increase in the amount of internal shareholder dividends paid by life insurers to other entities in the group. Moreover, the sensitivity of internal dividends to performance is higher during the financial crisis than the noncrisis period. Also, insurers with low (high) risk-based capital ratios receive more (less) internal capital contributions than other insurers, holding other factors constant.

Introduction

Despite a large literature on the determinants and regulation of capital held by insurance companies, there is limited research on how these institutions manage capital internally, that is, how they move capital among companies under common

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ownership.[1] Understanding the allocation of internal capital in financial institutions is important for insolvency risk assessment purposes, whether this is done by consumers, regulatory authorities, rating agencies, or internal risk managers. Understanding internal capital flows is also important for the formulation of policies regarding capital regulation and group versus company level supervision, topics that have received considerable attention since the financial crisis.[2]

The purpose of this article is to provide a peek inside insurance holding company systems to see how capital flows among the internal entities. The variables examined are motivated by a simple framework that views a holding company structure as an arrangement for allocating capital where it is most productive. The framework predicts that the flow of capital within a group, all else equal, will be inversely related to an insurer's performance. That is, when an insurer performs poorly (well) for exogenous reasons, capital will flow to (away from) the insurer. The empirical evidence, from both aggregate data and panel data, support this prediction. The negative relation between performance and internal capital flows may appear contradictory to intuition, and studies in the internal capital markets literature that indicate that capital should flow to entities that add the most value, which under plausible conditions means to entities that have performed well. The apparent discrepancy is easily resolved by the institutional context: in the life insurance industry, deterioration in a firm's capital, which follows from poor performance, is likely to be associated with reduced demand for the firm's products and a negative impact on franchise value.[3] As a consequence, for insurers whose capital is exogenously depleted (augmented), the marginal impact of additional capital on the

[1]Examples of insurer capital structure studies are Baronoff and Sager (2002), Cummins and Nini (2002), Klein, Phillips, and Shiu (2002), Harrington and Niehaus (2003), and Fier et al. (2013). The literature related to insurance groups will be reviewed below. Papers on internal capital markets in banks include Houston, James, and Marcus (1997), Houston and James (1998), Campello (2002), Holod and Peek (2010), de Haas and van Lelyveld (2010), and Cremers et al. (2011).

[2]AIG's problems during the financial crisis have led to calls for greater group-level supervision, federal regulation of insurance, and greater coordination between regulatory authorities in other countries. See Harrington (2009) for a discussion of AIG and the financial crisis; also see Committee on Financial Services (2010). The National Association of Insurance Commissioners (NAIC) identified group regulatory issues as one of the focus areas of its Solvency Modernization Initiative (see Solvency Modernization Initiative Task Force, 2013). In 2010 the NAIC modified model laws to enhance the ability of insurance regulators to "look in the window" of noninsurance affiliates. See Insurance Holding Company System Regulatory Act (Model #440) and the Insurance Holding Company System Model Regulation with Reporting Forms and Instructions (Model #450). Also, the task force has stated that it will require a group capital assessment under the Own Risk Solvency Assessment (ORSA). The Federal Insurance Office's (2013) report recommends movement toward more uniform regulation of national and global insurers and group supervision.

[3]See, for example, Epermanis and Harrington (2006) for empirical evidence on the response of premiums to ratings, and see Eling (2012) for a review of the literature on market discipline in insurance.

insurer's franchise value is high (low), and so internal capital is transferred to (away from) these insurers.

There are of course potential costs of shifting additional capital to an insurance company in a group. For example, adding capital will diminish the value of the option to default on that entity's claims. In addition, given regulatory restrictions on the ability to remove capital from insurance companies, placing capital in an insurance entity potentially diminishes the ability to reallocate that capital to better uses in future periods. Given these trade-offs, insurance groups have an incentive to allocate sufficient capital to their insurance entities to provide assurance to policyholders/rating agencies that the insurers will meet claim payments, but not put excess capital in the insurers. Instead, the group will hold excess capital in noninsurance entities so that it can be allocated to other projects. This reasoning implies that groups will transfer capital out of insurers when they are performing well and transfer capital to insurers following poor performance. This negative relationship between performance and internal capital transfers is the focus of this article.

The data are from life insurance companies from 2006 to 2011. This time period was selected so that internal capital movements during the financial crisis could be examined. As discussed by Berry-Stolzle, Nini, and Wende (2014) and Niehaus (2013), the life insurance industry, especially annuity providers, experienced lower operating income and large losses on their investments during 2008 and 2009. As a consequence, the capital cushion of many life insurers and annuity providers would have declined substantially during the crisis if not for actions that replenished capital (discussed further below), including internal capital market transactions.

I examine insurance company internal capital market transactions in the aggregate over time and using a panel data set. The aggregate data indicate substantial variation in internal capital market activity over the 6-year sample period. For example, in the 2 years before (after) the 2008–2009 financial crisis, life insurers contributed $2.7 billion ($3.0 billion) in capital to nonlife insurance entities in their group, but during the financial crisis these life insurers received $22.3 billion in capital contributions from nonlife insurance entities in their group. This evidence, along with other evidence using the aggregate time series data, suggests that internal capital markets act as a risk sharing arrangement for life insurers, where internal capital flows out of the industry during good times and into the industry during bad times. It also indicates that the capital of noninsurance entities is used in insurer capital management.

The panel data analysis indicates that internal capital market transfers (capital contributions and shareholder dividends) are related to the performance and capitalization of individual insurance companies. When life insurer performance (net income plus unrealized capital gains) is negative, a dollar decrease in performance is associated with a $0.26 increase on average in capital contributions received. When life insurer performance is positive, a dollar increase in performance is associated with a $0.56 increase in internal shareholder dividends paid, on average. Stated differently, if one just considers internal capital market transactions, life insurers augment their capital by about $0.44 for each dollar that they earn and their capital is reduced by about $0.74 for each dollar that they lose, on average. Since performance

on average would be expected to be positive, this asymmetry does not necessarily imply that capital declines over time. Indeed, if I use these two point estimates to characterize the flow of internal capital to and from a life insurer and assume a normal distribution for performance with parameters equal to those from the sample, then I find that the expected change in capital only considering internal capital flows is zero.

The sensitivity of internal dividends to performance increases significantly during the financial crisis. This finding is consistent with insurers facing greater financial constraints during this period and therefore extracting more capital from life insurers that had relatively good performance and extracting less capital from insurers that had relatively poor performance. In addition, I find that internal capital contributions are higher on average for insurers with risk-based capital ratios in the lowest decile and lower for insurers with risk-based capital ratios above the median. Overall, the sensitivity of internal capital market transactions to performance and capitalization found in the panel data is consistent with groups of companies providing an important risk-sharing mechanism for life insurance companies.

This article contributes to at least three strands of literature. First, there is a growing literature on how financial institutions responded to the financial crisis. Regarding life insurers, there are three recent papers. Koijen and Yogo (2015a) show that insurers sold policies at substantial discounts relative to actuarial value because under statutory accounting rules doing so resulted in higher reported capital during this time period. Koijen and Yogo (2015b) show that annuity providers increased their use of internal reinsurance, which increased statutory capital, during and after the financial crisis. The paper most closely related to this article is Berry-Stolzle et al. (2014), who report that life insurers raised substantial amounts of "external capital" in 2008 and 2009, where "external capital" is defined in their paper as capital from outside of the life insurance industry. However, Berry-Stolzle et al. do not identify whether this capital came from other nonlife insurance entities in the group or from external investors. This article augments the results in the Berry-Stolzle et al. paper by demonstrating that a substantial amount of the capital raised by life insurers during the financial crisis came from capital contributions from other nonlife insurance entities in their group.

Second, the analysis is related to the extensive corporate finance literature on internal capital markets. This literature examines the benefits and costs associated with giving managers the option to transfer capital across investment projects within a firm. The benefits of an internal capital market arise when headquarter managers can better allocate capital to investment projects and lower the financing costs that otherwise apply without an internal capital market (see e.g., Gertner, Scharfstein, and Stein, 1994; Stein, 1997). On the other hand, internal capital allocation could allow managers to allocate capital in ways that further their own interests and/or encourage unproductive lobbying efforts by project managers (see, e.g., Scharfstein and Stein, 2000).[4] The framework and empirical analysis in this article focuses on the comparative benefits of allocating scarce capital among entities in a group and

[4]Recent evidence highlights that subsidiary and divisional managers' connections to managers at headquarters influence capital allocation (see Glaser et al., 2013; Duchin and Sosyura, 2013).

ignores the agency issues associated with allocating capital. As discussed above, if franchise value increases with capital allocated to an entity in the group, albeit at a decreasing rate, then capital will flow into entities that would have otherwise suffered reductions in their capital base and out of entities that otherwise would have had increases in their capital base. Whether the benefits of shifting capital among entities in this way are offset by agency issues in some cases is left for future analysis.

The empirical evidence presented here for life insurance groups adds to the long list of papers that provide evidence that firms have active internal capital markets.[5] Moreover, the evidence is consistent with the prediction that internal capital flows to entities that would have otherwise suffered reductions in their capital base and out of entities that otherwise would have had increases in their capital base, which is consistent with internal capital markets providing an important risk sharing arrangement for insurance companies in a group. These findings are consistent with evidence of banking groups. For example, Cremers, Huang, and Sautner (2011) examine a large banking group and show that funds from the group are provided to member banks that experience deposit shortfalls. Campello (2002) shows that small banks that are affiliated with large groups are more insulated from negative shocks compared to unaffiliated banks.[6] In addition, I estimate the sensitivity of capital flows to performance and find an asymmetric relation. The rate at which capital flows out of insurers that perform well (via shareholder dividends) is greater than the rate at which capital flows into insurers that perform poorly. Also, I find that the sensitivity of internal dividends to performance is greater during the financial crisis than other years, consistent with greater financial constraints during this period.

Third, this article provides evidence relevant to the debate on how best to regulate insurance groups. In the United States, individual insurance companies are regulated primarily by their domestic regulator, that is, by the state in which the company is domiciled. In addition, for a group of insurance companies under common ownership that are domiciled in different states, one of the domestic regulators is designated as the lead regulator for the purpose of coordinating and fostering communication among the domestic regulators of the insurers in the group. The U.S. approach to group supervision is sometimes described as a "windows and walls" approach; that is, regulators have a window to see what is happening within the group of companies and have erected walls to prevent capital from moving out of

[5]See, for example, empirical studies by Shin and Stulz (1998), Khanna and Tice (2001), Maksimovic and Phillips (2002), Gertner, Powers, and Scharfstein (2002), and Billet and Mauer (2003). Triantis (2003–2004) and Maksimovic and Phillips (2007) provide summaries of the literature. For insurance industry studies, see Powell and Sommer (2007), Powell et al. (2008), Fier et al. (2013), Fier and McCullough (2015), and Koijen and Yogo (2015b).

[6]Also relevant is the economics literature on optimal risk sharing among entities in a group setting. These papers test whether the consumption of individual entities in a group is determined by shocks to the resources of the group as opposed to individual specific shocks. For example, Townsend (1994) examines households in Indian villages and Hayashi, Altonji, and Kotlikoff (1996) examine U.S. families.

insurance companies (DeFrain, 2012).[7] By examining the movement of capital across entities, this article provides evidence on the extent to which, and the circumstances under which, capital flows through the walls. I focus on direct capital transfers (capital contributions and shareholder dividends) among entities in life insurance groups, whereas the existing literature on internal capital markets for insurance groups generally focuses on internal reinsurance transactions, which involves a transfer of both assets and liabilities. Also, the existing literature, with the exception of Koigen and Yogo (2015b), has focused on property and liability companies.

Regarding regulatory issues, I make three observations based on the evidence presented in this article. First, capital is moved among entities within a group, which is consistent with insurance capital being managed at the group level.[8] Moreover, capital from noninsurance entities is used to manage the capital of insurers. Based on these findings, one can conclude that if capital supervision and regulation mirrored how capital is managed in practice, then supervision and regulation would be at the group level. Second, the evidence that capital is shifted to insurers that perform poorly indicates that groups view the amount of capital held by individual insurance entities in the group as being important. In other words, the overall amount of capital in the group is not all that matters. This in turn suggests that rating agencies and consumers view the insolvency put option as relevant.[9] Third, the evidence that capital flows out of insurers following good performance suggests that insurance groups are concerned about capital being "stuck" in an insurance company.

It is worth noting that insurance companies provide a useful venue for examining internal capital markets issues because insurers are required to disclose a summary of their transactions with other entities in their group each year. Even though the data have shortcomings (to be discussed below), the insurance data are from many companies in the same industry and therefore the sample companies have relatively homogenous investment opportunities.

This article proceeds as follows. In the next section, background information on insurance groups is provided. The "Conceptual Framework" section provides a simple model for thinking about internal capital market transactions in insurance groups and for motivating the empirical analysis. The "Data Description" section describes the data and discusses aggregate internal capital market transactions around the financial crisis. The "Panel Data Analysis" through "Group

[7]In contrast, under Solvency II, Europe has adopted group supervision and group capital requirements.

[8]The existing evidence from internal reinsurance provided by Powell and Sommer (2007), Powell et al. (2008), Fier et al. (2013), Fier and McCullough (2015), and Koijen and Yogo (2015b) is also consistent with capital being managed at the group level.

[9]Other studies in the literature also provide evidence that the option to allow a subsidiary to become insolvent is relevant. For example, Sommer (1996) and Phillips et al. (1998) provide evidence that premiums are lower for groups with widely dispersed liabilities among various affiliates versus concentrated in a few affiliates. This is consistent with consumers recognizing that the default option is more likely to be exercised when liabilities are dispersed among various affiliates.

Characteristics" sections present the panel data analysis. The final section summarizes and discusses implications.

BACKGROUND ON INSURANCE GROUPS[10]

Figure 1 provides an example of an organizational structure for an insurance group. Insurance companies in the group are in shaded boxes and noninsurance entities are in un-shaded boxes. In this example, the company is a stock company traded on the New York Stock Exchange. However, many of the entities in the analysis are not publicly traded.[11] Organizational charts such as the one presented in Figure 1 can be constructed using data reported by insurance companies to the NAIC starting in 2011, but not in prior years.

Regulation imposes restrictions on the transactions among companies in insurance groups. For example, state regulators must approve a change in control, be notified of the payment of ordinary dividends, and approve the payment of extraordinary dividends (defined in different ways, but usually as dividends that exceed some percentage of capital and surplus). In addition, regulators must be notified of plans to engage in material transactions with affiliates and state regulators have the authority to prevent such transactions from being conducted. In addition, the lead state regulator is responsible for assessing the overall financial condition of the group and has access to financial information of all entities in the group.[12]

As mentioned above, there is limited empirical research on how insurance groups like the one depicted in Figure 1 move capital across affiliates. Moreover, most of the existing work focuses on the use of internal reinsurance and most papers focus on property–casualty insurers. Powell and Sommer (2007) present evidence that the motivations for internal reinsurance transactions between affiliates within a group of property–liability insurers differs from the motivations for the purchase of external reinsurance. Powell, Sommer, and Eckles (2008) show that the amount of net internal reinsurance ceded to an insurer is positively related to that insurer's return on assets relative to the return of other insurers in the group, consistent with capital being allocated to the better performers in the group.[13] Fier, McCullough, and Carson (2013) present evidence that internal reinsurance is used by property–liability insurers to

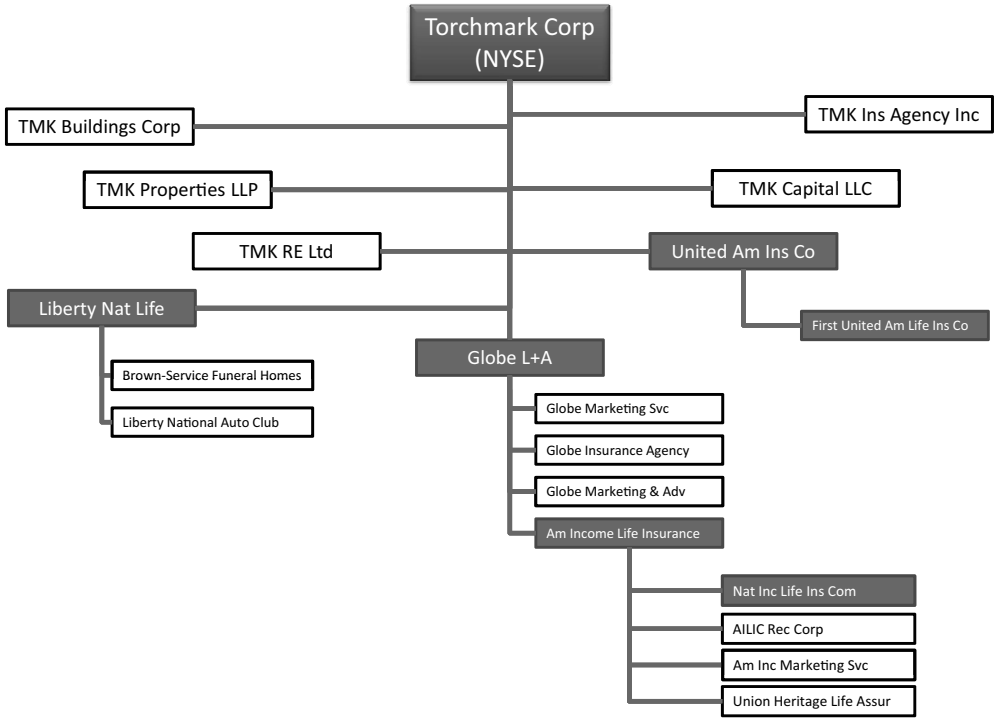
[10]See Colquitt and Sommer (2003) for background information on insurer groups. They show that group affiliation is more likely for stock insurers and for larger and more geographically diversified insurers. See Kahn and Winton (2004) for an analyses of why groups of separate companies are formed as opposed to having one larger entity.

[11]See Erhemjants and Leverty (2010) for an analysis of ownership structure in the life insurance industry, including mutual holding company structures. Laux and Muermann (2010) provide a theoretical analysis of the differences between mutual and stock companies.

[12]Aspects of (1) corporate law, (2) securities law, (3) tax law, and (4) debtor–creditor law are all pertinent to the treatment of affiliates under common ownership. See Triantis (2003–2004) for a summary.

[13]Berry-Stolzle and Liebenberg (2012) extend Powell et al. (2008) by considering how group characteristics, such as size and the parent's organizational form, influence the relation between premiums written and internal capital market flows.

FIGURE 1
Example of the Organizational Structure of an Insurance Group



reduce deviations from target capital ratios. Koijen and Yogo (2015b) provide an analysis of internal reinsurance transactions by life insurers. In contrast, this article focuses on internal capital transfers and internal shareholder dividends of life insurers, which represent a transfer of funds from one entity to another as opposed to an exchange of both assets and liabilities.

Several papers provide evidence that insolvency risk depends on whether an insurer is part of a group. Gaver and Pottier (2005) show that group information helps to explain A.M. Best ratings, and Pottier and Sommer (2011) show that group information improves insolvency predictions models. Zanjani (2010b) compares the insolvency risk of property–casualty insurers within insurance groups and finds that companies that have greater association with the flagship company (e.g., by name or through reinsurance arrangements) are more likely to fail than loosely affiliated companies.[14]

[14]At first glance, this result might seem surprising. As Zanjani (2010b) explains, if the flagship group of companies is doing well, then the group will not let a loosely affiliated entity in the group fail in fear of the repercussions to the reputation of the flagship. On the other hand, when the flagship operation is failing, the loosely affiliated entities often are spun off and survive.

There have been a number of theoretical papers that examine capital allocation and pricing for an insurer writing in different lines of business (e.g., Merton and Perold, 1993; Phillips, Cummins, and Allen, 1998; Myers and Read, 2001; Zanjani, 2010a; Ibragimov, Jaffee, and Walden, 2010). In this literature, the issue is cost allocation of a common resource—capital—across different activities. An important assumption in these papers is that capital flows freely across lines of business; consequently, the "physical" allocation of capital across separate legal entities is not addressed.[15] Stated differently, these papers consider one legal entity and how capital is "allocated" across projects within that entity. In contrast, this article examines the movement of capital across separate companies that are part of a group of companies.

Some of the trade-offs that are examined here are related to those examined by Ibragimov, Jaffee, and Walden (2013), who provide an explanation for why monoline insurance companies exist. In their model, the decision of how much capital to hold and the decision to be a monoline or a multiline company are endogenous. Their multiline company is organized as a single entity, which implies that its capital is available to cover all of the lines of business that it sells. The advantage of a multiline company therefore is the diversification of risk and the resulting efficiency in the use of capital. The advantage of a monoline company is that its performance is "walled off" and therefore cannot affect the other lines of business. In the framework presented here, the results of one insurance company in a group can be walled off from the other entities in the group, but the other entities have the option to recapitalize poorly performing insurers. Also, I take the organizational structure of a firm as given and focus on the movement of capital among the entities within the group.

CONCEPTUAL FRAMEWORK

Model With Constrained Capital

I use a simple model to clarify the assumptions and logic that motivate the empirical analysis. There are two entities in the group, a life insurer and a noninsurance entity, which can be thought of as a holding company. The group is managed to maximize the value of the group. The life insurer has a realization of capital equal to C^L and the noninsurance entity has a realization of capital equal to C^N. The question is how to allocate the fixed amount of capital $C^L + C^N$ between the two entities.[16] External capital that was previously raised is exogenous to the model and is included in $C^L + C^N$, which is assumed to be positive. Thus, the only decision is the amount of capital that is transferred from the noninsurance entity to the life insurer, which is denoted by T. Positive values of T indicate a flow of capital to the insurer and negative values indicate a flow of capital out of the insurer.

Assume that the tax and agency costs associated with holding capital internally is the same for each of the entities, and therefore these costs would influence the

[15]Phillips et al. (1998) also consider insurance groups and note that the option to allow an affiliate to default will lower the price of insurance for groups relative to a single entity that sells the same amounts and types of insurance.

[16]The model does not distinguish economic capital from reported statutory capital. Empirically, statutory accounting numbers are used.

total amount of capital, but not the allocation across the two entities. Insurance regulation restricts the flow of capital out of the insurer under some circumstances.[17] This is modeled by assuming that assets cannot be transferred out of an insolvent insurer, that is, $T \geq 0$ if $C^L \leq 0$. Other than this restriction, funds can flow freely to and from the insurance company.

The payoff to the life insurer consists of three components. First, there is the capital realized assuming unlimited liability, C^L, plus the transfer from the noninsurance entity, T. Second, there is the payoff on the default option arising from limited liability, $\text{Max}[0, -(C^L + T)]$. Third, there is the firm's franchise value, which is the value of the firm over and above the firm's tangible assets (financial capital in this model). Franchise value is the present value of expected rents on future business. I assume franchise value is a function of the amount of capital in the insurer $(C^L + T)$ and a productivity parameter f indicating other factors that increase franchise value, $F(C^L + T, f)$. Franchise value depends on capital because the expected rents and the uncertainty associated with receiving those rents depend on the likelihood that the insurer will pay its future liabilities, which in turn depends on the insurer's capital. Summing the three components gives the value of the life insurance entity:

$$C^L + T + \text{Max}[0, -(C^L + T)] + F(C^L + T, f),$$

where F(,) is zero if $C^L + T < 0$, consistent with a loss of franchise value if the insurer is insolvent. Let F_1 (F_2) be the derivative with respect to the first (second) argument, F_{11} (F_{22}) is the second derivative with respect to the first (second) argument, and F_{12} is the second cross-derivative. I assume F_1 and F_2 are positive, F_{11} is negative, and F_{12} is positive.

The noninsurance entity has a payoff that is equal to the realization of its financial capital less the capital transfer, $C^N - T$, plus the additional value it can create by allocating that capital to other projects, which is a function of its financial capital and a productivity parameter g: $G(C^N - T, g)$, where G has the same properties as F and g is the productivity parameter for the noninsurance entity. Adding the payoff from the noninsurance entity to the payoff from the insurance entity gives the total payoff to the group, P:

$$P = C^L + T + \text{Max}[0, -(C^L + T)] + F(C^L + T, f) + C^N - T + G(C^N - T, g).$$

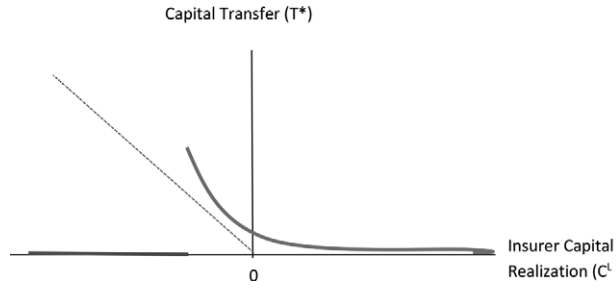
The group's objective is to choose T to maximize P.[18]

It will never be optimal for the group to default on the insurer's liabilities $(C^L + T < 0)$ and simultaneously make a capital contribution to the insurer $(T > 0)$. This is because the group would be using some of its capital to pay off insurance liabilities when those

[17]See NAIC Model Rule 440, Insurance Holding Company System Regulatory Act, 2011.

[18]Note that this framework assumes that value depends on how much capital is allocated to each entity. If the functions F and G were replaced by one concave value function that depends on total capital in the group, call it $H(C^N + C^L)$, then the capital transfer, T, would be irrelevant except for its impact on the insolvency put option.

FIGURE 2
Illustration of the Optimal Capital Transfer (T^*) as a Function of the Insurer's Capital Realization (C^L)



payments do not keep the insurer from being insolvent and that capital could create value if invested in other projects. Thus, if $C^L < 0$, then either $T^* = 0$ or $T^* > -C^L$, where the asterisk indicates the optimal value.

Assuming an interior solution, the first-order condition is $F_1(,) = G_1(,)$, which states that capital will be contributed until the marginal benefit from increasing the insurer's franchise value equals the marginal cost from decreasing the opportunity to deploy the capital elsewhere in the group. Intuitively, the group allocates capital across its projects until the marginal value created is equal across the projects. Comparative static analysis indicates that

$$dT^*/dC^L = -F_{11}/(F_{11} + G_{11}) < 0, \quad (1)$$

which implies that all else equal the capital contribution declines as the realization of insurer capital increases. Intuitively, a decrease in insurer capital (C^L), for example, a drop in net income or a decrease in unrealized capital gains, causes the marginal return on franchise value to increase, which induces the group to provide more capital to the insurer. The relationship between the optimal capital transfer (T^*) and the insurer's capital realization (C^L) is illustrated in Figure 2. Comparative statics with respect to the productivity parameter f yields

$$dT^*/df = -F_{12}/(F_{11} + G_{11}) > 0, \quad (2)$$

which implies that all else equal the capital contribution increases with the productivity parameter.[19]

[19]Other comparative statics results are $dT^*/dC^N = G_{11}/(F_{11} + G_{11}) > 0$ and $dT^*/dg = G_{12}/(F_{11} + G_{11}) < 0$. The first result indicates that additional capital for the noninsurance entity will increase the capital transfer, all else equal, and the second result indicates that an increase in the productivity parameter for the noninsurance entity reduces the capital transfer, all else equal. Given that the capital and industry of the noninsurance entities are not observable in the data, these comparative statics cannot be tested directly.

Unconstrained Capital

It is useful to consider, as a benchmark case, the allocation of capital within the group in the absence of capital constraints. Intuitively, without capital constraints, each entity in the group would obtain capital until the marginal benefit equals the marginal cost of capital. In this model, where there is no time value of money and no risk, the marginal cost of a dollar of capital is simply one dollar. Also, if capital is unconstrained, an increase in capital transferred to the insurer is not constrained to equal the negative of the capital transferred from the noninsurance entity. Thus, the first-order condition for the insurer would be $F_1(,) = 1$. Totally differentiating the first-order condition with respect to C^L yields

$$F_{11}(C^L + T, f)\ [1 + (dT/dC^L)] = 0,$$

which implies $dT^*/dC^L = -1$. That is, a shock to capital of −$1 would be associated with a transfer of capital of $1. In this setting (with no market imperfections and unconstrained capital), if an insurer experiences negative (positive) earnings or a decrease (increase) in the value of assets, there would be a transfer into (out of) that insurer equal to the amount that was lost (gained). In contrast, in the previous setting where capital within the group was constrained, the sensitivity of internal capital transfers to an insurer would be negative in sign, but less than one in magnitude (see Equation (1)).

Empirical Implementation

The empirical analysis is directed toward estimating how internal capital market transfers to and from life insurers, T^*, are related to life insurers' capital, C^L, (see Equation (1)). Two types of internal capital market transfers are examined: internal capital contributions and internal shareholder dividends. Note that both internal capital contributions and internal shareholder dividends are measured as the amount received by the life insurance subsidiaries. Consequently, the negative of internal shareholder dividends is the amount of internal shareholder dividends paid by the life insurer.

Other internal capital market transactions take place between entities in insurance groups, with internal reinsurance being an important one. However, I focus on the transactions that transfer funds from one entity to another, as opposed to transactions involving an exchange of cash for a service, such as reinsurance. See Koijen and Yogo (2015b) for an analysis of reinsurance transactions within life insurance groups and Powell and Sommer (2007), Powell et al. (2008), and Fier et al. (2013) for analyses of reinsurance transactions among property–liability insurers.

While capital could conceivably be contributed from any entity to any other entity in the group, explicit capital transfers are likely to go through the holding company.[20] Of course, the flow of internal shareholder dividends has to follow ownership

[20]Unfortunately, as will be discussed in the next section, the data do not identify the parties involved in each capital transfer; instead, I just observe the net amount transferred for each entity over the course of a year.

interests within the holding company system. Given mutual companies do not pay shareholder dividends, the sensitivity of dividends to performance for mutual companies is likely to differ from that of stock companies.

Shocks to an insurer's capital are proxied by the annual change in an insurer's net income plus unrealized capital gains (hereafter, performance). The remainder of this section discusses factors outside of the model that could influence internal capital market transfers and/or the sensitivity of internal capital transfers to performance.

Access to Capital. The model takes the capital available within the entire group as being exogenous. When groups have greater access to capital, they would have more resources to allocate among the entities in the group, and therefore would be expected to replenish a higher proportion of an insurer's lost capital than when they are more capital constrained, all else equal. As discussed above, in the extreme case of no capital costs or constraints, the model suggests that the lost capital of an insurer would be fully replenished. To the extent that groups were more capital constrained during the financial crisis than other years, groups would have fewer funds to distribute among group members and therefore the sensitivity of internal capital transfers to performance could be lower during the financial crisis, all else equal. On the other hand, greater capital constraints could have the opposite effect on the sensitivity of internal capital transfers to an insurer's performance because the constraint could cause groups to extract more funds than normal from entities with relatively good performance and less funds from entities with relatively poor performance. If this is the case, then the sensitivity of internal capital transfers to performance would be higher during the financial crisis.

Another factor that potentially increases a group's access to capital is whether the parent is publicly traded and therefore can raise capital from equity markets. Consequently, I also analyze the impact of having a publicly traded parent on the sensitivity of capital transfers to performance.

Proxies for Relative Productivity of Capital. The comparative static prediction regarding the parameter f (see Equation (2)) implies that variables that proxy for the relative productivity of capital for an insurer are expected to be positively related to the amount of internal capital transferred to the insurer. Three proxies are used in the empirical analysis for the relative value created from a capital investment in a life insurance subsidiary: (1) its past profitability (return on assets) relative to other life insurers in the group, (2) whether it has a name that is similar to the group name, and (3) its relative size. The justification for these three proxies are as follows. First, assuming persistency over time, past profitability will be related to expected future returns on investment. Powell et al. (2008) show that relative return on assets is positively related to internal reinsurance ceded by property–liability insurers. Also, Chen, Doerpinghaus, and Yu (2010) show that profitability has a positive association with franchise value. Second, there is likely to be greater damage to an institution's reputation and thus franchise value if a subsidiary with a name that is similar to the group name becomes financially distressed. Zanjani (2010b) uses similar reasoning in his analysis of bankruptcy of property–liability insurers. Third, there is likely to be greater damage to franchise value if a large life insurance subsidiary becomes

financially distressed than a small subsidiary, all else equal. Powell et al. (2008) also use relative size in their analysis of internal capital movement in the property–liability insurance industry.

Relative Versus Absolute Performance. As just mentioned, I use an insurer's performance relative to other life insurers in the group as one proxy for its marginal productivity of capital, which is consistent with Powell et al. (2008). If indeed recent relative financial performance measures productivity, then one would expect capital transfers to be positively related to recent relative financial performance (see Equation (2)). A potential problem is that recent relative performance is likely to be positively correlated with absolute performance, a variable that is predicted to be negatively related to capital transfers (see Equation (1)). To the extent that relative performance captures both capital changes and productivity differences across entities in the group, then the analysis provides evidence on which effect dominates.

DATA DESCRIPTION

Affiliate Data

The data come from the annual statements filed by life and accident and health insurance companies (hereafter, life insurers) with the National Association of Insurance Commissioners (NAIC) from 2006 to 2011.[21] The companies in the sample write a combination of life insurance, annuities, and accident and health insurance. To reduce the likelihood that insurer decisions are dictated by regulators, I eliminate companies that are inactive, that is, those that have been or are being liquidated, combined, or merged with another company, or placed in receivership. In addition, companies that have negative or zero capital and surplus, or negative or zero assets are dropped from the analysis.

To illustrate insurers' internal capital market transaction disclosures (under Schedule Y–Part 2–Summary of Insurer's Transactions with Any Affiliates) and some of their limitations, the hypothetical disclosures for a fictional insurer called LifeCo1 are presented below. The disclosures provide a summary of the net amount transacted during the year among all of the affiliates within the holding company system in which the insurer belongs. In this example, there are four other companies in the group in addition to LifeCo1: another life company (LifeCo2), a property and casualty insurer (P&CCo), and two noninsurance companies (NonInsCo1 and NonInsCo2).

Note that only insurance companies have an NAIC code. As a result, I am able to identify the affiliates that are property and casualty insurers or health insurers as those with an NAIC code that are not in the life insurer database. However, I am

[21]Property and casualty companies file a different annual statement, as do insurers whose business is almost all in the health lines, which includes hospital and medical, comprehensive, major medical, and managed care. The health lines exclude credit, disability, auto medical, workers compensation, accidental death and dismemberment, and long-term care.

not able to identify in a systematic way the type of business of the noninsurance affiliates.

Illustration of a Hypothetical LifeCo1's Disclosures Under Schedule Y–Part 2

Affiliate Name	NAIC Code	Capital Contr. Received	Shdr. Div. Received
LifeCo1	11111	700,000	−200,000
LifeCo2	11112	300,000	−100,000
P&CCo	21111	0	−400,000
NonInsCo1		−500,000	700,000
NonInsCo2		−500,000	0

It is important to highlight that the data give the net amount each company received from (positive numbers) or paid to (negative numbers) all of the other entities in the group in the form of capital contributions and shareholder dividends over the year, but the data do not identify which entities transacted with other entities. In the hypothetical example above, LifeCo1 received $700,000 in capital contributions from other entities in the group, but it does not identify how much each of the other entities contributed to LifeCo1. The $700,000 could have come from any of the other entities or some combination of them. For example, the two noninsurance entities could have each given $500,000 to the P&CCo, which in turn gave $700,000 to LifeCo1 and $300,000 to LifeCo2. Given that the data give the net amount each company received from or paid to all of the entities in the group, each of the insurers in a group should report the same numbers. For example, LifeCo2 should report the identical numbers as LifeCo1. Of course, only one of the observations is used in the analysis.

The panel data analysis is at the life insurance company level; thus, the data illustrated in the exhibit above provide two observations, one for each of the life insurance companies. For the aggregate-level analysis, the disclosures in the exhibit above are collapsed into three categories by aggregating the amounts for the life insurers, the nonlife insurers, and the noninsurance entities in the group. The following exhibit illustrates how the data in the exhibit above would be aggregated.

The collapsed data reveal that for this hypothetical group, the life insurers in the group received capital contributions from the other entities in the group equal to $1.0 million and paid $0.3 million in dividends to other entities.

Affiliate Type	Capital Contr. Received	Shdr. Div. Received
Life insurers	1,000,000	−300,000
Nonlife insurers	0	−400,000
Noninsurance entities	−1,000,000	700,000

The data require considerable "cleaning," which is described in more detail in the Appendix. There are two primary checks that are performed. First, for groups with multiple life insurers, each of the life insurers should report the same summary of intragroup transactions. I therefore check for consistency across the life insurer reports within the same group. If an insurer's reported numbers are not consistent with the reports of the majority of the life insurers in the group, I change the numbers to be consistent with the majority. For groups with one life insurer, I assume the numbers are correct. For groups that do not have consistency for a majority of the life insurers in the group, I drop the group from the sample. This process implies that all of the groups with two life insurers that have inconsistencies in their reports are dropped from the sample.

The second data check is that internal capital market transactions should sum to zero across all affiliates in the group. The exhibits above illustrate this characteristic: the sum of capital contributions across all of the affiliates equals zero. If capital contributions or shareholder dividends do not sum to zero, I attempt to identify the error in the reported data and correct it. If I cannot identify the error, then I drop the group from the sample.

Table 1 provides an overview of the sample selection process, which starts with over 800 life insurance company reports in each year from 2006 to 2011. The number of groups initially considered ranges from 436 to 506 over the sample period. After eliminating groups that either did not report consistent numbers or that reported numbers for internal capital contributions and shareholder dividends that did not sum to zero across affiliates, the sample has between 544 and 608 life insurance companies and between 290 and 321 groups over the sample period.

TABLE 1
Sample Description

	Initial Data		Sample Analyzed			
Year	# of Life Companies	# of Groups	# of Life Companies	# of Groups	# of Affiliates	Avg # of Affiliates per Group
2006	912	503	593	300	3,356	11.2
2007	907	506	594	316	3,446	10.9
2008	874	481	596	319	3,427	10.7
2009	847	460	599	316	3,736	11.8
2010	822	448	608	321	3,822	11.9
2011	806	436	544	290	3,748	12.9

Note: Data are from annual reports filed by life and accident and health insurers. Initial data include all "active" insurers, that is, those that have not been liquidated, combined or merged with another company, left the industry, or placed in receivership. In addition, companies that have negative or zero capital and surplus, or negative or zero assets, are dropped from the analysis. The sample analyzed excludes insurers without consistent reports in Schedule Y–Part 2 for a majority of reporting insurers in a group and insurers for which reported internal capital contributions and internal shareholder dividends do not sum to zero in the reporting period. See the Appendix for more detail.

The last column of Table 1 indicates that the number of affiliates per group averages between 10.7 and 12.9 over the sample period. However, the distribution of the number of affiliates per group is highly skewed. To illustrate, Panel A of Table 2 presents the frequency distribution for the number of affiliates per group in 2011. Over 50 percent of the groups have 5 or fewer affiliates, while less than 20 percent of the groups have more than 15 affiliates. In 2011, the group with greatest number of affiliates had 187 affiliates. A potential shortcoming is that the sample-selection process disproportionately eliminates groups with a large number of affiliates, as 19.2 percent of the groups in the sample in 2011 have more than 15 affiliates (see Table 3), whereas 37.5 percent of the groups in the initial data have more than 15 affiliates (not tabulated). As reported later, I examine whether the empirical results differ between large versus small groups and find that the main results are the same for the two groups. Panel B of Table 2 reports the frequency distribution for the number of life insurers in a group in 2011. The majority of groups (63.8 percent) have only 1 life insurer, 15.9 percent have 2 life insurers, and the remaining 20.3 percent of groups have between 3 and 12 life insurers.

Analysis of Aggregate Data

Figures 3a and 3b provide an overview of the net amount of internal capital market transactions between life insurers, nonlife insurers, and noninsurance entities from 2006 to 2011. The magnitude of capital contributions received by life insurers (Figure 3a) varies dramatically during the sample period. Life insurers in the sample received more than $16.7 billion of internal capital contributions in 2008 and over $5.5 billion in 2009, mostly from noninsurance entities within their groups. Figure 3b, which plots internal shareholder dividends, indicates that the internal dividends paid by life insurers were substantially lower in 2008 and 2009 relative to the years before and after the financial crisis.[22]

Figures 3a and 3b indicate that internal capital market transactions are substantial and that their magnitude varies over time based on the financial condition of insurers. More specifically, during the financial crisis, when life insurers as a group experienced losses on their investment portfolios, lower operating income, and higher values of liabilities in economic terms, internal capital contributions to life insurers increased substantially and internal shareholder dividend payments decreased substantially.

The evidence in Figure 3a augments that presented in Berry-Stolzle et al. (2014), who examine (among other issues) insurer capital changes around the financial crisis. Their evidence indicates that the life industry raised a substantial amount of capital during the financial crisis from entities that were external to the life insurance

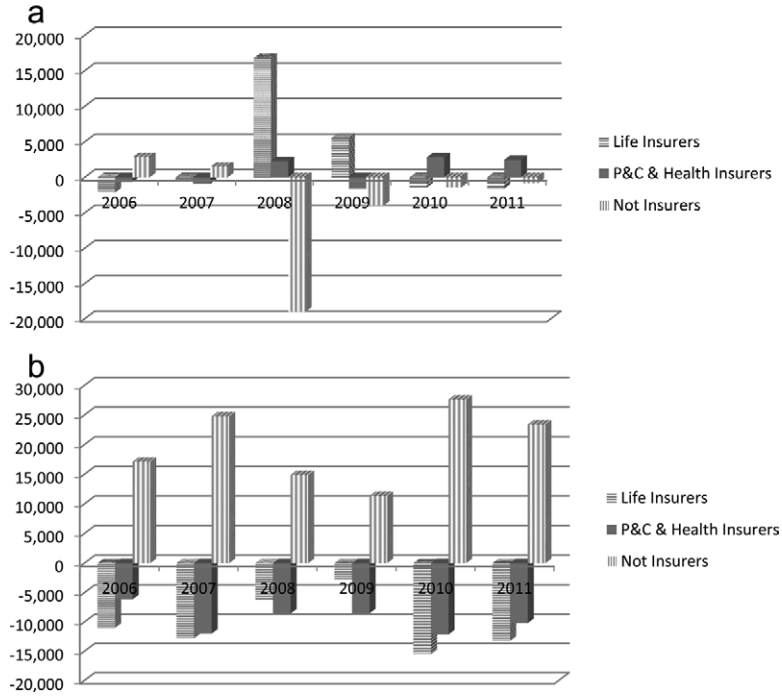
[22]The analysis here only examines internal capital contributions and internal shareholder dividends. Other internal transactions occur between entities in the group, including reinsurance. In 2008, life insurers disbursed almost $11 billion under reinsurance agreements to other entities in their groups. In 2009, life insurers received almost $16 billion in income under reinsurance agreements with other entities in their group. See Koijen and Yogo (2015b) for an analysis of internal reinsurance transactions by life insurers.

TABLE 2
Frequency Distribution for the Number of Affiliates (Panel A) and the Number of Insurers (Panel B) in Groups in 2011

Number of Affiliates in the Group	Frequency	Percent
Panel A: Frequency Distribution for the Number of Affiliates in Groups in 2011		
2	59	20.3
3	39	13.5
4	28	9.7
5	24	8.3
6	17	5.9
7	14	4.8
8	10	3.5
9	7	2.4
10	10	3.5
11	6	2.1
12	7	2.4
13	3	1.0
14	9	3.1
15	1	0.3
16–25	21	7.2
26–50	20	6.9
51–75	5	1.7
76–100	5	1.7
101–187	5	1.7
Total	290	100.0
Panel B: Frequency Distribution for Number of Life Insurers in a Group in 2011		
1	185	63.79
2	46	15.86
3	24	8.28
4	14	4.83
5	6	2.07
6	7	2.41
7	5	1.72
10	2	0.69
12	1	0.34
Total	290	100.0

industry. The evidence here indicates that life insurers received a substantial amount of capital from noninsurance entities in their group during the financial crisis. Unfortunately, neither study provides a complete picture of how much capital life insurers raised externally (from investors external to the group) during the year or how much capital they transferred from preexisting internal sources. Berry-Stolzle et al.'s (2014) measure of "external capital raised" equals the change in paid-in capital and surplus of all the insurers in a group, which includes capital transferred from noninsurance entities in the group. Thus, their definition of "external capital" is

FIGURE 3
Aggregate Internal Capital Contributions (a) and Internal Shareholder Dividends (b) Received (Positive Numbers) and Paid (Negative Numbers) for Groups That Include Life Insurers



Note: The data include all "active" life and health insurers, that is, those that have not been liquidated, combined or merged with another company, left the industry, or placed in receivership. In addition, companies that have negative or zero capital and surplus, or negative or zero assets, are dropped from the analysis. The sample analyzed excludes insurers without consistent reports in Schedule Y–Part 2 for a majority of reporting insurers in a group and insurers for which reported internal capital contributions and internal shareholder dividends do not sum to zero in the reporting period. See the Appendix for more detail. Amounts are in $millions.

capital that was supplied by entities outside of the insurance industry, not necessarily outside of the holding company system. The measure of internal capital used in this article is the capital transferred from one entity in the group to another, which could include capital that was raised externally during the year, say by the parent company.[23]

[23]Niehaus and Chiang (forthcoming) report that U.S. life insurers issued about $24.5 billion equity in 2008 and 2009; however, almost half of this amount was issued by AIG in May 2008, which is prior to their revelation of their significant losses. (AIG is not in the sample used in this article.) Niehaus and Chiang also report that life insurers issued surplus notes in 2008 and 2009 totaling $10 billion.

TABLE 3
Comparison of Internal Capital Contributions With the Total Change in Paid-in Capital and Surplus and Comparison of Internal Shareholder Dividends Received With Total Shareholder Dividend Payments for Life Insurance Companies Meeting Sample Requirements Described in Table 1

Year	# of Companies	Internal Capital Contributions	Total Change in Paid-in Capital and Surplus	Internal Shdr Dividends Received	Total Shdr Dividends Received	Internal Div as (%) of Total
2006	593	−2,155	1,761	−10,984	−16,844	65.2
2007	594	−607	4,609	−12,771	−17,723	72.1
2008	596	16,761	22,321	−6,315	−12,424	50.8
2009	599	5,553	18,191	−2,816	−5,884	47.9
2010	608	−1,425	1,166	−15,473	−20,993	73.7
2011	544	−1,637	2,919	−13,205	−19,625	67.3

To shed some light on the amount of capital raised externally versus transferred among entities within a group, Table 3 compares the aggregate internal capital contributions received by life insurance companies to their aggregate change in paid-in capital and surplus, where the latter equals the total amount of capital raised from both internal and external capital markets during the year. Aggregate paid-in capital and surplus are positive and range from $1.1 billion to $4.6 billion in each of the noncrisis years (2006, 2007, 2010, and 2011). Also, in each of these years, the aggregate value of internal capital contributions is negative, indicating that life insurers are paying out capital to other affiliates. In the crisis years (2008 and 2009), however, aggregate paid-in capital increases substantially to over $18 billion in each year, and as noted above, aggregate internal capital contributions are positive. The internal capital received accounts for a substantial share of the total paid-in capital and surplus: 75.1 percent in 2008 and 30.5 percent in 2009. These percentages represent an upper bound on how much of the capital received by insurers was from internal sources.[24]

Table 3 also compares the aggregate internal shareholder dividends paid by life insurers to other entities in the group with the total amount of shareholder dividend payments to both internal and external shareholders. The discussion above highlights that internal shareholder dividends dropped during the crisis for life insurers in aggregate. The data in Table 3 indicate that total shareholder dividends also dropped during 2008 and 2009. The last column of Table 3, however, indicates that the ratio of internal shareholder dividend payments to total shareholder dividend payments

[24]Using group-level data, I also calculated the Spearman correlation coefficients between internal capital contributions and total paid-in capital for each year of the sample period. The correlation coefficients for the years 2006–2011 are 0.54, 0.38, 0.59, 0.56, 0.40, and 0.28, respectively. The higher correlation coefficients in 2008 and 2009 relative to 2007, 2010, and 2011 suggest that internal capital contributions were more important during the financial crisis.

declines in 2008 and 2009, which suggests that internal dividends are more sensitive to performance than external dividends.[25]

Overall, the aggregate data on internal capital market transactions between life insurers and their affiliates suggest that the affiliates provide capital to life insurers when they experience reductions in capital from operations, both by making capital contributions and by allowing insurers to reduce dividend payments.

PANEL DATA ANALYSIS

Baseline Regressions

The main focus of the panel analysis is to measure the sensitivity of internal capital market transactions to life insurers' performance and capitalization. Thus, equations of the following form are estimated:

$$(\text{ICM})_{it} = \alpha + \beta_1 (\text{Performance})_{it} + \beta_2 (\text{Capitalization})_{it-1} + \beta_3 (\text{Controls})_{it} + \kappa_i + \lambda_t + \varepsilon_{it},$$

where ICM equals either internal capital contributions or internal shareholder dividends received divided by assets for insurer i during year t, Performance is a vector of variables measuring the insurer's performance during year t, Capitalization is a vector of variables measuring the capital of the insurer at the end of the prior year (beginning of year t), Controls is a vector of control variables, and κ and λ are fixed firm and year effects. The standard errors in the linear regression models are calculated allowing for clustering at the group level.

Performance is measured by net income plus unrealized capital gains divided by assets. Net income summarizes the insurer's operating performance, including realized capital gains, and unrealized capital gains measures the investment performance of the insurer's assets, not incorporated into net income. I allow the responsiveness of the internal capital market transactions to performance to depend on whether performance is good or bad by defining Neg_Perf (Pos_Perf) equal to net income plus unrealized capital gains divided by assets if net income is negative (positive), and zero otherwise. Using the mean or median value instead of zero as the knot in the two-segment linear spline does not change the main results, nor does using quartiles to define a four-segment linear spline.

The capitalization of an insurer is measured using its prior year-end risk-based capital ratio, RBC. The risk-based capital ratio equals the insurer's total adjusted capital divided by its "authorized control-level risk-based capital," where the latter variable is a measure of capital that is "needed" given the insurer's risk. If this ratio falls below 2, then regulatory action is required. Insurer ratings, which in turn affect consumer demand, are sensitive to risk-based capital (Koijen and Yogo, 2014b). I utilize capitalization measures that are relative to other firms in the industry. Specifically,

[25]The financial crisis does not appear to have had a major impact on aggregate policyholder dividends. Instead, there is a downward time trend for aggregate policyholder dividends during the sample period, with values for the years 2006–2011 equal (in $billions) to 14.1, 15.6, 14.6, 13.3, 13.4, and 10.5, respectively.

LowRBC equals one if the insurer's RBC is below the 10th percentile value for the year, and zero otherwise, and HighRBC equals one if the insurer's RBC is above the median value for the year, and zero otherwise. I also used absolute RBC ratios to define LowRBC (less than 4) and HighRBC (greater than 8) and found similar results. Finally, I control for firm size by including the natural logarithm of total assets (LogAssets) in the equations.

To reduce the influence of outliers, I winsorize each of the variables at the 1 and 99 percentile levels by year. Table 4 provides descriptive statistics of the main variables used in the analysis. While the average value for internal capital contributions and internal shareholder dividends is small (0.9 percent and −1.5 percent of assets), there is considerable variation in these variables across companies and time. The overall standard deviations for the ratios of internal capital contributions to assets and internal shareholder dividends to assets are 5.1 and 6.0 percent, the between standard deviations are 3.8 and 4.2 percent (unreported), and the within standard deviations are 3.8 and 4.6 percent (unreported). A noteworthy aspect about the internal capital market variables is that the 25th and 75th percentile values for internal capital contributions are zero in each year and that the 50th and 90th percentile values for internal shareholder dividends are zero in each year (not reported in the table). I address this issue after presenting the baseline regressions.

Net Income plus unrealized capital gains to assets (Performance) has an average value of 1.3 percent and a standard deviation of 5.9 percent. The distribution of risk-based capital ratios (RBC) is highly skewed as the mean value is 45.8 and the median value is 9.7. Not reported in the table, the 10th percentile value is 4.7.

TABLE 4
Descriptive Statistics for the Variables Used in the Panel Data Analysis

Variable	Mean	Median	Std Dev	Min	Max
Cap_Contr	0.009	0.000	0.051	−0.094	0.485
Shdr_Div	−0.015	0.000	0.060	−0.791	0.077
Performance	0.013	0.009	0.059	−0.389	0.275
Neg_Perf	−0.011	0.000	0.035	−0.389	0.000
Pos_Perf	0.025	0.009	0.041	0.000	0.275
RBC	45.8	9.7	176.7	1.2	2,627.9
LowRBC	0.1	0.0	0.30	0.0	1.0
HighRBC	0.5	1.0	0.5	0.0	1.0
Total Assets ($billion)	6.8	0.2	25.5	0.0003	159
LogAssets	19.318	19.248	2.823	12.797	25.794

Note: Cap_Contr is the value of internal capital contributions received (negative numbers indicate amount paid) divided by total assets; Shrd_Div is the value of internal shareholder dividends received (negative numbers indicate amount paid) divided by total assets; Performance equals net income plus unrealized capital gains divided by total assets; Neg_Perf (Pos_Perf) equals performance if performance is negative (positive), and zero otherwise; RBC is the reported total adjusted capital divided by authorized control level risk-based capital; LowRBC equals one if the insurer's RBC is below the 10th percentile value for the year, and zero otherwise; HighRBC equals one if the insurer's RBC is above the median value for the year, and zero otherwise; and LogAssets is the natural logarithm of Total Assets. All variables are winsorized at the 1 and 99 percentile values by year. The number of observations is 3,330.

The first column of Table 5 presents the baseline panel regression results for internal capital contributions (Cap_Contr). The coefficients on Neg_Perf and Pos_Perf are negative and statistically significant. However, the estimated sensitivity to negative performance is over three times larger than the sensitivity to positive performance. Moreover the difference in coefficients is statistically significant at the 0.10 level, indicating that capital contributions are more sensitive to negative performance than positive performance. When performance is negative, a dollar decline in performance is associated with $0.26 in additional capital contributions received, on average. In contrast, when performance is positive, a dollar increase in performance is associated with a $0.07 decrease in capital contributions received, on average. Absent other adjustments in capital, such as raising external capital (Berry-Stolzle et al., 2014), selling additional policies (Koijen and Yogo, 2014a), reducing dividends (see below and Berry-Stolzle et al., 2014), the results in the first column of Table 5 indicate that

TABLE 5
Panel Data Regressions of Internal Capital Market Variables

	Dependent Variables			
	Cap_Contr	Shdr_Div	Cap_Contr	Shdr_Div
Neg_Perf	−0.26 (0.10)***	0.09 (0.06)	−0.33 (0.14)**	0.16 (0.14)
Pos_Perf	−0.07 (0.04)*	−0.56 (0.16)***	−0.20 (0.09)**	−0.81 (0.22)***
LowRBC × 100	1.23 (0.61)**	0.23 (0.56)	1.99 (0.93)**	0.72 (1.19)
HighRBC × 100	−0.61 (0.30)**	−0.26 (0.46)	−0.88 (0.48)*	−0.31 (0.71)
LogAssets × 100	0.98 (0.59)*	1.56 (0.56)***	1.69 (1.03)*	2.85 (0.96)***
2007 × 100	0.21 (0.29)	0.01 (0.25)	0.38 (0.52)	−0.11 (0.42)
2008 × 100	−0.56 (0.23)**	−1.60 (0.49)***	−1.01 (0.39)***	−2.55 (0.76)***
2009 × 100	−0.19 (0.21)	−0.29 (0.32)	−0.46 (0.38)	−0.48 (0.49)
2010 × 100	−0.28 (0.27)	−0.28 (0.29)	−0.61 (0.47)	−0.37 (0.48)
2011 × 100	−0.55 (0.25)**	−0.58 (0.37)	−1.02 (0.44)**	−0.88 (0.58)
Constant	−0.18 (0.11)	−0.30 (0.11)***	−0.32 (0.21)	−0.56 (0.19)***
Sample	All	All	Cap_Contr ≠ 0 in each yr	Shdr_Div ≠ 0 in each yr
N	3,330	3,330	1,826	2,022
# of companies	712	712	384	414
Adj R^2	0.30	0.32	0.30	0.34

Note: The dependent variable is either internal capital contributions (Cap_Contr) or internal shareholder dividends received (Shdr_Div) divided by total assets. Cap_Contr is the value of internal capital contributions received (paid) divided by total assets; Shrd_Div is the value of internal shareholder dividends received (paid) divided by total assets; Neg_Perf (Pos_Perf) equals performance if performance is negative (positive), and zero otherwise, where Performance equals net income plus unrealized capital gains divided by total assets; LowRBC equals one if the insurer's RBC is below the 10th percentile value for the year, and zero otherwise; HighRBC equals one if the insurer's RBC is above the median value for the year, and zero otherwise; and LogAssets is the natural logarithm of total assets. All variables are winsorized at the 1 and 99 percentile values by year. The time period is from 2006 to 2011. Coefficients are reported with standard errors in parentheses. Standard errors are calculated allowing for clustering by group. ***, **, * indicate statistical significance at the 0.01. 0.05, and 0.10 levels, respectively.

groups replenish capital lost due to poor performance using internal capital transfers at a rate of about $0.26 per dollar lost, on average.

Capital contributions are also related to the initial capital positions of insurers, as both of the dichotomous risk-based capital variables have statistically significant coefficients. Holding other factors constant, the estimates indicate that an insurer with a low risk-based capital ratio receives 1.23 percent of assets more in internal capital contributions. On the other hand, an insurer with a high risk-based capital ratio receives 0.61 percent of assets less in internal capital contributions, all else equal. This is consistent with internal capital contributions being used to shore up the capital positions of insurers with low capital. Two of the year effects have significant coefficients. In years 2008 and 2011, lower capital contributions are provided to life insurers relative to other years, holding other factors constant.

Column 2 of Table 5 indicates that, in contrast to capital contributions, internal shareholder dividends received are more sensitive to positive performance than negative performance. When performance is positive, a dollar increase in performance is associated with a $0.56 decrease in internal shareholder dividends received (or a $0.56 increase in the dividends paid). However, when performance is negative, internal shareholder dividends are positively related to performance and the coefficient is statistically different from the coefficient on the positive performance variable. The evidence does not indicate that internal shareholder dividends are related to insurers' risk-based capital ratios. The year fixed effects indicate that, all else equal, internal shareholder dividends received by life insurers are lower in 2008 and 2011.

A potential concern with the baseline panel regressions is that some of the insurers do not utilize internal capital transfers or internal dividend transactions throughout the sample period. This could reflect the group's policy or structure rather than an annual choice based on its financial circumstances. I therefore re-estimate the equations after excluding companies that have a zero value in all of the years in which they are in the panel. The results, which are reported in columns 3 and 4 of Table 5, should be interpreted as the expected internal capital contribution (shareholder dividend) conditional on the insurer using internal capital contributions (shareholder dividends) in at least 1 year during the sample period.[26] Not surprisingly, the

[26]I investigated the possibility of using a selection model in which a first-stage equation estimates the likelihood of using internal capital transfers in a given year and the second-stage equation estimates the amount transferred. However, several problems developed. First, there is the issue of finding an appropriate instrument to identify the system. I considered the natural logarithm of the number of affiliates in the group, but it was not significant in explaining the likelihood of internal capital transfers. I also tried a dichotomous variable indicating whether capital was transferred in the prior year. It was statistically significant in explaining the likelihood of capital transfers; however, I lose a year of data with this approach. Second and more importantly, a panel selection model estimates the second stage ignoring all of the observations with zero values for the dependent variable, even if the insurer had nonzero values for the dependent variable in other years. This approach therefore ignores the information that the group decided not to use internal capital transfers in a particular year when we know they use internal capital transfers in other years. Using this information seemed more important than the potential selection bias, and therefore, I did not pursue the selection model.

estimated sensitivities of capital contributions and shareholder dividends to each of the explanatory variables increases relative to the regressions reported in columns 1 and 2. Notably, a $1 increase in performance when performance is positive is associated with a decrease of $0.81 in shareholder dividends received (or a $0.81 increase in dividends paid), on average. Another difference in results between the full versus restricted samples is that the sensitivity of capital contributions to negative performance is not statistically different from the sensitivity to positive performance.

The estimations discussed above include mutual companies, which comprise only 5.3 percent of the sample. Since mutual companies do not pay shareholder dividends, it is important to control for the impact of being a mutual company in the shareholder dividend equation. I also explore whether internal capital contributions for mutual companies differs from that of stock companies. Specifically, I interact a dichotomous variable (Mutual) indicating that the company is a mutual with each of the performance variables in both the capital contribution and shareholder dividend equations. Table 6 presents the coefficients on the performance variables; the other variables are included in the equation as well, but I do not report the estimated coefficients to conserve space. The coefficient estimate on each of the interaction variables is statistically significant and opposite in sign of the coefficient on the performance variable. Moreover, for both the capital contribution and the shareholder dividend equations, I cannot reject that the sum of the coefficients on the Neg_Perf variables equal zero, nor can I reject that the sum of the coefficients on the Pos_Perf variables equal zero. These results imply that for mutual companies, neither shareholder dividends nor internal capital transfers are sensitive to performance. Therefore, I exclude mutual companies in all of the subsequent analysis (although including mutuals would not change the reported results materially).

To summarize the baseline regression results, the amount of internal capital contributions received by life insurers is (1) negatively related to performance, (2) higher for insurers with low risk-based capital ratios, and (3) lower for insurers with high risk-based capital ratios. The amount of internal dividends paid by life insurers to other entities in their group increases with good performance.[27]

[27]I also estimated logit models to examine the determinants of (1) the likelihood that an insurer receives an internal capital contribution and (2) the likelihood that an insurer pays out internal shareholder dividends. For space reasons, I simply summarize the results here. Fixed effects are included in the logit models, so only insurers that had a change over the sample period in the dichotomous dependent variable are included in the analysis. The results indicate that the likelihood that life insurers receive internal capital transfers significantly increases (both in economic and statistical terms) with poor performance and if insurers have low risk-based capital ratios. The likelihood that life insurers pay internal shareholder dividends significantly (1) increases with good performance, (2) increases when insurers have high risk-based capital ratios, and (3) decreases when insurers have low risk-based capital ratios.

TABLE 6
Panel Data Regressions of Internal Capital Market Variables—Impact of Mutual Insurers

	Capital Contributions	Shareholder Dividends
Neg_Perf	−0.27 (0.10)***	0.09 (0.06)
Neg_Perf × Mutual	0.33 (0.17)*	−0.16 (0.10)
Sum of Coefficients	0.06	−0.07
F-statistic	0.22	0.60
p-value	0.63	0.44
Pos_Perf	−0.08 (0.04)*	−0.57 (0.17)***
Pos-Perf × Mutual	0.11 (0.07)*	0.49 (0.15)***
Sum of Coefficients	0.03	−0.08
F-statistic	0.47	1.54
p-value	0.49	0.23

Note: The regression equations are the same as the baseline equations in Table 5 except the performance variables are interacted with a dichotomous variable Mutual, which equals one if the life insurer is a mutual insurer, and zero otherwise. Only the coefficient on the performance variables are reported. In addition, the results of an *F*-test for whether the sum of the coefficients on the Neg_Perf variables equals zero and whether the sum of the coefficient on the Pos_Perf variables equals zero. *** and * indicate statistical significance at the 0.01 and 0.10 levels, respectively.

Do Sensitivities Change During the Financial Crisis?

The systematic drop in asset values and the disruptions in capital markets during the financial crisis could have imposed additional capital constraints on financial holding company systems. If so, the amount of capital that was available to transfer to poorly performing entities would have been more constrained than in other periods. The greater constraints could decrease the sensitivity of internal capital transfers to performance because groups have fewer funds to allocate. Alternatively, the greater constraints could increase the sensitivity to performance because groups extract more (less) funds than normal from entities with relatively good (poor) performance; that is, they rely more on redistributing funds among entities in the group. To investigate these potential effects, I include in the regression analysis interactions between the performance variables and a financial crisis dummy variable (FC), which takes the value of one in years 2008 and 2009, and zero otherwise.

The results are presented in Table 7 for the nonmutual company sample (columns 1 and 2) and the restricted sample of nonmutual life insurers that have at least 1 year of nonzero capital contributions (column 3) or dividends (column 4). For internal capital contributions, the coefficients on the financial crisis interaction variables are not statistically significant, indicating that the sensitivity of internal capital contributions to performance was not different during the financial crisis than in other years. This is consistent with Berry-Stolzle et al.'s (2014) finding that the ability of life insurers to

TABLE 7
Panel Data Regressions of Internal Capital Market Variables—Impact of the Financial Crisis

	Dependent Variables			
	Cap_Contr	Shdr_Div	Cap_Contr	Shdr_Div
Neg_Perf	−0.28 (0.14)**	0.09 (0.07)	−0.33 (0.17)**	0.13 (0.17)
Neg_Perf_FC	0.02 (0.14)	−0.02 (0.06)	−0.01 (0.17)	−0.10 (0.15)
Pos_Perf	−0.07 (0.05)	−0.39 (0.11)***	−0.19 (0.09)**	−0.59 (0.16)***
Pos_Perf_FC	−0.02 (0.05)	−0.44 (0.18)**	−0.13 (0.11)	−0.50 (0.21)**
LowRBC × 100	1.31 (0.65)**	0.44 (0.55)	2.09 (0.97)**	0.91 (1.10)
HighRBC × 100	−0.59 (0.32)*	−0.22 (0.48)	−0.86 (0.51)*	−0.27 (0.74)
LogAssets × 100	1.02 (0.61)*	1.51 (0.55)***	1.79 (1.09)*	2.79 (0.98)***
2007 × 100	0.24 (0.31)	0.09 (0.26)	0.46 (0.57)	0.00 (0.43)
2008 × 100	−0.52 (0.31)*	−0.57 (0.45)	−0.91 (0.52)*	−1.16 (0.73)
2009 × 100	−0.16 (0.28)	0.86 (0.50)*	−0.32 (0.48)	1.03 (0.71)
2010 × 100	−0.32 (0.29)	−0.25 (0.30)	−0.71(0.50)	−0.32 (0.49)
2011 × 100	−0.59 (0.27)**	−0.47 (0.38)	−1.12 (0.49)**	−0.71 (0.59)
Constant	−0.18 (0.12)	−0.29 (0.10)***	−0.34 (0.22)	−0.55 (0.19)***
Sample	All	All	Cap_Contr ≠ 0 in each yr	Shdr_Div ≠ 0 in each yr
N	3,132	3,132	1,693	1,916
# of companies	677	677	359	396
Adj R^2	0.30	0.34	0.30	0.36

Note: In addition to the variables defined in Table 5, the regressions include Neg_Perf_FC (Pos_Perf_FC), which equals performance if performance is negative (positive), and zero otherwise, times a dummy variable that takes a value of one for the financial crisis period (2008 and 2009), and zero otherwise, where Performance equals net income plus unrealized capital gains divided by total assets. All variables are winsorized at the 1 and 99 percentile values by year. The time period is from 2006 to 2011. Mutual companies are omitted from the analysis. Coefficients are reported with standard errors in parentheses. Standard errors are estimated allowing for clustering at the group level. ***, **, * indicate statistical significance at the 0.01. 0.05, and 0.10 levels, respectively.

replace capital depleted by operating losses was not significantly different during financial downturns versus other periods.

However, for internal shareholder dividends, the negative coefficient on the variable that interacts positive performance with the financial crisis dummy variable is statistically and economically significant. The results indicate that the sensitivity of internal shareholder dividends to positive performance during the financial crisis is about twice the sensitivity during the other years. These results are consistent with insurance holding company systems being constrained during the financial crisis, but that they relaxed the constraint (at least to some extent) by increasing the internal dividends paid by the insurers in the group that had relatively good performance

during the crisis and decreasing the internal dividends paid by insurers with relatively poor performance.[28]

I also estimate the model omitting 2008. For space reasons, I do not report the table and instead just summarize the findings, which corroborate the results reported above. For the capital contribution equation, omitting 2008 does not impact the estimated coefficients materially. For the shareholder dividend equation, omitting 2008 lowers the estimated coefficient on the positive performance variable. This finding is consistent with the findings above that the sensitivity of internal shareholder dividends to performance was greater during the financial crisis.

INSURER SUBSIDIARY CHARACTERISTICS

All else equal, the amount of internal capital transferred to an insurance subsidiary should increase with the marginal value of the capital investment. In this section, I examine three characteristics of insurers that potentially proxy for the relative value of one insurance subsidiary versus another insurance subsidiary in the same group. Consequently, for this analysis, I only include groups with two or more life insurers. As explained earlier, the three proxy variables are relative operating performance, relative size, and whether the subsidiary has a name that is the same or close to the name of the group to which the insurer belongs.

Regarding the impact of relative operating performance, one might expect that the better performing subsidiaries would be rewarded with additional capital. On the other hand, as analyzed in the conceptual framework, the marginal value of shoring up the capital base of poor relative performers could also be important. Relative operating performance is measured using the difference between the operating performance of the insurer minus the average performance of all of the life insurers in the group in the prior year (see e.g., Powell et al., 2008), where operating performance equals operating income before taxes and policyholder dividends divided by total assets. In addition, I also calculate the operating performance rank of each insurer in the group and then divide the rank by the number of insurers in the group to obtain an ordinal performance measure that is between zero and one. The operating performance variables are called Rel_OpInc and Rank_OpInc, respectively.

[28]I also investigated whether the sensitivities of capital contributions and shareholder dividends to performance depend on the insurer's capitalization by interacting the performance variables with LowRBC and HighRBC. If a low RBC ratio is associated with a greater return and a high RBC ratio is associated with a lower return on capital invested in the insurer, then the magnitude of the sensitivity of capital contributions to poor performance (net income and unrealized capital gains) should be greater when an insurer has a low RBC ratio, and the magnitude of the sensitivity of shareholder dividends to positive performance should be greater when an insurer has a high RBC ratio. I tried various specifications due to concerns that interacting the RBC variables with performance along with having the dichotomous RBC variables in the equation would cause collinearity problems. Regardless of the specification, the results indicate that the coefficients on the interaction variables were not statistically significant.

A potential concern is the correlation between the relative operating performance variables and the absolute performance variables that are included in the regressions. The correlation coefficients between absolute performance and the two relative operating performance variables are 0.34 and 0.23, respectively.

Relative size is measured by dividing the insurance subsidiary's total assets by the sum of the total assets of all of the life insurance subsidiaries in the group and is called Prop_Grp_Assets (Powell et al., 2008). Larger subsidiaries are likely to be more important to the overall franchise value, which would suggest that they would receive greater capital transfers. On the other hand, smaller subsidiaries being less diversified may rely more on capital transfers. The mean and standard deviation of Prop_Grp_Assets are 31 and 35 percent, respectively.

The third insurer characteristic is a dichotomous variable called Common_Name that takes a value of one if the insurance subsidiary has a name that is either the same or directly related to the group name. The motivation for this variable is that having a financially distressed subsidiary with the same name as the group name would likely be associated with greater reputational cost than if the insurer had an unrelated name (Zanjani, 2010b). A total of 41.5 percent of the companies in the sample have a name that is directly related to the group name.

Table 8 presents the results when the three insurer characteristics are included in the fixed effects regressions for capital contributions and shareholder dividends. The coefficient estimates on the relative operating income variables are either insignificantly different from zero or negative. Thus, it appears that the value associated with adding capital to companies that have performed poorly dominates the effect of allocating capital to companies that have better relative operating performance. The coefficient estimates on the relative size variable are negative and statistically significant in the capital contribution equations, suggesting capital is more likely to be transferred to smaller insurance subsidiaries than large ones, all else equal. None of the coefficients on the common name variable are statistically significant. The coefficient estimates and statistical significance of the other variables in the model are similar to those reported above.[29]

GROUP CHARACTERISTICS

In this section, I examine the sensitivity of the results to three group characteristics: (1) whether the group has a publicly traded parent (PUBLIC), (2) the number of affiliates in the group, and (3) the number of life insurers in the group. Having a publicly traded parent arguably gives the group greater access to capital. The number of affiliates and the number of life insurers measure group size, which could influence internal capital market transfers. One possibility is that small groups are less likely to have the diversification and resources to engage in significant internal capital transactions. On the other hand, internal capital transfers can be conducted with just two entities, and so a large number of entities is not necessary for an active internal capital market. In

[29]Interacting the performance variables with a financial crisis indicator variable as was done in earlier tables does not change the results with respect to the subsidiary characteristics.

TABLE 8
Panel Data Regressions With Insurer Subsidiary Characteristics

	Dependent Variables			
	Cap_Contr	Cap_Contr	Shrd_Div	Shdr_Div
Common_Name	0.00 (0.01)	0.00 (0.01)	−0.00 (0.02)	−0.00 (0.02)
Prop_Grp_Assets	−0.02 (0.01)**	−0.02 (0.01)*	0.00 (0.02)	0.00 (0.02)
Rank_OpIinc	0.00 (0.01)		−0.01 (0.01)	
Rel_OpInc		−0.18 (0.07)**		−0.01 (0.10)
Neg_Perf	−0.28 (0.12)**	−0.27 (0.12)**	0.16 (0.11)	0.16 (0.11)
Pos_Perf	−0.07 (0.05)	−0.04 (0.05)	−0.71 (0.25)***	−0.71 (0.25)***
Low_RBC × 100	1.65 (0.90)*	1.53 (0.90)*	0.08 (0.91)	−0.11 (0.89)
High_RBC × 100	−0.53 (0.42)	−0.42 (0.43)	−0.72 (0.70)	−0.73 (0.69)
Log_Assets × 100	0.34 (0.50)	0.23 (0.50)	2.00 (0.70)***	2.02 (0.70)***
Constant	−0.06 (0.10)	−0.03 (0.10)	−0.38 (0.13)***	−0.39 (0.14)***
Adj R^2	0.31	0.33	0.34	0.34

Note: The dependent variable is either internal capital contributions (Cap_Contr) or internal shareholder dividends received (Shdr_Div) divided by total assets. Rel_OpInc is the difference between the prior year's operating income before policyholder dividends and taxes divided by assets and the average for life insurers in the group. Rank_OpInc is the rank of the insurer's operating performance in the group (lowest equals one) divided by the number of life insurers in the group. Common_Name equals one if the insurer's name is closely related to the group name, and zero otherwise. All other variables are defined as in Table 5. Fixed firm and year effects are included in each regression. Standard errors are calculated allowing for clustering at the group level and reported in parentheses. The time period is from 2006 to 2011. Only groups with two or more life insurers are included and mutual companies are excluded. The number of observations is 2,023 and the number of companies is 481. ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

addition, as reported earlier, there is a concern that the sample-selection process disproportionately omits large groups. Consequently, an analysis of the impact of group size can provide evidence on whether the results are generalizable.

Intuition, as well as estimated correlations, suggest that the three group characteristics are positively correlated. Table 9 presents the mean values and the Spearman correlation coefficients between the three characteristics, plus two dichotomous variables used in the analysis to divide the sample. AFF_GTE10 equals one if the number of affiliates in the group is greater than or equal to 10, and zero otherwise, and MULT_LIFECOS equals one if the group has more than one life insurer, and zero otherwise.[30] The correlation coefficients range from 0.40 to 0.84.

Given the correlation between the group characteristics, rather than reporting three additional tables for each of the group characteristics, I report how the main results

[30]I also used other cutoffs to divide the sample based on the number of affiliates and found similar results.

TABLE 9
Spearman Correlations Coefficients Between Group Characteristics

		Correlation Coefficients			
	Means	PUBLIC	NUM_INS	MULT_INS	NUM_AFF
PUBLIC	0.41				
NUM_INS	3.34	0.57			
MULT_INS	0.69	0.40	0.78		
NUM_AFF	20.64	0.56	0.72	0.57	
AFF_GTE10	0.53	0.49	0.62	0.52	0.84

Note: PUBLIC equals one if the group has a publicly traded parent; NUM_INS equals the number of life insurers in the group; MULT_INS equals one if the there is more than one life insurer in the group, and zero otherwise; NUM_AFF is the number of affiliates in the group; and AFF_GTE10 equals one if there are 10 or more affiliates in the group, and zero otherwise.

are affected when the sample is divided in two subsamples based on each of the three group characteristics. The five main results from the previous sections of the article are as follows:

- Internal Capital Contributions Received

  1. Have a negative sensitivity to negative performance.
  2. Are higher for insurers with low RBC ratios.
  3. Are lower for insurer with high RBC ratios.

- Internal Shareholder Dividends Received

  4. Have a negative sensitivity to positive performance.
  5. The negative sensitivity to positive performance is greater during the financial crisis.

Table 10 summarizes the results of estimating the panel regression from Table 7 when the sample is divided based on whether PUBLIC equals zero or one, AFF_GTE10 equals zero or one, and MULT_LIFECOS equals zero or one. For convenience, the coefficient estimate from Table 7 for the whole sample is also reported in the last column. When interpreting the results, I consider both the economic and statistical significance of the coefficient. Given the smaller sample size with the subsamples, the statistical significance is expected to be lower in general for the subsample analysis.

For the capital contribution equations, the coefficient estimates on NEG_PERF for each of the subsamples are negative and are about the same magnitude as the estimate from Table 7. Thus, the negative sensitivity of capital contributions to negative

TABLE 10
Impact of Group Characteristics on Main Results

	Coefficient Estimates		Table 7 Results
Panel A: Internal Capital Contributions			
Neg_Perf	0	1	
Public	−0.29*	−0.21	
Aff_GTE10	−0.33*	−0.17	−0.28**
MULT_LIFECOS	−0.24	−0.30*	
Low_RBC			
Public	1.26	1.11*	
Aff_GTE10	0.09	2.39**	1.31***
MULT_LIFECOS	0.57	1.63*	
High_RBC			
Public	−0.86**	−0.33	
Aff_GTE10	−0.03	−1.10***	−0.59**
MULT_LIFECOS	−0.48	−0.50	
Panel B: Internal Shareholder Dividends			
Pos_Perf	0	1	
Public	−0.28*	−0.53***	
Aff_GTE10	−0.36**	−0.44***	−0.39***
MULT_LIFECOS	−0.23**	−0.51***	
Pos_Perf_FC			
Public	−0.35	−0.44	
Aff_GTE10	−0.55**	−0.32	−0.44***
MULT_LIFECOS	−0.29	−0.46*	

Note: This table reports coefficient estimates on variables listed in the first column from a panel regression including all of the variables in Table 7 for subsamples based on group characteristics listed in the second column. PUBLIC equals one if the group has a publicly traded parent, and zero otherwise; Aff_GTE10 equals one if the group has 10 or more affiliates, and zero otherwise; and MULT_LIFECOS equals one if the group has more than one life insurer in the group, and zero otherwise. ***, **, * indicate significance at the 0.01, 0.05, 0.10 levels, respectively.

performance does not materially differ based on these group characteristics. The positive relation between Low_RBC and internal capital contributions, however, is concentrated in larger groups (i.e., with more affiliates). The negative relation between High_RBC and internal capital contributions is concentrated in groups with more affiliates and groups without publicly traded parents. For the shareholder dividend equations, the negative sensitivity to positive performance is statistically significant in each of the subsamples examined. The greater negative sensitivity to positive performance during the financial crisis is also evident in each of the group-based subsamples based on the coefficient estimates, although the coefficients are not always statistically significant. Overall, the evidence indicates that sensitivity to

performance results (for both capital contributions and shareholder dividends) are not only concentrated in one of the group types examined.[31]

SUMMARY AND IMPLICATIONS

This article provides a peek inside the internal capital markets of groups of affiliated companies that include life insurers. The conceptual framework suggests that it is important for life insurance companies within a group to be adequately capitalized so that their products and services are attractive to potential customers. However, placing too much capital in an insurance company can cause the capital to be "stuck," which would prevent the group from reallocating capital to other more productive uses and reduces the value of the default option. Consequently, groups are expected to shift capital to insurers when they perform poorly and extract capital from insurers when they do well.

The empirical evidence supports these predictions. Aggregate data indicate that capital contributions to insurers from noninsurance affiliates increased substantially during the financial crisis, and internal shareholder dividends paid by life insurers to noninsurance affiliates declined during the financial crisis, both in absolute amount and relative to total (internal and external) dividends.

Panel data estimates indicate that on average individual life insurers receive internal capital contributions of about $0.26 for every dollar decrease in performance (net income plus unrealized capital gains) when performance is negative, and pay internal dividends of about $0.56 for every dollar increase in performance when performance is positive. In addition, internal capital contributions are higher for insurers with low risk-based capital ratios and lower for insurers with high risk-based capital ratios. Overall, the evidence is consistent with the notion that insurance groups provide a risk-sharing mechanism for life insurance companies.

The relatively high sensitivity of internal shareholder dividends to performance when performance is positive ($0.56 on the dollar) suggests that the "walls" that could potentially cause capital to be "stuck" in an insurance enterprise are relatively porous when insurers are performing well. Moreover, this estimated sensitivity is higher during the financial crisis than the noncrisis periods, which arguably is when other entities in the group needed the capital the most and the group was relatively constrained.

The implication of the estimated sensitivities of capital contributions and shareholder dividends to performance (the 0.26 and 0.56 estimates) for insolvency risk depends on the probability distribution of performance and other adjustments that insurers make to capital. To illustrate, suppose for simplicity that insurers operated in accordance with the estimated sensitivities; that is, they paid out $0.56 of every dollar of positive

[31]The group analysis did reveal a result regarding internal shareholder dividends that is not evident in Table 7. During the noncrisis period, a decline in negative performance increases the internal shareholder dividends paid on average for companies in groups with a publicly traded parent and in groups with more affiliates. This result is consistent with Powell et al. (2008) that more capital flows to good performers and away from poor performers.

performance, and they received $0.26 for every dollar of negative performance. Further, assume that the change in capital over the course of a year equals net income plus unrealized capital gains plus internal capital contributions minus internal dividends paid. If performance is normally distributed with a mean of 1.3 percent and a standard deviation of 5.9 percent (the values for the overall sample from Table 4), then the mean (median) annual change in the capital to asset ratio would be 0.000 (0.006). Thus, while the higher payout of internal capital when performance is good relative to the receipt of internal capital when performance is bad might initially cause concerns, the expected impact on capital is zero, given the assumptions above.

Finally, the evidence presented here is relevant to the debate over group- versus company-level supervision. The results are consistent with insurance groups managing capital and thus insolvency risk at the group level and also with the capital of noninsurance entities being used in the management of insolvency risk. Thus, group-level capital measurement and supervision of all of the entities in a holding company system would better mirror how capital is managed in practice. Taking into account the possibility of capital transfers from other entities in the group and the diversification benefits of multiple entities in the group would in general lower the required capital of the entire group. Group-level supervision could also help prevent one or more noninsurance entities in a group from being insufficiently capitalized, which could potentially cause a financial strain on the insurance entities in the group. On the other hand, group-level capital measurement and group supervision could add complexity, modeling costs, and regulatory costs.

APPENDIX

Data used in the study are drawn from many of the schedules in the annual statement, including data from Schedule Y–Part 2. The data in this schedule require considerable cleaning and the main purpose of the Appendix is to describe the "cleaning" process and the implications for the sample that is used. I start with 118,058 year/reporting insurer/affiliate observations reported in Schedule Y by the active insurers and then take the following steps:

1. Some observations have zero values for all variables and the affiliate is not identified by either name or federal identification number (fein); these are deleted, leaving 111,208 observations.
2. Some companies aggregate all transactions with an affiliate and others do not. As a result, some companies have multiple reports of transactions for the same affiliate. I therefore aggregate data for reported transactions with the same affiliate. After aggregating multiple reports with the same affiliate, there 102,806 year/reporting insurer/affiliate observations.
3. The data are then divided into two categories: those without an NAIC group code and those with an NAIC group code.

    a. I assign group codes to the observations without one and I check the observations for errors and inconsistencies. There are initially 2,405 year/

reporting insurer/affiliate observations without a group code. After "cleaning" these data, there are 2,378 year/reporting insurer/affiliate observations.

b. here are 100,410 year/reporting insurer/affiliate observations with a group code. These observations are checked to see if reports for the different insurers within the group are consistent.

(i) There are 32,323 year/reporting insurer/affiliate observations (1,495 year/group observations) that are not consistent within a group and therefore need to be "cleaned."

1. If a majority of the reported transactions with an affiliate are consistent, then the reports of the majority are copied to the cells of the minority, thus making them all consistent. There are 9,390 year/reporting-insurer/affiliate observations in this category. These observations are checked to see if the value of capital contributions and shareholder dividends sum to zero for each cocode. There are 8,888 year/reporting-insurer/affiliate observations that meet the requirement. There are 502 observations that do not sum to zero, and are deleted.

2. If a majority of the reports within a group are not consistent, then the group is omitted from the sample.

(ii) There 68,087 year/reporting insurer/affiliate observations that are consistent within the group code. These are checked to see if capital contributions and shareholder dividends of all affiliates within a group sum to zero. There is one group/year for which this was not the case, which was deleted.

4. Observations from steps 3a, 3b(i)1, and 3b(ii) are combined to create the sample.

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