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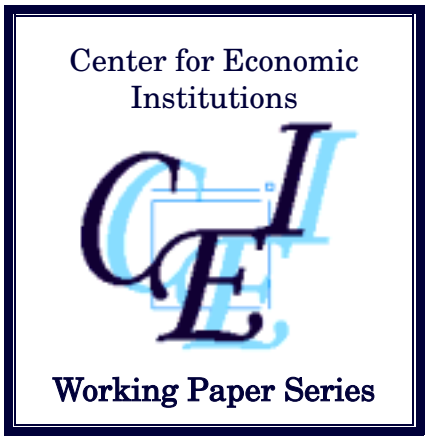

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Business Groups and Risk Sharing around the World

Abstract

We use a new database from fifteen emerging markets as well as from prewar and modern Japan to examine the popular view that business groups – ubiquitous in most emerging markets – facilitate risk sharing by smoothing the performance of affiliated firms. We replicate existing results on risk sharing by Japanese *keiretsu*, find evidence of risk sharing in some other countries (e.g. Korea, Thailand), and very limited evidence of "liquidity smoothing" in one country, India. However, in most countries, our estimates of risk sharing are usually not 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. We also find no correlation between the extent of capital market development and the extent of risk sharing provided by business groups. The popular view of the importance of risk sharing in business groups is thus not validated by our analysis.

Introduction

Diversified business groups are common 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] One function that is often attributed to such groups is that they enable member firms to share risks by smoothing income flows and by reallocating money from one affiliate to another in times of distress. Strachan (1976), for example, in an 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* suggests that the diversification of Chinese business groups has allowed them to spread their risks very widely (Pan, 1999). In addition, 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, recently argued that "diversification has provided us with varied sources of income and has shielded us from the worst of the (Asian) financial crisis" (*The Financial Times*, February 24, 1999).

Economic theory also suggests that, under certain circumstances, mutual insurance, or risk sharing, arrangements between firms may be beneficial. This is because negative outcomes are likely to be very costly to the firm. For example, a poorly performing firm may face bankruptcy costs and loss of firm-specific investments and assets. In less extreme situations, poor performers may find it hard to borrow or to raise external capital, and thus not be able to carry out their investment plans or meet their fixed obligations. While one can imagine partial solutions to these problems when capital

markets are highly developed, they are likely to be severe in emerging markets where it is quite plausible that the best defense against such negative outcomes is mutual insurance arrangements between firms within a business group. Additionally, tax considerations may make profit-smoothing arrangements between firms attractive.

If business groups are indeed able to efficiently share risks and smooth shocks to profitability, they may constitute an important substitute for missing financial markets. Thus, "insured" members of business groups may undertake otherwise shunned investment projects and contribute to economic growth. Firms within diversified business groups may also be able to absorb shocks to particular sectors in the economy, especially in a period of globalization and high volatility. If this is the case, then attempts by the IMF and others to dismantle business groups, most notably in South Korea, may have unintended social costs.

Nevertheless, despite the intuitive appeal of the risk sharing hypothesis and its potential economic importance, the extent of mutual insurance provided by business groups has received surprisingly little empirical attention in the literature. Indeed, risk sharing through business groups has been analyzed in only one country, Japan, using limited econometric techniques. In this paper we rely on a newly constructed database comprising firm-level information on business groups in 15 emerging markets, as well as in prewar (1930s) and postwar (1970s and 1980s) Japan. We are thus able to provide, for the first time and through multiple estimation techniques, a variety of estimates of risk sharing in business groups around the world.

We examine several types of insurance that business groups may provide. The first consists of various intra-group activities that smooth profit rates for member firms.

For example, the volume or price of intra-group trade with member firms in distress can be adjusted. Alternatively, "healthy" group firms may let other members share certain resources (e.g. trucks, engineers, or accountants). Such behavior will result in smoothed operating performance for both the firm providing the assistance and for the recipient. Other plausible forms of group-provided assistance that ensure, for example, that investment plans can be carried out with no interruptions are also likely to be reflected in smooth performance of group affiliated firms over time. Much of our analysis will therefore develop several tests comparing the volatility of operating profitability of group affiliates with those of otherwise comparable unaffiliated firms. This analysis will take into account heterogeneity among groups (extent of horizontal diversification, vertical integration, presence of group-specific financial institutions, and, in one country, degree to which group affiliate activity is coordinated), as well as the possibility that group risk sharing may be reflected in smooth asset growth rates rather than in smooth profit rates. We also derive and implement tests comparing the entire distributions (rather than the means) of operating profitability of group affiliated and unaffiliated firms.

Another type of insurance that we examine (for a sub-sample of three countries for which data are available) is through dividends, which could be a natural "shock absorber" given the extensive cross-ownership ties among member firms in different industries. A final mechanism of group-provided insurance that we study (using unique data available only for India) is "liquidity smoothing" through intra-group transfers (recorded as "loans and receivables").

Overall, our results cast doubt on the assertion that the *raison d'être* of business groups is the provision of mutual insurance to member firms. Although there is certainly

evidence for the income-smoothing role of business groups in some countries in our sample, it is not as common and extensive as previous conjectures suggest it might be. Moreover, there is no clear relation between the extent of risk sharing within business groups in various countries and the degree of capital market development. While we do not find extensive evidence of risk sharing, nor do we find evidence of the opposite pattern, that group affiliation exacerbates volatility of profitability as might occur if the very incidence of shocks to firm profitability is correlated with group membership (Fisman, 2001). Finally, our tests of two-dimensional stochastic dominance (of one distribution over another) demonstrate that the long established result in the Japan *keiretsu* literature – that group members have lower means and lower standard deviations of profitability relative to unaffiliated firms – does not generalize across our sample of countries.

The next section of the paper briefly reviews some of the related literature. The database is described in Section II and the empirical strategy in Section III. Section IV presents empirical results on risk sharing within business groups around the world, Section V provides extensions and alternative interpretations, and Section VI concludes.

I. Concepts of Risk Sharing and Related Literature

Why Do Firms Share Risk?

Firms may smooth operating profitability for two broad sets of reasons. The first assumes that firms maximize the joint utility of their corporate constituents, including employees, financial institutions, stockholders and management (Aoki, 1984 and 1988). Some of these constituencies who cannot diversify their human capital – such as

managers and employees – are naturally risk averse and smoothing of negative outcomes can enhance their utility (see also Bertand, 1999, on risk sharing contracts between firms and employees). If risk sharing reduces the required compensation for hired managers, it may be beneficial to shareholders as well (Hermalin and Katz, 2000). In addition, risk sharing reflected in intervention in times of distress can be economically efficient if it conserves human capital that would otherwise be dissipated.

A second reason for smoothing firm profitability has to do with inefficiencies in external capital markets, resulting in a need to ensure that a firm has adequate access to internal funds. One way to attain this objective is through mutual insurance among group firms through an "internal capital market." Our discussion of business groups and risk sharing is therefore related to the vast (and growing) literature on internal capital markets in the U.S. For example, Gertner, Scharfstein, and Stein (1994), as well as Stein (1997) provide theoretical justifications for the use of internal capital markets in the presence of some informational asymmetry in external capital markets. Hubbard and Palia (1999) argue that internal capital markets are particularly valuable when the financial system is underdeveloped. Other studies of internal capital markets have argued (theoretically and empirically) that internal capital markets may also involve substantial disadvantages.[2]

Whether the motivation for risk sharing arrangements is the former or the latter, mutual insurance among group members is likely to result in smoother measures of operating performance for these firms. Group firms whose profits are very low obtain cheap inputs and other forms of group assistance so that their profitability is not as low as it would have been otherwise, and group firms whose performance is good share some of their resources with less successful group members.

Risk Sharing within the Japanese Corporate Groups

Some empirical evidence on risk sharing within business groups can be found in several studies of the Japanese bank-centered corporate groups. For example, Nakatani (1984) shows that the variance of operating profitability (and growth rates) is lower for group affiliated companies than it is for unaffiliated firms. It has also been shown that the *level* of operating profitability among group firms is lower. This has sometimes been interpreted as evidence of risk sharing within the Japanese corporate groups, serving the interests of employees whose firm-specific human capital is non-diversifiable.[3] In addition, there is extensive evidence on another form of insurance within the Japanese corporate groups, namely assistance to firms in financial distress under the auspices of the group's main bank.[4] Finally, some degree of risk sharing has been documented in Japanese vertical (manufacturer-centered) groups as well.[5]

Business Groups in Emerging Markets

The descriptive literature on business groups in emerging markets provides a variety of definitions for this phenomenon. Typically, business groups are not legal constructs, and involve both formal and informal ties among member firms. For this reason, and because group definitions appear to be somewhat idiosyncratic to the country, the data on group membership used in this study are based on country-specific sources and on the definitions of groups as they exist for each country.

While members of bank-centered Japanese groups under-perform otherwise comparable unaffiliated firms, empirical studies in emerging markets suggest that group

membership is often associated with superior performance, though the reason for this is unclear (Khanna, 2000). One explanation is that groups make up for missing (capital market and other) institutions (Khanna and Palepu, 2000). Alternatively, groups may be associated with minority shareholder expropriation (sometimes referred to as "tunneling;" see Bertrand et al., 2002), or with rent seeking (Fisman, 2001).[6]

Because our objective here is not to evaluate the overall benefits and costs associated with corporate groups, we do not pursue these issues further, although we will discuss "tunneling" as an alternative interpretation for our results. We wish to emphasize, however, that we are unaware of studies evaluating the benefits generated by business groups through risk sharing in countries other than Japan. We therefore turn to this issue in the remainder of the paper.

II. The Data

Our emerging markets database contains firm level information from 15 countries (Table I). The countries are Argentina, Brazil, Chile, Colombia, India, Indonesia, Israel, Korea, Mexico, Philippines, Peru, 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 (local) source, collect financial and industry information from another (local) source, and then merge the two.[7] Note that, because information on group affiliation is based on local sources, our results apply to groups *as delineated within each country*. Groups are usually not legal entities (Chile is an exception in this respect); the classification of firms into groups is therefore based on historical reports published by the government for antitrust

purposes, announcements of new corporate ventures and public listings, filings made by firms, and more.[8]

The two Japanese databases that we use are described in Table II. The first covers the prewar period in which extremely large, diversified conglomerates (*zaibatsu*), controlled by wealthy families, dominated the Japanese economy (Hadley, 1970; Yafeh, 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. Group affiliated firms are defined as firms belonging to the three largest and most diversified *zaibatsu.* Although there are a number of group affiliation definitions commonly used in the literature on postwar Japan (Weinstein and Yafeh, 1995), the definition we use here is the most restrictive, that is, membership in one of the six bank-centered groups' Presidents' Clubs (*shacho-kai*). 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 these Presidents' Clubs.

III. Empirical Design

Most of our first set of tests gauge the extent to which business groups smooth measures of operating performance of member firms (Section A). A separate test is carried out to measure smoothing ex-post, that is, after firms' production and sales activities are completed, through the use of dividends and intra-group loans (Section B).

A. Smoothing of Operating Performance

If groups provide mechanisms through which member firms avoid extreme outcomes or through which they can operate and invest smoothly, this is likely to be

reflected in smooth operating performance. We therefore use several statistical procedures to compare the volatility of operating profitability (ROA) between group affiliated and unaffiliated firms. Beyond testing the general hypothesis that profit volatility of group firms is relatively low, we test a number of more specific notions of risk sharing. In particular, we examine the notion that groups provide assistance to member firms in depressed industries, or to member firms in financial distress.

The tests below focus on smoothing of profit *rates* rather than absolute profit streams (to better control for size) although the results are generally similar when we use the latter rather than the former. We use operating profitability rather than net profit rates because operating profits are not (directly) distorted by taxation rules, which differ dramatically across countries, and because a consistent measure of operating profit is available in more countries than is net profit.[9]

In general, the tests are based on the assumption that group and industry affiliations of firms are exogenous 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. This assumption is reasonable given that we are unaware of any study that explains the endogenous formation of corporate groups, and in view of the fact that the structure of groups is typically historically determined to a very large extent. For example, the Japanese prewar groups were formed following a large-scale privatization in the 1880s. Hoshi (1994) and Yafeh (1995) show that the best predictors of membership in postwar Japanese corporate groups are prewar ties. Indian groups emerged when wealthy families acquired assets previously held by the British (Piramal, 1996). Korean groups emerged in a similar fashion after the end of the Japanese

colonial rule (Nam, 2000). McDermott (2001) argues that membership in recently formed Eastern European groups (which are not included in our sample) is also based on historical factors. There is absolutely no evidence on firm selection into groups according to their profit volatility or attitudes towards risk, and, furthermore, groups appear to be extremely stable; exit and entry of firms seem to be rare events.

The Benchmark Specification

We begin with a simple benchmark test of the general notion that group members have smooth profit rates relative to other firms:

(1) $vprof_i$ = constant + $\beta_0(assets_i)$ + $\beta_1(prof_i)$ +β_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 the firm's average size (measured by assets), and $prof_i$ is the firm's average operating profitability. The group dummy variable equals one for firms affiliated with business groups.[10] 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.[11]

Equation (1) raises several conceptual and econometric concerns. First, it does not specify how groups provide insurance, and may not capture all forms of risk sharing. Second, it is possible that group firms might systematically choose risky investments if

they are "insured" by other members of their group, so that there may not be any observable differences in profit volatility even though groups do provide risk sharing. Persistent behavior of this type is implausible, because repeated interaction between group members is likely to penalize excessive risk taking. Nevertheless, the tests that follow are designed to address these issues and also to examine specific notions of risk sharing.[12]

Conditional Variance of Profitability

This test reflects profit sharing schemes in which group firms with "above normal" profits assist other group firms whose profitability is lower than usual. Unlike Equation (1), profitability (reflecting investment strategy) in this test is endogenously determined by firm and group characteristics. The test proceeds as follows. Profitability is regressed on firm size, year and firm-fixed effects, which capture all time-invariant firm attributes, including group affiliation. We then test whether unexplained changes in profitability (i.e. deviations from the regression line) are smaller for group firms. This is done 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). This specification is estimated for the seven countries where the time series is long enough to estimate the profitability regression with firm-fixed effects.

Matched Portfolios

In addition to linear regressions, we construct matched portfolios of firms for each group in our data. Matching for each firm in each group is based on industry, size and

country. We calculate the standard deviation of group operating profitability, which is an asset-weighted average of the standard deviation of operating profitability of firms within 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. This approach is relatively immune to the critique that industry choice by groups may be endogenous, or that groups tend to concentrate in certain industries.[13]

Responses to Shocks to Profitability

This test is designed to examine if groups provide assistance to member firms operating in an industry that is subject to an external shock.[14] Alternatively, group firms in industries performing better than expected may share their good fortunes with member firms in other industries. We examine the differential impact of industry shocks on the profitability of group affiliates and unaffiliated firms. Because industry (and group) affiliation of firms are certainly exogenous in the short run, these tests are not subject to the critique that groups may choose industries (or firms) so as to minimize vulnerability to economy-wide 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 identification of the shocks is based on the percentage change in real output (nominal output adjusted by producer price indices obtained from the U.N. 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, although even under this condition the number of observations in some of the industry shocks regressions is small. 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, pre-shock profitability and a group dummy.

Risk Sharing and Group Heterogeneity

All of the tests above treat all groups as similar to each other. It is, however, possible that group characteristics affect the extent of risk sharing provided to member firms. For example, it may be the case that diversified groups provide more insurance to member firms than focused groups, because of their ability to transfer resources between depressed and more successful sources. Perhaps vertically integrated groups can adjust prices and volumes of intra-group transactions more easily to assist member firms. The presence of financial institutions within a group may reduce the need to smooth operating profitability among group firms, because they can rely on such institutions to bail them out in case of distress. Banks may also provide easy credit to group firms so that they may have less need to smooth profitability (or cash flows) in order to guarantee normal operations. To examine these issues, we re-estimate Equation (1), with additional group control variables. Group diversification is defined as the number of 2-digit ISIC (International Standard Industrial Classification) industries in which the group operates.[15] Our measure of group vertical integration captures the extent to which group firms are in

industries that rely on the industries of other group firms for their inputs, on average.[16] The importance of financial institutions within the group is measured by the fraction of total group assets held by financial institutions.[17]

For Chile, we are also able to carry out a more detailed analysis of group heterogeneity. In particular, we are able to distinguish groups whose affiliates are more closely coordinated from those whose affiliates are less coordinated, with the intent of verifying whether more tightly coordinated groups are better able to carry out risk-sharing. For this purpose, we collect three data items from the *Superintendencia de Valores y Seguros* in Santiago, Chile, for 1996, the year for which our local data are most comprehensive. The three data items are the amount of equity in each group affiliate owned by other affiliates, the identity of the largest ten owners in each group affiliate, and the identity of the board members of each affiliate.[18]

From these data, we construct various measures of coordination through direct and indirect (including pyramidal) ownership, and of coordination through common owners and common directors. (See Appendix 1 for details.) We also construct an aggregate measure of coordination, which indicates the extent to which affiliates of a particular group are "tightly bound." We report univariate and multivariate correlations between these coordination measures and our measure of volatility of operating profitability.

Risk Sharing and the Volatility of Growth Rates

It is possible that some forms of risk sharing may not always be reflected in smooth operating profitability. For example, internal transfers among group members

could enable investment smoothing which, in certain cases, need not lead to smooth profit rates. To address this possibility, we estimate a version of Equation (1) where the dependent variable is the volatility of asset growth rates rather than the volatility of profit rates.

Comparisons of Distributions of Profit Volatility among Group and Non-group Firms

In this sub-section, we develop several tests comparing the *distributions* of profit volatility of group and non-group firms.

(a) One-dimensional Stochastic Dominance Tests

If group-affiliated firms are indeed mutually insured, the whole distribution of profit volatility among them is likely to differ from that of uninsured firms. We use a non-parametric test of the hypothesis that 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).[19] We first conduct a one-sided Kolmogorov-Smirnov test of the equality of distributions, and then 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).

(b) Skewness of the Distribution of Profitability

One plausible form of group-provided insurance is assistance during financial distress. According to this form of risk sharing, no reallocation of resources takes place

within the group in normal circumstances. However, troubled affiliates receive assistance from other group members (e.g. Hoshi et al., 1990). An implication of this conjecture is that the distribution of profit rates among group affiliated firms will not be normal, but rather skew to the right.[20] In other words, relative to the distribution of profit rates of unaffiliated firms there will be fewer firms with very negative profits among the groups. However, the opposite prediction can also be derived from the hypothesis that group firms help member firms in distress. It may be that existing non-group companies are a "Darwinian selection of survivors" (because poorly performing non-group firms have gone bankrupt), whereas it is feasible for poorly performing group firms to remain in business longer. If this is the case, one would expect to see a normal distribution of profitability among group affiliated firms, whereas unaffiliated firms will be predominantly high performers. We measure skewness statistics for the distributions of each of group and non-group firms. Since we are unaware of any existing formal test of the statistical significance of the difference in skewness coefficients of two distributions, we also derive bootstrap confidence intervals for the difference in skewness coefficients (see Appendix 2). This allows us to confirm whether the skewness of the profitability distributions of group and non-group firms are statistically significantly different in either direction.[21]

(c) Two-dimensional Stochastic Dominance Tests

We develop a two-dimensional stochastic dominance test of the joint hypothesis that group firms have both low risk (low volatility) and low returns (low profitability), as the literature on the Japanese groups has suggested (albeit somewhat informally).

Unfortunately, unlike tests of stochastic dominance for a single variable for which there are standard non-parametric tests based on ranks, there seems to be no standard theory on non-parametric multivariate tests. We therefore design 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). The test is carried out by computing 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, and then converting them to normal scores. Parametric tests designed for normally distributed data are then used to test if group affiliated firms have both lower standard deviation of returns and lower mean returns than unaffiliated firms. Technical details of this test appear in Appendix 3.

B. Risk Sharing through Dividends and Intra-group Loans

For Chile, India and postwar Japan, we collect dividend data and measure within-group risk sharing using a method adapted from Asdrubali, Sorensen, and Yosha (1996).[22] A large volume of literature suggests that frequent increases in dividend payout ratios are not very common, in part because future reductions in dividends may have a large negative impact on share prices (Lintner, 1956; Benartzi, et al. 1997). Tax considerations, as well as the fact that when dividends are distributed funds are transferred to all shareholders and not just to group members that require funds to smooth income, also suggest that corporate groups are unlikely to use dividends as a major time-varying risk sharing mechanism. Nevertheless, even a relatively constant dividend payout

ratio can provide a regular mechanism of smoothing income for group firms operating in different industries.[23]

Our test of this hypothesis proceeds as follows. Denoting the operating profitability of firm *i* in year *t* by *x*, and the after-dividend profitability by *y*, and 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 risk sharing 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.[24]

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 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:

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

and it is thus possible to obtain an estimate of the amount of smoothing achieved at each layer.

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

After reporting some summary statistics, we present the results in the order in which the tests were presented, with the results for tests on operating performance reported in Section B, and for tests on dividends and intra-group loans in Section C.

A. Sample Statistics: A First Look at Group Firms and Their Risk

Table III describes the corporate groups in our sample countries. 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 (Weinstein and Yafeh, 1995). With one exception (Turkey), group affiliated firms are larger than unaffiliated firms in all countries in the sample.

We also find that in 11 out of 15 emerging markets the standard deviation of profitability for group firms is lower than for unaffiliated firms, although not always in a statistically significant manner (in line with anecdotal evidence on Japanese groups). We will argue below that these simple statistics overstate the magnitude of group-provided insurance. Only in six of the emerging markets in the sample is the low standard deviation of operating profitability accompanied by low profitability.

B. Tests of the smoothing of operating profitability

Results for the Benchmark Specification

Table IV presents measures of risk sharing by corporate groups, which are based on country-by-country OLS estimation of Equation (1). We find a negative and

significant effect of groups on the standard deviation of operating profitability in about a third of the emerging markets in the sample (Column 1). In the majority of countries, the group coefficient is negative but insignificantly different from zero. There is evidence of profitability smoothing in prewar Japan, and some smoothing among core members of the large bank-centered corporate groups in postwar Japan as well (in line with Nakatani, 1984). Nevertheless, 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. Despite these mixed results, the coefficients on the group dummy variable in all countries are jointly negative.[25] Moreover, in the emerging markets in Column 1 where group affiliated firms do exhibit significantly lower profit 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, Korea, and Taiwan, and by about 30 percent in Brazil. The estimated effect for Colombia, where the sample is admittedly very small, is even larger.

Conditional Variance of Profitability Results

We now turn to the regressions using the conditional variance of profitability (Table IV, Column 3), reflecting smoothing of deviations from "normal" profit rates. In general, the results of this test are similar to those in the previous specification (in the case of Mexico, we find significant risk sharing according to this test, versus an insignificant coefficient before). Out of the seven countries included in this test, there is evidence of significant risk sharing in four (Brazil, Mexico, Taiwan, and postwar 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 V indicates that there is statistically significant evidence of smoothing of profitability in only two countries, Korea and Thailand. The results for these countries are consistent with earlier tests. There seems to be "dis-smoothing" in Indonesia (in line with Fisman, 2001) and in Taiwan. Much like previous tests, the matched portfolio test shows a very mixed picture of group risk sharing.

Group Responses to Profitability Shocks Results

Using the U.N. data, we identify three positive industry-specific shocks and a single negative one (Table VI). The group effect is statistically significant in two of the four shocks, reflecting smoothing in India and Korea. This smoothing appears to be in response to both positive and negative shocks. The power of this test, however, is limited by the small number of observations in three of the four regressions. The impression that group firms are not necessarily well insured against industry-specific shocks is in line

with Chui, Titman and Wei's (2000) findings for Indonesian groups during the Asian financial crisis.

Results regarding effects of group heterogeneity

The columns of Table VII show within-country means of the three measures of group hetgerogeneity for which we have cross-country data – group diversification, group vertical integration and percentage of group assets in financial firms. Group diversification ranges from an average of 1.6 firms in Taiwan to 5.5 in Turkey. Group vertical integration levels are rather low – on average between 2 percent and 5 percent of the inputs in our groups are derived form industries within which the group also has some representation.[26] The group financial assets measure exhibits the widest variation (from 1 percent of group assets that are in financial firms in Taiwan to 60 percent in the Philippines). There is little commonality across countries regarding whether or not these measures of group heterogeneity are correlated. Thus, in Indonesia, all three measures are strongly correlated across groups, whereas in Taiwan, no pair of measures is significantly correlated.

Table VII also displays regression coefficients measuring the effect of group characteristics on the extent of risk sharing provided. These are derived from an estimation of an equation similar to (1), with additional controls for group diversification, group vertical integration, and percentage of group assets in financial firms. Our earlier results do not change qualitatively. The group dummies are still significant and similar in magnitude to those reported in Table IV in Brazil, Korea, Taiwan and Thailand (the coefficient for Turkey is significant as well). More generally, it is hard to argue that

diversified or vertically integrated groups provide more insurance to member firms than other groups (all but two of the coefficients are statistically insignificant).

There is, however, some evidence that, in countries where groups do provide insurance, the presence of a large financial "arm" tends to reduce the extent of operating profitability smoothing, perhaps because these groups rely more on loans from their financial institutions and less on other within-group transfers.[27] Thus group risk-sharing and bank assistance during distress may be substitutes in these countries, in contrast with evidence from Japan, where the two seem to be complements.[28]

We now discuss the effects of group heterogeneity in Chile. Our coordination through total ownership measure has a median of 2 percent. Thus the median (across all groups) of the average extent to which pairs of firms in a group share equity is 2 percent.[29] The mean and standard deviation of this statistic are 15 percent and 26 percent, suggesting not only a lot of variation, but also a skew distribution of this statistic. The coordination through common owners has a median of 10 percent (mean of 19 percent and standard deviation of 20 percent) while coordination through common directors has a median of 14 percent (mean of 19 percent and standard deviation of 18 percent). Our indicator of aggregate coordination (which ranges from zero to three as described in Appendix 1) shows 41 percent of groups in the most tightly coordinated category (all three coordination measures are above their respective medians) and 11 percent in the least coordinated category (all three coordination measures are below their respective medians). Thus there appears to be substantial heterogeneity in the degree of measured coordination.

All these coordination measures are weakly negatively correlated with group level measures of the standard deviation of operating profitability (constructed as in the matched portfolio tests) though not statistically significantly. Regressions similar to our benchmark specification with group coordination measures in addition to the group dummy also tend to yield negative relations between the standard deviation of operating profitability and measures of group tightness, but the estimated coefficients are far from being statistically insignificant.[30] Our conclusion is that the evidence that tight coordination of groups is correlated with more risk sharing in Chile is rather weak.

Smoothing of Asset Growth Rates

To examine if group members enjoy smooth (investment streams and therefore also) growth rates, we estimate for Brazil, Chile, India, Indonesia, Korea, Mexico, Philippines, Taiwan and Thailand a version of (1), with the volatility of asset growth rate as the dependent variable. (This specification is close to the one estimated by Nakatani, 1984, for the Japanese corporate groups). The results (not shown) indicate that significant (at the 10 percent level) smoothing of growth rates by corporate groups takes place only in Korea, but not in other countries, where the coefficients are typically very close to zero. We conclude that our results on the limited extent of risk sharing by groups are probably not driven by our focus on the volatility of firm profitability rather than on other measures.

Results based on Comparisons of Distributions

Results of tests for first-order-stochastic-dominance are presented in Columns 1 and 2 of Table VIII. There is evidence of group-provided insurance in Korea, Taiwan, Thailand and postwar Japan, in line with previous tests. In addition, there is evidence of group provided insurance in certain other countries (e.g. Colombia where the sample is very small, Indonesia, and Turkey). However, stochastic dominance tests do not support the view that business groups around the world typically provide substantial risk sharing opportunities (reflected in a lower distribution of profit volatility) to member firms.

In Columns 3 and 4 of Table VIII we examine the skewness of the distribution of profitability among group and non-group firms in each country. First, we test if each of these distributions (separately) is significantly different from a normal distribution. In the cases where this is so, we find a roughly equal number of departures in the direction of both positive and negative skewness, revealing no consistent pattern in either group or non-group profitability distributions. This is inconsistent with the idea that groups provide similar risk-sharing benefits in all countries in the sample.

We also report, based on our bootstrap confidence interval estimation, whether the difference in skewness between the distributions of group and non-group firms is statistically significant. In the vast majority of cases, the group profitability distribution has a more positive (or, less negative) skewness coefficient. However, only in postwar Japan, Korea and Chile, is this difference statistically significant at the 5 percent level. Thus, there is some evidence that groups in these three countries support firms in distress, in line with the Japan results (Hoshi et al., 1990), but this does not seem to be generally true across most countries.

Finally, Columns 5 through 8 of Table VIII describe the more complex two-dimensional stochastic dominance tests. Graphical depictions of confidence ellipses for group affiliated and for unaffiliated firms are displayed in Figure 1, providing 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. The results are consistent with those of earlier tests: in some countries (e.g. Korea or Thailand) there is certainly evidence of group provided insurance. Yet 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. The "conventional wisdom" about Japanese corporate groups as low-risk and low-return institutions does not appear to be generally valid.[31]

C. Results based on smoothing using dividends and intra-group loans

The Role of Dividends

We find that dividends do not play much of a smoothing role in any of the three countries – Chile, India and postwar Japan – where we have the data to estimate equation (2) (Table IX). 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. The figures are even lower in postwar Japan and India. In Chile, dividend smoothing of

profitability seems higher in the post-liberalization period than in the period of regulated capital markets, an issue to which we return below. The limited role of dividends in income smoothing is consistent with the conjecture that, because dividends cannot be adjusted easily and because they have to be distributed to all shareholders, they do not constitute a major mechanism of income smoothing within corporate groups.[32]

The Role of Loans

Using data for India only, we estimate Equation (2') with two levels of profitability smoothing – dividends and intra-group loans. In comparison with dividends, intra-group loans dampen a somewhat larger fraction of shocks to operating profitability, about 5 percent. The existence of a certain degree of liquidity smoothing in India is consistent with evidence from Japan on (main bank and) group transfers to member firms in financial distress (e.g. Hoshi et al., 1990). However, the magnitude of smoothing through this mechanism is quite small.

In summary, we find evidence of group smoothing of operating profitability in Japan, as well as in Korea, and, in most tests, in Thailand. We also find only limited evidence of such smoothing in other emerging markets. In addition, the pattern of lower-variance and lower levels of profitability of the Japanese *keiretsu* can 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) and that the importance of intra-group loans in India is limited.

V. Discussion and Interpretation

Group Risk Sharing and Capital Market Development

We now turn to the relation between the extent of group risk sharing and financial market development. Table X lists the emerging markets in the sample in order of the extent of income smoothed in the benchmark specification. The extent of profitability smoothing reported is the coefficient on group affiliation estimated in Column 1 of Table IV divided by the country mean of the standard deviation of operating profitability (Column 2 of Table IV). 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 India, where capital markets are also under-developed, there is even "dis-smoothing" according to this test. 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" (ignoring Colombia where the sample is small). This can be seen also from simple correlation coefficients between measures of capital market development and the extent of profitability smoothed which are actually positive (albeit not very high).

Inter-temporal evidence also casts doubt on the relation between capital market

development and group risk sharing. For Chile and Japan, we compare profitability smoothing by groups 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 identical before the liberalization of the early 1980s and afterwards (Table IV). 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 (Table IX). 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.[33]

Can "Tunneling" Account for the Risk Sharing We Observe in the Data?

Tunneling (the expropriation of minority shareholders by controlling shareholders) can explain why some group firms are insulated from positive shocks: the additional profits are diverted to group owners (Bertrand, et al., 2002, Claessens et al., Johnson et al., 2000b). However, this phenomenon is unlikely to explain why group members would be insulated from negative shocks, as our evidence suggests they sometimes are (Table VI). Furthermore, if tunneling is worse when firm profits are low, as Johnson et al. (2000a) suggest, then we should observe risk exacerbation (firms whose profits are low are "plundered"), not risk sharing, but this too is not a common phenomenon in our data. If tunneling is interpreted primarily as a diversion of 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 skew with a tail to the left. However, for two countries only,

Colombia (where the sample is small) and prewar Japan, does the distribution seem to be statistically significantly different from a normal distribution and skew in this direction.[34] [35]

More generally, Johnson et al. (2000b) 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 "civil law" tradition. The countries where we consistently observe evidence of risk sharing in several different statistical tests (e.g. Japan and Korea) are, however, not part of this set - 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. We also do not find significant differences in smoothing between group affiliated and unaffiliated firms in most of our Latin American countries where minority shareholders are generally unprotected. We therefore believe that tunneling is unlikely to fully account for our results, although it may well be an important phenomenon in its own right.[36]

Do Group Firms Locate in Volatile or Concentrated Industries?

It is interesting to examine if the amount of risk sharing that we do observe in the data is due to the fact that group tend to operate in less volatile industries (Maksimovic and Philips, 2001). It is also possible that groups tend to operate in relatively concentrated industries where the possibility of collusion is arguably higher, and consequently profit volatility is lower. We find little support for either of these conjectures. Using industry-level U.N. data (described in our analysis of profitability shocks), we do not find evidence that group firms tend to locate in relatively volatile

industries. Calculating industry concentration using firms in our sample, we also do not find that group firms tend to locate in more concentrated industries relative to other firms.

Do Group Characteristics Explain the Observed Differences across Countries?

We inquire whether groups in countries where there is some evidence of risk sharing (Brazil, Korea, Taiwan, Thailand and Japan) are typically different from groups in other countries (Table VII). However, we find no consistent differences in group diversification, vertical integration, and presence of financial institutions between countries where risk sharing is observed and other countries in the sample, suggesting that different group attributes cannot (easily) explain inter-country differences in group provided risk sharing.

VI. Conclusion

Theoretical work, empirical work set primarily in Japan, and anecdotal evidence all suggest that risk sharing may be an important function of corporate groups. Table XI summarizes our findings. In several of our estimations using data from postwar Japan, we are able to replicate results consistent with the notion that group affiliation is correlated with lower standard deviation (and lower levels) of profitability in that country. Most of our estimations support a similar conclusion regarding the effect of business group affiliation on the variance of profitability in two of our 15-country emerging market sample: Korea and Thailand, and, to a lesser extent, in Taiwan and Colombia. 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 evidence of profitability smoothing in some of the tests, but the majority of tests do not support this conclusion. In Chile, a country where groups have increased in dominance over time (Khanna and Palepu, 1999), there is no indication of group provided smoothing of profitability in any test (except for the comparison of skewness of distributions 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, at least not in the form of smoothing operating performance. Moreover, 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 firms. Finally, dividends do not seem to be used by groups as a "shock absorber," and evidence from India casts doubt on the extent of liquidity smoothing through intra-group loans and receivables, although we do not know how widespread is the use of such transfers elsewhere. Even though the power of some of our tests is not that high, and although the sample size for some countries is small, our results are nevertheless consistent with those of Shin and Stulz (1998) who argue that transfers within internal capital markets in the U.S. are of limited magnitude.

There are several interesting issues that data limitations prevent us from addressing. First, we do not find evidence that the extent of smoothing is related to capital market underdevelopment or to group structure. This leaves open the question of the motivation for smoothing. Second, a long-time series investigation of the manner in which the industry composition of groups evolves over time could shed further light on the causes and consequences of risk sharing within business groups.

Appendix 1: Constructing Measures of Group Coordination in Chile

From 1996 data obtained from *Superintendencia de Valores y Seguros* in Santiago, Chile, we construct an equity interlock matrix, detailing the ownership of every company i in every company j (for all i,j pairs), from the raw data. We transform the matrix so that the i,j'th entry is the maximum of two figures: the fraction of firm i's shares held by firm j and the fraction of firm j's shares held by firm i. To account for indirect holdings, we calculate firm i's total stake in j by all direct and indirect routes and then subtract out any direct holding. Formally, let $\mathbf{H}[k]$ be a matrix with entry $h_{ij}[k]$, the portion of firm j held by firm i through k links. (Thus, if i owns x percent of j directly, then $h_{ij}[1]=x$. If i owns x percent of firm m, and m owns y percent of firm j, $m \neq i,j$ then $h_{ij}[2]=\sum_m xy$, and so on). Then the matrix of indirect stakes is equal to

$$\mathbf{H}[2] + \mathbf{H}[3] + \mathbf{H}[4] + \ldots \text{ where } \mathbf{H}[n] = \mathbf{H}[n-1]*\mathrm{H} - \mathrm{diag}(\mathbf{H}[n-1]*\mathbf{H}).$$

From this we are able to construct a matrix of indirect equity ownership whose i,j'th entry is the maximum of i's indirect share in j and j's indirect share in i. We also manipulate the data on the identity of owners and directors to construct a measure of the fraction of common owners (directors) among the firms in each pair: (number of owners (directors) in common)/(average number of owners (directors) in pair).

Group level measures of coordination through ownership are constructed by averaging the pairwise direct equity measure across all pairs in the group. Similarly, we construct measures based on the average, across all pairs, of the pairwise indirect equity measure, and the average of the pairwise total equity measure (the sum of direct and indirect equity ownership links between i and j). Firm-level measures of coordination with other group affiliates are simply the corresponding averages across all pairs within

the group in which the firm in question is one of the pair members. We also construct analogous group and firm level measures of coordination based on the derived measures of common owners and common directors.

Finally we construct a measure of aggregate coordination of the group as follows. We create an indicator variable, which takes on the value of unity if a group has a measure of coordination through total ownership greater than the median of this statistic in our sample. Similar indicator variables indicate "high" levels of group coordination through common owners and common directors. The sum of the three indicators gives a statistic, ranging from zero to three, of the degree to which group affiliates are "tightly bound." Similar firm level indicator variables are constructed and aggregated to indicate whether an individual firm is tightly bound to other affiliates in its group.

Appendix 2: Test of Statistical Significance of Differences in Skewness

We calculate bootstrap confidence intervals for a test statistic, which is the difference in the skewness coefficients of the distribution of operating profitability for group firms, and the corresponding distribution for non-group firms. This is a useful technique for calculating precision of estimation measures in the absence of a precise formula (Davison and Hinkley, 1997; Efron and Tibshirani, 1998).

For each country, we generate 500 samples, each of the same size as the country-specific dataset (equal to the total number of firms in the data). Each sample is generated by sampling with replacement. Thus, within each sample, some observations occur multiple times and some do not occur at all. For each sample, we compute the difference of skewness coefficients (skewness of group distribution minus skewness of non-group distribution). The confidence intervals are ultimately constructed from the empirical

distribution of the difference of skewness coefficients thus generated (across the 500 runs). Efron and Tibshirani (1998) provide recent evidence that the statistics generated in this way are nearly unbiased (i.e. almost as good as if we had been able to sample from some underlying population distribution). The point estimate is the difference in skewness obtained from the original dataset. This has been shown to be a better point estimate than the average difference of skewness measure obtained across all 500 runs (Mooney and Duval, 1993).

Appendix 3: A One-sided, Two-dimensional Test of Stochastic Dominance

We first compute the ranks of the standard deviation of profitability of all firms (with low ranks corresponding to low standard deviations), as well as the ranks of mean of profitability. These ranks are then converted to normal scores using the formula $Vnorm_j = \Phi^{-1}(Vrank_j/(N+1))$, where $Vrank_j$ is the rank based on variable j, N is the total number of ranks, and Φ^{-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 normal distribution. We then estimate simple seemingly unrelated regressions (SUR), where the normal scores of ranks, based (separately) on firm standard deviation of returns and on firm mean returns, are regressed on group affiliation:

$$Vrank_{sd} = \beta_1 * \{\text{group dummy}\} + \varepsilon_1$$

$$Vrank_{mean} = \beta_2 * \{\text{group dummy}\} + \varepsilon_2,$$

where ε_1 and ε_2 are allowed to be correlated. The null hypothesis is that $\beta_1=0$, $\beta_2=0$. The alternative hypothesis is that $\beta_1<0$, $\beta_2<0$, corresponding to group affiliated firms having both lower standard deviation of returns and lower mean returns than unaffiliated firms.

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. (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; see Kudô 1963, Nüesch, 1966, Barlow et al., 1972).

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 χ^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,

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

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

where $Q(j,p)$ is the probability that **b*** has exactly *j* non-zero elements, and χ_j^2 denotes a random variable that is distributed as χ^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 β_1 and β_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 χ_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 difficult 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 **b** are negative, 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).

Finding $\mathbf{b}^*$ 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 $b_1^* = 0$ and one where $b_2^* = 0$. When $b_1^* = 0$, then $b_2^* = b_2 + \mathbf{V}^{-1}_{1,2} / \mathbf{V}^{-1}_{2,2} * b_1$. When $b_2^* = 0$, then $b_1^* = b_1 + \mathbf{V}^{-1}_{1,2} / \mathbf{V}^{-1}_{1,1} * b_2$. If the calculated b_1^* or $b_2^* < 0$, then the corresponding solution is not admissible. If neither solution is admissible, then $\mathbf{b}^* = (0,0)$. If only one is admissible, then the

solution is (b_1^*, 0) or (0, 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 (**b'** * $\mathbf{V^{-1}}$ * **b**) - ((**b-b***)**'** * $\mathbf{V^{-1}}$ * (**b-b***)), which Barlow et al. (1972, chapter 4) show is equivalent to **b*****'** * $\mathbf{V^{-1}}$ * **b***. Now the problem is to find the distribution of the test statistic under the null. There is a non-zero probability that the test statistic will be zero, corresponding to the case where **b*** = (0,0). Then there is a certain probability that the QP solution will be on a boundary (b_1^*, 0) or (0, 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 greater or equal to **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 **b*** is non-zero, and Q(2,2) is the probability that both are non-zero. 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).

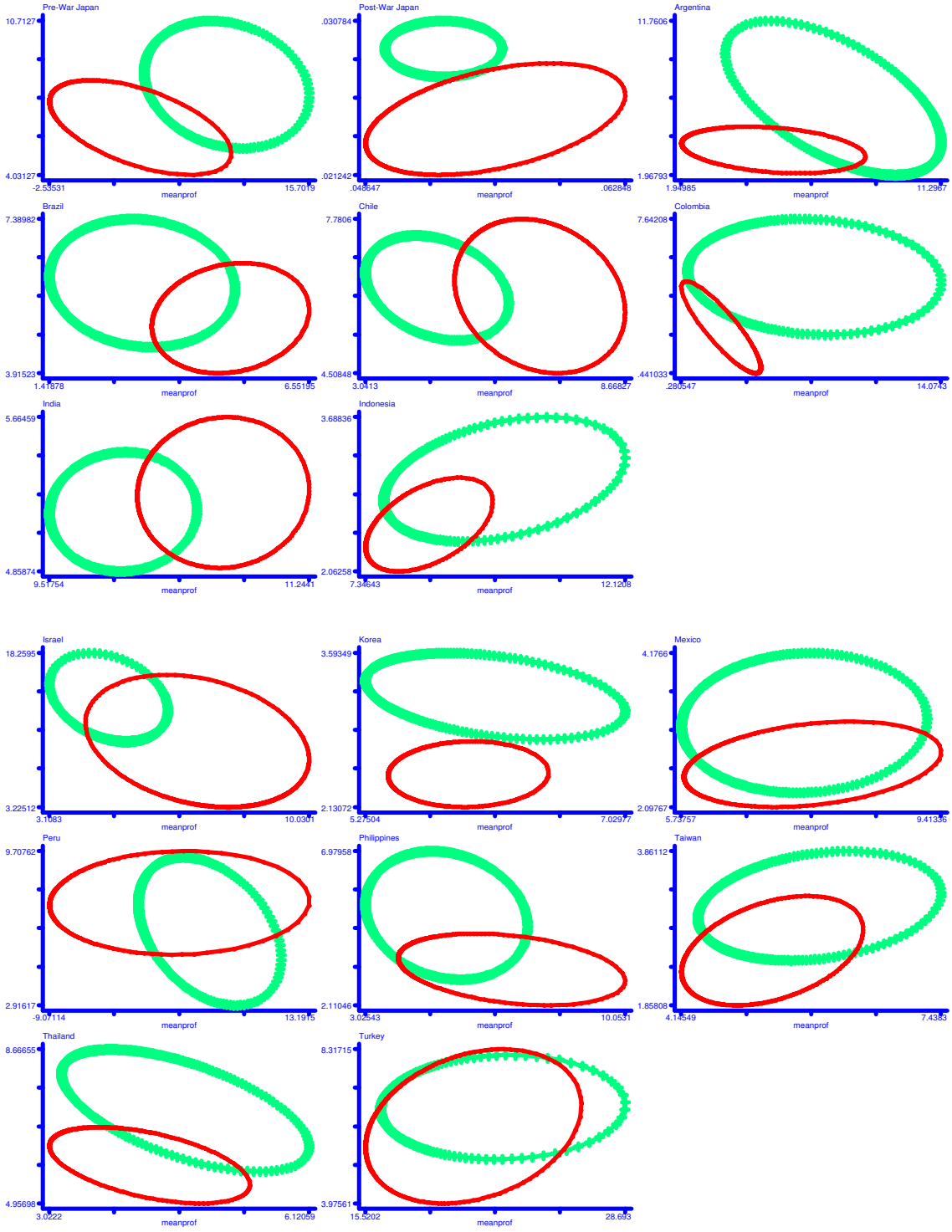

Table I: Emerging Market Data Sources

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 in multiple trips from mid to late 1997, with assistance from Professor Carlos Caceres, Universidad Adolfo Ibanez, Santiago, Chile. (See 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 in Chennai, Mumbai, and New Delhi 1996-1998. (See Khanna and Palepu, 1999, 2000).	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, reported in Fisman (2001).	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 II – 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 III: Group Affiliation around the World

The table shows summary statistics on group risk and operating performance for fifteen emerging markets as well as for prewar 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. 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. Firms with profit rates above 100 percent or below –100 percent are excluded from the analysis. * 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	5.5	3.9	7.8**	3.7	4.9**
Brazil	90-97	108	51	2.5	3.3	1.8**	4.1	5.1
Chile	89-96	225	50	18.7	5.9	2.2*	4.4	4.1.
Colombia	88-97	16	7	4.5	1.4	0.9	2.8	9.6**
India	90-97	5446	1821	4.4	11.7	9.6*	4.6	4.4*
Indonesia	93-95	236	153	2.8	7.3	7.8	1.9	2.5*
Israel	93-95	183	43	5.0	6.3	3.9*	2.1	2.6
Korea	91-95	427	218	3.9	4.8	5.1	1.9	2.6*
Mexico	88-97	55	19	2.3	8.2	6.1	3.1	2.6
Peru	88-97	21	5	1.6	7.9	7.9	6.7	7.2
Philippines	92-97	148	37	3.4	7.3	4.0	2.5	2.9
Taiwan	90-97	178	79	2.0	5.1	6.2	1.7	2.3**
Thailand	92-97	415	258	2.3	2.9	4.4*	4.3	4.9**
Turkey	88-97	40	21	1.0	24.6	26.3	6.2	9.1
Venezuela	88-97	11	2	1.5	3.7	4.6	4.1	3.2
Prewar Japan	32-43	58	17	6.8	5.5	6.4	4.4	7.1
Postwar Japan	77-92	1002	94	8.5	3.4	3.6	2.2	2.3

Table IV: Risk Sharing and Operating Profitability

The table displays coefficients on a group-affiliation dummy in two 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 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, year, 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 IV – 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	-8.3	5.3	N/A	N/A
Brazil	-1.7*	5.6	-25.4**	67.7
Chile	-1.0	6.4	-16.5	186.1
Pre-liberalization Chile (pre 1991)	+0.2	4.5	N/A	N/A
Post-liberalization Chile (1991-1996)	-1.9	5.8	N/A	N/A
Colombia	-5.6*	6.1	N/A	N/A
India	+0.1*	6.1	+0.3*	1.20
Indonesia	-0.0	2.7	N/A	N/A
Israel	-0.3	3.7	N/A	N/A
Korea	-0.6*	2.8	N/A	N/A
Mexico	-0.9	3.4	-26.7**	39.1
Peru	-2.3	7.8	N/A	N/A
Philippines	-0.8	4.5	N/A	N/A
Taiwan	-0.7**	2.9	-32.9*	39.6
Thailand	-1.4*	6.1	-20.4	93.2
Turkey	-1.5	8.1	N/A	N/A
Venezuela*	-0.5	3.5	N/A	N/A
Prewar Japan	-3.8*	4.9	N/A	N/A
Postwar Japan, 1977-1992	-0.4*	2.5	-0.1*	0.25
Postwar Japan, 1977-1983	-0.4**	2.5	N/A	N/A
Postwar Japan, 1984-1992	-0.4*	2.4	N/A	N/A

* No industry dummies are included in the Venezuela regression because of the small sample size.

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

The table compares the standard deviation of operating profitability of groups (calculated as a size 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. Firms with profit rates above 100 percent or below –100 percent are excluded from the analysis. Significance levels are based on two-tailed difference of means t-tests, and on Wilcoxon signed-rank tests for the difference of medians. * denotes a difference that is significant at the 5 percent level, and ** denotes a difference that is significant at the 10 percent level.

	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	4.9	12.7	5.2	6.2
Brazil	35	5.4	5.4	4.3	4.4
Chile	19	9.4	4.8	4.5	4.7
India	439	7.4	6.7	5.1	5.2
Indonesia	85	2.6	1.9**	2.0	1.4**
Korea	122	2.3	3.6*	1.9	3.9*
Mexico	13	3.5	3.1	3.7	2.8
Peru	5	7.0	6.7	6.7	7.8
Philippines	11	2.7	2.0	1.8	1.5
Taiwan	45	2.4	1.6**	2.1	1.7**
Thailand	99	5.9	11.1*	5.2	9.0*
Turkey	7	9.3	7.7	9.9	8.5

Table VI: Responses to Industry Specific Shocks

The table reports estimates of 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 U.N. data and from the IMF) is used to identify candidate shocks of at least 30 percent. In addition, there must be at least five group affiliated and five unaffiliated firms in our country-specific data sets for which performance data exists in the year surrounding the shock. The group coefficient is estimated in a regression of the 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, pre-shock profitability 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). 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.

Country	Year of Shock	Magnitude of Shock (U.N. Data)	Industry (ISIC Code)	Group Coefficient	N
India	1994-95	30%	Indust'l/Comm/ Mach. 3500	-1.3	95
India	1994-95	37%	Transportation Equip. 3700	-5.9*	23
Indonesia	1993-94	39%	Transportation Equip. 3700	4.8	10
Korea	1991-92	-40%	Transportation Equip. 3700	2.2*	28

Table VII: The Impact of Group Heterogeneity

The dependent variable is firm-level standard deviation of operating profitability. Right-hand-side variables include firm assets, industry dummies, average profitability (coefficients not shown), the group dummy, a measure of group diversification (number of 2-digit industries in which the group operates), a measure of group vertical integration (average input-output coefficient across all pairs of firms within the group), and the fraction of all group assets in group financial firms. The columns report point estimates and significance levels for the group dummy, and for the variables which measure group diversification, group vertical integration and the percentage of assets in group financial firms. The country-specific mean levels of these latter categories are also displayed. Results are not available for countries with small samples, for Israel because of data limitations and for Japan where only the largest and most diversified groups are included in the analysis. We are also unable to develop measures of the presence of group financial firms in Brazil and Korea. Regressions are weighted by the number of observations per-firm and include heteroskedasticity-consistent standard errors. 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.

Country	Coefficient on group dummy	Mean group diversifica-tion	Coefficient on group diversifica-tion	Mean group vertical integration	Coefficient on group vertical Integration	Mean percentage of group assets in financial firms	Coefficient on percentage of group assets in financial firms
Brazil	-1.8*	1.4	-0.5	0.04	5.7	N/A	N/A
Chile	-0.8	5.1	-0.1	0.06	11.6	0.24	-0.5
India	0.9*	4.2	-0.4	0.04	-4.1*	0.05	1.0
Indonesia	0.1	2.1	+0.0	0.04	-2.9	0.45	-0.5
Korea	-0.6*	1.7	+0.1	0.04	-1.6	N/A	N/A
Mexico	-0.8	2.7	-0.3	0.02	12.8	0.05	-0.2
Philippines	-1.4	3.1	0.1	0.08	5.8	0.60	0.3
Taiwan	-0.8**	1.6	-0.1	0.02	7.4	0.01	0.2*
Thailand	-1.1**	3.5	-0.3*	0.04	4.4	0.35	2.0*
Turkey	-3.1*	5.5	0.1	0.07	7.2	0.32	1.7

Table VIII: 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 profitability 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 profitability for group affiliated firms is lower than they are for unaffiliated firms. Columns 3 and 4 compare the skewness of the profitability distribution of group affiliated 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. $^{\#}$ (in Column 4) denotes that the difference in the skewness coefficients is statistically significantly different from zero at the 5 percent level, based on our bootstrapping estimate of the standard deviation of this measure described in Appendix 2. Columns 5 and 6 report the coefficient on the group dummy in seemingly unrelated regressions (SUR) of the normalized ranks of the standard deviations and means of profitability on the group dummy (see Appendix 3 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 equal to 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 equal to 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	-0.5	-0.1	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	0.14	0.05*	2.4	2.0	-0.28	-0.27	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	0.27	0.15

Table IX: Risk Sharing through Dividends

Estimates of the percent of operating profitability that is smoothed through the issuance of dividends are based on the Asdrubali-Sorensen-Yosha method described in the text. Heteroskedasticity-consistent standard errors are used throughout. Firms with profits 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.

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
India, group firms, 1989-1996	2.2*
India, non-group firms, 1989-1996	2.9*
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*

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

For countries where significant profitability smoothing is found in Column 1 of Table IV, the percent of volatility in operating profitability smoothed by groups (the ratio of Column 1 to Column 2 in Table IV) is presented. Countries where there is a negative but statistically insignificant effect of groups on volatility are listed as "insignificant." 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 bank credit/ GDP**
Colombia	92	0.22	0.06	0.004	0.09	.0.25
Brazil	31	0.32	0.21	0.04	0.35	0.23
Taiwan	22	N/A	0.41	1.16	2.05	1.38
Thailand	23	0.14	0.18	0.14	0.74	0.75
Korea	22	0.09	0.21	0.19	0.83	0.82
Argentina	Insignificant	0.18	0.05	0.01	0.27	0.29
Chile	Insignificant	1.02	0.40	0.02	0.06	0.75
Indonesia	Insignificant	0.13	0.03	0.01	0.19	0.47
Israel	Insignificant	0.48	0.36	0.14	0.67	0.96
Mexico	Insignificant	0.45	0.13	0.04	0.50	0.24
Peru	Insignificant	0.27	N/A	0.004	N/A	0.12
Philippines	Insignificant	0.35	0.15	0.03	0.25	0.45
Turkey	Insignificant	0.31	0.07	0.03	0.21	0.65
Venezuela	Insignificant	0.18	0.09	0.01	0.09	0.47
India	Dis-smoothing	0.36	0.10	0.04	0.54	0.46

Table XI: 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 Table IV	Conditional Variance test Table IV	Matched portfolio test Table V	Response to industry specific shocks Table VI	KS test of FOSD Table VIII	Wilcoxon test of FOSD Table VIII	Skewness test Table VIII	1-sided test of 2-dimensional stochastic dominance - Table VIII	Dividends Table IX
Argentina	No	N/A	No	N/A	No	No	No	Yes	N/A
Brazil	Yes	Yes	No	N/A	No	No	No	No	N/A
Chile	No	No	No	N/A	No	No	Yes	No	No
Colombia	Yes	N/A	N/A	N/A	Yes	Yes	No	Yes	N/A
India	No	No	No	Yes	No	No	No	No	No
Indonesia	No	N/A	No	No	Yes	Yes	No	Yes	N/A
Israel	No	N/A	N/A	N/A	No	Yes	No	Yes	N/A
Korea	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Mexico	No	Yes	No	N/A	No	No	No	No	N/A
Peru	No	N/A	No	N/A	No	No	No	No	N/A
Philippines	No	N/A	No	N/A	No	No	No	No	N/A
Taiwan	Yes	Yes	No	N/A	Yes	Yes	No	No	N/A
Thailand	Yes	No	Yes	N/A	Yes	Yes	No	Yes	N/A
Turkey	No	N/A	No	N/A	Yes	Yes	No	No	N/A
Venezuela	No	N/A	N/A	N/A	No	No	No	No	N/A
Prewar Japan	Yes	N/A	N/A	N/A	No	No	No	Yes	N/A
Postwar Japan	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes

[1] Ghemawat and Khanna (1998) list countries where business groups are prevalent.

[2] The negative consequences of internal transfers within a group may include managerial moral hazard and soft budget constraints. Thus, Scharfstein and Stein (2000) describe the internal capital allocations of diversified U.S. conglomerates as "socialist," whereby strong divisions inefficiently support weaker ones. Rajan, Servaes, and Zingales (2000) also argue that internal power struggles can generate distortions in the allocation of resources within a diversified organization. This, however, is not necessarily inconsistent with the positive aspects discussed above. Empirically, early studies, such as Montgomery (1994), Lang and Stulz (1994), and Berger and Ofek (1995) associated unrelated diversification with a "diversification discount." The reasons for the existence of the discount are the subject of a recent debate; see Campa and Kedia (1999), Maksimovic and Phillips (2001), Villalonga (2001), and Whited (2001)). Schoar (2000) makes a distinction between static and dynamic effects of diversification.

[3] Aoki (1988) discusses theoretical reasons for risk sharing within the Japanese corporate groups. For empirical evidence on low profitability and low risk within the Japanese corporate groups, see Caves and Uekusa (1976), and Weinstein and Yafeh (1995, 1998).

[4] For example, Sheard (1989) and Hoshi and Kashyap (2001) document a variety of cases in which banks rescued ailing clients 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.

[5] See Asanuma (1989) and Kawasaki and McMillan (1992) who argue that contracts between members of Japanese vertical groups are designed to combine risk sharing and incentives. Beason (1998) and Kang and Stulz (2000) challenge the conventional wisdom that Japanese groups provide a low risk environment.

[6] See Khanna (2000) for further detail on the characterization of business groups and on empirical studies of their performance.

[7] Local data sources are used wherever available. Such sources cover far more firms than do international sources, although they typically require translation and data entry by hand. In several countries where no local source for financial information is available, we use the Company Accounts Database of Datastream International, one of the most comprehensive international providers of information on publicly traded firms. However, the results of Furman (1998) suggest that the bias that results from using Datastream data may not be severe. Due to data limitations, the individual country-level data sets cover different periods of time but are all in the late 1980s and 1990s. We construct a concordance of the industry definitions across all our local datasets so that the industries all correspond to 2-digit International Standard Industrial Classifications (ISIC). Finally, it is prudent to note the sample sizes for Colombia, Peru and Venezuela. We therefore have less confidence in the results for these countries.

[8] 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 (Khanna, 2000).

[9] We feel that stock market based measures of firm performance, such as Tobin's *q*, are 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. Furthermore, 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.

[10] This specification is in line with early studies of risk sharing in Japanese corporate groups; see Caves and Uekusa (1976) and Nakatani (1984). In India, data constraints force us to use (net income + interest expenses * (1 - tax rate)) / (total net assets) instead of operating profits.

[11] 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 not necessarily within groups.

[12] "Simple" joint determination of risk and return 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.

[13] This test is similar in spirit to the "chop shop" approach used by Lang and Stulz (1994) and LeBaron and Speidell (1987). The matching may be flawed if one believes that unobserved intra-industry heterogeneity

is high, leading to comparisons between a group firm in a particular industry sub-segment and an unaffiliated firm in a different industry sub-segment. To guard against this, we rank industries within each country by intra-industry variation in long-run average returns, and repeat the analysis by constructing matched portfolios using only those industries that display below-median intra-industry variation in returns, where the matching is likely to be more accurate. This implies that we can only construct meaningful matched portfolios for a subset of groups; the results remain qualitatively unchanged, and are not reported. In addition, recent econometric developments propose matching algorithms that improve upon the method used here (e.g. Dehejia and Wahba, 1999; Villalonga, 2000). Data constraints preclude the implementation of these methods here.

[14] Within the internal capital markets literature, Lamont (1998), who examines the impact of oil price shocks on U.S. conglomerates, is close in spirit.

[15] Due to the concordance of industry definitions mentioned in endnote 7, the group diversification measures are comparable across countries.

[16] Following Rajan and Zingales (1998), we use U.S. tables throughout. U.S. input-output tables can be found at http://www.bea.doc.gov/bea/dn2/i-o.html. International input-output tables are available from UNIDO but we found these to be of generally poor and inconsistent quality. Classifying group firms into two-digit ISIC industries, we observe for each pair of firms (x, y) the fraction of inputs from x's industry to y's and vice versa. We then record the higher value for each pair and average over all pairs in the group to obtain the group's vertical integration index. Since we are dealing with a fairly coarse industry categorization, it is possible that groups having multiple firms within a two-digit ISIC code supply inputs to one another. As such, we do not treat all group firms in a particular two-digit ISIC code as a single entity, but form pairs out of these firms just as we do when group firms are in different two-digit ISIC codes. We thus potentially overstate the vertical integration of the groups.

[17] We include banks, insurance companies, mutual funds and pension funds in our definition of financial institutions. Restricting this measure to banks only or using the number of financial institutions as a fraction of total number of group affiliates do not affect the results.

[18] We are unable to obtain data on other possible coordination mechanisms, such as family involvement or debt ties, but do not have reason to believe that their exclusion is systematically related to the data items that we do collect.

[19] 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, $D = \min_x(F(x)\text{-}G(x))$, for which exact p-values can be obtained through numerical approximation techniques (Gibbons, 1971: pp. 127-131).

[20] 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.

[21] We compute these statistics for the difference in skewness of group and non-group profitability distributions for each year for which we have data, as well as for a dataset which pools the observations across all years. Since the bootstrapping process does not perform efficiently for small datasets, we perform the year-wise computations for only those country-years where there are more than 100 firms. For the countries where we have small datasets, we only perform the pooled sample computation. We only report skewness differences as significant if they are found to be so in virtually all the year-wise computations for that country and for the pooled sample computation.

[22] We require data on net dividends issued by each firm since the objective is to measure the smoothing of income after all flows due to dividends (received as well as issued) have been accounted for. While data on dividends issued is commonly available for publicly traded companies around the world, data on dividends *received* from other firms – as a result of ownership stakes in these other firms – is exceedingly hard to find. (Datastream has a field for dividends received, but the data contained therein is exceedingly sparse and unreliable.) We have been able to collect these data from local sources for the three countries on which we focus in this section.

[23] The (plausible) premise here is that there exist 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). Khanna and Rivkin (2000) provide evidence for this in the case of Chile.

[24] Suppose x goes up by one. If income shocks are perfectly smoothed, dividends will fall by exactly one, keeping after-dividends profitability, y, unchanged, and regressing Δx - Δy on Δx would yield a coefficient of one. If Δx goes up by one and there is no smoothing at all, regressing Δx -Δy on Δx will yield coefficient

of zero. 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." When there is only one level of profitability 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, and firm-fixed effects.

[25] The test statistic is calculated as follows: under the null hypothesis, group affiliation should not be correlated with profit volatility (i.e, $\beta_2 = 0$). Thus, under the null hypothesis, the sum across all the individual country equations of the β_2 coefficients divided by the square root of the sum of their variances 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.

[26] To relate this to a distinction commonly seen in the literature on Japanese groups, the groups in our sample are better thought of as closer to the horizontally diversified Japanese groups rather than the vertical Japanese *keiretsu*.

[27] The coefficients imply that, in Thailand for example, a change in the composition of a group increasing the fraction of assets held by financial institutions by 10 percent, would reduce group risk sharing by 0.2 or close to 20 percent. The regressions in Table VII do not control for group size, because it is typically highly correlated with group diversification. Using a measure of group size (assets), we find little evidence that large groups provide more risk sharing opportunities to member firms (results not shown).

[28] One possible explanation for this is the large influence that Japanese banks have traditionally had on the groups (Weinstein and Yafeh, 1998).

[29] While this number seems low, it is important to note what this statistic is *not* measuring. It does not summarize the strongest equity ownership link between a particular firm in a group and some other group affiliate (that number is much higher). As an example, consider a 10-affiliate group. Suppose affiliate A owns 75 percent of affiliate B, but no other group affiliate owns any part of B either directly or indirectly, nor does B own any part of any affiliate. Then B's contribution to the measure in question will be scaled by 1/9 (since there are 9 pairs of firms of which B is a member).

[30] Including the coordination measure along with the other measures of Chilean group heterogeneity does not qualitatively change any of the results reported for Chile in Table VII.

[31] In postwar Japan, we do not find a significant difference between group-affiliated and unaffiliated firms in this test. The effect of group affiliation becomes significant if a broader definition of group affiliation (Dodwell Marketing Consultants') is used.

[32] Surprisingly, in India non-group firms rely on dividends to dampen profitability shocks more than group members do. This bears some resemblance to Nakatani's (1984) finding that *keiretsu* firms pay out lower dividends than comparable unaffiliated firms.

[33] Indeed, groups often increase in prominence at times of rapid capital markets development; see Khanna and Palepu (1999) for Chile and India. The recent Israeli experience also seems to support this view.

[34] The only case where tunneling would be observationally equivalent to risk sharing is if profitable firms within the group are "plundered," and distressed firms are bailed out. Then unusually high profits would be diminished, and unusually low profits would be supplemented. It is prudent to note that we cannot dismiss this possibility.

[35] Using the more detailed Chilean data (Appendix 1), we construct firm-level measures that theory suggests are likely to be correlated with propensity to tunnel: (a) the average extent to which the group affiliate is linked to others in the group through indirect equity links, and (b) the ratio of (a) to the average extent to which the group affiliate is linked to others in the group through all equity links. These measures are uncorrelated with the standard deviation of operating profitability. At least in Chile, there does not appear to be a strong link between tunneling proxies and profit volatility.

[36] Ball, Kothari and Robin (2000) 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 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.