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ABSTRACT

This paper studies the role of insider trading in explaining cross-country differences in stock market volatility. It introduces a new measure of insider trading. The central finding is that countries with more prevalent insider trading have more volatile stock markets, even after one controls for liquidity/maturity of the market, and the volatility of the underlying fundamentals (volatility of real output and of monetary and fiscal policies). Moreover, the effect of insider trading is quantitatively significant when compared with the effect of economic fundamentals.

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1. Introduction

Stock markets are volatile. That is not news. But the volatility varies substantially across countries. Suppose we use the standard deviation of the monthly returns of a major market index as the measure, then the volatility in Italy is almost twice as high as in the United States. The volatility in developing countries is typically even higher. For example, the Chinese and the Russian markets, respectively, are 350% and 650% as volatile as the U.S market[1].

Market volatility affects the incentive to save and to invest. In almost any model with a representative agent maximizing utility under uncertainty, the more volatile the asset market, holding the average return constant, the less the agent will save, and hence the less the investment will be. A certain degree of market volatility is unavoidable, even desirable, as one would like the stock price fluctuation to indicate changing values across economic activities so that resources can be better allocated. However, precisely because stock prices are supposed to serve as signals for resource allocation, excessive volatility that is not related to economic fundamentals would diminish the signaling function and impede resource allocation[2].

The purpose of this paper is to assess the role of insider trading in explaining the difference in market volatility across countries. As far as we know, this has not been examined on a systematic basis. To do this, we first consider major factors other than inside trading that could also be potential explanations for market volatility. These factors can be grouped in several categories. First, the volatility of the underlying fundamentals, in particular, the volatility of the real output stream whose present discount value that the asset price is supposed to reflect, should matter. In addition, the maturity of the asset market also matters. For example, it may be reasonable to expect a young market to be more volatile than a long established and highly liquid one, even holding constant the volatility of the underlying fundamentals, just because the average

[1] We calculated the numbers based on a monthly sample during 1984:12 – 1998:12. The details are explained later in the paper.

[2] There is a long literature on whether stock price volatility is excessive relative to the present discounted values of the future dividend streams. After the pioneering work by Shiller (1981) and a large volume of subsequent work, no consensus has emerged. While this literature focuses on a single country case (most typically, the U.S.), the current paper examines the difference in volatility across countries.

experience and skill of the investors and of the market regulators may improve with market maturity.

The implication of insider trading for stock price volatility and economic efficiency is ambiguous in theory. The first view is that, by allowing relevant information to be reflected in the stock price faster than otherwise, insider trading should increase the signal-to-noise ratio(Manne, 1966). Conditional on the variance of the signals (i.e., the fundamentals), this should lead to a reduction in market volatility and an improvement in economic efficiency A more sophisticated refinement is that, by allowing a one-time jump in the price, insider trading may temporarily raise the price volatility at the time of the price adjustment, but improve the overall efficiency nonetheless (Leland, 1992). Under this view, if one measures the return volatility at an appropriately long horizon, insider trading should not raise market volatility.

On the other end of the spectrum, it has been argued that insider trading can raise price volatility in the long run and reduce economic efficiency. Access to inside information is more valuable when there is either a big rise or a big fall in prices. Therefore, there may be two channels through which insiders may choose to generate more volatility. First, other things equal, insiders may have an incentive to choose riskier projects than they otherwise would. Second, even holding the inherent risk characteristics of a production process constant, insiders have an incentive to manipulate the timing and content of the information release in a such way that will generate more price volatility than otherwise (Brudney, 1979; Easterbrook, 1981; Allen and Gale, 1992; and Benabou and Laroque, 1992).

Relative to the active theoretic modeling, empirical work on the subject is lagging behind[3]. The small empirical literature on insider trading so far has made use of three types of data. The first is based on self-reported legal trading by corporate insiders filed with government regulators, mostly in the U.S. and the U.K.(see Seyhun, 1986; Elliot, Morse, and Richardson, 1984; Givoly and Palmon, 1985; John and Lang, 1991; Chowdhury, Howe and Lin, 1993; and Gregory, Matatko, Tonks and Purkis, 1994). Of course, reported legal trading by insiders, by its nature, is unlikely to be associated with a large price movement. The second type of data is a compilation of illegal insider trading

[3] The discussion in this and the following paragraphs is derived from Bhattacharya and Daouk (2002).

cases as discovered by the government regulator. We are aware of only one published paper on the subject by Meulbroke (1992) who studied the impact on the stock prices of the illegal insider trading in the U.S. market. A possible concern is that the link between insider trading and market volatility may be exaggerated by this type of data: presumably only a subset of insider trading cases are discovered by the government, often as a result of observing a large price movement.

All of these papers are studies of a single country (typically either the U.S. or the U.K.). Moreover, the countries in these studies have relatively comprehensive regulations against insider trading, and the enforcement of the laws is reasonably vigorous. It may not be possible to draw strong inferences from these studies about what would happen to the stock market volatility when insider trading is rampant and unchecked by the legal system. In a well regulated market such as the U.S. and the U.K., even though there are violations of the insider trading laws from time to time, the majority of insiders or would-be "insiders" are deterred from engaging in illegal insider trading. Non-insider investors understand this and can still have confidence in the system. In a market where insider trading is either explicitly or implicitly tolerated, non-insider investors would assume that insider trading takes place routinely and take measures accordingly (including withdrawing from the domestic stock market altogether). In other words, we need to exercise caution when extrapolating lessons from well-regulated markets to emerging markets.

The third type of data is a cross-country measure developed by Bhattacharya and Daouk (2002). These authors collected information on the existence of anti-insider-trading laws and the year of first prosecution under the law (if any) for 103 countries. They then show that the enforcement of anti-insider trading laws is rewarded in the market in the sense of a higher level of stock prices.

This paper differs from Bhattacharya and Daouk (2002) both in terms of the objectives and in terms of the measure of insider trading. First, the aim of this paper is to study stock market volatility, whereas they focused on the cost of equity. Second, their information on the year of first enforcement potentially still does not capture how aggressive the law has been enforced and how comprehensive the anti-insider-trading law covers different countries. We will introduce a new measure of the prevalence of insider

trading that may improve on these dimensions. The correlation coefficients between our index of insider trading and their two measures are only 0.04 and –0.30, respectively. So our index evidently captures certain things not in the Bhattacharya and Daouk measures[4].

To summarize our main messages, we will report evidence that the difference in the degree of insider trading, is a crucial factor in understanding the vastly different market volatility across countries. This is true even after we take into the account the effects of the volatility of economic and policy fundamentals, and of market liquidity and maturity.

The rest of the paper is organized as follows. Since insider trading plays a central role in our study, and its measurement is most problematic, Section 2 is devoted to issues related to its definition and measurement. Section 3 presents the empirical findings. Section 4 concludes.

2. Insider Trading: Variation and Measurement

The central objective of the paper is to assess the role of insider trading in explaining the differences in volatility across different national markets. Insider trading is an elusive concept to measure and its effect on market volatility is somewhat controversial. Therefore, we choose to devote this section to discuss the definition of this concept and the sources of variation in the degree of insider trading across countries.

Sources of Variation in Insider Trading across Countries

Insider trading refers to trading by people who possess some material non-public information – where "material" means "relevant for the price of a stock or stocks." To make comparisons across countries, a natural benchmark to use is the United States. This is because it has perhaps the most comprehensive anti-insider trading laws, the most stringent requirement on information disclosure, and the strictest enforcement. In addition, the U.S. insider trading laws, accounting rules, and their enforcement are two frequent subjects of the economic and legal literature.

[4] For comparison, we will report statistical results with both their and our measures of insider trading. As it turns out, their measures are not statistically significant.

The definition of illegal insider trading in the U.S. is not an immutable concept, but evolves over time[5]. The notion that some form of insider trading is wrong was well established before the passing of the federal securities laws. For example, back in 1909, the United States Supreme Court held that a director of a corporation who knew that the value of the stock would soon change, committed fraud when he bought the stock from uninformed outsiders. The U.S. Securities Exchange Act (SEA) of 1934 addressed insider trading directly (through Section 16(b)), by prohibiting profits realized in any short period (less than six months) by corporate insiders. Corporate insiders are defined as directors or officers of the corporation or major shareholders (with over 10% of the shares).

What about the type of insider trading not covered by the law directly? The law (SEA, Section 109b)) authorizes the Securities and Exchange Commission (SEC) to issue rules and regulations to prevent security fraud. In that context, Rule 10b-5 issued by the SEC prescribed the principle of "disclose or abstain": any person should either disclose truthfully what he/she knows before trading or abstain from trading. This has been used to prohibit trading on material non-public information acquired by people other than "corporate insiders" defined in the SEA. These people can include outside auditors, outsider lawyers, investment bankers and so on that are temporarily retained by the corporation but have access to material non-public information. People in this category are labeled as "temporary insiders" or "constructive insiders," and are prohibited from trading on the information.

In the early 1980s, in response to some legal challenges, the SEC promulgated a new rule (Rule 14e-3), which made it illegal for anyone to trade on the basis of material non-public information regarding a tender offer if he/she knows the information comes from an insider. This came to be known as the "misappropriation" theory in the parlance of insider trading jargon.

Relative to the United States, the prevalence of insider trading varies widely from country to country. The market integrity in the United Kingdom is perhaps similar to the

[5] The following discussion is based on Newkirk and Robertson (1998).

U.S., whereas that in China is different. We will make these cross-country comparisons more precise later.

There are three reasons why these dimensions of market integrity vary across countries. First, the set of activities that are defined as illegal under a national law or regulation can vary from country to country. For example, some countries may choose not to prohibit certain activities that are prohibited in the U.S. such as trading by "tipees" or "mis-appropriators." Indeed, there are countries that still do not prohibit any type of insider trading.

Second, for a given violation, the penalties allowed by laws in different countries can also vary. In the U.S., insider trading is a criminal offense. So the set of penalties can include jail terms. The Insider Trading Sanctions Act of 1984 provides penalties for up to three times the profit gained or the loss avoided by the insider trading. The Insider Trading and Securities Fraud Enforcement Act of 1988 further expanded the power of the SEC, including a greater scope for cooperation with foreign governments. In comparison, in several other economies, including Hong Kong, insider trading is a civil violation. So the maximum penalty is a fine rather than a combination of a jail term and a fine. In Europe, extensive insider trading regulation occurred relatively recently in 1989 with the adoption of the European Community Directive Coordinating Regulations on Insider Trading (the "EC Directive"). The EC Directive was modeled after French and English laws that treat insider trading as a criminal offense. It prohibits insiders from trading on inside information and from tipping other people to take advantage of the information. It also prohibits people who receive a tip from the insiders from trading on the information. However, the EC Directive allows individual member countries to enact stricter laws and decide on appropriate penalties at their own preference.

Third, holding constant the set of prohibited activities and penalties on the book, the vigor with which a country chooses to enforce the laws and the punishment also differs widely. It is believed that the U.S. SEC's effort to enforce the laws on truthful and timely information disclosure as well as insider trading is vigorous. For example, in the fiscal year of 1997 (Oct. 96-Sept. 97) alone, the SEC brought 57 insider trading cases (Newkirk and Robertson, 1998). [Among those, 90% of all the cases have been settled out of court.]

In Europe, the extent of enforcement differs across countries. For example, Italy is still perceived to be a place where insider trading is relatively common. Some observed that "[i]n spite of the passage of laws on takeovers and insider trading since 1992, the bourse has not shaken its reputation as a fiefdom of an inward-looking financial community that treats small shareholders shabbily." (Graham, 1997, as quoted in Newkirk and Robertson, 1998, p7). In Hong Kong, as mentioned before, insider trading is considered a civil offense (so the penalty on the book is not as grave as in the U.S. or many European countries). However, Hong Kong compensates for the small penalty with a relatively tough enforcement. It has a tight anti-fraud regulation and relatively rigorous and predictable law enforcement. The government regulators enjoy a good reputation for being well trained, professional, and relatively uncorrupt. This makes Hong Kong less likely to have a situation in which corporate insiders release misleading information or commit financial fraud than might otherwise be the case.

In contrast, both South Africa and China prohibit insider trading on the book and in principle the penalty can be severe. For example, in South Africa, insider trading is a criminal offense, with penalties of up to 10 years in prison and a fine up to half a million Rand (Business Times, February, 1997). However, the enforcement has been lax, without a single person convicted of insider trading at least up until May 1999 (Business Times, May 16, 1999). In China, while the exact number is not available, an informal discussion between the authors and some market participants suggested that corporate information release is considered not comprehensive and unreliable. Insider trading and price manipulation is perceived to be widespread and relatively unchecked.

To sum up, prevalence of insider trading depends on three sources: the scope of prohibited behavior, the penalty for a given offense, and the enforcement of existing laws and regulations. In this conjuncture, it is clear that the information on the existence of an insider trading law only provides an imperfect description on the scope of prohibition and does not carry information on the severity of penalty and the rigor of enforcement. Information on the year of first prosecution tells us when the law was first enforced, but it does not necessarily capture the rigor of the enforcement over a sustained period of time and does not necessarily capture the severity of punishment.

A New Measure of the Extent of Insider Trading

The new measure is derived from the Global Competitiveness Report (GCR) in 1997 and 1998. The GCR report was developed jointly by the World Economic Forum and Harvard University. A survey of corporate officers in around 3000 firms around the world was conducted where respondents were asked a variety of questions about the business environment in the countries. In one of the questions (Question 3.13), the respondents were asked to rate the extent of insider trading on a scale of 1 to 7. The exact question was

"Do you agree that insider trading is not common in domestic stock market?" (1=strongly disagree, 7=strongly agree)

For each country, the report presents the average answer from all respondents in that country. To avoid awkwardness in interpretation, we define our variable, "Insider Trading Index" = 8 – country mean answer to Question 3.13, so that a large value means more insider trading. To further reduce sample variations, we use the average of the ratings in 1997 and 1998 as our measure of insider trading.

A potential shortcoming of this measure is that a perception based measure may not be accurate.[6] Furthermore, most firms in the survey are not financial firms. However, many firms are multinational, and generally the corporate officers who responded to the survey were likely to be sophisticated in matters related to financial markets.

There are also advantages associated with this measure. Since the respondents were asked to assess the prevalence of insider trading in reality rather than in law, presumably the answer reflects the consequences of all three dimensions (whether a given act is illegal, how likely the offender will be caught, and how severe the penalty will be). In this sense, the index might contain information that is not captured by the earlier measure in Bhattacharya and Daouk (2002). Indeed, the correlation between our index

[6] Worse, systematic bias could be introduced by the survey question. In the empirical part, we will discuss the possibility of a systematic bias and an instrumental variable approach to deal with it.

and their measure is low. Therefore, at a minimum, the new index supplements the existing measure.

3. Empirical Evidence

We now turn to the empirical results. As we do not have a time-series measure of insider trading[7], we focus exclusively on the cross-sectional variation. Let V(k) be the volatility of stock returns for country k – measured by the standard deviation of the monthly returns over December 1984 – December 1998. Our benchmark specification is the following.

$$V(k) = \alpha + F(k)\beta_1 + G(k)\beta_2 + L(k)\beta_3 + M(k)\beta_4 + \beta_5 I(k) + e(k)$$

where F(k) is a vector of variables measuring economic fundamentals; G(k) is a vector for government macroeconomic policy fundamentals; L(k) is a vector for liquidity of the market; M(k) is a vector for maturity of the market; and finally, I(k) is an index of the degree of insider trading. α, β_1, β_2, β_3, β_4, and β_5 are parameters to be estimated (with appropriate dimensions). And e(k) is a random variable that is assumed to be normally distributed with zero mean and a constant variance.

Our cross-national sample has a relatively small number of observations (55 at a maximum). As a result, we adopt a strategy of sequential estimation. Starting with the volatility of economic fundamentals, we progressively augment the regression with other factors as additional explanations: uncertainty regarding a government's macroeconomic policies, liquidity and maturity of the market, and insider trading. As we need to conserve the degrees of freedom, in each successive regression, we drop those regressors that have consistently been insignificantly different from zero in prior regressions. To be on the safe side, in each round, we keep all regressors that are statistically significant at the 15% in the previous round. In other words, we keep more control variables in each round than it would have been the case if we were to drop all regressors not significant at

the 10% level. [In the final set of regressions, we add the dropped regressors one by one to ensure that our procedure does not bias our inference.]

Uncertainty about Economic Fundamentals

To measure the volatility of the economic fundamentals that underlie the stock prices, we use several proxies. First, we use the standard deviation of the real GDP growth rate, computed over the same sample period as the volatility of the stock market. Figure 1 presents a scatter plot of the stock market volatility against the volatility of the GDP growth rate. It suggests a positive relationship between the two variables. The regression result is reported in Column 1 of Table 2. The coefficient is positive and statistically significant. In other words, as consistent with our intuition, countries with more volatile GDP growth processes also have more volatile GDP growth rates[8]. In fact, one cannot reject the hypothesis that the slope coefficient is equal to one at the ten-percent level. That means that, on average, there is a one-to-one correspondence between the volatility of real GDP growth and the volatility of the stock returns. If the GDP in

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[7] While the insider trading measure is available in all GCR reports since 1997, we found that there is very little time series variation in terms of the ranking of the countries. Thus, we choose to use the earliest available index.

[8] Using standard deviation of the GDP growth as a regressor in a regression for market volatility can be justified relatively easily. Let p(t) be the level of stock index and use "stdv" to denote standard deviation. Recall that stock market volality is defined as the standard deviation of the monthly stock returns, or stdv[p(t+1)-p(t)].

We make an assumption which is fairly common in macroeconomics that log real GDP, denoted by y(t), follows a random walk. Without loss of generality in the subsequent discussion, we assume that there is no drift.

(a1) $y(t) = y(t-1) + e(t)$

where e(t) is iid normal (o, v). Note, here, var(e) is the volatility of the real GDP grwoth Now we assume that p(t) is (approximately) the present discounted value of current and all future log real GDPs.

(a2) $p(t) = \sum_{s=0} [y(t+s) / (1+r)^s]$

where r is the discount rate – for simplicity, invariant over time and across countries. Then,

(a3) $p(t+1) - p(t) = \sum_{s=0} \{[y(t+1+s)-y(t+s)] / (1+r)^s\}$

Therefore, $var[p(t+1) - p(t)] = K\ var(e)$

where $K = \sum_{s=0} [1 / (1+r)^s]$ which is a constant. We then have

(a4) $stdv[p(t+1)-p(t)] = (\sqrt{K})\ stdv\ (e)$

Therefore, in this formulation, the volatility of the stock returns would be proportional to the volatility of the real GDP growth.

country A is more volatile than country B by 10%, the stock market in country A is also likely to be more volatile by 10%.

Not all firms whose output values go into a country's GDP figure are publicly listed companies[9]. An alternative way to measure the uncertainty of the corporate fundamentals is to look at the variability of operating income for publicly traded companies in a country. More precisely, we utilize the standard deviation of the change in operating income for a subject of major listed companies over 1991-96, scaled by the mean operating income in absolute value during the same period[10]. The regression result with this alternative measure of the volatility of the fundamentals is reported in the second column of Table 2. The coefficient is positive, consistent with the hypothesis that a more volatile corporate operating income stream generates a more volatile aggregate stock return. Unfortunately, this estimate comes with a relatively large standard error so that we cannot reject the null hypothesis that it is equal to zero. Of course, the same large standard error also indicates that we cannot reject either the null hypothesis that it is equal to one.

At this point, it is useful to note that there may be many reasons why some countries' real output or operating income is more volatile than others'. The discussion in the introductory section suggests that more prevalent insider trading itself may contribute to a higher volatility of real output as the managers of firms may have an added incentive to choose riskier projects than they may have otherwise.

Other aspects of economic fundamentals may also be relevant. In particular, firms in some economies are more leveraged (i.e., with a higher debt-to-equity ratio) than other economies. It has been recognized at least since Black and Scholes (1973) that a higher leverage ratio may induce firm managers to undertake riskier projects than they otherwise would have. To measure this effect, we adopt an economy-wide leverage ratio measure, which is the ratio of aggregate corporate debt to the sum of corporate debt and equity. The third column of Table 2 reports the regression with this leverage ratio

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[9] One might assume, however, that the output of the non-listed firms and that of the listed companies within a common country are highly correlated. Indirect evidence on this is seen in the empirical findings that business cycles are far more correlated for regions within a country than across different countries (e.g., Rose and Engel, 2000).

[10] This comes from Claessens, Djankov and Nenova (1999).

measure as the only regressor. The coefficient is positive, consistent with the notion that a higher economy-wide debt-to-equity ratio leads to more volatile stock returns. Like the cash flow variability measure, this measure by itself is not statistically significant at the 10% level.

Concentration of wealth in an economy might also raise the market volatility if one thinks that concentrated wealth might imply that large shareholders are more likely to expropriate small shareholders. The effect could also go the other way if one thinks that concentrated wealth implies that companies are mostly controlled by a concentrated group of large shareholders who can overcome the principal-agent problem more effectively vis-à-vis the managers. As we do not have a perfect measure of the wealth concentration, we experiment with two different proxies. As a first proxy, we use the ratio of the total wealth of all billionaires in a country relative to the size of its GDP. As reported in Column 4 of Table 2, this measure of wealth concentration turns out to be insignificant as an explanatory variable for stock return volatility.

As a second proxy, we adopt a more direct measure of income inequality, namely the Gini coefficient. The regression result is reported in Column 5 of Table 2. This time, the coefficient is positive and statistically significant at the ten percent level. In other words, countries with more polarized income distribution tend to have more volatile stock markets.

Interestingly, when they are introduced collectively into the regression, only the volatility of real GDP growth, leverage ratio, and Gini coefficient (and Cash flow risk if Gini coefficient is left out) are marginally significant. Collectively, these proxies for economic fundamentals explain about 38-43% of the variation in the cross-country dispersion in stock market volatility.

Uncertainty about Macroeconomic Policies

Another potentially important factor is uncertainty associated with macroeconomic policies. As proxies for monetary policy uncertainty, we use volatility of the exchange rate and volatility of the inflation rate. As a proxy for fiscal policy uncertainty, we use the volatility of the fiscal deficit as a share of GDP. In addition, we

use to the ratio of trade (exports plus imports) to GDP as a measure of the government's willingness to adopt pro-competition policies. The results are reported in Table 3.

We first look at the regression results when these policy variables are included one by one. Either a more volatile exchange rate or a more volatile inflation rate is associated with a higher volatility of stock returns (Columns 1-2 in Table 3). So a less predictable monetary policy is indeed associated with a higher volatility. In addition, countries with more open trade regimes tend to have a less volatile stock market. However, fiscal policy uncertainty does not appear to matter: the coefficient on the volatility of the ratio of fiscal deficit-to-GDP is not statistically different from zero even though the point estimate is positive.

When these measures of policy uncertainty are included simultaneously (together with the economic fundamentals from the previous table), the volatility of the exchange rate continues to be positive and significant (at the 5% level). The coefficient on the volatility of inflation switches the sign, probably indicating a relatively high correlation between inflation volatility and exchange rate volatility. Hence, one may say that stock market volatility is related (weakly) to some measure of monetary policy uncertainty, but is unrelated to fiscal policy uncertainty. Uncertainty about economic fundamentals, particularly the real GDP growth rate, the leverage ratio, and the Gini coefficient continue to play a role in explaining the dispersion in the market volatility.

Liquidity and Maturity of the Market

Less liquid or less matured markets may be more volatile. We measure liquidity of the market by the ratio of the stock market turnover to market capitalization. The notion of the maturity of a market lacks a precise definition. But it is sometimes asserted that a newer and less matured market may be more volatile. In this paper, we examine three possible dimensions of market maturity: the ratio of stock market capitalization to GDP, the age of the stock exchange (i.e., number of years since the inception of the main exchange), and the level of economic development as proxied by per capita GDP. All three are imperfect, but each may capture something that is useful. The results are reported in Tables 4-5.

We found that the ratio of the stock market turnover to market capitalization is not significant. That is, across countries, there is no discernible association between liquidity and the market volatility. Both the ratio of market capitalization to GDP and the age of the stock exchange are significant when entered alone in the regression, but not when economic and policy fundamentals are taken into account. On the other hand, the average income level (log GDP per capita) is consistently negative across specifications. In other words, richer countries have consistently lower stock market volatility even after one takes into account economic and policy fundamentals. Note that income level may also be a proxy for the quality of institutions, in addition to being a proxy for market maturity. So we are not able to pin down a precise interpretation of this coefficient, but simply note that the effect of economic development on market volatility is controlled for.

Insider Trading

A central question in this paper is whether insider trading contributes to market volatility. To start with, we first make use of the information on the existence of an insider trading law and the date of first prosecution collected by Bhattacharya and Daouk (2000). More specifically, we construct a measure of the fraction of the time during our sample (1985-98) in which a country has an insider-trading law. For example, if the law went into effect in 1990, then, this fraction would be (98-90)/(98-85)=0.62. Next, based on the year that the first prosecution occurs, we construct a measure of the fraction of the time in the sample since the first prosecution. For example, if the first prosecution took place in 1995, then this ratio would be equal to (98-95)/(98-85)=0.23.

The regression results are reported in Table 6. From the first three columns, we see that the fraction of time an insider-trading law is in place is not different from zero statistically. This could simply reflect the fact that some countries that have such laws on the books do not seriously enforce them. In the last three columns of Table 6, the fraction of time since the first prosecution is used as a regressor. The coefficients are all negative, consistent with the notion that law enforcement on insider trading is associated with a reduction in stock market volatility. However, these coefficients are not statistically different from zero either. Therefore, the supportive evidence is fairly weak.

As suggested in Section 2, the information on first prosecution may not capture all aspects of the rigor of enforcement or the severity of punishment. As an alternative, we also adopt the new GCR-survey-based index of insider trading.

To obtain some visual impression, Figure 2 presents a scatter plot of the stock market volatility against the index of insider trading. As can be seen clearly, more insider trading is associated with a higher market volatility. To see if the positive association remains when one controls for other determinants of the market volatility, we perform a sequence of regressions. In the first column of Table 7, we regress stock market volatility on the GCR measure of insider trading. The coefficient is positive (2.62) and statistically significant at the five percent level. This regression is no more than simply summarizing the positive associated demonstrated in Figure 2 by a linear line. In the second column, we add several regressors (per capita GDP, volatility of GDP growth, volatility of exchange rate change and the number of listed companies) that have been found to be important for market volatility in the earlier part of the paper. Two of these regressors (volatility of exchange rate change and the number of listed companies) are found to be statistically significant. For our purpose, it is important to note that the coefficient on insider trading continues to be positive and statistically significant. In Column 3, we add corporate leverage ratio, cash flow risk and Gini coefficient to the regression. Only corporate leverage ratio is statistically significant. Insider trading remains positively associated with stock market volatility. Since cash flow risk and Gini coefficient are not statistically significant, in Columns 4-6, we experiment with dropping one at a time or both. These exercises are designed to see whether the positive association between insider trading and market volatility is sensitive to small variations in the specification. In all these cases, the coefficient on insider trading stays positive and statistically significant at the ten percent level, although the point estimates fluctuate a bit. These results are consistent with the hypothesis that a more prevalent insider trading is associated with a higher volatility of the stock market.

Besides statistical significance, it might be useful to ponder over the quantitative and economic significance of the point estimate. Let us use the point estimate in Column 6 of Table 7 for illustration. Note that the insider trading index in the table has already been re-scaled by its standard deviation (0.84). The point estimate 1.03 means that a one

standard deviation increase in insider trading tends to be associated with a rise in market volatility by 103 basis points. To illustrate the economic significance of the estimate in a different way, consider a thought experiment of a rise in the extent of insider trading from what prevails in the U.S (with the index of insider trading=2.62) to what prevails in China (with the index value = 4.62). This increase in insider trading would increase the volatility of stock returns by **245 basis points** {=[(4.62-2.62)/0.84]*1.03}. As a comparison, the increment in the volatility of the GDP growth rate from the U.S. level of 1.7 percent to the Chinese level of 3 percent generates only an extra volatility in the stock market by **104 basis points** (=(3-1.7)X0.8). So the higher stock market volatility in China relative to the U.S. is explained more by the excessive insider trading in China than by the extra volatility of China's economic fundamentals[11].

Instrumental Variable Regressions

One potential concern with the previous regressions is the possible endogeneity of insider trading. For example, some countries may have higher volatility in their stock markets for reasons unrelated to insider trading. But higher volatility *per se* offers more opportunity for insiders to profit from insider trading and may induce them to do more of it. In this case, the direction of causality could run from market volatility to insider trading rather than the reverse. Secondly, the perception of the survey respondents about the insider trading in their country can be influenced by the actual extent of market volatility (this is another form of reverse causality). Either of the two reasons could generate a spurious correlation between the insider trading index and market volatility even if the insider trading activities do not cause a rise in the volatility.

To deal with this possibility, we adopt an instrumental variable approach. In fact, we consider two potential sets of possible instruments. The first is the extent of corruption in a country's judicial system ("legal corruption" for short). On an *ex ante* basis, it is plausible to expect that legal corruption and insider trading are positively correlated: if the judges can be influenced by bribery, then it is highly probable that the laws regarding insider trading prohibition are not vigorously and/or fairly enforced.

[11] Other factors may have reduced the market volatility in China, such as a relatively stable exchange rate and a relatively large number of listed companies.

Furthermore, it seems unlikely that the extent of legal corruption is caused/influenced by the volatility of the stock market.

The legal corruption measure comes from a different question in the GCR survey. Question 8.09 of the survey asked the respondents to rate the level of corruption in the country's legal system on a one to seven scale. The exact question is the following:

"Do you agree that irregular payments to judges or other officials involved in the enforcement and execution of judgement are not common and do not influence the outcome of court proceedings?" (1= strongly disagree, 7= strongly agree)

We define legal corruption for a particular country = 8 - the average of the answers for that country. A bigger number implies a higher degree of legal corruption.

As another candidate for instrument variables, we also consider the origin of a country's legal system ("legal origin" for short). The legal origin classification, proposed by La Porta, Lopez-de-Silanez, Shleifer and Vishny (1998), separates legal systems around the world into five categories: British common law, French civil law, German tradition, Scandinavian tradition, and the socialist legal system. Because legal systems are by and large determined by colonial expansion or revolution in history, they are unlikely to be influenced by stock market volatility in the last fifteen years. On the other hand, as legal origins influence a country's preference to offer protection for minority shareholder rights and creditor rights, they may also influence a country's proclivity to disallow insider trading, which may be a form of exploitation of minority shareholders.

To have an idea of whether the instruments are actually correlated with the insider-trading index, we report in Table 8 two regressions of the insider-trading index on the instrumental variables. We observe that legal corruption is positively and significantly associated with insider trading: countries with a higher degree of legal corruption are also likely to have more prevalent insider trading. Legal origins are not successful: none of the legal origin dummies is shown to be statistically significant in explaining insider trading once legal corruption is taken into account. In light of this, we will use legal corruption as the instrumental variable for insider trading.

The results of the 2SLS estimation are reported in Table 9. In the first column, we use the specification identical to Column 6 of Table 7. The coefficient is positive, consistent with the hypothesis that insider trading and market volatility are positively associated. In fact, the point estimate from the IV regression (2.66) is bigger than the corresponding OLS regression. However, because the standard error of the IV estimate is more than three times as large as that of the OLS estimate, the coefficient is only statistically different from zero at the fifteen percent level. We perform a formal Hausman test for the null hypothesis that the differences in the coefficients between the IV regressions and the corresponding OLS regressions are not systematic. This null hypothesis cannot be rejected even at the 28% level. In other words, from a pure statistical point of view (as indicated by the Hausman test), we cannot say that the IV regression is necessary.

We note that four of the other regressors, leverage ratio, number of listed companies, volatility of GDP growth rate, and log per capita GDP are not statistically significant either. In Column 2 of Table 9, we omit leverage ratio from the IV regression. In this case, insider trading becomes statistically significant at the five percent level. In Column 3, we omit volatility of GDP growth rate from the regression (but still retain lverage ratio as a regressor). In this case, insider trading becomes statistically significant at the ten percent level. In Column 4, we omit log per capita GDP from the IV regression (but retain volatility of GDP growth rate and leverage ratio). In this case, the coefficient on insider trading again becomes statistically significant (at the 5% level). The same is true when we omit the number of listed companies from the regression (reported in Column 5). Therefore, the significance of the insider trading variable improves when one omits any of the other insignificant regressor. In Column 6, we omit log GDP per capita, volatility of exchange rate change, and leverage ratio simultaneously. In this case, the coefficient on insider trading variable is positive and statistically significant at the one percent level.

Note also that when legal corruption is used as the instrument for insider trading, the system is exactly identified. As a result, we cannot perform a formal over-identifying restriction test on the validity of the instrument. We can add the dummies for legal origins to the list of the possible instruments (and ignore the fact that the legal origins are

not statistically significant according to Table 8). This allows us to formally test the null hypothesis that the instruments and the error term are not correlated. We find that the null hypothesis cannot be rejected with a p-value equal to 0.24 (the regression results not reported to save space). This bolsters the validity of the instruments.

To summarize, the coefficients on insider trading in all OLS regressions are always positive and significant. In the IV regressions, if we drop any of the insignificant regressors, the coefficient on insider trading – instrumented by legal corruption – is positive and statistically significant at the ten level or better. Therefore, the instrumental variable approach supports the notion that insider trading raises market volatility.

Further Robustness Checks

We have pursued a number of additional robustness checks. First, we note that we have assumed that the error term is normally distributed in all previous regressions. The assumption was made for expedience. Of course, since volatility of stock returns – the left-hand-side variable – is always non-negative, the normality assumption on the error term cannot be literally true. To see if this assumption is innocuous or not, we have tried an alternative distributional assumption on the error term. More specifically, we assume that the error term (and by extension, the dependent variable in the regression) follows a Gamma distribution[12]. This way, we ganrantee that the error term is non-negative.

A sequence of regressions with this assumption are run. The results are reported in Table 10. With the new non-negative Gamma distribution for the error term, the qualitative features of our previous results remain largely the same. Most importantly, the insider trading index is consistently positive and statistically significant.

Second, we have employed an alternative definition of stock market volatility. Instead of using standard deviation of the returns, we define the volatility of a country's stock market as the difference between the first and third quartile of the monthly returns for that country during 1985:1 and 1998:12. The advantage of this alternative notion of

[12] A (non-negative) random variable is said to follow a (generalized) gamma distribution if its probability density function is given by

$$f(x) = [\theta / \Gamma(\rho)] \, (x^{\theta\rho-1} / \gamma^{\theta\rho}) \exp[-(x/\gamma)^{\theta}], \quad x>0$$

where γ, θ, and ρ are all positive parameters, and $\Gamma(a)$ is the Gamma function, i.e., $\Gamma(a) = \int_0^{\infty} u^{a-1}e^{-a}du$.

volatility is that it is less sensitive to possible extreme values in the data (the outliers). We have repeated all the main regressions reported before with this new definition of volatility. The qualitative results remain the same (not reported to save space). In particular, the extent of insider trading as measured by the GCR index is positively and statistically related to the stock market volatility.

Third, because we do not have a meaningful time-series variation in the insider trading measure, we cannot do a fixed-effects panel regression. Nonetheless, we have attempted a random-effects panel regression on three years of data (1997, 1998 and 1999). The results are reported in Table 11. The coefficient on the insider trading measure are always positive and mostly statistically significant at the 10% level.

Fourth, we have reversed the order of conducting the regressions. Specifically, we start with a regression with the insider trading variable as the only regressor. The coefficient on this regression is positive and statistically significant (as one can see from Figure 2). We then retain this regressor in all subsequent regressions. We sequentially add blocks of regressors, from economic fundamentals, macro policy fundamentals, to liquidity and maturity of the markets. To conserve the degree of freedom, we sequentially drop out regressors that are consistently insignificant. We do not report these regressions to conserve space, but the main message is clear. As this new order of adding/deleting the regressors intends to show, the insider trading measure is a statistically and economically significant explanatory variable for stock market volatility when it is put to compete with each block of potential explanatory variables.

4. Conclusion

The volatility of the stock market varies widely across countries. This paper studies whether insider trading contributes to a rise in market volatility. The evidence suggests that it is indeed important. More insider trading is found to be associated a higher market volatility even after one controls for the volatility of the real output growth, volatility of monetary and fiscal policies, and maturity of the stock market. Moreover, the quantitative effect of insider trading on market volatility is also big when compared with the effect of the volatility of other fundamentals. For example, a rise in

the extent of insider trading from what prevails in the U.S to what prevails in China would increase the annual stock market volatility by 245 basis points.

In future research, it would be useful to ascertain the precise mechanisms through which insider trading raises market volatility and to investigate if the rise in volatility translates into reduced economic efficiency.

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Table 1: Summary Statistics

Name of variables	# of Obs.	Mean	Std. Deviation	Minimum	Maximum
Stock Market Volatility (%)	54	9.8	4.7	4.3	29.0
Fundamentals					
Real GDP growth volatility (%)	54	3.0	1.7	1.0	7.5
Cash flow risk	45	0.57	0.28	0.20	1.39
Leverage ratio	46	0.42	0.38	0.079	2.49
Billionaire wealth/GDP (%)	39	31.6	57.2	0	351.0
Gini coefficient	52	37	10	19.5	59.3
Policy Unpredictability					
Exchange rate volatility	54	0.086	0.23	0	1.18
Volatility of inflation rate	54	1.25	5.03	5.7-E5	25.51
Volatility of real interest rate (X1000)	53	4.99	35.46	6.6-E7	258.2
Volatility of fiscal deficit/GDP	51	2.60	1.53	0.25	6.04
(export + import) /GDP (%)	53	34.9	28.6	8.2	181
Market Liquidity and Maturity					
Market capitalization/GDP (%)	52	29.07	35.43	0.045	143.02
Turnover / market cap (%)	49	45.54	37.72	1.25	205.67
Age of stock exchange	54	115	77.1	4	413
Log of GDP per capita	53	8.63	1.43	5.40	10.73
Number of listed companies (average over 1995-96)	53	704	1519	47	8665
Market Integrity					
% time insider trading law in place	54	0.80	0.28	0	1
% time since first prosecution	54	0.34	0.37	0	1
Insider trading prevalence (GCR)	49	3.70	0.84	2.11	5.12

Table 1b: Pair-wise Correlation

	Stock Market volatility	GDP Growth volatility	Cash flow risk	Leverage ratio	Billionaire wealth /GDP	Exchange Rate Volatility	Inflation Rate Volatility	Volatility of Fiscal Deficit /GDP
GDP volatility	0.62							
Cash flow risk	0.26	0.083						
Leverage ratio	0.16	-0.12	0.088					
Billionaire wealth /GDP	0.15	0.034	-0.31	-0.0015				
Exchange rate volatility	0.57	0.21	0.49	0.22	0.0025			
Inflation volatility	0.51	0.72	0.29	-0.048	-0.099	0.45		
Volatility of fiscal deficit	0.20	0.29	0.029	-0.11	-0.070	0.24	0.029	
Total trade /GDP	-0.18	-0.0064	-0.15	-0.085	0.26	-0.19	-0.23	0.31

Table 1c: Pair-wise Correlation

	Stock market volatility	Stock mkt cap /GDP	Mkt turnover /mkt cap	Age of stock exchange	Log GDP /capita	# of listed companies	%time insider trading law is in place	%time since the first prosecution
Stock mkt cap/GDP	-0.37							
Stock market turnover /mkt cap	-0.077	-0.14						
Age of stock exchange	-0.22	-0.031	0.56					
Log of GDP/ Capita	-0.45	0.41	0.32	0.40				
# of listed companies	-0.24	0.10	0.15	0.14	-0.13			
%time insider trading law in place	-0.040	0.15	-0.17	-0.41	-0.12	0.0028		
%time since the first prosecution	-0.19	0.26	0.17	-0.034	0.38	0.24	0.42	
Insider trading Index	0.53	-0.44	0.0017	-0.49	-0.76	-0.14	0.035	-0.30

Table 2: Stock Market Volatility and Economic Fundamentals

Dependent Variable: Standard deviation of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Volatility of Real GDP Growth Rate	1.15 ***					1.86 ***	1.70 ***	1.44***
	(0.51)					(0.55)	(0.63)	(0.61)
Cash Flow Risk		2.25				1.72	2.67 *	0.94
		(2.55)				(1.60)	(1.77)	(1.41)
Leverage Ratio			0.909			1.84***	1.94 ***	1.77***
			(1.02)			(0.73)	(0.76)	(0.70)
Billionaire Wealth /GDP				0.0046			0.0046	
				(.0055)			(0.0073)	
Gini Coefficient					0.11**			0.087**
					(0.06)			(0.049)
Constant	6.3 ***	8.41 ***	9.30 ***	9.23 ***	0.054 ***	3.00 *	2.41	1.19
	(1.2)	(1.36)	(0.80)	(0.71)	(0.024)	(1.83)	(1.86)	(2.51)
# of observations	54	45	46	39	52	45	39	44
Adj. R-squared	0.15	0.023	-0.015	-0.022	0.042	0.43	0.39	0.38

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Table 3: Macroeconomic Policy Uncertainty and Economic Openness

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)
Volatility of Exchange Rate	0.150***				0.075 ***
	(0.029)				(0.019)
Volatility of Inflation Rate		0.31***			-0.30 ***
		(0.15)			(0.10)
Volatility of Fiscal Deficit/GDP			0.31		0.10
			(0.48)		(0.28)
Economic Openness: (exports+imports)/GDP				-0.029**	-0.017 **
				(0.018)	(0.010)
Volatility of Real GDP Growth Rate					1.46 ***
					(0.44)
Leverage Ratio					1.79 ***
					(0.54)
Cash Flow Risk					1.37
					(1.37)
Gini Coefficient					0.13 ***
					(0.042)
Constant	8.55 ***	9.42 ***	9.15 ***	10.8***	-0.91
	(0.47)	(0.62)	(1.28)	(1.06)	(1.96)
#Observations	54	54	51	53	42
Adjusted R-squared	0.48	0.092	-0.01	0.012	0.62

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Table 4: Liquidity of the Market

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)
Stock Market Capitalization /GDP	-0.050 ***		-0.017	-0.017	-0.027 ***
	(0.018)		(0.012)	(0.013)	(0.012)
Stock Market Turnover/ Market Capitalization		0.0099	0.0033	0.0026	0.013
		(0.017)	(0.012)	(0.012)	(0.0092)
Volatility of Real GDP Growth Rate			1.40 ***	1.53 ***	0.76
			(0.55)	(0.62)	(0.57)
Volatility of Exchange Rate			0.063 ***	0.058	0.071 ***
			(0.030)	(0.032)	(0.021)
Economic Openness: (Exports+Imports)/GDP			-0.0066	-0.0042	0.0071
			(0.013)	(0.011)	(0.010)
Leverage Ratio			3.10 *	2.71	2.08
			(1.89)	(2.03)	(1.77)
Cash Flow Risk				0.86	-0.92
				(1.52)	(1.44)
Gini Coefficient					0.14 ***
					(0.044)
Constant	11.17 ***	9.54 ***	4.94 ***	4.30***	1.45
	(0.93)	(1.13)	(1.51)	(1.90)	(1.77)
Number of observations	52	49	40	39	38
Adjusted R-squared	0.12	-0.015	0.53	0.63	0.61

(1) Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.
(2) Stock market volatility is re-scaled by multiplying by 100

Table 5: Market Maturity

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)
Stock Exchange Age	-0.015 **		0.0012	-0.0013	-0.0032
	(0.008)		(0.0038)	(0.0035)	(0.0037)
Log GDP/Capita		-1.32 ***	-0.95 ***	-1.00 ***	-0.95 ***
		(0.31)	(0.29)	(0.29)	(0.28)
Volatility of Real GDP Growth rate			1.16 ***	1.21 ***	0.76 *
			(0.53)	(0.60)	(0.49)
Volatility of Exchange Rate			7.27 ***	6.51 ***	7.42 ***
			(3.10)	(2.54)	(1.80)
Leverage Ratio			1.55 ***	1.10 **	1.19 ***
			(0.63)	(0.60)	(0.48)
Cash Flow Risk				2.62 ***	1.57 *
				(1.02)	(0.98)
Gini Coefficient					0.067 **
					(0.040)
Constant	11.59 ***	21.09 ***	13.57 ***	13.12 ***	11.45 ***
	(1.33)	(3.01)	(3.24)	(3.37)	(3.71)
# observations	54	53	45	44	43
Adjusted R-squared	0.046	0.14	0.64	0.69	0.66

Robust standard errors are in the parentheses. ***, **, and * indicate statistically significant at the 5%, 10%, and 15% level, respectively.

Table 6: Insider Trading In Terms of Law and First Prosecution

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of Time in Which Insider Trading Law is in Place	2.31	0.86	0.85			
	(2.13)	(1.82)	(1.30)			
Fraction of Time Since The First Prosecution Of Insider Trading				-1.14	-1.20	-1.03
				(1.79)	(1.17)	(0.96)
Log GDP/capita		-0.90 ***	-1.02 ***		-0.74 ***	-0.84 ***
		(0.24)	(0.26)		(0.31)	(0.33)
Volatility of Real GDP Growth Rate		0.29	0.59		0.34	0.69 *
		(0.39)	(0.49)		(0.41)	(0.44)
Volatility of Exchange Rate		0.13 ***	7.21 ***		0.13 ***	8.19 ***
		(0.032)	(1.81)		(0.027)	(2.00)
Log (# of Listed Companies)		-0.25	-0.55 ***		-0.0022	-0.37
		(0.33)	(0.25)		(0.38)	(0.29)
Leverage Ratio			1.31 ***			1.45 ***
			(0.48)			(0.52)
Cash Flow Risk			1.34			0.88
			(1.25)			(1.07)
Gini Coefficient			0.071 **			0.078 ***
			(0.038)			(0.038)
Constant	7.96 ***	16.22 ***	14.91 ***	10.20 ***	14.38 ***	12.96 ***
	(1.67)	(3.25)	(4.10)	(0.94)	(0.44)	(4.73)
Number of Observations	54	53	43	54	53	43
Adjusted R-squared	0.001	0.57	0.68	-0.011	0.57	0.69

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Table 7: Insider Trading as Measured by the GCR Index

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)	(6)
Insider Trading Index	2.62 ***	1.65 ***	1.05 ***	0.81 **	1.39 ***	1.03 **
	(0.52)	(0.48)	(0.48)	(0.44)	(0.45)	(0.55)
Log GDP Per Capita		-0.14	-0.66	-0.75 ***	-0.43	-0.67
		(0.41)	(0.41)	(0.35)	(0.45)	(0.46)
Volatility of Real GDP Growth Rate		0.24	0.54	0.41	0.99 *	0.80 *
		(0.42)	(0.46)	(0.36)	(0.61)	(0.51)
Volatility of the Change In Exchange Rate		0.12 ***	0.072 ***	0.076 ***	0.065 ***	0.072***
		(0.028)	(0.018)	(0.016)	(0.025)	(0.028)
Log # of Listed Companies		-0.49***	-0.43*	-0.57 ***	-0.28	-0.57 ***
		(0.22)	(0.26)	(0.21)	(0.26)	(0.24)
Leverage Ratio			0.99 ***	1.17 ***	0.90 **	1.25 ***
			(0.43)	(0.45)	(0.45)	(0.56)
Cash Flow Risk			0.69		1.48	
			(1.06)		(1.21)	
Gini Coefficient			0.039	0.059		
			(0.041)	(0.041)		
Constant	-1.56	5.00	9.17 **	11.71 ***	4.86	11.31 **
	(1.89)	(6.24)	(6.02)	(5.14)	(6.87)	(7.33)
No. of Observations	49	48	41	42	42	43
Adjusted R-squared	0.29	0.67	0.72	0.72	0.70	0.67

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Insider trading index has been re-scaled by its standard deviation in the sample. Hence, the associated coefficient can be interpreted as the effect of a one standard-deviation increase in insider trading on market volatility.

Table 8: Explaining Insider Trading
(First stage in 2SLS regressions)

Dependent Variable: Insider Trading Index

Legal Corruption Index	0.56***	0.53***
	(0.057)	(0.067)
French Legal Origin		-0.15
		(0.26)
German Legal Origin		-0.12
		(0.30)
Scandinavian Legal Origin		-0.45
		(0.42)
Socialist Legal Origin		0.25
		(0.32)
Constant	2.88***	3.04***
	(0.18)	(0.24)
Number of Observations	49	49
Adjusted R-squared	0.64	0.64

Table 9: Insider Trading Measured by the GCR Index, 2SLS Regressions

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)	(6)
Insider Trading Index	2.66 *	4.41 ***	3.83 **	2.29***	3.17 **	2.77 ***
	(1.70)	(1.69)	(2.12)	(0.47)	(1.69)	(0.49)
Log GDP Per Capita	0.27	1.31	0.73		0.64	
	(1.10)	(1.02)	(1.35)		(1.05)	
Volatility of Real GDP Growth Rate	0.61	-0.036		0.64	0.64	
	(0.49)	(0.49)		(0.49)	(0.52)	
Volatility of the Change In Exchange Rate	0.078 ***	0.12 ***	0.091***	0.076***	0.082***	0.11 ***
	(0.025)	(0.021)	(0.021)	(0.025)	(0.024)	(0.023)
Log # of Listed Companies	-0.45	-0.45	-0.52	-0.49 **		-0.53 **
	(0.30)	(0.37)	(0.33)	(0.25)		(0.28)
Leverage Ratio	0.48		-0.40	0.64	0.22	
	(0.69)		(1.11)	(0.49)	(0.70)	
Constant	-3.96	-19.29	-10.81	0.16	-12.10	-0.18
	(17.69)	(16.47)	(21.66)	(2.17)	(16.11)	(2.53)
No. of Observations	43	48	43	43	43	48
Adjusted R-squared	0.60	0.53	0.46	0.64	0.55	0.65
p-value for Hausman test	0.28	0.77	0.94	0.46	0.96	0.31

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Insider trading index has been re-scaled by its standard deviation in the sample. Hence, the associated coefficient can be interpreted as the effect of a one standard-deviation increase in insider trading on market volatility.

Table 10: Assuming a (Non-negative) Gamma Distribution for the Error Term

Dependent Variable: Volatility of monthly stock market returns (1985-98)

	(1)	(2)	(3)	(4)	(5)	(6)
Insider Trading Index	2.51 ***	1.14 ***	0.87 ***	1.02 ***	0.67 **	0.87 ***
	(0.41)	(0.33)	(0.40)	(0.35)	(0.38)	(0.37)
Log GDP Per Capita		-0.37	-0.69 ***	-0.59 **	-0.76 ***	-0.68 ***
		(0.30)	(0.35)	(0.35)	(0.31)	(0.34)
Volatility of Real GDP Growth Rate		0.44	0.78 **	1.10 ***	0.59 **	0.92 ***
		(0.40)	(0.43)	(0.43)	(0.33)	(0.39)
Volatility of the Change In Exchange Rate		0.14 ***	0.081 ***	0.086 **	0.085 ***	0.097 ***
		(0.043)	(0.030)	(0.043)	(0.025)	(0.047)
Log # of Listed Companies		-0.42 ***	-0.36 **	-0.29 *	-0.48 ***	-0.41 ***
		(0.17)	(0.21)	(0.19)	(0.18)	(0.16)
Leverage Ratio			0.93 ***	0.84 **	1.07 ***	0.96 **
			(0.45)	(0.46)	(0.47)	(0.49)
Cash Flow Risk			0.40	0.65		
			(1.03)	(1.01)		
Gini Coefficient			0.025		0.046	
			(0.037)		(0.039)	
Constant	-1.09 ***	8.10 ***	9.84 ***	8.08 ***	11.80 ***	10.81 ***
	(1.39)	(4.49)	(4.59)	(4.61)	(4.32)	(4.93)
No. of Observations	49	48	41	42	42	43
Pearson Residual	6.04	2.42	1.19	1.34	1.25	1.50
Log Likelihood	65.94	66.26	58.41	58.88	59.75	60.18

Robust standard errors are in the parentheses. ***, **, and * denote statistically significant at the 5%, 10%, and 15% level, respectively.

Insider trading index has been re-scaled by its standard deviation in the sample. Hence, the associated coefficient can be interpreted as the effect of a one standard-deviation increase in insider trading on market volatility.

Table 11: GLS Random Effects Regressions

Dependent Variable: Volatility of monthly stock market returns
(separate years for 1997, 1998, and 1999)

	(1)	(2)	(3)	(4)
Insider Trading Index	1.23 *	1.31 **	1.45 **	1.12 **
	(0.84)	(0.77)	(0.83)	(0.68)
Log GDP Per Capita	-1.51 ***	-1.50 ***	-1.27***	-1.47***
	(0.62)	(0.60)	(0.60)	(0.54)
Volatility of Real GDP Growth Rate	0.32 ***	0.32 ***	0.32 ***	0.33***
	(0.16)	(0.15)	(0.16)	(0.15)
Volatility of the Exchange Rate Change	0.37 ***	0.37 ***	0.38 ***	0.37***
	(0.12)	(0.11)	(0.12)	(0.11)
Log # of Listed Companies	-0.60	-0.59		
	(0.41)	(0.39)		
Leverage Ratio	3.05 ***	2.97 ***	2.12 **	2.35 ***
	(1.32)	(1.27)	(1.17)	(1.09)
Cash Flow Risk	-1.36	-1.20	-0.26	
	(1.75)	(1.67)	(1.60)	
Gini Coefficient	0.0069		0.0025	
	(0.055)		(0.055)	
Year dummies?	yes	yes	yes	yes
Country random effects?	yes	yes	yes	yes
No. of Countries	39	40	39	41
No. of Observations	112	115	112	118
Wald Chi2(1)	130.70	136.64	127.41	134.62
Prob>chi2	0.00	0.00	0.00	0.00

Notes:
1)Year dummies and constant term are included but not reported to save space.
2) Robust standard errors are in the parentheses. ***, ** and * denote statistically significant at the 5%, 10% and 15% level, respectively.
3) Insider trading index has been re-scaled by its standard deviation in the sample. Hence, the associated coefficient can be interpreted as the effect of a one standard-deviation increase in insider trading on market volatility.

Appendix A: Data Definition and Source

Volatility of stock returns

The stock return volatility is defined as the standard deviation of monthly returns over December 1984 to December 1998, multiplied by 100. The monthly return in U.S. dollars is defined as the change in the log of the stock market index (in dollar terms). Suppose P_{t-1} and P_t denote the values of the stock market index in months t-1 and t, respectively. The return in period t is $r_t = \log(P_t)-\log(P_{t-1})$.

The US$ denominated stock market price index data for emerging stock markets comes mainly from the International Finance Corporation's Emerging Markets Database (EMDB). We include all countries for which we also have data on insider trading. The countries covered are: Argentina, Brazil, Chile, China, Colombia, Czech, Egypt, Greece, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Peru, Philippines, Poland, Portugal, Russia, Saudi Arabia, Slovakia, South Africa, Sri Lanka, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe.

The data for most of the developed markets are derived from the Morgan Stanley Capital International database, which covers a wide range of countries including Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK and US. In addition, stock price indexes for Ireland, Singapore and South Africa are derived from the Financial Times database.

A few countries have data only after December 1984. The exact starting dates for these countries are as follows: China (01/93), Czech (01/94), Egypt (01/96), Hungary (01/93), Indonesia (01/90), Morocco (01/96), Peru (01/93), Poland (01/93), Portugal (01/86), Russia (01/96), Saudi Arabia (01/98), Slovakia (01/96), South Africa (01/93), Sri Lanka (01/93), and Turkey (01/87).

Economic Fundamentals

Volatility of real GDP growth rate

This variable is computed as the standard deviation of the annual real GDP growth rate over 1985-1998, multiplied by 100. Real GDP growth rate is the first difference in the log of GDP in 1995 constant U.S. dollars. The data are obtained from the World Bank's World Development Indicators.

Cash flow risk

Cash flow risk measures the variability of operating income, defined as the standard deviation of the change in operating income relative to mean operating income in absolute value over the period of 1991-96. Data are taken from Claessens, Djankov and Nenova (1999).

Leverage ratio

The leverage ratio is the ratio of total debt to the sum of total debt and the market value of the equity, from Classens, Djankov, and Nerova (1999).

Entrepreneurial billionaire wealth/GDP:

This variable is defined as the ratio of the wealth of the billionaires (acquired through entrepreneurship or inheritance) relative to GDP, in 1993. The data are originally from Forbes magazine, cited by Morck, Stangeland, and Yeung (1998).

Policy Fundamentals

Volatility of inflation

The volatility of the inflation rate is the standard deviation of the monthly inflation rate over January 1985 to December 1998. Inflation data is defined as the change in the log consumer price index, which is from the IMF's IFS data base (line 64). For Ireland, CPI data is not available and the wholesale price index is used instead (IFS, line 63). The CPI indexes for Hong Kong, New Zealand and Taiwan are from the National Government Statistics dataset in Datastream. Inflation for Australia is computed from the manufacturing producer price index from the National Government Statistics dataset in Datastream.

Volatility of real interest rate

The volatility of the real interest rate is the standard deviation of the monthly real interest rate from January 1985 to December 1998. The real interest rate is defined as the nominal interest rate minus the monthly inflation rate. The nominal interest rate is the monthly central bank discount rate from IFS (line 60). For Hong Kong, it is the one-month interbank offered rate. For Taiwan, it is the 91-day Treasury Bill rate in primary market. Both are from Datastream's International/National Government Dataset.

Volatility of fiscal deficit/GDP

This is computed as the standard deviation of the annual ratio of the government budget deficit to GDP over 1985 to 1998. The data on the overall budget deficit/GDP are obtained from the World Bank's World Development Indicators CD Rom.

Exchange rate volatility

The exchange rate volatility is measured as the standard deviation of the change in monthly log nominal exchange rate with respect to US$, multiplied by 100. The nominal exchange rate is the monthly average exchange rate from the IMF's International Financial Statistics. The period covered is 1985-1998.

Trade openness

The average value of (imports + exports)/GDP over the period of 1985-98.

Market Liquidity and Maturity

GDP per capita

GDP per capita is measured in 1995 constant U.S. dollars, averaged over 1985-1998, taken from the World Bank's World Development Indicator.

Ratio of stock market capitalization to GDP

The source of this data is the World Bank's World Development Report, various issues.

Age of stock exchange

The age of the main stock exchange in each country is calculated as 1998 minus the founding year of the exchange. The data on the founding year of the exchange are obtained from Bhattacharya and Daouk (2000).

Number of listed companies

This variable is computed as the average number of listed companies during 1990-1996. Source: the World Bank's World Development Report 2000 (Table 3).

Insider Trading

Fraction of the time an insider trading law is in place

This is calculated as the fraction of the sample time that an insider trading law already exists for each country. Data on the year when an insider trading law is introduced are obtained from Bhattacharya and Daouk (2000).

Fraction of the time since the first insider trading prosecution

The data on the year of the first prosecution are extracted from Bhattacharya and Daouk (2000).

Insider trading index and legal corruption index:

The source for both variables is The Global Competitiveness Report (1997 and 1998).

The insider trading index is created from the question: "insider trading is not common in domestic stock markets", 1=strongly disagree, 7=strongly agree.

The legal corruption index is created from the question: "Irregular payments to judges or other officials involved in the enforcement and execution of judgements are not common and do not influence the outcome of court proceedings", 1=stronly disagree, 7=strongly agree.

We scale these two variables by the following formula: new value = 8-original value. We use the average of the values in 1997 and 1998. As a result, a higher number implies more insider trading or legal corruption.

In the regressions, we re-scale the insider-trading index further by dividing it by its standard deviation in the sample. The regression coefficients can be interpreted as the effect of an increase in insider trading by one standard deviation on market volatility.

Appendix 2: Market volatility and insider trading index by country

Country Name	Stock Market Volatility	GCR Insider Trading Index	Country Name	Stock Market Volatility	GCR Insider Trading Index
Argentina	0.212	4.04	Mexico	0.140	4.49
Australia	0.077	2.57	Morocco	0.046	-
Austria	0.078	3.19	Netherlands	0.046	3.09
Belgium	0.054	2.80	New Zealand	0.083	2.54
Brazil	0.182	4.24	Nigeria	0.157	-
Canada	0.050	2.71	Norway	0.077	3.55
Chile	0.081	3.64	Pakistan	0.089	-
China	0.146	4.62	Peru	0.098	4.11
Colombia	0.084	4.31	Philippines	0.110	4.60
Czech	0.094	5.12	Poland	0.176	3.82
Denmark	0.054	2.11	Portugal	0.105	3.56
Egypt	0.075	4.21	Russia	0.285	4.63
Finland	0.077	2.61	Saudi Arabria	0.043	-
France	0.063	3.07	Singapore	0.091	2.44
Germany	0.064	2.48	Slovakia	0.082	4.64
Greece	0.110	4.50	South Africa	0.090	4.20
Hong Kong	0.093	3.87	Spain	0.074	3.45
Hungary	0.119	4.08	Sri Lanka	0.090	-
India	0.093	4.53	Sweden	0.068	2.47
Indonesia	0.144	4.56	Switzerland	0.056	3.02
Ireland	0.070	2.62	Taiwan	0.132	4.70
Israel	0.068	3.77	Thailand	0.118	4.73
Italy	0.076	3.87	Turkey	0.183	4.08
Japan	0.075	2.85	United Kingdom	0.056	2.26
Jordan	0.046	4.32	United States	0.043	2.62
Korea	0.112	4.09	Venezuela	0.147	4.83
Malaysia	0.103	4.47	Zimbabwe	0.109	4.14

Notes:

1. Market volatility is the standard deviation of the monthly returns in US dollars over 1984.12 – 1998.12.

2. Insider trading index is derived from the Global Competitiveness Report in 1997 and 1998. Insider trading index = 8 – the average of the orignal index in 97 and 98. A higher number implies a higher degree of insider trading.

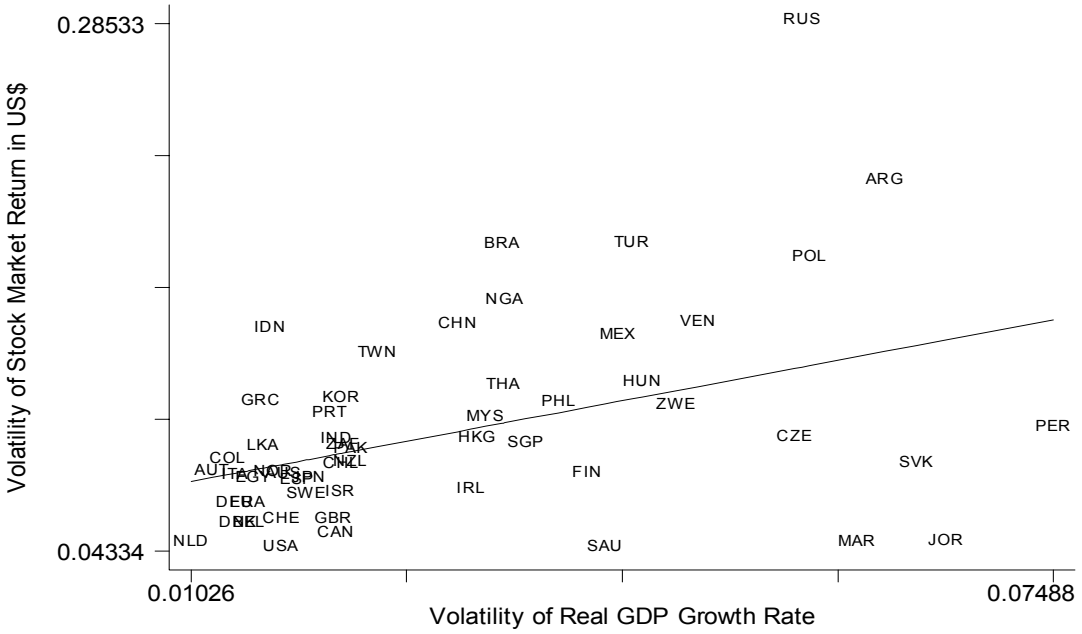

Figure 1: Volatility of Stock Returns versus Volatility of GDP Growth Rate
(Country names are denoted by the World Bank's 3-letter country codes)

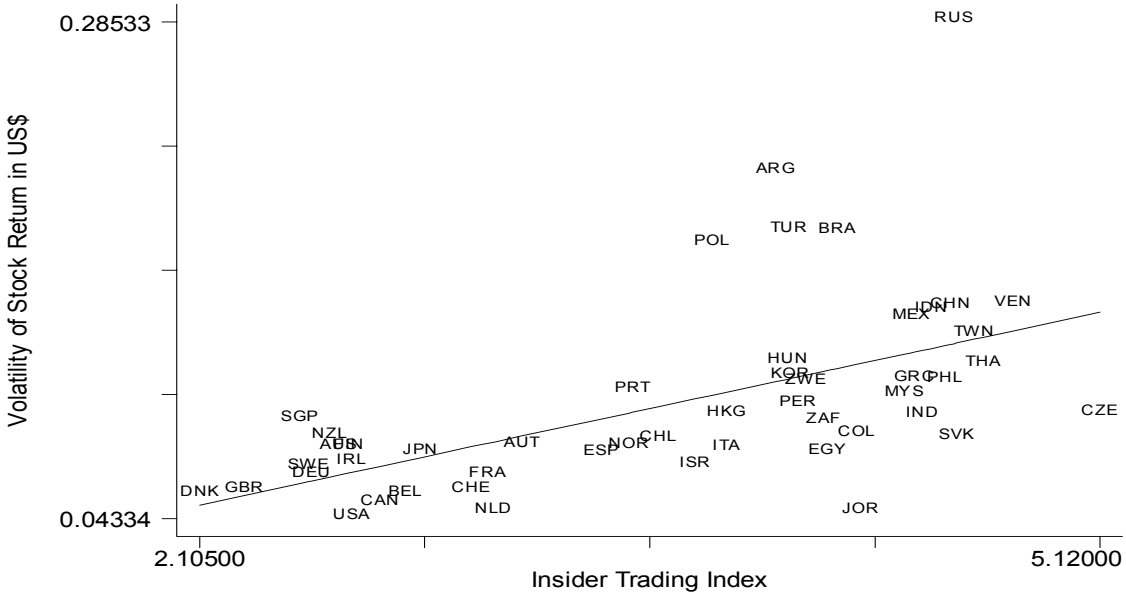

Figure 2: Volatility of Stock Returns versus the Extent of Insider Trading
(Country names are denoted by the World Bank's 3-letter country codes)