Business Groups and Risk Sharing around the World

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Abstract

Researchers commonly assume that business groups, a ubiquitous organizational form in emerging markets, permit affiliated firms to share risk by smoothing income flows and by reallocating money from one affiliate to another in times of distress. This view has received support in the literature on Japanese *keiretsu*. To examine the generality of these findings worldwide, we amass a new data set on business groups in 15 emerging markets, and couple this with historical and modern data from Japan. Our results, using multiple estimation techniques, corroborate the existing evidence on risk sharing within the Japanese *keiretsu*. In addition, in some emerging markets such as Brazil, Korea, Taiwan and Thailand, we find evidence suggesting that group affiliation is associated with a 20 – 30 percent reduction in the standard deviation of operating returns. We also find evidence of substantial "liquidity smoothing" in India, although data constraints prevent us from knowing the extent to which this phenomenon is widespread. However, risk reduction by business groups is far from a universal phenomenon -- the magnitude of the effect is small in most of the other countries in our sample, even though it is sometimes statistically significant. Tests of two-dimensional first-order-stochastic-dominance suggest that the Japan result – that group affiliated firms have both lower levels of operating profitability and lower standard deviations of operating profitability – does not generalize to most emerging markets. Finally, we find no correlation between the extent of income smoothing provided by groups and measures of capital market development. We conclude that the provision of risk sharing, to compensate for under-developed capital markets, is probably not the most important reason for the ubiquity of business groups around the world.

I. Introduction

Diversified business groups are a highly visible and dominant organizational form in most emerging markets. They play an important, yet poorly understood, role in the economies of Chile and Mexico, India and Pakistan, Indonesia and Thailand, South Korea and pre-World War II Japan, to name just a few examples.[1] Researchers have commonly assumed that such groups enable member firms to share risk by smoothing income flows and by reallocating money from one affiliate to another in times of distress. Thus, Strachan (1976), in his early study of Central American business groups, says that groups serve an insurance function in the face of unstable markets. "The Encyclopedia of the Chinese Overseas" notes that the diversification of Chinese business groups has allowed them to spread their risks very widely (Pan, 1999). Indeed, business executives in several countries routinely cite the advantages of stability emanating from membership in a diversified organization. For example, Li Ka-shing, the Hong Kong billionaire and dominant owner of the Hutchinson Whampoa group, commented on this issue in the wake of the recent Asian financial crisis: "Our diversification has provided us with varied sources of income and has shielded us from the worst of the financial crisis" (*The Financial Times*, February 24, 1999). Although some recent work has focused on the performance effects of business group membership (e.g. Chang and Choi, 1988; Weinstein and Yafeh, 1995; Khanna and Palepu, 2000a), risk sharing has received surprisingly little empirical attention.

The term risk sharing, or income smoothing, can be interpreted in more than one way. It could refer to mutual insurance between related firms, designed to lower tax

[1]See Ghemawat and Khanna (1998) for a more comprehensive list of countries where business groups are prevalent.

liabilities, to increase debt capacity or to reduce bankruptcy costs. It could also refer to inter-firm transfers designed to guarantee enough cash to meet the firm's fixed obligations or investment plans. Finally, in countries where financial markets are under-developed and the availability of financial assets is limited, the diversified structure of business groups could also generate a diversified portfolio for the group owners that would not have been attainable otherwise.

Though generally not recognized by anecdotes or the existing literature, it is important to note that group affiliation might also exacerbate risk, to the extent that shocks to firms are themselves correlated with group membership. An example is provided by shocks to the political systems of countries where groups are especially connected with the political apparatus (as in Fisman's (2000) study of groups in Suharto's Indonesia). Another example has to do with shocks to the banking system where groups are based around especially close banking relationships (as in Kang and Stulz's (2000) study of a banking shock in Japan in the early 1990s).

The extent of risk sharing (or lack thereof), is important to determine for several reasons. First, risk sharing through business groups, when it is not possible through specialized institutions in the economy, can help firms undertake otherwise shunned risky investment projects, and thus contribute to economic growth. Second, diversified business groups may be able to absorb shocks to particular sectors in the economy. Several scholars believe that the opening up of previously closed (or partially closed) economies heightens economic instability (e.g. Rodrik, 1997; Aghion, Bacchetta, and Banerjee, 1999). Since our set of emerging markets is generally within the category of those that have undergone a process of fairly rapid integration into global markets (Sachs

and Warner, 1995), this is a material concern. Third, multilateral institutions have spearheaded a dismantling of business groups in some countries, most notably South Korea, as a partial response to the recent financial crisis. If groups replace under-developed financial markets and alternative risk sharing mechanisms are absent in the economy, these actions may have unintended social costs.[2]

Evidence from the U.S. and Japan is consistent with the theory that business groups serve a risk sharing and mutual insurance role when capital markets are under-developed, but not when capital markets function well (Leff, 1978; Aoki, 1988; Kali, 1999). In developed economies with a variety of state-contingent assets, the argument goes, investors can minimize risk efficiently through diversified portfolios, leaving little need to reduce risk through diversification of firm production away from its core activity (see a survey in Montgomery, 1994). The U.S. perhaps comes closest to such an ideal Arrow-Debreu world. It is well established that U.S. firms are not, on average, rewarded for being diversified (Lang and Stulz, 1994; Berger and Ofek, 1995). On the other hand, evidence from Japan in the 1970s and 1980s, when capital markets were quite far from the ideal Arrow-Debreu world, suggests that risk sharing may be an important function of the Japanese *keiretsu* corporate groups (Aoki, 1988; Nakatani, 1984).

Previous literature has analyzed risk sharing through business groups in one country, Japan, has tended to use a single econometric technique, and has emphasized risk sharing rather than the exacerbation of risk. In this paper, we follow the Japan literature by equating risk sharing largely, though not exclusively, with the smoothing of operating profitability. We provide, for the first time, estimates of risk sharing around the

[2] For example, there is much pressure on the largest Korean *chaebol* to stop intra-group financial activity and to shed what are described as "non-core assets."

world, using multiple estimation techniques. Our database comprises firm-level information on business groups in fifteen emerging markets, supplemented by data from pre-war (1930s) Japan and post-war (1970s and 1980s) Japan.

We examine three avenues through which operating profitability may be smoothed:

(One) First, groups might smooth profitability by adjusting either the volume or price of intra-group trade. We therefore conduct a series of statistical tests comparing the standard deviation of operating income/assets for group-affiliated firms relative to unaffiliated firms. We then compare the standard deviation of operating profitability of business groups with that of "matched portfolios," which are constructed by matching group affiliated firms with otherwise comparable (on the basis of size, industry and time) unaffiliated firms. Next, we examine whether the effect of exogenous (industry and macroeconomic) shocks is a function of group affiliation. This is followed by a series of (stochastic dominance) tests based on comparisons of the distributions of standard deviations of operating profitability for group affiliated and for unaffiliated firms. We conclude the analysis of group insurance through intra-group trade by investigating whether or not the extent of smoothing provided by the groups depends on the group's size and diversification. Although we find evidence of risk sharing within business groups in certain countries, the magnitude and prevalence of this phenomenon appears to be quite small in most countries.

(b) Since groups are typically characterized by extensive cross-ownership among member firms, a second possible avenue of group-provided insurance in addition to intra-group trade is through the distribution of dividends. If, for example, dividend payout ratios are

constant and groups are diversified across a range of industries, then dividends would be an automatic stabilizer of group firms' income. Further, relatively high levels of cross-ownership within groups (e.g. see Sheard, 1994, for Japan) make dividend payments a natural mechanism for income smoothing. We investigate this issue in the three countries (Chile, India and postwar Japan) where dividend data are available. To do this, we use a technique developed by Asdrubali, Sorensen, and Yosha (1996) to measure the extent of risk sharing among U.S. states. We find, however, that dividends do not play much of a role as "shock absorbers" in any of the three countries. The highest level of income smoothing through dividends is found in Chile, where dividends dampen less than three percent of the shocks to operating profitability in the post-1991 period, and even this figure is not statistically significant.

(c) A third mechanism of group-provided insurance that we study using unique data from India is liquidity (rather then income) smoothing through intra-group loans and receivables. Unlike dividends, we do find that within-group loans are associated with substantial liquidity smoothing in India. The absence of comparable data on this form of risk sharing for other countries makes it impossible for us to evaluate the extent to which this phenomenon is widespread.

We also examine if risk sharing within business groups is related to capital market development. Our results cast some doubt on the assertion that the *raison d'être* of business groups is income smoothing. We do not find much difference in the extent of smoothing in two countries where we can distinguish between pre- and post- capital market liberalization sub-periods in our data (Chile and Japan). Moreover, the relation

across countries between the extent of profitability smoothing and multiple measures of capital market development is rather weak.

We conclude that, while there is certainly evidence for the smoothing role of business groups, it is much less common and extensive than previous conjectures suggest it might be. Profitability smoothing does not appear uniformly across countries, and seems not to be closely related to capital market development.[3] There is very little evidence that group affiliation is correlated with greater volatility, however.

In the next section of the paper we review the literature on business groups. The data and empirical approaches are discussed in Section III. Section IV presents the empirical results on risk sharing within business groups around the world, Section V contains additional analyses to help interpret the earlier results, and Section VI concludes.

II. The Literature on Business Groups[4]

Our review of the multiple definitions of business groups below first establishes that it is important to rely on local (country-specific) data sources. We then review the literature, almost exclusively set in Japan, which establishes the importance of risk sharing by groups in that country, and the literature from emerging markets which suggests that groups might also have a variety of effects on firm performance unrelated to the reduction of risk.

What is a Business Group?

[3] Intra-group transfers could also be due to "tunneling" (Johnson et. al., 2000) rather than risk sharing. We discuss this issue below.
[4] For a more extensive literature survey, see Khanna (2000).

The definition of a "business group" varies extensively across researchers and countries. Leff (1978: p. 673) refers to a business group as "a group of companies that does business in different markets under a common administrative or financial control" and says that its members are "linked by relations of interpersonal trust on the basis of a similar personal, ethnic or commercial background." Strachan (1976) defines a group as a long-term association of firms and the men who own and manage them, and points out that a group cannot be identified purely on the basis of a single metric. Indeed, Encarnation (1989: p. 45), referring to Indian "business houses," emphasizes multiple forms of ties among group members: "[I]n each of these houses, strong social ties of family, caste, religion, language, ethnicity and region reinforced financial and organizational linkages among affiliated enterprises." There is a voluminous literature on the Japanese corporate groups, or *keiretsu*, which share some of the features of business groups in less developed economies. For example, Gerlach (1992) says that the *keiretsu* embody elements of "alliance capitalism," characterized by long-term relationships across a broad spectrum of markets.

Apparently, business groups, which are typically not legal constructs, involve both formal and informal ties among group firms. This impression is confirmed in at least one recent econometric study of Chilean groups. Khanna and Rivkin (2000b) find that, whereas equity ties between pairs of firms do explain co-membership in a group, substantial additional explanatory power is gained by a variety of other factors. These include overlaps in the identity of owners or in the composition of the boards of directors, and common family involvement. Equating groups with collections of firms grouped purely through equity interlocks is therefore likely to be a mistake. For this reason, and

because group definitions appear to be idiosyncratic to the country, it seems most prudent to gather information on group membership by delving into country-specific sources.

The Risk-Return Tradeoff in Japanese Keiretsu

Several studies of Japanese *keiretsu* suggest that groups provide an organizational mechanism through which risks are shared.[5] Caves and Uekusa (1976) argue that operating profitability is relatively low for *keiretsu* firms, and Weinstein and Yafeh (1995, 1998) provide more recent evidence on this issue. However, it has been argued that the variance of operating profitability is also lower for group members in comparison with unaffiliated firms (Nakatani, 1984). The lower returns may be the cost of greater stability, which is valued by employees with non-diversifiable, firm-specific human capital (e.g. Aoki, 1988). Aoki (1984) shows that fluctuations of the joint income of a group should be allocated among its member firms in a manner inversely proportional to their respective risk aversions, in order to ensure the efficient distribution of maximized group income.

The idea that Japanese firms might be willing to sacrifice performance benefits in exchange for "security" appears in the sociology literature as well. Lincoln et al. (1996) argue that in Japan under-performing firms recover faster if they are members of one of the large six bank-centered groups, and also that firms within the groups that perform better than average at a certain point tend to do worse than unaffiliated firms in

[5] The literature distinguishes between horizontal, bank-centered corporate groups (*keiretsu*) and vertical, manufacturer-centered *keiretsu*. Horizontal *keiretsu* are centered on one of the major six city banks, and are extensively diversified across a range of industries. Vertical *keiretsu* consist of manufacturing firms like Toyota or Hitachi and multiple tiers of suppliers, and are typically concentrated in one industry. Groups in virtually all of the emerging markets studied in this paper should be thought of as closer to the horizontal *keiretsu*, although different groups exhibit varying degrees of horizontal diversification and vertical integration.

subsequent periods. There is also evidence on risk sharing under the auspices of the main bank within the big six groups. For example, Sheard (1989) documents a variety of cases in which banks rescued ailing clients, typically within their group and often with the assistance of other group members. Hoshi et al. (1990) provide econometric evidence on main bank assistance to financially distressed firms. Finally, Weinstein and Yafeh (1998) also argue that members of the bank-centered Japanese groups adopt low risk investment strategies, although the motivation for this behavior is, in their view, not related to risk sharing.[6]

Some degree of risk sharing apparently exists in vertical *keiretsu* as well. For example, Asanuma (1989) and Kawasaki and McMillan (1992), among others, have argued that the contracts between the members of the vertical *keiretsu* are designed to combine risk sharing and incentives.

It should be noted that the Japanese corporate groups, involving relatively loose ties between members and no centralized decision making mechanism or family ownership are rather different from groups that are commonly observed in emerging markets. It should also be noted that some recent studies have challenged the view that the *keiretsu* provide a low risk environment (e.g. Beason, 1998; Kang and Stulz, 2000). This begs the question of how common is risk sharing among diversified groups elsewhere.

[6] Weinstein and Yafeh (1998) argue that the group's main bank has monopoly power and extracts rents from member firms by inducing them to adopt low-risk business strategies, which in turn allows the firms to increase their use of debt finance.

Group Affiliation in Emerging Markets

While members of bank-centered Japanese groups under-perform otherwise comparable unaffiliated firms, studies in emerging markets suggest that group membership is often associated with superior performance. These include Chang and Choi (1988) for Korea, Keister (1998) for China, Khanna and Palepu (1999, 2000a) for Chile and India, and Khanna and Rivkin (2000a) for a cross-country sample. These studies complement an earlier, primarily descriptive and country-specific, literature suggesting that groups are responses to market imperfections (Leff 1976, 1978; Caves, 1989). Some studies suggest that groups are especially adept at substituting for imperfect capital markets (e.g. Encaoua and Jacquemin (1982) for France, and Fisman and Khanna (1998) for India). Also in this vein, Perotti and Gelfer (1999) argue that Russian Financial-Industrial Groups (FIGs) manage an internal capital market that may add value in the face of inefficient external capital markets in that country. In addition, there is some evidence that internal capital markets in the Korean *chaebol* conglomerates create value (Chang and Hong, 1999), although this view is challenged by Shin and Park (1999). In a recent study, Khanna and Palepu (1999) suggest that groups may also constitute efficient intermediaries in the face of poorly-functioning managerial labor markets and poorly-functioning markets for cross-border movements of technology and capital.[7] Of course, the generally positive performance effects of group affiliation may

[7] Other reasons why groups may be efficient are that they provide effective corporate governance by informed, stable shareholders (e.g. when legal systems provide poor investor protection, see La Porta et al. 1997, 1998 and 1999). Groups may also lower transaction costs associated with trade between group members (Flath, 1996), and possibly enable efficient information sharing among members.

also be the result of monopoly power or rent-seeking behavior brought about by a nexus with the power structure of the country.[8]

Group membership need not always create value (Khanna, 2000). For example, because of the difficulty of acquiring expertise in a variety of industries at the same time, the central office of a diversified group may make sub-optimal decisions. According to Claessens et al. (1999), groups are associated with minority shareholder expropriation in Asia. Johnson et al. (2000) as well as Bertrand et al. (2000) similarly view groups as institutions that are associated with poor protection of property rights and enable "tunneling" of funds from minority shareholder to the controlling party.

Even reallocations of profits within a group, of the sort discussed above as needed for risk sharing, can be value destroying. Thus, Scharfstein and Stein (1997) describe the internal capital allocations of diversified organizations as "socialist," whereby strong divisions support weaker ones. Similarly, Rajan, Servaes, and Zingales (2000) argue that internal power struggles can generate distortions in the allocation of resources within a diversified organization. While profit reallocations can thus have negative connotations, this is not inconsistent with the positive aspects that we discussed earlier, especially in environments where risk sharing is not feasible through external agencies.

Because our objective here is not to evaluate the overall benefits and costs associated with corporate groups, we do not pursue these issues further. We wish to emphasize, however, that we are unaware of studies of evaluating the benefits generated

[8] For example, the politically connected families in Pakistan, Latin America and Indonesia are described in White (1974), Strachan (1976), and Schwartz (1994), respectively. Fisman (2000) uses event study techniques to find a positive relation between the market value of Indonesian group affiliated firms and a measure of proximity to President Suharto and his family.

by business groups through risk sharing in countries other than Japan. We therefore turn to this issue in the remainder of the paper.

III. The Data and Measurement Techniques

Data Sources and Coverage

Our emerging markets database, containing firm level information from fifteen countries, is described in Table 1. The countries included are Argentina, Brazil, Chile, Colombia, India, Indonesia, Israel, Mexico, Philippines, Peru, South Korea, Taiwan, Thailand, Turkey, and Venezuela. For each firm in each country we obtain three critical pieces of information: the group (if any) with which the firm is affiliated, its financial results over as many years as possible, and the industry in which it operates. In most cases, we gather group affiliation data from one source, collect financial and industry information from another source, and then merge the two.

There exists no common, international database of group affiliation. Instead, we rely on local, and in many cases, multiple sources for affiliation data. It is difficult to gain access to such sources, but they tend to be comprehensive and reliable. The use of multiple, local sources is both a strength of this paper and a cause for caution. As discussed above, there is no common definition of a group across countries. Therefore, our main results apply to groups *as delineated within each country*.[9] Note that Chile is one of the few countries where a group is a legal entity. In most other countries, for example in India, the classification of firms into groups is based on a number of criteria. These include historical reports published by the government for antitrust purposes,

[9] We have annual information concerning group affiliation in Chile. In other countries, the affiliation data are from a single point in time. In practice, changes in affiliation appear to be rare in most countries.

announcements of new corporate ventures and public listings, filings made by firms, and more.

Wherever they are available, we use local sources to obtain financial results and to identify the industry in which each firm competes. Such sources cover far more firms than do international sources, though they typically require translation and data entry by hand.[10] In several countries, however, we could obtain no local source for financial information. In those cases, we turned to the Company Accounts Database of Datastream International, one of the most comprehensive international providers of information on publicly traded firms. Datastream International, in turn, relies largely on Worldscope, a division of Disclosure Corporation, which compiles financial data from public filings of firms around the globe. In all countries, and especially in emerging economies, Datastream International and Worldscope provide accounting information for only the largest, most prominent firms.[11] This clearly raises the specter of selection bias, and accordingly, we have less confidence in our results for these countries than for the others. We take some solace, however, in the results of Furman (1998) who shows that, at least in the case of the U.S., Worldscope's selection process appears not to create a substantial bias. Due to data limitations, the country-level data sets cover different periods of time but are all in the late 1980s and 1990s.

The two Japanese databases that we use are described in Table 2. The first covers the prewar period in which extremely large, diversified conglomerates (*zaibatsu*), controlled by wealthy families, dominated the Japanese economy (Hadley, 1970; Yafeh,

[10] For example, our Chilean source covers over three times as many firms as does Datastream.

[11] Datastream International provides fairly comprehensive stock price information for publicly traded firms in many countries, but it offers accounting information for only a subset of those firms. However, Datastream representatives report that there is no formal process by which firms are selected for accounting

1995). Of the few empirical studies using firm level data in the prewar period, Miyajima (in progress) has one of the largest databases on prewar Japanese firms, which we use here. In the empirical analysis we define group affiliated firms as firms belonging to the largest and most diversified three *zaibatsu.* As for the postwar Japanese data, there are a number of controversial group affiliation definitions commonly used in the literature (see Weinstein and Yafeh (1995) for a detailed discussion). This is because *keiretsu* members are related to each other through a variety of informal ties including cross-shareholding and exchange of personnel. Here we use the most restrictive and unambiguous definition of group affiliation: membership in one of the six bank-centered groups' Presidents' Clubs (*shacho-kai*), which are regular meetings of the leaders of core firms within each group. If groups provide mechanisms for risk sharing, they are likely to be most pronounced among the group's core members, which are typically members of the group's Presidents' Club.

Measuring Risk Sharing within Corporate Groups

We first describe several techniques that investigate whether groups smooth operating profitability by varying either the volume or price of intra-group trade. A core specification mirroring the existing literature is first discussed, and this is followed by several refinements designed to probe the limitations of the core specification. We then describe a separate test designed to investigate smoothing through the issuance of dividends and through intra-group loans and receivables.

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coverage. Note also that Datastream International collects financial information for a broad spectrum of firms around the globe, but does *not* provide data on group affiliation.

a. Differences in the Standard Deviation of Operating Profitability

We use several statistical procedures to compare the volatility of operating profitability (ROA) between group affiliated and unaffiliated firms. Our tests measure group smoothing of profit ratios rather than absolute profit streams. The results are generally similar when we use the latter rather than the former. We focus on operating profit rather than net profit for two reasons. First, operating profit is not (directly) distorted by taxation rules, which differ dramatically across countries. Second, a consistent measure of operating profit is available in more countries than is net profit. We also feel that another popular measure of firm performance, Tobin's *q*, is not appropriate for the present study. An implicit assumption in using Tobin's *q* is that stock prices reflect true firm value. This is a troubling assumption in emerging economies, where capital markets are often illiquid, and plagued with untimely disclosure and other problems. Further, we have appropriate data to construct a proxy for Tobin's q only for a subset of countries in the sample, and only for a subset of firms in each country. Moreover, it is not clear why groups would smooth Tobin's *q*. Finally, to examine the robustness of our findings, we also examine the volatility of operating income plus dividends as a measure of profitability for Japan, Chile, and India, and find that this specification too does not alter the results.

It should be noted that our empirical analysis is based on the assumption that group and industry affiliation of firms is exogenous, at least in the relatively short-run for which we have data. Whether or not groups are formed and evolve over time in a fashion that enhances risk sharing is beyond the scope of the present paper. We now turn to the formulation of the empirical tests.

The Core Specification

The core specification, similar in spirit to the ones used by Caves and Uekusa (1976) and by Nakatani (1984), is based on (modified) OLS estimation of the following regression equation for each country separately:

(1) $vprof_i$ = constant + $b_0(assets_i)$ + $b_1(prof_i)$ +b_2(group dummy) + industry dummies,

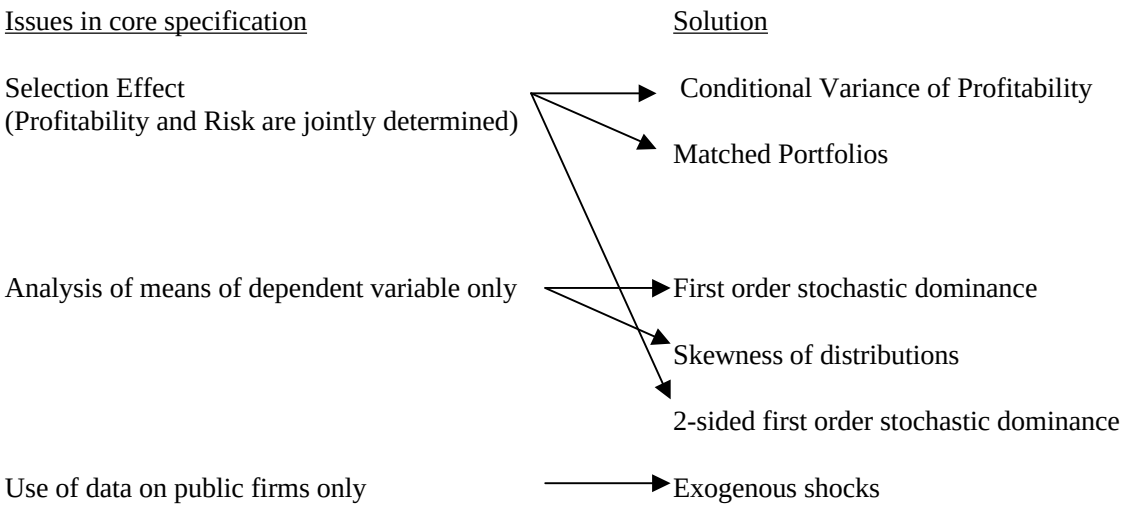
where $vprof_i$ is the standard deviation of each firm's operating profitability calculated over all years for which we have data, $assets_i$ is firm assets, and $prof_i$ is the firm's average operating profitability.[12] [13] The group dummy variable equals one for firms affiliated with business groups. We control for the fact that the standard deviation of profits is calculated on the basis of time series of different lengths for different firms within each country by using weighted regressions, where we use the number of observations per firm as weights. We also examine a specification where we estimate standard errors while allowing for the fact that the error terms are not independent across firms of the same business group. This specification does not affect any of the results and is not reported. [14]

[12] Consider two firms with assets a and b and with profit streams x and y. Define s_x and s_y as the standard deviations of x and y, respectively, and r as the correlation coefficient of x and y. Our estimation compares the average standard deviation when the two firms are not in a business group, $0.5*s(x/a) + 0.5*s(y/b)$, with the case in which both firms are in a business group and some smoothing takes place, $0.5*s((x+y)/2a) + 0.5*s((x+y)/2b)$. In this stylized example, the idea of smoothing is captured in the assumption that the total profits are equally split between the two firms, so that each gets $(x+y)/2$. It is then easy to show that as long as assets and standard deviations of profit streams are inversely correlated, then $r<1$ suffices to ensure that operating profitability is smoother for the firms if they are part of a business group. $r<1$ is also sufficient if either of the following conditions hold: $a = b$, or $s_x = s_y$.

[13] In India, data constraints force us to use (net income + interest expenses * (1 - tax rate)) / (total net assets) instead of operating profits.

[14] Following Moulton (1990), we note that observations sharing an observable characteristic like group membership may also share unobservable characteristics that may cause the error terms to be correlated. This could make the standard errors obtained using OLS incorrect, leading to potentially spurious claims of statistical significance, with the problem being more acute the greater the extent of within group unobservable correlation (Moulton, 1986). Accordingly, we also examine a specification in which we assume that observations are independent across groups, but relax the independence assumption within groups.

Simple estimation of the parameters in Equation (1) raises several concerns. First, firm risk and return may be jointly determined. Group firms might systematically opt for risky investment projects (risky industries) if they are effectively "insured" by other members of their group. In practice, this is unlikely to be a serious problem in our accounting data, where there is a low correlation between profitability (which may depend, for instance, on the firm's market power) and its standard deviation. Second, the estimation of (1) focuses on the mean effect of group affiliation on the standard deviation of profitability – however, there may be considerable dispersion around the mean because of differences in the ability of different groups to reduce such variability. Finally, we should be sensitive to the fact that we use data on public firms only – groups may include firms that are not publicly traded. While we cannot completely address all these concerns, we detail below a battery of different tests designed to probe each of these issues. The exhibit below highlights which issues each 'solution' is designed to address.



Conditional Variance of Profitability

Groups may systematically choose risky, high-return projects, and subsequently smooth operating profitability, implying that there may be no equilibrium difference between observed smoothness of operating profitability between group affiliated and unaffiliated firms. To account for this, we first regress profitability on firm characteristics – size, year and firm-fixed effects. The firm-fixed effects capture all time-invariant firm attributes, including group affiliation. We then test whether unexplained changes in profitability are correlated with group affiliation. We accomplish this by regressing the squared residuals from the first regression – the conditional variance of profitability – on the group affiliation dummy and other control variables (firm size and year dummies). We examine this specification in the seven countries where there is a time series long enough to estimate this profitability regression with firm-fixed effects: Brazil, Chile, India, postwar Japan, Mexico, Taiwan, and Thailand.

Matched Portfolios

As a way of conditioning our comparison between groups and non-groups that is an alternative to the above regression-based method, we construct portfolios of otherwise comparable unaffiliated firms for each group in our data. Matching is based on industry, size and country. For each group and for each matched portfolio, we calculate the standard deviation of operating profitability, which is an asset-weighted average of the standard deviation of operating profitability of firms in the group (or portfolio). We then compare means and medians of the standard deviation of operating profitability calculated across "real" groups with the means and medians of the standard deviation of

operating profitability calculated across the matched portfolios. We would expect the former to be statistically significantly lower than the latter if groups smoothed profitability.[15]

It is important to note that the matching may be flawed if one believes that unobserved intra-industry heterogeneity is high, as we may then be comparing a group affiliated firm in a particular industry sub-segment with an unaffiliated firm in a quite different industry sub-segment. To guard against this, we rank industries within each country by intra-industry variation in long-run average returns. We repeat the analysis by constructing matched portfolios using only those industries that display below-median intra-industry variation in returns, where we expect the matching to be more accurate. This implies that we can only construct meaningful comparable portfolios for a subset of groups, yet the results remain qualitatively unchanged and are therefore not reported.

Responses to Shocks to Profitability

We examine the differential response of group affiliated and unaffiliated firms to industry-specific as well as macroeconomic shocks to profitability. Because industry affiliation of firms is certainly exogenous in the short run, these tests are not subject to the possible critique that groups may choose industries to minimize vulnerability to economy-wide shocks (which may be the case in the long run). These tests also address the possibility that the observed profits of group affiliated firms may not be accurate because groups might siphon, the argument goes, money away from their publicly traded

[15] This is similar in spirit to the "chop shop" approach used by Lang and Stulz (1994) and LeBaron and Speidell (1987). Recent econometric developments suggest matching algorithms that improve upon this method. Dehejia and Wahba (1999) study the problem of selecting matching characteristics when there are a large number of dimensions along which the treatment units (here, group affiliated firms) vary. Villalonga

entities towards the unobserved privately held group firms. Different responses of group affiliated and unaffiliated firms to positive and negative shocks can shed light on the extent to which this phenomenon exists in our data.

Data from the United Nations' International Yearbook of Industry Statistics (2000) are used to identify shocks to 2-digit manufacturing industries (ISIC codes between 20 and 39). The identification of the shocks is based on the percentage change in real output (nominal output adjusted by producer price indices obtained from the UN data and from the IMF). A 30 percent threshold for this statistic proves sensible in delineating periods of shocks from others. For a shock to enter our analysis, it must also be the case that there are at least five group affiliated and five unaffiliated firms in our country-specific data sets for which performance data exist in the years surrounding the shock. We then regress the change in profitability (ROA), defined as the difference between the profit rate at the end of each shock and the profit rate at the beginning of the shock, on firm size and a group dummy, with robust standard errors.

Macroeconomic shocks are identified from our country-specific data sets. We use changes in the mean profit rate (ROA) of all firms in our data as the statistic to delineate shocks. The ratio of change in ROA/initial ROA, a measure of the magnitude of the shock, must exceed 15 percent for the event to qualify as a shock. We then regress changes in firm ROA on firm size, industry affiliation and a group dummy, with robust standard errors.[16]

(2000) demonstrates how matching purely upon size and industry can be improved upon. However, we lack the data needed to implement such methods.

[16] Again, the results remain unchanged when we allow for correlation of errors among observations within a group (Moulton, 1986, 1990).

Comparisons of Distributions

The above tests generally focus on the mean group effect. Since this may mask interesting intra-country variation in the ability of groups to smooth shocks to profitability, we are also interested in formal tests of equality of distributions of the standard deviation of profitability. The first three tests described below compare such distributions for group affiliated and unaffiliated firms, without controlling for differences in profitability. The fourth test compares, in two dimensions, the distributions of profitability and its standard deviation across group affiliated and unaffiliated firms.

We first implement a one-sided Kolmogorov-Smirnov test of the equality of distributions, which is the equivalent of testing whether the distribution of the standard deviation of returns for group-affiliated firms is first-order stochastically dominated by that for unaffiliated firms (Conover, 1980: pp. 344-385).[17] We then verify the results of this test using a one-sided Wilcoxon (sum-of-ranks) test to see whether or not the ranks of the standard deviations of group affiliated firms are lower (indicating lower values of standard deviations) than they are for unaffiliated firms (Wilcoxon, 1945).

The above non-parametric tests are supplemented by a third test of skewness. It is possible that group affiliated firms are insured against adverse outcomes, but do not necessarily share their profits with other members of the groups in good times (for example, only group members in financial distress receive group assistance). In this case, the distribution of profit rates among group affiliated firms will be skewed to the right relative to the distribution of profit rates of unaffiliated firms. To address this question we

[17] Let $F(x)$ denote the cumulative density function for group affiliated firms' standard deviation of returns (x), and $G(x)$ denote the same for unaffiliated firms. Then the test is based on deriving the asymptotic limiting distribution for the test statistic, $D = \min_x(F(x)-G(x))$, for which exact p-values can be obtained through numerical approximation techniques (Gibbons, 1971: pp. 127-131).

present skewness statistics on the distribution of profitability for group affiliated and for unaffiliated firms.[18]

Finally, we turn to tests based on *both* the standard deviation and the mean of returns, rather than just on the former. In contrast to tests of stochastic dominance for a single variable, for which there are standard non-parametric tests based on ranks, there has been much less research on non-parametric multivariate tests. We therefore implement a parametric test of stochastic dominance in two dimensions by adapting one-sided tests based on normal theory. In two dimensions, stochastic dominance means that the distribution for one set of firms (group affiliated firms) is below and to the left of the other (unaffiliated firms). For a normal distribution, this is equivalent to testing that the means of the two variables lie in one quadrant (i.e. the "bottom-left" one), against the null hypothesis that the means are equal.

To implement our test, we first compute the ranks of the standard deviation of profitability of all firms (with low ranks corresponding to low standard deviations), and the ranks of the mean of profitability. These ranks are then converted to normal scores using the formula $Vnorm_j = F^{-1}(Vrank_j/(N+1))$, where $Vrank_j$ is the rank based on variable j, N is the total number of ranks, and F^{-1} is the inverse cumulative normal. This conversion from the original non-normally distributed data to approximately normally distributed data allows us to use parametric tests based on normally distributed data. We then estimate a simple version of Zellner's (1962, 1963) seemingly-unrelated regressions (SUR), where the normal scores of ranks based (separately) on firm standard deviation of returns and on firm mean return are regressed on group affiliation:

[18] If a distribution is normal, the skewness statistic equals zero. If there is a "tail" to the right and a "hump" to the left, the coefficient is positive, and if there is a "tail" to the left the coefficient is negative.

$Vrank_{sd} = b_1$*{group dummy} + e_1

$Vrank_{mean} = b_2$*{group dummy} + e_2

where e_1 and e_2 are allowed to be correlated. The null hypothesis is that b_1=0, b_2=0. The alternative hypothesis is that b_1<0, b_2<0, corresponding to group affiliated firms having both lower standard deviation of returns and lower mean returns than unaffiliated firms.[19] Further details on the maximum likelihood technique devised to compute *p*-values for this test are provided in the Appendix.

The various tests based on distributions are accompanied by a diagram, one per country, plotting mean operating profitability versus the standard deviation of operating profitability for each firm. Confidence ellipses (at the 95 percent level) are then derived, one for group affiliated firms and another for unaffiliated firms, to provide a visual depiction of stochastic dominance in two dimensions. Each ellipse is centered on the average (across firms) value of the mean operating profitability and the mean of the standard deviation of operating profitability. It therefore corresponds to the set of points for which one would not reject the hypothesis that the mean profitability and the mean of the standard deviation are equal to the values at the center of the ellipse.

b. Group Risk Sharing according to the Asdrubali-Sorensen-Yosha Method

For Chile, India and postwar Japan, we use dividend data to measure within group risk sharing using a method adapted from Asdrubali, Sorensen, and Yosha (1996). This method is designed to capture an important mechanism of smoothing firm profits ex-post, that is, after the firm's production and sales activities are completed. If group

firms receive dividend streams from other group members that are spread across various industries, then dividends should smooth income more for group firms than for non-group firms.[20]

Denote the operating profitability of firm *i* in year *t* by *x*, and the after-dividend profitability by *y*. Then, using the identity $x = x - y + y$ (and omitting firm and time subscripts), we take first differences and multiply both sides by Δx to get:

$$\Delta x^2 = \Delta x[(\Delta x - \Delta y) + \Delta y)].$$

Taking expectations on both sides, we obtain

$$\text{Var}\ (\Delta x) = \text{Cov}\ [\Delta x, (\Delta x - \Delta y)] + \text{Cov}\ [\Delta x, \Delta y].$$

Dividing by Var (Δx) yields

$$(2)\ 1 = \text{Cov}\ [\Delta x, (\Delta x - \Delta y] / \text{Var}\ (\Delta x) + \text{Cov}\ [\Delta x, \Delta y] / \text{Var}\ (\Delta x).$$

Our estimate of income smoothing is based on the first term, which is the regression coefficient of ($\Delta x - \Delta y$) on Δx, whereas the second term represents income that is not smoothed.[21] [22] Finally, India is the only country for which we have additional information on intra-group loans and receivables. We use this information to estimate an

[19] This is essentially a test of the generality of the claim regarding the effects of *keiretsu* affiliation in Japan on both the standard deviation and mean level of profitability (Caves and Uekusa, 1976; Nakatani, 1984).

[20] The premise here is that there are more equity interlocks within groups than there are between firms across group boundaries (i.e. between firms that are in different groups, or between unaffiliated firms). In at least one country, Chile, this has been shown to be true (Khanna and Rivkin, 2000b).

[21] To see that suppose *x* goes up by one. If income shocks are perfectly smoothed, dividends will fall by exactly one, keeping after-dividends profitability, *y*, unchanged. In this case, Δx is one, Δy is zero, and $\Delta x - \Delta y$ is one so that regressing $\Delta x - \Delta y$ on Δx would yield a coefficient of one, corresponding to perfect smoothing. Now suppose Δx goes up by one but there is no smoothing at all, so that Δy is also one, and $\Delta x - \Delta y$ is zero. Regressing $\Delta x - \Delta y$ on Δx will yield coefficient of zero, which corresponds to complete absence of smoothing. In intermediate cases, the magnitude of the estimated coefficient (between zero and one) corresponds to the percent of income smoothed by dividends, and a negative coefficient represents "dis-smoothing."

[22] When there is only one level of income smoothing, the extent of risk sharing can be expressed as 1-[Cov [Δx, Δy] / Var (Δx)]. In practice, when estimating Equation (2), we include year dummies in the regressions to control for macroeconomic effects. Note that because in our data the cross-sectional dimension far exceeds the time series dimension, the estimates reflect mostly cross-sectional variance.

equation similar to (2) with two layers of smoothing, one being dividends and the other loans and receivables (which actually smooth "liquidity" rather than income). Denoting changes in the ratio of loans to assets by Δz, the estimated equation becomes:

(2') $1 = \text{Cov}[\Delta x, (\Delta z - \Delta y)] / \text{Var}(\Delta x) + \text{Cov}[\Delta x, (\Delta x - \Delta y)] / \text{Var}(\Delta x) + \text{Cov}[\Delta x, \Delta z] / \text{Var}(\Delta x)$.

IV. The Results: Corporate Groups and Risk Sharing around the World

Table 3 describes the corporate groups in our sample countries. Observe that the fraction of firms classified as group affiliated ranges from about a fifth in Chile and Venezuela to about two thirds in Indonesia. In Japan, members of Presidents' Clubs account for less than 10 percent of the firms although other group definitions (e.g. the one provided by Dodwell Marketing Consultants) are much more expansive (see Weinstein and Yafeh, 1995). Note also that group affiliated firms are larger than unaffiliated firms in virtually all countries in the sample (except Turkey).

In 10 out of 15 emerging markets, the standard deviation of profitability for group affiliated firms is lower than for unaffiliated firms, though not always in a statistically significant manner. This is in line with anecdotal evidence about group risk sharing; we will argue later that these simple statistics probably overstate the magnitude of group-provided insurance. It is also worth noting that low standard deviation of operating profitability is accompanied by low profitability – the Japan pattern – in only five of these 10 emerging markets.

The Role of Intra-group Trade in Income Smoothing

Table 4 presents measures of risk sharing by corporate groups, which are derived

from OLS estimation of Equation (1) and estimation of the conditional variance of operating profitability. The regressions are run separately for each country, and the coefficients measure profitability smoothing through intra-group transactions that affect the volatility of member firms' profitability. If groups help ailing members by adjusting the volume or price of intra-group transactions, one would expect the operating profitability of member firms to exhibit smaller fluctuations than the operating profitability of non-group firms. However, looking at Column 1, we find a negative and significant effect of groups on the standard deviation of operating profitability in only a few emerging markets in the sample. By contrast, in the majority of countries it is possible to reject the hypothesis that profit volatility is lower for group firms. In fact, in some countries group affiliation seems to be associated with higher volatility.

There is also evidence of profitability smoothing in prewar Japan, where the *zaibatsu* conglomerates were highly developed and diversified, and some smoothing among core members of the large bank-centered corporate groups in postwar Japan as well (in line with Nakatani, 1984). These results do not appear to be very robust, however. Prewar smoothing is restricted to the largest groups. The magnitude of postwar profitability smoothing in Japan falls significantly if a broader definition of group affiliation (Dodwell Marketing Consultants') is used. Overall, it is impossible to reject the hypothesis that the coefficients on the group dummy variable in all countries are jointly equal to zero.[23] Nevertheless, it is interesting to note that in the four emerging markets in Column 1 where group affiliated firms do exhibit significantly lower profit

[23] The test statistic is calculated as follows: under the null hypothesis, group affiliation should not be correlated with profit volatility (i.e, $b_2 = 0$). Thus, under the null hypothesis, the sum across all the individual country equations of the b_2 coefficients divided by the square root of the sum of their variances

volatility, the magnitude of the difference is rather large. Group firms enjoy a standard deviation of operating volatility that is lower than the sample average (Column 2) by over 20 percent in Thailand and Korea, and Taiwan, and by about 30 percent in Brazil.

Conditional Variance of Profitability Results

We now turn to the regressions using the conditional variance of profitability (Column 3). With one exception, the results of this test other are similar to those in the previous specification. Only in the case of Mexico do we find some risk sharing according to this test, and none before. Out of the seven countries examined in this part of the analysis, there is evidence of significant risk sharing in four (Brazil, Mexico, Taiwan, and post-war Japan). There is also evidence of a certain degree of risk sharing in Thailand although it is not quite significant at conventional significance levels. As in the previous test, the magnitude of the group coefficients in these countries is quite large (relative to the mean dependent variable, which appears in Column 4). By contrast, no significant effect of group affiliation on the unexplained volatility of profits is found in the remaining two countries, Chile and India, in line with the OLS regressions.

Matched Portfolios Results

We are able to construct matched portfolios in all our emerging markets except Colombia, Israel and Venezuela, where data limitations preclude such construction. Table 5 indicates that there is statistically significant evidence of smoothing of profitability in only two countries, Korea and Thailand. The results for these countries are in keeping

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is a standard normal variable. Critical values for the standard normal distribution can then be used to calculate the probability that the null hypothesis is correct.

with our earlier tests. There seems to be "dis-smoothing" in Indonesia and Taiwan. The results for Indonesia are in keeping with our tests based on responses to shocks, and also with Fisman's (2000) work on Indonesian groups. We conclude that the matched portfolio test shows no evidence of smoothing in most countries.

Responses to Shocks to Profitability

From the UN data, we are able to identify four positive and two negative industry-specific shocks across India, Indonesia, Korea and post-war Japan (Table 6, Panel A). The group effect is statistically significant in two thirds of our sample of shocks. We find some statistically significant smoothing in India, Korea and Japan. Further, this smoothing is in response to both positive and negative shocks. In Indonesia, we find that group affiliation exacerbates the one industry-specific shock in this country.[24]

Within the constraints imposed by the length of the time series of our data, we are also able to identify two positive and five negative macroeconomic shocks spread across six countries. The group effect is typically opposite in sign to the sign of the shock (Table 6, Panel B).[25] This is consistent with the idea that groups dampen extreme (positive and negative) movements in profitability. However, the group coefficients are never statistically significant. It appears as though groups are not much better insured than unaffiliated firms to macroeconomic shocks, a conclusion similar to that of Chui, Titman and Wei (2000) in the case of Indonesian groups during the Asian financial crisis.

Risk Sharing in Large v. Small Groups

[24] Fisman (2000) has shown that groups exacerbate political shocks in Indonesia. Our results are consistent with his findings.

It is possible that we would detect more risk sharing by groups if we allowed for heterogeneity in group size and structure. It may be the case that large and diversified groups do provide insurance to member firms whereas smaller, more focused groups do not. These issues are examined in Table 7 where an interaction between the group dummy variable and group size (total assets of firms in the sample belonging to the group) is added to our basic regression specification (1). We find that large groups are indeed more important than smaller groups in providing insurance opportunities in some countries. For example in Brazil, only large groups seem to smooth operating profitability for members. In Thailand, all groups do so, yet large groups seem to do so more. The magnitude of the coefficient, however, appears to be rather small: a one standard deviation increase in the assets of average sized Thai group will increase the extent of smoothing by less than two percent. The overall impression from Table 7 is that even when taking into account the size (and diversification which is typically correlated with size) of corporate groups, the evidence that groups substantially smooth of member firm profitability is very mixed.

Comparisons of Distributions

Tests for first-order-stochastic-dominance are presented in the two left-hand-side columns of Table 8. There is evidence of group-provided insurance in Korea, Taiwan, Thailand and postwar Japan in which groups appear to provide insurance according to several previous tests as well. In addition, there is evidence of group provided insurance in a number of other countries that were not identified in our earlier tests (e.g. Colombia, Turkey). However, stochastic dominance tests, as well as the other tests conducted so far,

[25] The virtually non-existent group effect in the Indian shock is an exception.

do not support the view that business groups around the world typically provide substantial risk sharing opportunities to member firms.

It is possible, however, that, groups provide assistance to member firms only during financial distress, as Hoshi et al. (1990) argue with respect to the Japanese bank-centered groups. We investigate this issue more formally by examining the skewness of the profitability distributions for group and non-group firms (Columns 3 and 4 of Table 8). In 11 of the 15 emerging markets, the skewness coefficient for group firms is higher (i.e. more positive) than for non-group firms, which is consistent with the risk sharing hypothesis (i.e. there are fewer group firms with very negative profits). In particular, we find higher skewness coefficients for groups in the same countries identified in our earlier tests as the ones where there is some group provided insurance (Brazil, Korea, Mexico, Taiwan, Thailand and postwar Japan). Nevertheless, the observed differences in the skewness of the profitability distributions between group affiliated and unaffiliated firms appear to be rather small.

Finally, Columns 5 through 8 of Table 8 describe the more complex two-dimensional stochastic dominance tests. Graphical depictions of confidence ellipses for the group affiliated and for unaffiliated firms, for pre- and post-war Japan and for the emerging markets can be seen in Figure 1. The results are consistent with those of our other tests: in some countries (e.g. Korea or Thailand) there is certainly evidence of group provided insurance. But in the majority of countries it is impossible to reject the hypothesis that the distributions of profitability and profit volatility are identical for group affiliated and for unaffiliated firms.[26]

[26] In postwar Japan, we do not find a significant difference between group-affiliated and unaffiliated firms in this test. If a broader definition of group affiliation provided by Dodwell Marketing Consultants is used,

The Role of Dividends in Profitability Smoothing

In Table 9 we move to examining an alternative mechanism of profitability smoothing within business groups, namely dividends, which may serve as an automatic mechanism to smooth profitability among group firms operating in a variety of industries. Here we adapt the Asdrubali-Sorensen-Yosha (1996) method to measure risk sharing by estimating Equation (2) using dividend data from Chile, India, and postwar Japan. We find that in none of these countries do intra-group dividends play a substantial smoothing role. In Chile dividends dampen less than three percent of shocks to the operating profitability of group firms in the post-1991 period, but the coefficient is very imprecisely estimated so that it is impossible to reject the hypothesis that it is in fact zero. In other samples the figures are lower or statistically insignificant.[27] Surprisingly, non-group firms in India seem to rely on dividends to dampen profitability shocks more than group members do. This bears some resemblance to Nakatani's (1984) finding that *keiretsu* firms paid out lower dividends and higher wages than did otherwise comparable unaffiliated firms – thus reallocating firm rents away from shareholders and towards labor within Japanese groups. Another surprising finding is that in Chile, dividend smoothing of profitability seems higher in the post-liberalization period than in the period of regulated capital markets. We return to this issue later.

The Role of Loans

We now turn to intra-group loans as a smoothing mechanism. Using data for India

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the effect of group affiliation becomes significant, providing some evidence of group-provided insurance in Japan according to this test as well.

[27] This could be due to tax rules or simply to the fact that when dividends are distributed funds are transferred to all shareholders and not just to group members who need funds to smooth income.

only, we re-estimate Equation (2) with two levels of profitability smoothing namely, dividends and intra-group loans. Unlike dividends, intra-group loans dampen a significant fraction of shocks to operating profitability, about 27 percent. This finding for India is supported by some anecdotal evidence on the use of intra-group loans to stabilize income in both Hong Kong (cited above) and Korea.[28] There is also some evidence from Japan on (main bank and) group transfers to member firms in financial distress. These "rescue operations" are often associated with the provision of new loans (e.g. Hoshi et al., 1990). This suggests that, unlike our findings on profitability smoothing, loans may well be an important mechanism by which stronger group members assist firms in distress within their group and provide liquidity. Unfortunately, we do not have the data to test this hypothesis explicitly in other countries.

To summarize, we do find strong evidence of the smoothing of operating profitability in Japan, as well as in three other countries – Korea, Taiwan and Thailand. We also find milder evidence of such smoothing in many other emerging markets, though none of our tests reveals any evidence of smoothing in Chile. The pattern of lower-variance and lower levels of profitability of the Japanese *keiretsu* can only be replicated in less than half of our sample of emerging markets. We conclude that the Japan results regarding the smoothing of operating profitability by corporate groups are not universal. We also find that dividends play virtually no role in smoothing in three countries (Chile, India and Japan) but that intra-group loans do in one country, India.

[28] The experience of the Korean conglomerate *Daewoo* corroborates the importance of intra-group loans as a mechanism of risk sharing. During Daewoo's recent crisis, creditors attempted to restrict financial ties

V. Interpretation

Group Risk Sharing and Capital Market Development

We turn next to the relation between the extent of group risk sharing and financial market development. Table 10 lists the emerging markets in the sample in order of the extent of income smoothed through intra-group trade. The extent of income smoothing reported is the coefficient on group affiliation estimated in Column 1 of Table 4 divided by the standard deviation of operating profitability (Column 2 of Table 4). The table also presents several measures of capital market development, drawn from IMF data and from Levine and Zervos (1998). It is quite clear that there is little relation between the degree of capital market development and the role of business groups in profitability smoothing. For example, among the countries where no profitability smoothing is detected, one can find Chile, where capital markets and bank credit appear to be fairly developed (in particular, the 1997 ratio of market capitalization to GDP in Chile is the highest in the sample). Yet there is also no profitability smoothing in Turkey and Peru, where financial markets are quite under-developed. In two other countries with under-developed capital markets, India and Venezuela, there is even "dis-smoothing" according to this test (although we have seen before that Indian firms smooth liquidity through intra-group loans). Moreover, the group of countries where some risk sharing is detected seems to consist of countries in the middle range of the capital market development "league." This can be seen also from the simple correlation between measures of capital market development and the extent of profitability smoothed. The only negative correlation is between the extent of profitability smoothed and 1997 market capitalization, although this correlation is quite low (around –0.27). The correlation between profitability

between successful and ailing group units (*The Financial Times*, August 31, 1999).

smoothing and every one of the other measures of capital market development is actually positive (although close to zero).

There is yet more evidence casting doubt on the relation between capital market development and group risk sharing. For Chile and Japan, we compare profitability smoothing by groups through intra-group trade and through dividends before and after capital markets were liberalized. For Chile, profitability smoothing is insignificant both before and after the deregulation of financial markets in 1991, and in Japan, the effect of group affiliation on the standard deviation of operating profitability is roughly identical before the liberalization of the early 1980s and afterwards (Table 4). Turning to dividends, in pre-1984 Japan there appears to be somewhat more use of this mechanism, although the magnitude of the coefficient is miniscule, implying that merely one percent of shocks to operating profitability is smoothed. We conclude that there is no evidence for higher group risk sharing in periods or in countries where capital markets are restricted or under-developed.[29]

Can "Tunneling" Explain all our Results?

Johnson et al. (2000) argue that "tunneling" (the expropriation of minority shareholders by those holding large equity stakes, especially within corporate groups), is a widespread phenomenon. Bertrand et al. (2000) argue, using the same Indian data used in this study, that "tunneling" is common within the Indian corporate groups. They show, using a different empirical approach, that firms at the bottom of the group hierarchy are the ones least exposed to external shocks because, they argue, much of their revenues

[29] Indeed, groups often appear to increase in prominence at times when capital markets are also developing rapidly. Thus, the Israeli experience supports this view; the recent emergence of several privately owned

have already been siphoned by other firms further up the group ladder.

Note first that while tunneling may explain why some group affiliated firms are insulated from positive shocks (the additional profits are diverted to group owners), it is more difficult to explain why group affiliated firms would be insulated from adverse shocks. Since our results (Table 6) suggest that group affiliation reduces the responsiveness of firm to both positive and negative shocks, they are not consistent with a pure version of the tunneling story. Further, if tunneling primarily diverts funds from public firms to private ones when the former are profitable, we would expect to see the distributions of operating profitability of group members to include relatively few profitable firms – i.e. be skewed with a tail to the left. For only two countries, Colombia (where the sample is small) and prewar Japan, does the distribution seem to be statistically significantly different from a normal distribution and skewed in this direction.

More generally, Johnson et al. (2000) imply that tunneling is likely to be relatively common in countries where minority shareholders are least protected, typically countries whose legal system is of the French "civil law" tradition. Some countries where we consistently observe some risk sharing in several different statistical tests (e.g. Japan, Taiwan and Korea) are not included in this group (they belong to the German legal tradition). In Japan, for example, minority shareholders are relatively well protected, and furthermore, there is no "large shareholder" within the Japanese corporate groups. Finally, to the extent that tunneling and risk sharing are hard to distinguish empirically without information on the position of each firm within the group hierarchy, we would

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business groups in Israel coincided with significant liberalization of financial markets. Khanna and Palepu (1999) document similar evidence in Chile and India.

expect to find significant differences between group affiliated and unaffiliated firms in Latin American countries, where minority shareholders are not well protected. This, however does not appear to be the case: evidence of group provided insurance appears to be less common in Latin America than it is in East Asia. We therefore believe that tunneling is unlikely to fully account for our results, although it may well be an important phenomenon. Our point here is not to test risk sharing v. "tunneling" (we do not have appropriate data) but simply to argue that there is limited evidence on Japanese style risk sharing in other countries.[30]

VI. Conclusion

Theoretical work, empirical work set primarily in Japan, and anecdotal evidence all suggest that risk sharing is an important function of corporate groups. Table 11 summarizes our findings. In several of our estimations using data from pre-war and post-war Japan, we are able to replicate results consistent with the conventional wisdom – that *keiretsu* affiliation is correlated with lower variance (and lower levels) of profitability. Most of our estimations support a similar conclusion regarding the effect of business group affiliation on the variance of profitability in three of our 15-country emerging market sample: Korea, Taiwan and Thailand. In addition, whenever we find statistically significant evidence of profitability smoothing in our core estimation, the magnitude of the estimate is economically large – of the order of 20-30 percent reduction in the standard deviation of operating profitability. In most of the other countries there is some evidence for profitability smoothing in some of the tests, but the majority of tests do not

[30] Ball, Kothari and Robin (1998) argue that, in civil law countries, non-shareholders are involved in determining how earnings are reported, and, since they are less diversified than individual shareholders, their demand for earnings smoothing is higher. However, this does not appear to drive our results either

support this conclusion. In Chile there is no indication of group provided smoothing of profitability in any test. We conclude that business groups around the world do not generally follow the pattern of the Japanese *keiretsu* in providing mutual insurance to member firms. Further, our test of two-dimensional stochastic dominance shows that in less than half of our sample is it the case that both the standard deviation and level of operating profitability are lower for group affiliated firm. Finally, dividends do not seem to be used by groups as a tool for smoothing, although there is strong evidence from India that intra-group loans and receivables are used to smooth liquidity.

In addition to verifying that the Japan results do not show up in most of the emerging markets in our sample, the alternative hypothesis, namely that the incidence of shocks is itself correlated with group membership, receives no support in our data. Group affiliation is generally not correlated with increases in the standard deviation of operating profitability.

Cross-country correlations and time-series variation in two countries suggest that the extent of risk sharing is not correlated with capital market under-development. It is possible that the risk sharing which we do observe may have to do with labor market, rather than capital market, imperfections, so that managers who cannot diversify the risks of their specific human capital prefer to operate within the smoother environment provided by a business group. We also argue that, while tunneling and minority shareholder abuse may well be important phenomena in numerous countries around the world, these cannot explain many of our specific results.

There are several interesting issues that data limitations prevent us from

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because (a) our results do not bifurcate cleanly between civil law and other countries and (b) this reasoning does not explain intra-country variations in risk-sharing.

addressing. Such smoothing as one observes might be the result, not of moving money around within a group, but of groups concentrating their activities in industries whose fortunes are imperfectly correlated with each other. It is also possible that groups, knowing that they are able to smooth profitability ex post, actively seek out higher variance opportunities (and subsequently smooth these), implying that equilibrium difference in the smoothness of operating profitability between group affiliated and unaffiliated firms may not exist. Though we partially attempt to control for the endogeneity in the industries in which a group operates through our conditional variance and matched portfolio estimations, for the most part we treat the group's industries as exogenously given. A study with longer time-series data should analyze the manner in which the industry composition of groups evolves over time. Such a study could further address the causes and consequences of the smoothing within business groups that does exist.

Appendix:

Implementing a One-sided, Two-dimensional Test of Stochastic Dominance

The null hypothesis is that $b_1=0$, $b_2=0$. The alternative hypothesis is that $b_1<0$, $b_2<0$. It can be shown that a one-sided modification of the usual likelihood ratio test rejects this null against the alternative for large values of the test statistic

$$(\mathbf{b}' * \mathbf{V}^{-1} * \mathbf{b}) - ((\mathbf{b}-\mathbf{b}^*)' * \mathbf{V}^{-1} * (\mathbf{b}-\mathbf{b}^*))$$

where **b** is the estimate of β, **V** is the variance/covariance matrix of the estimates, and **b*** is the maximum likelihood estimate under the alternative ((Kudô, 1963, Nüesch, 1966, Barlow et al., 1972).[31]

The log likelihood under the alternative is more complex than under the null. The null hypothesis distribution of the test statistic is a mixture of c^2 distributions. The *p*-values for the test can be computed from the observation that, under the null, for a value *C* of the test statistic,

$$\Pr\{c^{\wedge 2} \geq C\} = \sum_j (Q(j,p) \Pr\{c_j^2 \geq C\}, \quad C>0$$

$$\Pr\{c^{\wedge 2}=0\} = Q(0,p)$$

where $Q(j,p)$ is the probability that **b*** has exactly *j* non-zero elements, and c_j^2 denotes a random variable that is distributed as c^2 with *j* degrees of freedom (Barlow, et al. 1972).

Computing p-values

The regular Wald/likelihood ratio test, where the alternative hypothesis does not restrict b_1 and b_2 to a particular quadrant, would calculate $\mathbf{b}' * \mathbf{V}^{-1} * \mathbf{b}$, where **b** is the estimate of β, and **V** is the variance/covariance matrix of the estimates. This is

asymptotically distributed as c_p^2 where p is the number of parameters. This can be derived from -2 * (log likelihood under null hypothesis minus log likelihood under alternative hypothesis (unrestricted)).

The one-sided test is done similarly, but the log likelihood under the alternative hypothesis is more complicated to calculate, and the test statistic is distributed as a mixture of χ^2 with different degrees of freedom. Under the null, -2 * log likelihood has a term $\mathbf{b}' * \mathbf{V}^{-1} * \mathbf{b}$, just as in the usual test. However, the corresponding term under the alternative hypothesis is no longer zero, but $(\mathbf{b}-\mathbf{b}^*)' * \mathbf{V}^{-1} * (\mathbf{b}-\mathbf{b}^*)$, where $\mathbf{b}^*$ is the maximum likelihood estimate under the alternative. If the coefficient estimate actually satisfies $\mathbf{b} > 0$, then the maximum likelihood (ML) estimate will be the usual one, and the term will be zero. However, if one or more components of $\mathbf{b}$ are < 0, the ML estimate will be on the boundary of the alternative region (i.e. one or more of the components of $\mathbf{b}^*$ will be 0).

To find $\mathbf{b}^*$ in the general case requires solving a quadratic programming (QP) problem (i.e. minimizing $(\mathbf{b}-\mathbf{b}^*)' * \mathbf{V}^{-1} * (\mathbf{b}-\mathbf{b}^*)$ subject to $\mathbf{b}^* > 0$). However, in our case there are only two parameters, so the solution to the quadratic programming problem is relatively simple. As mentioned above, if $\mathbf{b} > 0$, then $\mathbf{b}^* = \mathbf{b}$. If not, then either the first or second component of $\mathbf{b}^*$ must be zero, and the other component can be found by solving a univariate minimization problem (where the objective function is quadratic, so the solution is unique.) So there is a potential solution where $\mathbf{b_1}^* = 0$ and one where $\mathbf{b_2}^* = 0$. When $\mathbf{b_1}^* = 0$, then $\mathbf{b_2}^* = \mathbf{b_2} + \mathbf{V^{-1}}_{1,2}/\ \mathbf{V^{-1}}_{2,2} * \mathbf{b_1}$. When $\mathbf{b_2}^* = 0$, then $\mathbf{b_1}^* = \mathbf{b_1} + \mathbf{V^{-1}}_{1,2}/\ \mathbf{V^{-1}}_{1,1} * \mathbf{b_2}$. If the calculated $\mathbf{b_1}^*$ or $\mathbf{b_2}^* < 0$, then the corresponding solution is not

[31] The first term in this expression corresponds to –2*log likelihood under the null, and the second corresponds to –2*log likelihood under the alternative.

admissible. If neither solution is admissible, then $\mathbf{b}^*$ = (0,0). If only one is admissible, then the solution is ($\mathbf{b_1}^*$, 0) or (0, $\mathbf{b_2}^*$). If both are admissible, then the solution with the smaller function value is taken.

Once the quadratic program is solved, the test statistic is $(\mathbf{b}' * \mathbf{V}^{-1} * \mathbf{b}) - ((\mathbf{b}-\mathbf{b}^*)' * \mathbf{V}^{-1} * (\mathbf{b}-\mathbf{b}^*))$, which Barlow et al. (1972; chapter 4) show is equivalent to $\mathbf{b}^{*\prime} * \mathbf{V}^{-1} * \mathbf{b}^*$. Now the problem is to find the distribution of the test statistic under the null. There is a nonzero probability that the test statistic will be zero, corresponding to the case where $\mathbf{b}^*$ = (0,0). Then there is a certain probability that the QP solution will be on a boundary ($\mathbf{b_1}^*$, 0) or (0, $\mathbf{b_2}^*$), in which case the quadratic form corresponds to only one parameter, and the test statistic ~ χ_1^2. If the QP solution is inside the region, then the test statistic ~ χ_2^2. So for a value of the test statistic **C**, the probability of obtaining a value **C** under the null is 1 if **C** is 0, otherwise $Q(1,2) * Pr(\chi_1^2 \geq C) + Q(2,2) * Pr(\chi_2^2 \geq C)$, where Q(1,2) is the probability under the null that exactly one of the components of $\mathbf{b}^*$ is nonzero, and Q(2,2) is the probability that both are nonzero. It turns out that Q(1,2) = 1/2, independent of the correlation between the parameters, and $Q(2,2) = 1/2 - \cos^{-1}(\rho)/2\pi$, where ρ is the correlation between the parameter estimates (Gouriéroux et al., 1982, p. 71).

For accuracy, we should observe that these results are asymptotic. Not only do they depend on $\mathbf{V}^{-1}$ being known, but they depend on ρ being known in order to calculate Q(2,2). However, our sample sizes are large enough for us to sensibly rely on asymptotic results.

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Fig. 1:Confidence Ellipses by Country for Group Affiliated and Unaffiliated Firms

The thinner (red) line is the 95 percent confidence ellipse for group affiliated firms, while the thicker (green) line is the 95 percent confidence ellipse for unaffiliated firms. The plot is of standard deviation of operating profitability (y-axis) versus mean of operating profitability (x-axis). No ellipse is produced for Venezuela (small sample).

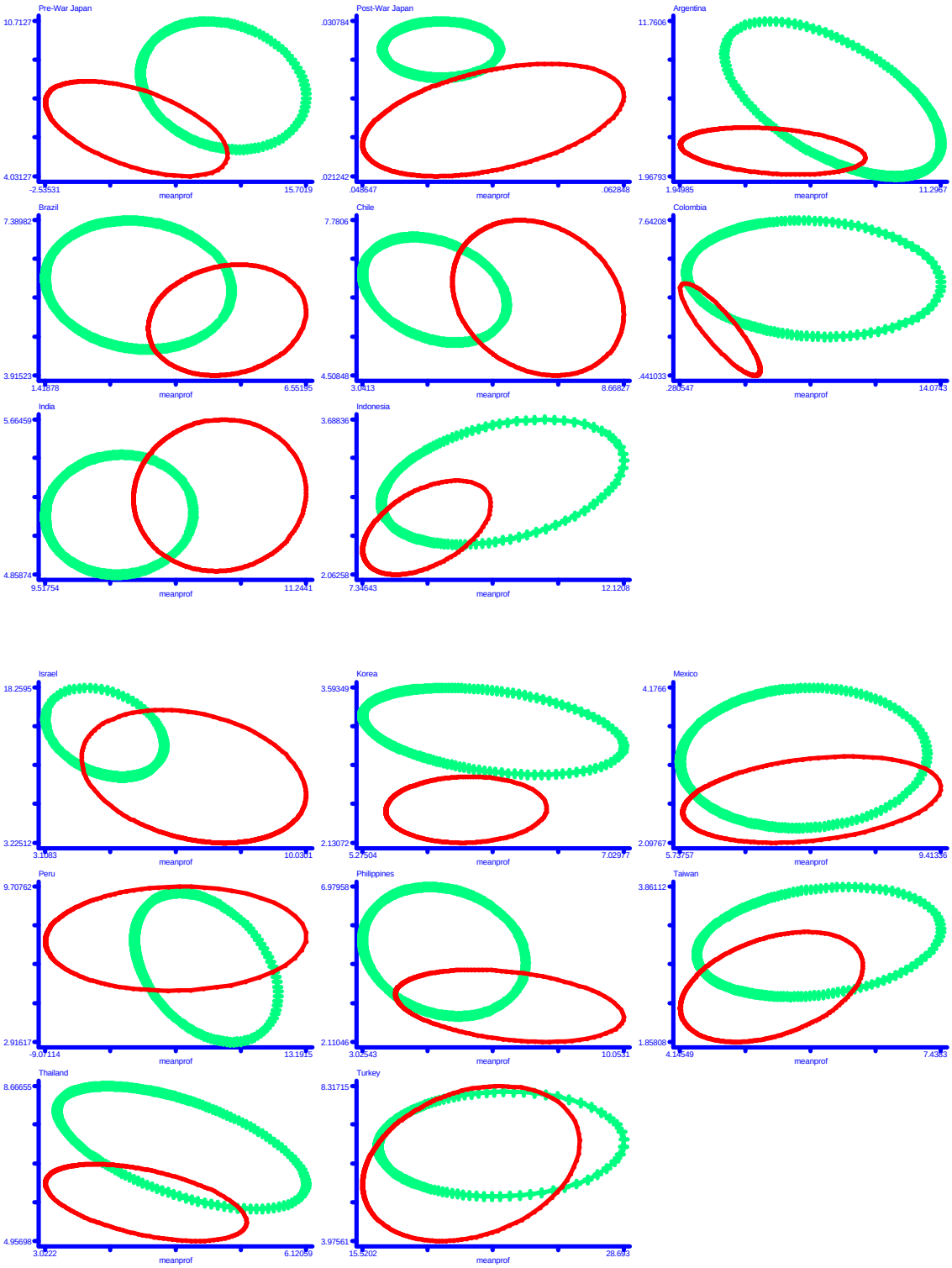

Table 1: Emerging Market Data Sources Used

Country	Source of Group Affiliation Data	Source of Financial and Industry Data
Argentina	Interviews by field research team, coupled with publicly available information. Field research carried out by Professor Alvaro Vilaseca in early 1998.	Datastream International.
Brazil	America Economica "Los principales conglomerados" 1997, published by Dow Jones.	Datastream International.
Chile	Superintendencia de Valores y Seguros, Santiago, Chile. Verified through field research carried out in Chile by Tarun Khanna in multiple trips from mid to late 1997, with assistance from Professor Carlos Caceres, Universidad Adolfo Ibanez, Santiago, Chile. See also Khanna and Palepu (1999).	Superintendencia de Valores y Seguros, Santiago, Chile. Bolsa de Commercio, Santiago, Chile.
Colombia	America Economica "Los principales conglomerados" 1997, published by Dow Jones.	Datastream International.
India	Centre for Monitoring the Indian Economy, Mumbai, India. Verified through field research and interviews by Tarun Khanna and Krishna Palepu in Chennai, Mumbai, and New Delhi from 1996-1998. See also Khanna and Palepu (1999, 2000a).	Centre for Monitoring the Indian Economy, Mumbai, India.
Indonesia	Kompass Indonesia, Top Companies and Big Groups in Indonesia, (Jakarta: Kompass Indonesia, 1996). Cross-checked through field research by Raymond Fisman, see Fisman (2000).	Jakarta Stock Exchange, Indonesian Capital Markets Directory 1996, (Jakarta: Institute for Economic and Financial Research, 1996).
Israel	Liat Sack, Hebrew University, unpublished M.A. thesis "Belonging to a Conglomerate in Israel and Its Impact on Firm Profitability, Growth and Risk," 1998.	Liat Sack, Hebrew University, unpublished M.A. thesis "Belonging to a Conglomerate in Israel and Its Impact on Firm Profitability, Growth and Risk," 1998.
Korea	Korea Company Handbook, Autumn 1996, Dongwon Securities Co. Ltd.	Korea Company Handbook, Autumn 1996, Dongwon Securities Co. Ltd. Datastream International.
Mexico	America Economica "Los principales conglomerados" 1997, published by Dow Jones.	Datastream International.
Peru	America Economica "Los principales conglomerados" 1997, published by Dow Jones.	Datastream International.
Philippines	The Ayala Group, Manila, Philippines.	Datastream International.

Table 1 - Continued

Country	Source of Group Affiliation Data	Source of Financial and Industry Data
Taiwan	Translated from the Mandarin edition of Business Groups in Taiwan, 1997, with assistance from Ishtiaq Mahmood, Kennedy School of Government, Harvard University, and personnel at Yenching Library, Harvard University.	Datastream International.
Thailand	Thai Business Groups 1996/1997, Tara Siam Business Information Limited, Bangkok.	Datastream International.
Turkey	Investext, Istanbul Stock Exchange: Yearbook of Companies 1996, Worldscope, ISI Emerging Markets.	Datastream International.
Venezuela	America Economica "Los principales conglomerados" 1997, published by Dow Jones.	Datastream International.

Table 2 – Japanese Data Sources Used

	Source of Group Affiliation Data	Source of Financial and Industry Data
Prewar Japan	Miyajima (in progress)	Miyajima (in progress)
Postwar Japan	Members of Presidents' Clubs based on *Keizai Chosa Kyokai*'s *Keiretsu no Kenkyu* (in Japanese, 1988 edition).	The Japan Development Bank data tapes

Table 3: Group Affiliation around the World

The table shows summary statistics on group risk and operating performance for fifteen emerging markets as well as for pre- and postwar Japan. Firm numbers, as well as statistics on firm size (total assets) and median return on assets (ROA) are all based on the year for which we have maximal coverage for the country in question. Firms with profit rates above 100 percent or below –100 percent are excluded from the analysis. In prewar Japan, group affiliation refers to affiliation in the largest three *zaibatsu* only. In postwar Japan, group members are defined as members of Presidents' Clubs only. Significance levels for the comparisons of medians are based on Wilcoxon signed-rank tests. * denotes significance at the 5 percent level and ** denotes significance at the 10 percent level.

Country	Years of data	No. of firms	No. of group affiliated firms	(Median size of group affiliated firms)/ (Median size of unaffiliated firms)	Median ROA of group affiliated firm (percent)	Median ROA of unaffiliated firms (percent)	Median standard deviation of ROA, group affiliated firms (percent)	Median standard deviation of ROA, unaffiliated firms (percent)
Argentina	90-97	25	11	5.53	3.95	7.78**	3.67	4.91**
Brazil	90-97	108	51	2.50	3.30	1.85**	4.05	5.07
Chile	89-96	225	50	18.71	5.93	2.20*	4.42	4.10.
Colombia	88-97	16	7	4.54	1.43	0.90	7.40	9.02
India	90-97	5446	1821	4.37	11.73	9.56*	4.65	4.37*
Indonesia	93-95	236	153	2.79	7.31	7.81	1.93	2.53*
Israel	93-95	183	43	4.99	5.6	3.9*	4.4	6.8
Korea	91-95	427	218	3.93	4.85	5.12	1.88	2.58*
Mexico	88-97	55	19	2.29	8.22	6.08	4.89	4.92
Peru	88-97	21	5	1.62	7.92	7.86	10.51	9.98
Philippines	92-97	148	37	3.43	7.34	3.98	2.48	2.95
Taiwan	90-97	178	79	2.05	5.07	6.22	1.75	2.26**
Thailand	92-97	415	258	2.33	2.90	4.41*	4.32	4.93**
Turkey	88-97	40	21	0.96	24.62	26.32	12.52	12.37
Venezuela	88-97	11	2	1.45	3.68	4.60	6.11	3.90*
Prewar Japan	32-43	58	17	6.8	5.5	6.4	4.4	7.1
Postwar Japan	77-92	1002	94	8.5	3.41	3.63	2.23	2.29

Table 4: Risk Sharing through Intra-group Trade

To gauge the effect of groups on the volatility of operating profitability, the table displays coefficients on a group-affiliation dummy in several regression specifications. In Column 1, the dependent variable is the standard deviation of operating profitability and right-hand-side variables include firm assets, industry dummies, average profitability (coefficients not shown), and the group dummy. All the regressions in this column are weighted by the number of observations per-firm and include heteroskedasticity-consistent standard errors. To get a sense of the magnitude of the coefficients, the mean standard deviation of operating profitability for each country appears in Column 2. Column 3 presents conditional variance estimates calculated as follows: firm profitability is regressed on firm size, industry and firm-fixed effects. The squared residuals from this regression are then regressed on the group affiliation dummy (shown), firm size and year dummies (not shown). To get a sense of the magnitude of the coefficients, Column 4 presents the mean squared residuals from the profitability regression described above for each country. Firms with profit rates above 100 percent or below –100 percent are excluded from the analysis. * denotes a coefficient that is significant at the 5 percent level, and ** denotes a coefficient that is significant at the 10 percent level.

(continued on the next page)

Table 4 – continued

Country	(1) Effect of group affiliation on profit volatility: estimation of Equation (1)	(2) Mean std. Deviation of operating profitability in the sample	(3) Effect of group affiliation on conditional volatility of profitability	(4) Mean squared residuals in the sample (from profitability regression)
Argentina	-8.27	5.26	N/A	N/A
Brazil	-1.73*	5.58	-25.4**	67.7
Chile	-1.04	6.40	-16.5	186.1
Pre-liberalization Chile (pre 1991)	+0.24	4.53	N/A	N/A
Post-liberalization Chile (1991-1996)	-1.92	5.79	N/A	N/A
Colombia	-8.47	8.94	N/A	N/A
India	+0.06*	6.1	+0.3*	1.2
Indonesia	-0.01	2.73	N/A	N/A
Israel	+24.0	47.5	N/A	N/A
Korea	-0.63*	2.80	N/A	N/A
Mexico	+0.18	5.38	-26.7**	39.1
Peru	-4.66	11.05	N/A	N/A
Philippines	-0.77	4.49	N/A	N/A
Taiwan	-0.65**	2.89	-32.9*	39.6
Thailand	-1.40*	6.08	-20.4	93.2
Turkey	+1.37	12.88	N/A	N/A
Venezuela	+3.41*	4.33	N/A	N/A
Prewar Japan	-3.83*	4.94	N/A	N/A
Postwar Japan, 1977-1992	-0.41*	2.46	-0.07*	0.25
Postwar Japan, 1977-1983	-0.39**	2.50	N/A	N/A
Postwar Japan, 1984-1992	-0.41*	2.42	N/A	N/A

Table 5: The Volatility of Profitability for Business Groups v. Matched Portfolios

The table compares the standard deviation of operating profitability of groups (calculated as a weighted average of the standard deviation of operating profitability of affiliated firms) with a similar measure calculated for a matched portfolio for each group. Portfolios are matched on the basis of industry, size and country. This test is not conducted for Colombia and Venezuela (small samples), Israel (data limitations) and Japan. The number of groups within each country represents those groups for which a matched portfolio could be constructed. * denotes a difference that is significant at the 5 percent level, and ** denotes a difference that is significant at the 10 percent level. Significance levels are based on two-tailed difference of means t-tests, and on Wilcoxon signed-rank tests for the difference of medians.

	Number of groups	Mean std. deviation of group operating profitability	Mean std. deviation of matched portfolio operating profitability	Median std. deviation of group operating profitability	Median std. deviation of matched portfolio operating profitability
Argentina	4	4.90	12.67	5.21	6.21
Brazil	35	5.38	5.38	4.27	4.40
Chile	19	9.39	4.80	4.47	4.67
India	439	7.40	6.68	5.09	5.20
Indonesia	85	2.63	1.92**	2.05	1.41**
Korea	122	2.26	3.60*	1.87	3.89*
Mexico	13	3.54	3.08	3.70	2.81
Peru	5	7.04	6.69	6.66	7.81
Philippines	11	2.68	1.98	1.83	1.46
Taiwan	45	2.42	1.62**	2.10	1.67**
Thailand	99	5.91	11.08*	5.16	8.98*
Turkey	7	9.31	7.69	9.94	8.49

Table 6: Responses to Shocks

Panel A: Responses to Industry Specific Shocks

The panel reports the differential responses of group firms and unaffiliated firms to industry-specific shocks. Data from the United Nations' International Yearbook of Industry Statistics (2000) are used to identify shocks to 2-digit manufacturing industries (ISIC codes between 20 and 39). The percentage change in real output (nominal output adjusted by producer price indices obtained from the UN data and from the IMF) is used to identify candidate shocks. For a shock to be listed in the table below there must be at least five group affiliated firms and five unaffiliated firms in our country-specific data sets for which performance data exists in the year surrounding the shock. We are thus able to identify four positive shocks and two negative shocks in three emerging markets and in post-war Japan. The group coefficient is the point estimate from a regression of change in ROA, defined as the difference between the mean ROA at the end of the shock and the mean ROA at the beginning of the shock, on firm size and a group dummy, with robust standard errors. The results are similar when we allow for correlation of errors among observations within a group (Moulton, 1986, 1990). * denotes a coefficient that is significant at the 5 percent level, and ** denotes a coeffiecient that is significant at the 10 percent level.

Country	Year of Shock	Magnitude of Shock (UN Data)	Industry (ISIC Code)	Group Coefficient
India	1994-95	30%	Indust'l/Comm/ Mach. 3500	-1.54
India	1994-95	37%	Transportation Equip. 3700	-3.87**
Indonesia	1993-94	39%	Transportation Equip. 3700	6.35**
Korea	1991-92	-40%	Transportation Equip. 3700	2.46*
Japan	1979-80	35%	Petroleum Refining 2900	-0.01*
Japan	1985-86	-34%	Petroleum Refining 2900	-0.03

Panel B: Responses to Macroeconomic Shocks

The table reports regression estimates of the effect of group affiliation on changes in ROA around the period surrounding economy-wide (macroeconomic) shocks. Shocks are identified on the basis of the difference between the mean ROA at the end of a candidate shock and the mean ROA at the beginning of the candidate shock. The ratio of change in ROA/initial ROA, our measure of the magnitude of the shock, must exceed 15 percent for the event to qualify as a shock. Two positive and five negative shocks are thus identified. The group effect reports the coefficient of a group dummy variable in a regression of change in ROA on firm size, industry affiliation and group membership. The results are similar when robust standard errors are used as well as when we allow for correlation of errors among observations within a group (Moulton, 1986, 1990). None of the reported coefficients is statistically significant at conventional levels.

Country	Duration of shock	Change in ROA	Change in ROA/ Initial ROA	Group Effect
Brazil	1992-93	+2.61	62%	-1.58
India	1995-96	-3.50	-26%	-0.03
Mexico	1993-94	-1.49	-18%	1.38
Mexico	1995-96	+1.22	19%	-1.60
Philippines	1995-96	-2.97	-43%	1.76
Taiwan	1995-96	-2.18	-44%	0.35
Thailand	1995-97	-7.41	-141%	0.92

Table 7: Large v. Small Groups

The dependent variable is the standard deviation of operating profitability and right-hand-side variables include firm assets, industry dummies, average profitability (coefficients not shown), the group dummy and the interaction between the group dummy and total assets of the group. Results are not available for Israel and Venezuela because of data limitations and for Japan where only the largest groups are included in the analysis. * denotes a coefficient that is significant at the 5 percent level, and ** denotes a coefficient that is significant at the 10 percent level. Firms with profit rates above 100 percent or below –100 percent are excluded from the analysis.

Country	Effect of group affiliation on profit volatility	Coefficient on group dummy times group assets
Argentina	-6.92	-0.05
Brazil	-0.11	-0.09*
Chile	+2.03	-0.0002*
Colombia	-8.03*	+0.0003
India	+0.55*	-2.00
Indonesia	-0.32	+0.01
Korea	-0.56*	-0.008
Mexico	-0.70	-0.001
Peru	+2.14	-3.1*
Philippines	-0.84	-0.0003
Taiwan	-0.62	-0.0006
Thailand	-1.13*	-0.0001**
Turkey	-0.50	0.0000

Table 8: Tests based on Comparisons of Distributions

Column 1 shows the significance level of a one-sided Kolmogorov-Smirnov test of the hypothesis that the standard deviation of returns for affiliated firms is first-order stochastically dominated (FOSD) by that for unaffiliated firms. Column 2 shows the significance level of a one-sided Wilcoxon test of the hypothesis that the sum of the ranks of the standard deviation of group affiliated firms are lower than they are for unaffiliated firms. Columns 3 and 4 compare the skewness of the distribution of returns of group affiliated firms and of unaffiliated firms. The skewness measures should be interpreted as follows: if a distribution is normal, the skewness statistic equals zero. If there is a "tail" to the right, the coefficient is positive, and if there is a "tail" to the left the coefficient is negative. $^{+}$ denotes that it is impossible to reject the hypothesis that the distribution is normal at the 5 percent level. Columns 5 and 6 report the coefficient on the group dummy from the seemingly unrelated regressions (SUR) of the normalized ranks of standard deviations of profitability and of means of profitability on the group dummy (see text for details). Columns 7 and 8 report results of a parametric test of two-dimensional stochastic dominance: Column 7 reports the significance level of a test of the joint hypothesis that the group dummy is zero in both the mean and the standard deviation of profitability SUR regressions. Column 8 reports the significance level of the one-sided test that the group dummy is zero in each of the two SUR regressions against the alternative that the group dummy is negative in each of the SUR regressions. Firms with profits above 100 percent or below –100 percent are excluded from the analysis. In columns 1, 2, 7 and 8 * indicates significance at the 5 percent level, ** indicates significance at the 10 percent level.

Country	**(1) *p*-value of 1-sided KS test of FOSD**	**(2) *p*-value of 1-sided Wilcoxon ranksum test of FOSD**	**(3) Skewness of the profit distribution of group firms**	**(4) Skewness of the profit distribution of non-group Firms**	**(5) Coefficient of the group dummy in $Vrank_{sd}$ equation**	**(6) Coefficient of the group dummy in $Vrank_{mean}$ equation**	**(7) *p*-value of 2-sided test of 2-dimensional stochastic dominance**	**(8) *p*-value of 1-sided test of 2-dimensional stochastic dominance**
Argentina	0.16	0.04*	-0.4^{+}	-2.4	-0.61	-0.33	0.03*	0.01*
Brazil	0.27	0.19	0.8	-0.5	-0.16	0.07	0.14	0.34
Chile	0.71	0.57	-1.2	-1.3	-0.11	0.26	0.01*	0.18
Colombia	0.02*	0.000*	-0.7	-0.3^{+}	-1.11	-0.63	0.00*	0.00*
India	1.00	1.00	-0.52	-0.11	0.13	0.22	0.00*	1.00
Indonesia	0.08**	0.02*	1.8	1.9	-0.31	-0.18	0.06**	0.03*
Israel	0.22	0.05*	-1.1	-1.1	-0.23	-0.32	0.03*	0.01*
Korea	0.00*	0.00*	-0.05^{+}	-0.8	-0.34	-0.07	0.00*	0.00*
Mexico	0.17	0.38	0.15^{+}	-1.5	0.01	0.04	0.47	0.99
Peru	0.68	0.41	-0.4^{+}	-0.6	1.00	-0.05	0.97	0.69
Philippines	0.38	0.44	-1.6	-1.1	-0.05	0.33	0.18	0.52
Taiwan	0.06**	0.05*	1.0	0.5	-0.23	-0.04	0.29	0.14
Thailand	0.06**	0.05*	-0.9	-2.1	-0.14	-0.11	0.10**	0.04*
Turkey	0.04*	0.07**	0.1^{+}	-0.1^{+}	-0.39	-0.12	0.38	0.18
Venezuela	0.78	0.41	0.9	-0.2^{+}	0.18	1.00	0.28	1.00
Prewar Japan	0.28	0.26	-1.0	0.8^{+}	-0.43	-0.19	0.26	0.10**
Postwar Japan, 1977-1992	0.07**	0.00*	0.7	0.0^{+}	-0.13	-0.11	0.15	0.27

Table 9: Risk Sharing through Dividends

Estimates are based on the Asdrubali-Sorensen-Yosha method described in the text. * denotes a coefficient that is significant at the 5 percent level, and ** denotes a coefficient that is significant at the 10 percent level. Heteroskedastic-consistent standard errors are used.

Country	% of operating profitability smoothed through dividends
Chile, group firms, 1988-1996	0.7
Chile, non-group firms, 1988-1996	0.0
Chile, group firms pre-1991	0.0
Chile, group firms post-1991	2.8
Japan, Presidents' Clubs members	0.7*
Japan, other firms	0.4*
Japan, Presidents' Clubs members 1977-1983	1.1*
Japan, Presidents' Clubs members 1984-1992	0.3*
India, group firms, 1989-1996	0
India, non-group firms, 1989-1996	1.7**

Table 10: Risk Sharing and Capital Market Development in Emerging Markets

For countries where significant income smoothing is found in Column 1 of Table 4, the percent of volatility in operating profitability smoothed by groups (the ratio of Column 1 to Column 2 in Table 4) is presented. Countries where there is a negative but statistically insignificant effect of groups on volatility are listed as "insignificant." Countries where the coefficient is positive but statistically insignificant are described by "no smoothing," and countries with a positive and significant effect of groups on volatility are described by "dis-smoothing." 1997 market capitalization is based on the IMF's *International Financial Statistics*. All the other measures of capital market development are from Levine and Zervos (1998) and refer to average values for 1976 through 1993.

Country	**% of Operating profitability smoothed (the ratio of Column 1 to Column 2 in Table 4)**	**1997 market capitalization/ GDP**	**1976-1993 market capitalization/ GDP**	**1976-1993 value of trade on the stock market/ GDP**	**1976-1993 turnover/ stock market value**	**1976-1993 measure of stock market volatility**	**1976-1993 bank credit/ GDP**
Brazil	31	0.32	0.21	0.04	0.35	0.20	0.23
Taiwan	22	N/A	0.41	1.16	2.05	0.15	1.38
Thailand	23	0.14	0.18	0.14	0.74	0.06	0.75
Korea	22	0.09	0.21	0.19	0.83	0.08	0.82
Argentina	Insignificant	0.18	0.05	0.01	0.27	0.31	0.29
Colombia	Insignificant	0.22	0.06	0.004	0.09	0.06	.0.25
Indonesia	Insignificant	0.13	0.03	0.01	0.19	N/A	0.47
Peru	Insignificant	0.27	N/A	0.004	N/A	N/A	0.12
Philippines	Insignificant	0.35	0.15	0.03	0.25	0.07	0.45
Chile	Insignificant	1.02	0.40	0.02	0.06	0.06	0.75
Israel	No Smoothing	0.48	0.36	0.14	0.67	0.07	0.96
Mexico	No Smoothing	0.45	0.13	0.04	0.50	0.10	0.24
Turkey	No Smoothing	0.31	0.07	0.03	0.21	0.17	0.65
India	Dis-smoothing	0.36	0.10	0.04	0.54	0.04	0.46
Venezuela	Dis-smoothing	0.18	0.09	0.01	0.09	0.08	0.47

Table 11: Summary of the Results in Different Tests

The table summarizes the results of nine of the tests reported earlier. "Yes" denotes evidence of statistically significant risk sharing. In prewar Japan, group affiliation refers to affiliation in the largest three *zaibatsu* only. In postwar Japan, group members are defined as members of Presidents' Clubs only.

Country	OLS test	Conditional Variance test	Comparable portfolio test	Response to industry specific shocks	Response to macro shocks	KS test of FOSD-	Wilcoxon test of FOSD -	Skewness test –	1-sided test of 2-dimensional stochastic dominance -	Dividends
	Table 4	Table 4	Table 5	Table 6	Table 6	Table 7	Table 7	Table 7	Table 7	Table 9
Argentina	No	N/A	No	N/A	N/A	No	No	No	Yes	N/A
Brazil	Yes	Yes	No	N/A	No	No	No	No	No	N/A
Chile	No	No	No	N/A	N/A	No	No	No	No	No
Colombia	No	N/A	N/A	N/A	N/A	Yes	Yes	Yes	Yes	N/A
India	No	No	No	Yes	No	No	No	No	No	No
Indonesia	No	N/A	No	No	N/A	Yes	Yes	No	Yes	N/A
Israel	No	N/A	N/A	N/A	N/A	No	Yes	No	Yes	N/A
Korea	Yes	N/A	Yes	Yes	N/A	Yes	Yes	Yes	Yes	N/A
Mexico	No	Yes	No	N/A	No	No	No	Yes	No	N/A
Peru	No	N/A	No	N/A	N/A	No	No	Yes	No	N/A
Philippines	No	N/A	No	N/A	No	No	No	No	No	N/A
Taiwan	Yes	Yes	No	N/A	No	Yes	Yes	No	No	N/A
Thailand	Yes	No	Yes	N/A	No	Yes	Yes	No	Yes	N/A
Turkey	No	N/A	No	N/A	N/A	Yes	Yes	No	No	N/A
Venezuela	No	N/A	N/A	N/A	N/A	No	No	No	No	N/A
Prewar Japan	Yes	N/A	N/A	N/A	N/A	No	No	Yes	Yes	N/A
Postwar Japan	Yes	Yes	N/A	Yes	N/A	Yes	Yes	Yes	No	Yes