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Credible reforms and stock return volatility: Evidence from privatization☆

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ABSTRACT

In this paper we investigate how privatization affects stock return volatility. A credible privatization builds investors' confidence through a reduction in political risk. In particular, a privatization program that is maintained over time signals credibility, which reduces political risk and in turn volatility. We further show that privatization is associated with lower idiosyncratic volatility mainly among developed markets, while it is associated with lower systematic volatility in developing markets. Additional tests suggest that the reduction in volatility is greater when privatization sales are carried out through the stock market than through asset sales.

1. Introduction

Privatization – defined as the deliberate sale of state-owned enterprises or assets to firms in the private sector – is often viewed as a response to the failure of government-owned firms to achieve efficient outcomes, perhaps because such enterprises focus more on promoting political objectives than on maximizing investor profits (see, e.g., Boycko, Shleifer, and Vishny, 1996; Megginson and Netter, 2001; Djankov and Murrell, 2002; Estrin, Hanousek, Kočenda and Svejnar, 2009). In this paper we examine how privatization reforms introduced over the past three decades influence stock return volatility. While prior research provides insights into how volatility affects investors and the economy (Campbell, Lettau, Malkiel, and Xu, 2001; Wurgler, 2000; Bollerslev, Engle, and Wooldridge, 1988; Bekaert and Harvey, 1997), the question of how privatization affects stock return volatility remains unexplored.

Prior work shows that the introduction of a privatization reform is associated with favorable market sentiment (e.g. Boutchkova and Megginson, 2000; Perotti and van Oijen, 2001; Perotti and Laeven, 2002). However, while a committed government will maintain its privatization program over time, an uncommitted government will reverse the reform to pursue political objectives unrelated to efficiency. Incorporating investor uncertainty about a government's commitment to its privatization program, Perotti (1995) shows that investors delay participation in the program until this uncertainty has been resolved. Accordingly, we argue that maintaining a privatization program over time signals the government's commitment to the program and thus reduces volatility by decreasing the political risk perceived by investors. Consistent with this view, we show that privatization progress (i.e., the sustainability of a privatization program) reduces volatility through the resolution of political risk.

Next, we examine whether the privatization–volatility relation varies with the type of transaction. Megginson (2010) argues that privatizations via share offerings are more transparent than those through asset sales. Assessment of a privatization program's credibility should thus be less difficult, and the resolution of policy uncertainty more complete, for sales via the stock market. We

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find supportive evidence. In particular, privatization sales through the stock market are strongly associated with lower volatility, while privatization sales through asset sales are weakly related to volatility.

We also examine how the privatization–volatility relation varies with the level of economic development. Political risk, and in turn volatility, tends to be higher in emerging markets than in developed markets (Bekaert and Harvey, 1997; Perotti and van Oijen, 2001). This suggests that the effect of privatization progress on volatility should be more pronounced in emerging markets. In line with this argument, we find that the decrease in volatility associated with privatization programs that have been maintained over time is greater in developing countries than in developed countries.

Our work is related to the literature that studies the impact of political events on volatility (e.g., Manning, 1989; Bittlingmayer, 1998; Voth, 2002; Mei and Guo, 2004; Beaulieu, Cosset, and Essaddam, 2005) and relates volatility to political risk ratings (Boutchkova, Doshy, Durnev, and Molchanov, 2012; Bartram, Brown, and Stulz, 2012). We contribute to this literature by presenting novel evidence that the credibility of a privatization reform is related to volatility through the resolution of political risk, particularly the risk of policy reversal. Indeed, Pastor and Veronesi (2012, 2013) discuss the condition**s** under which political uncertainties increase stock return volatilities and correlations among stocks. Furthermore, Amengual and Xiu (2014) find that resolution in political uncertainty (e.g., Federal Open Market (FOMC) meetings or European Central Bank (ECB) meetings, or speech schedules of the Federal Reserve's Chairman) improves investors' sentiment and leads to lower market volatility. We add to this literature since we focus on privatization, an economic reform that shifts ownership from the government to the private sector. We show that a privatization program that is maintained over a long period of time enables a resolution of political uncertainty, which builds investors' confidence and reduces stock return volatility.

Our study also contributes to the literature on market-oriented reforms and volatility. Bekaert and Harvey (1997), for example, compare pre- and post-liberalization volatility in emerging markets and find that financial liberalization reforms do not increase market volatility. We extend this literature by showing that credible privatization reforms are associated with lower volatility.

The remainder of the paper is organized as follows. Section 2 summarizes the literature on privatization, political risk, and volatility. Section 3 describes the sample construction and defines the variables used in the analysis. Section 4 discusses the methodology and presents descriptive statistics. Sections 5 and 6 present our empirical findings and robustness tests. Section 7 concludes.

2. Literature review: volatility, privatization, and the political risk channel

In this section we first summarize the literature on the importance of volatility for investors and the economy. Next, we discuss how political uncertainty is related to volatility. We then summarize prior work and develop on how privatization programs influence the systematic and idiosyncratic volatility of a country's stock returns through the political risk channel.

2.1. Volatility, investors, and the economy

Prior work shows that volatility has implications for both investors and the economy. At the investor level, an upward movement in the idiosyncratic component of volatility affects an investor's portfolio and hedging strategies. As pointed out by Campbell, Lettau, Malkiel, and Xu (2001), the number of stocks needed to fully diversify a portfolio depends on their idiosyncratic volatility and the correlation among stocks. To maintain a well-diversified portfolio, an investor must compensate for an increase in idiosyncratic volatility with a corresponding increase in the number of stocks. Further, investors require a risk premium for carrying volatile stocks whose payoffs are correlated with the stochastic discount factor (see, e.g., Cochrane, 2001), and thus an increase in the systematic component of volatility implies a higher cost of capital (Bollerslev, Engle, and Wooldridge, 1988; Bekaert and Harvey, 1997). Furthermore, there is evidence that idiosyncratic volatility could predict expected stock returns (e.g., Ang, Hodrick, Xing, and Zhang, 2006) or future earnings (Jiang, Xu, and Yao, 2009).[1]

At level of the economy, Wurgler (2000) shows that countries with a lower correlation among stocks, and hence higher average idiosyncratic volatility, allocate capital more efficiently. However, higher systematic volatility may prevent new firms from raising capital through IPOs as the cost of capital rises. Hence, systematic volatility may increase the value of the option to delay investment, affecting overall economic development (see Bekaert and Harvey, 1997).

2.2. Political uncertainty and volatility

Governments influence markets through various rules such as taxes, laws, regulation of competition etc. Unexpected changes in those rules can elicit strong market reactions. Indeed, what frightens investors is when they do not know the government's next move. This perceived political uncertainty has been related to drops in stock prices and market volatility. Indeed, Pastor and Veronesi (2012) develop a model in which a firm profitability follows a stochastic process. The model allows government policy to affect the process mean. The policy impact on the mean is uncertain and the market learns about this impact through realized profitability. Uncertainty about the policy declines over time due to learning, unless a policy change triggers a discrete jump. The model shows the conditions under which government changes its policy: policy change occurs when its effect on firm profitability is perceived as sufficiently unfavorable or when the government derives an unexpected large amount of political benefits from the change. Following a policy announcement, investors face two uncertainties: there is uncertainty about whether the policy will change or be maintained; and there is uncertainty about the effects of the new policy. The model shows that stock prices drop, at the announcement, when the old policy was not perceived as having a negative impact on profitability, because policy changes are expected only after downturns (i.e. periods of low profitability). The model shows that political uncertainties increase stocks volatilities and correlations among stocks (Pastor and Veronesi, 2012, 2013). Consistent with this result, Amengual and Xiu (2014) show that resolution in political uncertainty shifts investors' sentiment and leads to lower market volatility.

Next, we discuss how a government policy such as privatization can affect the market volatility through the resolution of political uncertainty.

2.3. Political risk channel

Political risk refers to the risk of political events that affect firm profits or investments (e.g., expropriation or nationalization of property or resources, inconvertibility of currency, regulations on operations; see Robock, 1971; Howell and Chaddick, 1994;

[1] Bali and Cakici (2008), however, find that the relation between idiosyncratic volatility and expected stock returns varies with the data frequency and methodology used to calculate the portfolio and their returns.

Bekaert, Harvey, Lundblad, and Siegel, 2014).[2] If political risk is priced (e.g., Erb, Harvey, and Viskanta, 1996; Bekaert and Harvey, 1997; Butler and Joaquin, 1998; Bilson, Brailsford, and Hooper, 2002), then a political event that heightens (resolves) political risk should negatively (positively) affect stock return volatility. Consistent with this view, Beaulieu et al. (2005) show that unfavorable (favorable) political news related to the possible separation of Quebec from Canada increased (decreased) firm volatility. Using a sample of fifty countries, Boutchkova et al. (2012) similarly show that high political uncertainty around regular political events (e.g., election cycles, rotation of parties in power, incremental changes in political risk scores) is associated with higher industry-level systematic and idiosyncratic volatility.

The above research suggests that political events that reduce the risk of a policy reversal (or policy change) should decrease stock return volatility. In the context of privatization programs, a policy reversal might take the form of the government reallocating resources to preferred constituencies, discontinuing further privatizations, or even re-nationalizing privatized firms (e.g., see Biais and Perotti, 2002).[3] Perotti (1995) suggests that uncertainty about a government's commitment to its privatization program deters investors from participating in the program, as an uncommitted government is likely to reverse its policy after privatization revenues are raised.[4] Pastor and Veronesi (2012) show that such political uncertainty drives up stock return volatility. To resolve this uncertainty, Perotti (1995) argues that a government establishes its commitment to the program by maintaining it over time. Therefore a privatization program must be sustained over a long period of time to produce a learning effect (see, e.g., Pastor and Veronesi, 2012) about the government policy's credibility and thus resolving political uncertainty. As a consequence, stock correlations and volatility should decrease.

To the extent that credible privatizations reduce uncertainty surrounding a government's market-oriented policies in general, and that resolution of political uncertainty reduces correlation among stocks, they are expected to decrease systematic volatility. However, the effect of a reduction in political uncertainty on volatility is likely to vary across firms. For example, monopolies or companies in protected industries that are highly sensitive to public policy choices should see a more pronounced effect than companies less sensitive to changes in public policies (Perotti, 1995). As a result, one expects a reduction in policy uncertainty through credible privatizations to decrease idiosyncratic volatility as well.[5]

[2] Political risk is preferred in this section and throughout the rest of the paper because it includes more aspects than the ones that are related to policy changes only, i.e. political uncertainty as discussed in the previous section.

[3] In Biais and Perotti (2002) policy reversal risk may be perceived at two levels: first, a right-wing government has a tendency to re-nationalize if its preferred constituencies (the rich) are better off through re-nationalization than with privatization. Second, after the mandate of a right-wing government, a left-wing government will always prefer to re-nationalize to transfer resources to its constituencies (the poor).

[4] Privatizations are often a response to difficult economic conditions (Perotti and van Oijen, 2001). For example, the government may announce a privatization program to resolve a public deficit. After sufficient privatization revenues are raised, that the government no longer faces financial pressure to pursue the program, an uncommitted government may interfere with the privatizing firms or terminate the privatization program.

[5] Previous empirical evidence suggests that political risk can be firm-specific rather than country-specific. For example, ahead of the 1987 general election in England, it was rumored that the Labour Party would re-nationalize the formerly privatized British Telecom (BT). The possibility of the Labour Party winning the election represented a risk to BT investors, since it was expected that they would not be fully compensated. Manning (1989) shows that this risk drove BT stock return volatility up over the 1985 to 1987 period, but that this effect was specific to BT and did not affect overall market volatility. Thus, the market appears to have viewed the potential re-nationalization of BT as a risk affecting only one firm that could be diversified away.

3. Sample construction and description of variables

Our privatization sample begins with all privatization deals reported in the Security Data Corporation (SDC) International Merger and Acquisition database, complemented with privatization IPOs from SDC Global New Issues.[6] For each country, we sum all transaction values each year to construct the country's annual revenues from privatization sales. We match this initial sample with data on volatility measures constructed from Datastream. Our panel data set is based on a sample of forty-seven countries over a span of 6 to 20 years between 1990 and 2009. The panel is unbalanced, with some countries having more data than others.

3.1. Privatization variables

To study the effect of privatization on volatility, we first follow Perotti and van Oijen (2001) and construct for each country and year the ratio of total gross revenues from privatization sales to gross domestic product (GDP) (all values are expressed in US dollars). This measure captures privatization *intensity*, that is, the government's willingness to privatize. However, because an uncommitted government may reverse its policy after a certain amount of privatization revenues have been raised, we also follow Perotti and Laeven (2002) and Boubakri, Cosset, and Smaoui (2009) to construct a measure of privatization *progress* as the temporal average of privatization sales to GDP (from the beginning of the study period).[7] We expect that the longer a privatization program has been maintained, the greater is the credibility of the privatization program.

3.2. Political risk variables

Our main risk measure is the credit ratings from *Institutional Investor*. These ratings are based on information provided by leading global banks, money managers, and security firms. Respondents are surveyed by *Institutional Investor,* who rates each country on a scale of 0 to 100. Higher ratings represent a lower likelihood of default. The survey is conducted each March and September. For each year, we take the simple average of a country's credit ratings as our political risk measure. The survey contains factors that assess a country's political uncertainty, ability to service debt, and economic health. Respondents appear to put more weight on political uncertainty, which suggests that they are more concerned about the government's ability to maintain market-oriented economic policies (Perotti and van Oijen, 2001). The ratings (*credit risk* in the regressions) are forward-looking, as respondents assess the likelihood of default based on current policies. For robustness, we use two ratings from *International Country Risk Guide* (ICRG). To capture political risk related to policy uncertainty, we use a country's ICRG composite risk rating, which ranges from 0 (very high) to 100 (very low). In addition to assessing a country's political risk, the composite risk rating measures the country's current economic strength and ability to service its debt. Then we focus on the ICRG political risk index alone, although its components are related more to political turmoil than to policy uncertainty. This index includes components of corruption and government stability that may be associated with government credibility and thus pol-

[6] These SDC databases only include privatization transactions of 500,000 USD or more. However, these transactions are representative of the population of major privatization deals (Bortolotti, Fantini, and Siniscalco, 2003).

[7] Indeed, if the privatization program involves several firms, a committed government will spread privatization sales over time to establish credibility (Perotti, 1995).

icy uncertainty. The index ranges from 0 (high political risk) to 100 (low political risk).[8]

For each of the three measures of political risk, we expect lower political risk to be associated with lower volatility.

3.3. Investor protection

Morck, Yeung, and Yu (2000) capture investor protection using two proxies. First, they use the strength of property rights protection. They argue that strong property rights is associated with less co-movement among stocks and higher idiosyncratic volatility.[9] The rationale is that strong property rights increase the benefit of expending resources to collect firm-specific information and conduct informed trading, while weak property rights discourage informed trading and thus lead to large systematic price swings. In line with this view, Li, Morck, Yang, and Yeung (2004) find that financial reforms followed by the reinforcement of property rights are associated with greater firm-specific volatility.[10] Morck et al. (2000) also measure investor protection using the anti-director rights index of La Porta, Lopez-De-Silanes, Shleifer, and Vishny (1998). They argue that this measure is more relevant for stock markets in countries with an effective legal system, that is, strong law enforcement.

In this paper we proxy for investor protection using the product of two variables related to the above measures. The first is the revised anti-director rights index of Djankov, La Porta, Lopez-De-Silanes, and Shleifer (2008), which assesses the extent to which minority investors are protected against expropriation by corporate insiders and controlling shareholders. This index ranges from 0 to 5, with higher values indicating stronger protection of minority investors. The second variable is ICRG's law and order index, which provides an assessment of the strength, impartiality, and effectiveness of a country's legal system. This index ranges from 0 to 6, with higher values indicating a lower likelihood of property rights violation without effective sanctions. The product of these two variables thus captures both the existence and the enforcement of laws protecting investors.[11] Following prior literature, we expect stronger property rights to be associated with lower systematic volatility and higher idiosyncratic volatility (Morck et al., 2000; Li et al., 2004).

3.4. Economic and financial development

A country's economic and financial development also affects stock return volatility (Bartram et al., 2012). Compared to emerging market countries, developed countries are likely to be more economically diverse, and thus their stock market less dependent on a particular sector of the economy. As a result, stock co-variance and in turn market volatility should be lower (e.g., Bekaert and Harvey, 1997). We measure economic development using the logarithm of per capita GDP, which comes from the World Bank's world development indicators (WDI). We expect per capita GDP to be negatively related to stock return volatility, particularly its systematic component.

Bartram et al. (2012) further find that a country's level of financial development can help explain the idiosyncratic component of stock return volatility. Greater financial development indicates that risk is diversified (or shared) among a larger investor base. This allows firms to carry out riskier projects, increasing their idiosyncratic volatility. We measure financial development using the ratio of the country's stock market capitalization to GDP. We expect financial development to be positively related to volatility, particularly its idiosyncratic component.

3.5. Economic instability

Prior research shows that stock return volatility is higher during recessions (Officer, 1973; Schwert, 1989). Errunza and Hogan (1998) similarly show that macroeconomic instability helps predict stock return volatility. Beltratti and Morana (2006) find supportive evidence for S&P 500 firms, and Diebold and Yilmaz (2008) generalize this evidence to more than forty countries around the world. Accordingly, we control for macroeconomic instability using the standard deviation of per capita GDP growth over five years (Morck et al., 2000). We expect higher macroeconomic instability to be associated with higher stock return volatility.

3.6. Product market competition

Gaspar and Massa (2006) show that strong product market competition increases uncertainty about a firm's future cash flows and thus affects volatility. While a firm in a less competitive (i.e., more concentrated) market can transfer a large part of its idiosyncratic cost shocks to consumers to maintain stable cash flows, a firm in a highly competitive market cannot set prices and thus is likely to experience more volatile cash flows, which would be reflected in higher stock return volatility.[12] Following this reasoning, firms in a less competitive industry should observe lower idiosyncratic volatility as they are better able to smooth cash flow fluctuations.

Based on the above, we follow Morck et al. (2000) to construct firm- and industry-level Herfindahl indices that measure market concentration. For each country, the firm-level Herfindahl index (firm concentration) is the sum of squared market shares of all firms, while the industry-level Herfindahl index (industry concentration) is the sum of squared market shares of all two-digit SIC code industries; the greater the indices, the weaker the product market competition. Morck et al. (2000) interpret higher firm (industry) concentration as indicating the dominance of a few firms (the lack of industry diversity) in the economy. If the product market is concentrated in the hands of few firms, a shock affecting those firms should increase systematic volatility. Similarly, a lack of industry competition should be negatively related to idiosyncratic volatility as shocks that are industry specific can be transferred to consumers. Data on sales are from Datastream/Worldscope.

3.7. Equity market liberalization

The finance literature on whether volatility increases or decreases following stock market reforms finds mixed evidence. On

[8] However, ICRG's political risk index also includes components measuring socioeconomic conditions, internal and external conflicts, and religious and ethnic tensions, which might not be directly related to our definition of policy uncertainty.

[9] Morck et al. (2000) measure property rights using the *good government index*, which is constructed from indices on corruption, the risk of contract repudiation by the government, and the risk of expropriation of private property by the government. We cannot construct the *good government index* for comparison purposes because two of the component indices, namely, the risk of contract repudiation and the risk of expropriation of private property, were discontinued in 1997 (for more details, see http://www.prsgroup.com/prsgroup_shoppingcart/pc-62-7-iris-dataset.aspx). In robustness tests presented below, we consider the *good government index* in cross-sectional (Fama–Macbeth) regressions.

[10] As Stulz (2005) and Bartram et al. (2012) also discuss, under stronger investor protection, agency problems between corporate insiders and outside investors are reduced and corporate insiders do not need to invest as much of their wealth in the firm's shares. As a result, insiders are less exposed to firm-specific risk and thus are willing to undertake riskier projects, increasing the idiosyncratic volatility of the firm's stock.

[11] For similar measures, see Durnev and Kim (2005) and Doidge, Karolyi, and Stulz (2007).

[12] Following Pástor and Veronesi (2003), Gaspar and Massa (2006) argue that strong competition could increase uncertainty about the firm's future performance even if the volatility of cash flows is low, in line with the view that competition increases stock return volatility.

the one hand, volatility may increase due to speculative money flowing into the country or stock markets becoming more efficient as prices react to new information.[13] On the other hand, volatility may decrease after liberalization with the gradual development and diversification of the stock market (Bekaert and Harvey, 2003).

To isolate the impact of privatization from that of financial liberalization on stock return volatility, we control for liberalization using a measure of the intensity of liberalization from Bekaert, Harvey, and Lundblad (2005). This measure, which reflects the number of restrictions imposed on foreign investment in the stock market, is based on the ratio of the market capitalization of the stock in International Finance Corporation's (IFC) investable index to the market capitalization of the stock in IFC's global index. The IFC global index represents the overall market portfolio of a country, while the IFC investable index represents the market portfolio of local stocks that are available to foreign investors. An open market will have a ratio of one, with all local stocks available to foreign investors, whereas a closed market will have a ratio of zero, with no local stock available to foreign investors. Note that we construct the intensity of liberalization for developing countries; developed countries are expected to have liberalized their markets before the beginning of our study period in 1990.[14] Whether the relation between the intensity of liberalization and stock return volatility is positive or negative is an empirical question.

3.8. Volatility measures

To measure stock return volatility, we use stock market data from Datastream.[15] We collect weekly stock return indices (RI), which include dividends and price changes. We employ weekly returns because daily data may be missing for several countries where trading is infrequent due to low market liquidity. Common stock returns are expressed in US dollars; the results remain the same when we use local currency returns. To enter the sample, a firm must have at least 25 weeks of returns in a particular year.[16] We drop common stock returns that exceed 0.75 in absolute value to avoid the influence of outliers.[17] For each year, we estimate a stock's total volatility as

$$\sigma_i = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(r_{i,t} - \frac{1}{T}\sum_{t=1}^{T} r_{i,t}\right)^2}, \quad (1)$$

where σ_i is the total volatility of stock i, $r_{i,t}$ is stock i's week t return, and T is the number of weeks of returns for the stock in the given year. We compute a country's total volatility in a given year by averaging σ_i over every stock in the country that year and then annualizing by multiplying by the square root of 52.

A change in total volatility can be explained by a change in its components, that is, systematic and/or idiosyncratic volatility. To examine the effect of privatization on the components of total volatility, we use an international market model where returns depend on local as well as global factors. In particular, for each stock i,

$$r_{ijt} = \alpha_i + \beta_{1,i} r_{j,t} + \beta_{2,i} r_{world,t} + e_{it}, \quad (2)$$

where r_{ijt} is the week t return for stock i in country j, r_{jt} is the week t market return index for country j, and $r_{world,t}$ is the week t MSCI (Morgan Stanley Capital International) world index. Country and world indices are from Datastream. For each year, we compute a stock's return systematic and idiosyncratic return volatilities as the standard deviation of the explained and unexplained components of weekly returns in Eq. (2), respectively. For each country, we obtain annual volatilities by taking the average systematic and idiosyncratic volatilities across all firms in a given year and multiplying by the square root of 52. Note that we take the log of all volatility measures. Table 1 summarizes the variable definitions and sources.

4. Empirical specification and descriptive statistics

4.1. Model specification

To investigate the relation between privatization and volatility, we begin by estimating the following equation:

$$Volatility_{j,t} = \beta \times Privatization_{j,t} + \gamma \times Control\ Variables_{j,t} + \alpha_j + \delta_t + \varepsilon_{j,t}, \quad (3)$$

where j indexes the country and t the time period (year). The dependent variable is the logarithm of the average (total, systematic, or idiosyncratic) volatility. Privatization is either current privatization sales to GDP (privatization intensity) or the temporal average of this ratio (privatization progress). The control variables include investor protection (ICRG law and order index times the anti-director rights index of Djankov et al., 2008), firm and industry product market concentration measures, the logarithm of per capita GDP, the volatility of GDP growth, the country's aggregate stock market capitalization, and a measure of the country's degree of liberalization (liberalization intensity). We also include country (α_j) and year (δ_t) fixed effects to account for unobserved heterogeneity. This methodology has the advantage of mitigating the omitted variable bias. In another model, similar to model (3) above, we further control for lagged volatility measures. The lagged volatility incorporates components of individual country characteristics that affect volatility and persist over time. However, the lagged volatility already incorporates the impact of past privatization policies, which could undermine the current effect of the progress of privatization. We also expect a reduction in the economic and statistical significance of the control variables when controlling for the lagged dependent variables. We present the results without and with lagged volatility in each Table.

4.2. Descriptive statistics

Table 2, Panel A provides descriptive statistics for our main variables by country. The volatility measures vary markedly across countries, as shown by the standard deviations. Further, volatility is higher in developing countries (total volatility is 0.48) than in developed countries (total volatility is 0.39). These results are in line with prior studies on volatility across countries (Bekaert and Harvey, 1997; Bartram et al., 2012).

In Table 2, Panels B, C, and D, we divide the sample into low versus high privatization intensity, progress of privatization, and level of economic development, respectively, using the sample medians.[18] We find no evidence that volatility varies across levels of privatization intensity. In contrast, we find that greater progress of privatization is associated with lower volatility. This

[13] Volatility may also increase if liberalization increases the number of irrational traders in the markets. Indeed, investors may have irrational expectations about future returns (see, e.g. Greenwood and Shleifer, 2014). De Long, Shleifer, Summers, and Waldmann (1990) argue that larger proportion of such traders relative to informed traders limit the effectiveness of risk-return arbitrage, and thus could trigger higher systematic stock price volatility.

[14] The official liberalization dates are from Bekaert et al. (2005).

[15] For studies using a similar methodology, see Boutchkova et al. (2012), Bartram et al. (2012) and Morck et al. (2000).

[16] We obtain essentially the same results if we instead include firms with relevant stock returns for up to 30 weeks as in Morck et al. (2000).

[17] The dropped returns represent less than one percent of the entire sample of weekly returns.

[18] The developing (developed) countries subsample comprises low and middle (high) income countries according to the World Bank income classification.

Table 1
Variable definitions and sources.

Variable	Definition	Source
Volatility measures		
Total volatility (TVOL)	Annualized standard deviation of weekly returns from 1990 to 2010. All stock-years with less than 26 weeks of returns are excluded, and returns are trimmed at −.75 and +.75. Country averaged for country-level regressions	Author calculations. Returns are obtained from Datastream
Systematic volatility (SVOL)	Annualized standard deviation of the explained component from International CAPM model, on weekly returns from 1990 to 2010. Standard deviations are defined as square root of the regression sum of squares divided by the number of parameters minus one. All stock-years with less than 26 weeks of returns are excluded, and returns are trimmed at −.75 and +.75. Country averaged for country-level regressions	
Idiosyncratic volatility (IVOL)	Annualized standard deviation of the residuals from International CAPM model, on weekly returns from 1990 to 2010. Standard deviations are defined as square root of the residuals sum of squares divided by the number of weeks used in regression minus the number of parameters. All stock-years with less than 26 weeks of returns are excluded, and returns are trimmed at −.75 and +.75. Country averaged for country-level regressions	
World return variance	Annualized standard deviation of Morgan Stanley Capital International World index returns from 1990 to 2010. All years with less than 26 weeks of returns are excluded	
Local market return variance	Annualized standard deviation of Morgan Stanley Capital International Country index returns from 1990 to 2010. All years with less than 26 weeks of returns are excluded	
Privatization measures		
Privatization intensity	Annual privatization sales over GDP	Author calculations. SDC Platinum, Thomson Financial, and World Development Indicators (WDI)
Privatization progress	Temporal average of privatization sales over GDP from the beginning of the study period to period *t*	
Privatization progress (PS)	Temporal average of privatization sales via private sales over GDP from the beginning of the study period to period *t*	
Privatization progress (SIP)	Temporal average of privatization sales via public offerings over GDP from the beginning of the study period to period *t*	
Proportion of public offerings	Ratio of the number of public offerings to the number of privatized firms, each year	
Country risk ratings		
Political risk	Assessment of a country's political stability	International Country Risk Guide (ICRG)
Composite risk	Assessment of a country's economic strengths and weaknesses, ability to service its debt, and political stability	
Country risk	Yearly average of sovereign credit ratings. The ratings are disclosed each year in March and September	Institutional investor
Property rights and investor protection indices		
Law-and-order index	Assessment of the strength, impartiality, and effectiveness of a country's legal system. The index ranges from zero to six	ICRG
Anti-director rights index	Measure of the legal protection of minority investors against expropriation by corporate insiders and controlling shareholders. The measure lies in zero and five	Djankov et al. (2008)
Good government index	Morck et al. (2000) index of property rights – a combination three indices: corruption index, risk of government expropriation, and risk of contract repudiation	Jin and Myers (2006)
Political orientation	Measure of the largest government party orientation: takes on the value of one if it is right wing and zero otherwise	World Bank Database on Political Institutions
Financial and economic measures		
Stock capitalization/GDP	Ratio of stock market capitalization over GDP	World Bank Financial Structure
Stock market turnover	Ratio of a country's annual trading volume to the total number of shares outstanding	World Bank Financial Structure
GDP per capita	Logarithm of GDP per capita	WDI
Volatility of GDP	Standard deviation of GDP growth over five years	Author calculations. WDI
Public debt/GDP	Ratio of the country's public debt in percentage of its GDP	Fiscal Monitor, International Monetary Fund (IMF)
Industry concentration	Sum of squared market shares of all industries (SIC two-digit) in the country	Author calculations.Worldscope/Datastream
Firm concentration	Sum of squared market shares of all firms in the country	
Earnings co-movement index	Measure of the synchronicity of returns on assets, as in Morck et al. (2000)	
Research and development	Country average of firm-level research and development expenses to total assets	
Intensity of liberalization	Index of the intensity of liberalization from Bekaert et al. (2005)	
Firm-level regression variables		
SIP dummy	Dummy variable set to one if the firm is a share issue privatization (SIP) and zero otherwise	Author calculations. SDC Platinum, and WDI
IPO dummy	Dummy variable set to one if the firm is an Initial public offering (IPO) and zero otherwise	
Privatization progress (SIP)	Measure of privatization progress multiplied by the SIP dummy	
Privatization progress (IPO)	Measure of privatization progress multiplied by the IPO dummy	
Total assets	Logarithm of total assets	Author calculations. Worldscope/Datastream
PPE/assets	Property, plant, and equipment scaled by total assets	
RD/assets	Research and development scaled by total assets	
Cash/assets	Cash and short-term investment divided by total assets	
Market-to-book	Common equity price over book value per share	
Gross profit margin	Gross income divided by net sales	
Leverage	Ratio of total debt (long-term plus short-term) to total assets	
Dividend dummy	Dummy variable set to one if the firm pays dividend and zero otherwise	
Product market concentration	Sum of squared market shares of all firms in each industry (SIC two digit)	

Table 2
Summary statistics.

Panel A: by country

Country	Country-years	TVOL	SVOL	IVOL	Priva-tizationintensity	Priva-tization progress	GDP per capita	Political risk ratings	Composite risk ratings	Law and order
Argentina	14	0.54	0.30	0.44	1.17	1.33	7077.52	71.04	68.64	4.11
Australia	20	0.53	0.25	0.47	1.03	1.01	26821.45	84.76	81.28	5.89
Austria	20	0.29	0.14	0.25	0.50	0.48	30620.65	86.65	85.32	6.00
Belgium	13	0.24	0.12	0.21	0.63	0.41	29906.38	81.04	82.61	5.45
Brazil	19	0.58	0.25	0.44	0.61	0.58	4663.66	65.70	65.82	2.64
Canada	19	0.57	0.27	0.50	0.14	0.18	27195.70	84.95	84.19	5.98
Chile	15	0.28	0.14	0.24	0.41	0.50	5648.41	76.20	77.37	4.92
China	17	0.52	0.25	0.44	0.36	0.28	1422.45	67.39	75.01	4.69
Colombia	14	0.33	0.17	0.27	0.73	0.53	3119.10	55.67	63.59	1.48
Czech Republic	14	0.30	0.14	0.26	1.63	1.09	9675.49	79.46	77.60	5.21
Denmark	15	0.29	0.14	0.25	0.47	0.52	38121.34	86.90	85.64	6.00
Egypt	10	0.46	0.26	0.37	0.60	0.66	1634.17	62.68	68.83	3.90
Finland	17	0.38	0.19	0.33	1.22	0.88	26756.94	89.03	85.34	6.00
France	20	0.36	0.17	0.31	0.59	0.42	28848.61	79.30	79.84	5.20
Germany	20	0.37	0.18	0.32	0.35	0.29	29320.95	83.62	83.55	5.45
Greece	17	0.47	0.25	0.39	0.91	0.81	17068.14	75.43	72.86	4.11
Hungary	14	0.43	0.21	0.36	1.34	1.70	7916.74	79.87	74.89	4.73
India	16	0.66	0.32	0.56	0.13	0.14	609.38	61.01	67.89	4.00
Indonesia	16	0.58	0.29	0.50	0.31	0.38	1229.22	54.45	62.62	2.89
Ireland	8	0.37	0.19	0.32	0.91	0.81	35267.51	88.35	85.32	6.00
Israel	15	0.46	0.22	0.40	0.59	0.83	18898.00	63.74	70.44	5.00
Italy	20	0.30	0.16	0.25	0.73	0.67	24714.39	76.80	77.91	4.86
Japan	15	0.40	0.21	0.34	0.13	0.19	35155.06	81.74	84.62	5.41
Jordan	9	0.40	0.21	0.33	1.90	1.66	2313.51	71.11	72.85	4.00
Malaysia	17	0.46	0.24	0.39	0.77	1.16	4479.08	73.01	78.13	3.81
Mexico	17	0.32	0.17	0.27	0.51	0.90	6193.07	70.24	71.40	2.73
Morocco	11	0.30	0.18	0.23	1.59	1.22	1921.35	70.89	73.29	5.38
Netherlands	18	0.29	0.15	0.25	0.72	1.10	31798.86	88.03	85.70	6.00
New Zealand	13	0.37	0.17	0.33	1.30	2.86	16347.44	85.21	81.25	5.94
Norway	19	0.38	0.19	0.32	0.87	0.68	47018.74	86.35	89.30	6.00
Pakistan	10	0.43	0.22	0.36	0.80	0.58	651.81	51.93	59.81	3.14
Peru	16	0.37	0.17	0.32	1.13	1.55	2550.54	60.42	66.28	2.97
Philippines	17	0.53	0.26	0.46	0.80	0.67	1188.36	60.50	65.02	2.83
Poland	16	0.52	0.27	0.44	0.95	0.89	6461.30	78.37	76.50	4.59
Russia	14	0.54	0.29	0.45	0.84	0.51	4544.00	62.23	68.75	3.71
Singapore	20	0.45	0.23	0.38	0.70	0.65	24165.79	83.69	87.31	5.45
South Africa	11	0.41	0.19	0.36	0.32	0.40	3960.14	69.08	71.52	2.50
South Korea	18	0.60	0.30	0.51	0.31	0.28	13180.30	76.58	79.67	4.64
Spain	18	0.30	0.16	0.25	0.62	0.61	18466.66	76.36	77.25	4.89
Sri Lanka	8	0.48	0.27	0.38	0.58	0.43	823.65	56.88	62.52	3.24
Sweden	19	0.42	0.22	0.36	1.18	0.96	33841.02	86.57	84.28	6.00
Switzerland	9	0.27	0.13	0.23	0.53	0.55	41984.83	87.20	88.87	5.76
Taiwan	14	0.47	0.24	0.40	0.46	0.33	12818.51	78.03	83.75	4.50
Thailand	18	0.47	0.24	0.40	0.36	0.47	2635.94	65.61	71.99	3.97
Turkey	19	0.65	0.36	0.53	0.45	0.21	5236.55	59.26	59.84	4.08
United Kingdom	20	0.31	0.15	0.27	0.46	0.82	27707.94	82.85	81.16	5.76
Venezuela	6	0.63	0.33	0.53	0.96	1.30	3543.82	64.46	65.94	4.00
Total	725									
Mean		0.43	0.21	0.36	0.71	0.73	16435.95	74.8078	76.41	4.66
Standard deviation		0.17	0.09	0.14	1.05	0.59	14789.49	11.16	8.86	1.29

	Country × years	TVOL	SVOL	IVOL	Privatization intensity	Privatization progress	GDP per capita
Panel B: by level of privatization intensity							
Low intensity	360	0.43	0.22	0.36	0.12		17878.77
High intensity	365	0.43	0.21	0.36	1.29		15012.89
Mean difference		0.01	0.00	0.00	−1.18		2865.88
p-Values		0.63	0.65	0.99	0.00***		0.00***
Panel C: by level of privatization progress							
Low progress	360	0.46	0.23	0.39		0.34	16069.87
High progress	365	0.40	0.20	0.34		1.11	16797.01
Mean difference		0.06	0.02	0.05		−0.77	−727.14
p-Values		0.00***	0.00***	0.00***		0.00***	0.51

(*continued on next page*)

Table 2 (*continued*)

Panel A: by country

Country	Country-years	TVOL	SVOL	IVOL	Priva-tizationintensity	Priva-tization progress	GDP per capita	Political risk ratings	Composite risk ratings	Law and order

Panel D: by level of economic development

Developing	310	0.48	0.24	0.40	0.69	0.71	3426.75			
Developed	415	0.39	0.19	0.33	0.72	0.74	26153.66			
Mean difference		0.09	0.05	0.07	−0.02	−0.03	−22726.91			
p-Values		0.00***	0.00***	0.00***	0.77	0.46	0.00***			

Panel E: correlation coefficients

	TVOL	SVOL	IVOL	PI	PP
TVOL	1				
SVOL	0.912*	1			
IVOL	0.974*	0.803*	1		
Privatization intensity (PI)	−0.01	−0.02	−0.004	1	
Privatization progress (PP)	−0.182*	−0.144*	−0.183*	0.651*	1

Panel F: autocorrelations coefficients

	TVOL			**SVOL**		
Lags	Mean	Min	Max	Mean	Min	Max
1	0.50	−0.01	0.84	0.37	−0.28	0.79
2	0.24	−0.49	0.63	0.10	−0.45	0.59
3	0.12	−0.30	0.48	−0.01	−0.34	0.47
4	0.00	−0.46	0.37	−0.08	−0.42	0.24
5	−0.13	−0.44	0.23	−0.20	−0.44	0.01
6	−0.15	−0.41	0.18	−0.16	−0.39	0.17

	IVOL		
Lags	Mean	Min	Max
1	0.53	−0.23	0.85
2	0.29	−0.46	0.64
3	0.17	−0.16	0.48
4	0.04	−0.46	0.44
5	−0.11	−0.42	0.28
6	−0.15	−0.42	0.17

	Privatization intensity			**Privatization progress**		
Lags	Mean	Min	Max	Mean	Min	Max
1	0.13	−0.30	0.52	0.55	0.02	0.85
2	0.03	−0.24	0.50	0.37	−0.34	0.73
3	0.01	−0.39	0.35	0.26	−0.28	0.61
4	−0.04	−0.36	0.32	0.14	−0.23	0.41
5	−0.06	−0.37	0.27	0.10	−0.17	0.26
6	−0.08	−0.24	0.20	−0.02	−0.23	0.16

This table reports summary statistics of the main variables used in the study. All variables are described in Table 1. Privatization measures are expressed in percentages. Panel A contains summary statistics by country, averaged values across years from 1990 through 2009. Country × years is the number of years a country appears in the sample. Panels B through D report the mean difference tests (with unequal variances) of volatility, privatization, and GDP per capita split according to three groups: privatization intensity (Panel B, low intensity vs. high intensity); privatization progress (Panel C, low progress vs. high progress); and economic development (Panel D, developing vs. developed). Panels E and F present correlations and autocorrelations coefficients. TVOL is total volatility, SVOL is systematic volatility, and IVOL is idiosyncratic volatility. Mean difference is the difference between the values of two levels of the same group. *p*-Values represent significance levels. **Reflects significance at 5% level.

* Reflects significance at 10% level.

*** Reflects significance at 1% level.

evidence suggests that maintaining a privatization program over time reduces political uncertainty. The results further indicate that the intensity and the progress of a privatization program are similar in developing and developed countries, suggesting that the willingness of the government to privatize and the ability of the government to commit to a privatization program over time do not vary with the level of economic development.

Next, we present the statistics about the autocorrelations and correlations of our main variables. Panel E of Table 2 presents the correlation coefficients between privatization and volatility. All the volatility variables are negatively correlated with the privatization measures, but only significantly with the progress of privatization. The two privatization measures are also strongly correlated as one would expect. Panel F of Table 2 shows the autocorrelations coefficients. For each country we compute the autocorrelations between t and $(t-i)$ with i representing the number of lags. Next, we take the average (Mean) of all coefficients at each lag. Panel F also shows the minimum (Min) and the Maximum (Max) of the autocorrelation coefficients. For the volatility measures, the first autocorrelation coefficient is generally around 50%. As the number of lags increases, the coefficients drop; they are all below 20% at lag 3 and between 0% and 10% at lag 4. For privatization intensity, the first coefficient is 13% and all other coefficients are below or around 8% in absolute values. For privatization progress, the coefficients are much higher, which is possibly due to the construction of the variable. For all variables, except for privatization progress, the autocorrelation substantially drops after the first year.

Table 3
Privatization and volatility.

	Panel A						Panel B					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL
Lag1.TVOL				0.63 (0.00)***						0.63 (0.00)***		
Lag1.SVOL					0.52 (0.00)***						0.51 (0.00)***	
Lag1.IVOL						0.64 (0.00)***						0.64 (0.00)***
Privatization intensity	−1.34 (0.16)	−2.28 (0.04)**	−1.60 (0.14)	0.21 (0.81)	0.30 (0.79)	−0.31 (0.76)						
Privatization progress							−8.98 (0.00)***	−11.51 (0.00)***	−8.89 (0.00)***	−6.91 (0.02)**	−8.44 (0.05)**	−6.47 (0.03)**
Investor protection	0.02 (0.00)***	0.01 (0.17)	0.02 (0.00)***	0.00 (0.55)	0.00 (0.61)	0.00 (0.60)	0.02 (0.00)***	0.01 (0.27)	0.02 (0.00)***	0.01 (0.15)	0.00 (0.80)	0.01 (0.11)
Stock capitalization/GDP	0.20 (0.00)***	0.27 (0.00)***	0.19 (0.00)***	0.09 (0.01)***	0.11 (0.03)**	0.09 (0.00)***	0.22 (0.00)***	0.29 (0.00)***	0.21 (0.00)***	0.12 (0.00)***	0.14 (0.01)***	0.11 (0.00)***
GDP per capita	−0.11 (0.16)	−0.45 (0.00)***	−0.08 (0.30)	0.02 (0.64)	−0.21 (0.00)***	0.03 (0.61)	−0.12 (0.12)	−0.39 (0.00)***	−0.09 (0.24)	−0.02 (0.59)	−0.15 (0.01)**	−0.01 (0.72)
Volatility of GDP	0.71 (0.00)***	0.92 (0.01)***	0.64 (0.00)***	−0.04 (0.79)	0.29 (0.21)	−0.05 (0.71)	0.65 (0.00)***	0.85 (0.01)**	0.58 (0.00)***	0.01 (0.95)	0.25 (0.28)	0.02 (0.89)
Industry concentration	−0.24 (0.19)	−0.16 (0.58)	−0.44 (0.03)**	−0.09 (0.71)	0.17 (0.66)	−0.11 (0.69)	−0.25 (0.18)	−0.20 (0.50)	−0.45 (0.02)**	−0.14 (0.57)	0.14 (0.70)	−0.25 (0.30)
Firm concentration	0.21 (0.31)	1.18 (0.00)***	0.25 (0.32)	0.28 (0.17)	0.97 (0.00)***	0.14 (0.57)	0.22 (0.32)	1.19 (0.00)***	0.26 (0.33)	0.52 (0.02)**	1.01 (0.00)***	0.49 (0.02)**
Intensity of liberalization	0.06 (0.50)	0.19 (0.21)	0.02 (0.82)	0.03 (0.71)	0.01 (0.92)	0.01 (0.94)	0.10 (0.29)	0.16 (0.28)	0.05 (0.56)	0.01 (0.88)	−0.01 (0.94)	−0.02 (0.86)
Constant	0.48 (0.48)	1.92 (0.00)***	−0.04 (0.95)	−0.42 (0.30)	0.72 (0.11)	−0.43 (0.30)	0.67 (0.32)	1.56 (0.01)***	0.15 (0.83)	−0.10 (0.74)	0.33 (0.48)	−0.16 (0.60)
Observations	718	718	718	671	671	671	718	718	718	671	671	671
Adjusted *R*-square	0.645	0.712	0.619	0.807	0.800	0.802	0.652	0.718	0.625	0.795	0.802	0.791

This table reports values from country-level regressions of the logarithm of either total volatility (TVOL), systematic volatility, (SVOL) or idiosyncratic volatility (IVOL) on privatization measures, further including control variables. All variables are defined in Table 1. All regressions include year fixed effects (not reported); columns (1)–(3) and (7)–(9) also include country fixed-effects (not reported). Panels A tests the impact of the intensity of privatization on volatility, Panels B tests the impact of privatization progress on volatility. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.
** Reflects significance at 5% level.
*** Reflects significance at 1% level.

5. Multivariate analysis

5.1. Privatization and volatility

In this section we conduct multivariate analyses of the relation between privatization and volatility. In Table 3, Panel A we regress each of the volatility measures (total, systematic, or idiosyncratic) on privatization sales to GDP, the measure of privatization intensity. The coefficient on intensity is negative for all three volatility measures but significant only for systematic volatility. When controlled for the lagged volatility measures (columns 4–6), none of the privatization intensity coefficients are statistically significant. The intensity measure thus does not provide a supportive evidence for the prediction that privatization reduces volatility. This result suggests that contemporaneous privatization sales do not strongly increase the credibility of a new government policy.

In Table 3, Panel B we repeat the above analysis but replace privatization intensity with privatization progress, which captures the government's commitment to its privatization policy over time. The coefficient on progress is negative and significant for all three types of volatility. In particular, a one standard deviation (0.006) increase in privatization progress is associated with a 0.054 decrease in total volatility, which represents a 12.53% decline from the sample mean of 0.43 (see column 7). For systematic and idiosyncratic volatility, the decrease associated with a one standard deviation increase in privatization progress corresponds 32.88% and 14.81%, respectively. These results are consistent with a credible privatization program increasing investor confidence and thus decreasing both systematic and idiosyncratic volatility (recall that the effect on idiosyncratic volatility reflects the heterogeneous exposure of firms to the risk of policy reversal).

The results for the control variables are in line with the literature, (see columns 7–9). Investor protection is associated with greater total volatility, but only through the idiosyncratic component. This result is consistent with the view that strong property rights protection facilitates informed trading (Morck et al., 2000) and risk taking (Bartram et al., 2012), which results in higher firm-specific volatility. Stock market capitalization/GDP is positively associated with idiosyncratic volatility, as risk is better shared among investors in financially developed countries, allowing firms to undertake riskier projects. The positive relation between stock market capitalization/GDP and systematic volatility could be explained by the presence of noise traders in liquid markets, which typically increases this volatility. As predicted, GDP per capita is associated with lower systematic volatility and economic instability (volatility of GDP) is positively related to all three volatility measures. Also as expected, idiosyncratic volatility decreases with industry concentration, as concentrated industries can smooth cash flow variations and thus reduce uncertainty surrounding their future performance, while firm concentration is positively related to systematic volatility, consistent with higher product market concentration leading to higher systematic volatility. However, the inclusion of the lagged volatility measures affect the impact of most independent variables. The lagged volatility measures are strongly related to current volatility while the privatization progress variables are now significant only at the 5% level (see columns 10–12). We notice that the lagged volatility affects more the measure of investor protection than the privatization progress.

Table 4
The impact of privatization on political risk.

Panel A			
	(1) Credit risk	(2) Composite risk	(3) Political risk
Privatization progress	125.65	151.53	69.28
	(0.01)***	(0.00)***	(0.10)*
Stock capitalization/GDP	2.91	1.45	2.48
	(0.00)***	(0.00)***	(0.00)***
GDP per capita	6.44	2.87	−1.14
	(0.00)***	(0.01)**	(0.29)
Intensity of liberalization	11.02	3.23	2.77
	(0.00)***	(0.04)**	(0.06)*
Public debt/GDP	−0.17	−0.03	−0.04
	(0.00)***	(0.00)***	(0.00)***
Investor protection	0.29	0.62	0.92
	(0.00)***	(0.00)***	(0.00)***
Constant	−30.70	32.55	69.33
	(0.01)***	(0.00)***	(0.00)***
Observations	718	718	718
Pseudo *R*-squared	0.387	0.321	0.319

Table 4 reports results from the Tobit regressions of political risk measures on privatization progress and control variables. All variables are defined in Table 1. All regressions include country and year fixed effects. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.

** Reflects significance at 5% level.

*** Reflects significance at 1% level.

Further, macroeconomic volatility (GDP volatility), does not seem to affect contemporaneous volatility anymore after controlling for past volatility. These findings on privatization, which were expected as discussed in Section 4.1, are robust to the lagged volatility specification. Note also the increase in the adjusted *R*-squares once the lagged volatility has been included in the regressions.

5.2. The role of political risk

In this section we examine how incorporating political risk affects the above relation between privatization and volatility.

We begin by regressing political risk on privatization, controlling for stock market capitalization, GDP per capita, the intensity of liberalization, investor protection, and the ratio of public debt to GDP. As discussed in Section 3, we proxy for political risk using three measures, namely, the credit risk ratings of *Institutional Investor*, the composite risk and the political risk ratings of ICRG. Each of these ratings is bound between zero and 100, where higher ratings indicate lower political risk. We use a Tobit regression model, which is designed to estimate a linear model when the dependent variable is censored at the left and/or right. All regressions include country and year fixed effects to control for unobserved heterogeneity.

The results, presented in Table 4, support the view that privatization reduces political risk. In column (1) of Table 4, Panel A, where we measure political risk via *Institutional Investor's* credit risk ratings, the coefficient on privatization progress is positive and significant at the 1% level. In columns (2) and (3), where the political risk measures are ICRG's composite risk and political risk ratings, respectively, the coefficients of privatization progress are positive and significant at the 1% and 10% level, respectively. Thus, increasing a privatization program's credibility by maintaining it over time increases a country's risk rating (i.e., reduces its political risk), suggesting that privatization does indeed reduce policy uncertainty. For the ICRG political risk measure the weak relation with privatization is not surprising because this risk measure is related more to a country's overall stability than to policy uncertainty per se (see also Perotti and van Oijen, 2001, who consider the intensity of privatization).[19]

Thus far we have demonstrated that privatization reduces volatility, and we have argued that this occurs through a reduction in political risk, as suggested by Table 4. However, we have treated privatization as the main determinant of political risk – yet privatization and political risk may have independent effects on volatility. Accordingly, we next examine whether the component of political risk that is related to privatization is also related to volatility. To do so, we follow the approach adopted by Ferreira and Laux (2007) and separate political risk into the part that is explained by privatization and the part that is unrelated to privatization. First, we regress the political risk variables on privatization progress alone (see Panel A of Table 5); then we collect both the predicted values and the residuals for political risk. The residuals represent the part of political risk that is orthogonal to privatization. Second, we run regression (3) replacing privatization progress with the predicted values and the residuals for political risk.

We present the results in Table 5. We find that the coefficients on all predicted political risk measures are statistically significant in all specifications, suggesting that privatization directly affects volatility (systematic and idiosyncratic). This sheds light on the privatization-to-political risk pass-through. The negative and significant coefficients on the residuals, particularly for political risk and composite risk would be consistent with the literature on the impact of political events and political news on volatility (e.g., Beaulieu et al., 2005; Bartram et al., 2012; Boutchkova et al., 2012). However, the residual political risk coefficient loses its significance when controlling for the lagged volatility measures. Overall, these results support the view that privatization affects volatility through the reduction in political risk.

5.3. The role of economic development

Compared to developed equity markets, emerging equity markets exhibit higher sample average returns, lower correlations with developed market returns, more predictable returns, and higher volatility (Bekaert and Harvey, 1997). Furthermore, political risk is more of a concern in emerging markets than in developed markets. Aggarwal, Inclan and Leal (1999) for instance, find that emerging markets volatility shows frequent and sudden changes, and is driven, mostly, by political events. Bilson et al. (2002) provide evidence of a strong relation between political risk and stock returns in emerging markets but not in developed markets; Perotti and Laeven (2002) show that credible privatizations reduce political risk in emerging markets. Since higher political risk may lead to higher volatility, the literature above suggests that the effect of political risk, and hence of privatization, on volatility is greater in emerging markets than in developed markets.[20] Another reason for the differential impact of privatization on volatility between developed and developing countries could be the differential in the government ownership of firms.[21] Indeed, ownership is more concentrated in the hand of the government in developing countries (e.g., for government ownership of banks see La Porta, Lopez-De-Silanes and Shleifer, 2002). Specifically, government

[19] Tobit regression models are well suited when the dependent variable is censored at the left and/or right as our political risk measures. Thus censoring might not be necessary because the values of the measures are not close to the censoring levels, 0 and 100. In this case, a censored regression should not deliver a significant correction of the regression coefficients. The regression estimates with OLS are essentially identical to the Tobit estimates. We thank a reviewer for mentioning this.

[20] For studies on political risk and volatility that cover developed as well as developing countries, see Boutchkova et al. (2012) and Bartram et al. (2012). However, these studies do not investigate whether political risk affects volatility differently across developed and developing countries.

[21] We thank a reviewer for pointing this out.

Table 5
The role of political risk.

Panel A

	(1) Credit risk	(2) Composite risk	(3) Political risk
Privatization progress	336.20 (0.00)***	242.38 (0.00)***	479.60 (0.00)***
Constant	63.26 (0.00)***	74.02 (0.00)***	70.07 (0.00)***
Observations	718	718	718
pseudo *R*-squared	0.001	0.005	0.012

Panel B

	Credit risk						Composite Risk						Political Risk					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL	(13) TVOL	(14) SVOL	(15) IVOL	(16) TVOL	(17) SVOL	(18) IVOL
Lag1.TVOL				0.58 (0.00)***						0.58 (0.00)***						0.59 (0.00)***		
Lag1.SVOL					0.46 (0.00)***						0.49 (0.00)***						0.41 (0.00)***	
Lag1.IVOL						0.61 (0.00)***						0.60 (0.00)***						0.61 (0.00)***
Credit risk *predicted*	−0.03 (0.00)***	−0.03 (0.00)***	−0.03 (0.01)***	−0.01 (0.04)**	−0.02 (0.05)**	−0.01 (0.08)*												
Credit risk *residuals*	0.002 (0.32)	−0.01 (0.00)***	0.005 (0.17)	0.00 (0.01)**	0.00 (0.56)	0.00 (0.11)												
Composite risk *predicted*							−0.14 (0.00)***	−0.09 (0.01)**	−0.14 (0.00)***	−0.02 (0.01)**	−0.03 (0.04)**	−0.02 (0.03)**						
Composite risk *residuals*							−0.01 (0.01)***	−0.02 (0.00)***	−0.01 (0.01)***	−0.00 (0.91)	−0.00 (0.46)	−0.00 (0.93)						

(*continued on next page*)

Table 5 (*continued*)

Panel A

	(1) Credit risk								(2) Composite risk				(3) Political risk			
Political risk *predicted*									−0.06	−0.06	−0.06	−0.01	−0.02	−0.01		
									(0.00)***	(0.00)***	(0.00)***	(0.02)**	(0.02)**	(0.04)**		
Political risk *residuals*									−0.01	−0.01	−0.01	0.00	0.01	0.00		
									(0.06)*	(0.02)**	(0.03)**	(0.65)	(0.17)	(0.87)		
Investor protection	0.02	0.01	0.01	0.00	0.01	0.00	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.02	0.00	0.00	0.01
	(0.00)***	(0.24)	(0.00)***	(0.26)	(0.22)	(0.90)	(0.00)***	(0.09)*	(0.00)***	(0.05)**	(0.79)	(0.04)**	(0.00)***	(0.16)	(0.00)***	(0.30)	(0.98)	(0.19)
Stock capitalization/ GDP	0.23	0.33	0.22	0.12	0.17	0.10	0.23	0.31	0.22	0.13	0.15	0.12	0.23	0.31	0.22	0.12	0.12	0.12
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.02)**	(0.00)***
GDP per capita	−0.13	−0.02	−0.13	−0.10	−0.21	0.00	−0.09	−0.07	−0.06	0.01	0.01	0.02	−0.11	−0.07	−0.08	0.07	0.01	0.07
	(0.12)	(0.87)	(0.15)	(0.10)	(0.02)**	(0.96)	(0.26)	(0.57)	(0.46)	(0.84)	(0.87)	(0.75)	(0.15)	(0.54)	(0.30)	(0.27)	(0.87)	(0.27)
Volatility of GDP	0.70	0.64	0.70	0.01	0.15	0.03	0.53	0.75	0.45	0.03	0.24	0.03	0.59	0.88	0.52	0.08	0.46	0.07
	(0.00)***	(0.04)**	(0.00)***	(0.97)	(0.50)	(0.85)	(0.01)***	(0.02)**	(0.02)**	(0.87)	(0.30)	(0.83)	(0.00)***	(0.00)***	(0.01)***	(0.63)	(0.06)*	(0.63)
Industry concentration	−0.26	−0.29	−0.44	−0.05	0.31	−0.13	−0.34	−0.26	−0.55	−0.32	0.04	−0.42	−0.31	−0.21	−0.52	−0.30	0.32	−0.42
	(0.16)	(0.33)	(0.03)**	(0.81)	(0.35)	(0.62)	(0.10)*	(0.41)	(0.01)**	(0.21)	(0.92)	(0.09)*	(0.13)	(0.49)	(0.02)**	(0.26)	(0.41)	(0.11)
Firm concentration	0.22	1.25	0.23	0.15	0.71	0.16	0.26	1.15	0.31	0.56	1.15	0.53	0.26	1.18	0.31	0.64	0.81	0.62
	(0.29)	(0.00)***	(0.35)	(0.37)	(0.00)***	(0.50)	(0.27)	(0.00)***	(0.28)	(0.01)**	(0.00)***	(0.01)**	(0.27)	(0.00)***	(0.27)	(0.01)***	(0.02)**	(0.00)***
Intensity of liberalization	0.04	0.11	−0.02	−0.01	0.00	−0.00	0.13	0.05	0.09	−0.12	−0.12	−0.13	0.11	0.02	0.07	−0.03	0.07	−0.06
	(0.65)	(0.40)	(0.81)	(0.90)	(0.98)	(0.98)	(0.16)	(0.74)	(0.35)	(0.24)	(0.30)	(0.28)	(0.23)	(0.86)	(0.45)	(0.71)	(0.53)	(0.55)
Constant	3.10	0.66	2.65	1.74	2.46	0.57	11.12	6.16	10.46	1.44	1.27	0.98	5.29	3.65	4.77	0.30	0.59	0.11
	(0.00)***	(0.56)	(0.02)**	(0.02)**	(0.03)**	(0.35)	(0.00)***	(0.05)**	(0.00)***	(0.11)	(0.30)	(0.26)	(0.00)***	(0.05)**	(0.00)***	(0.64)	(0.52)	(0.85)
Observations	718	718	718	671	671	671	718	718	718	671	671	671	718	718	718	671	671	671
Adjusted *R*-square	0.654	0.736	0.627	0.817	0.810	0.808	0.657	0.733	0.630	0.799	0.805	0.793	0.654	0.729	0.627	0.797	0.747	0.792

Panel A reports results from the regressions of political risk measures on privatization progress alone. Panel B presents values from country-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on explained and residual values of political risk (obtained from regression political risk measures on the progress of privatization) and control variables. All variables are defined in Table 1. All regressions include year fixed effects. Columns (1)–(3), (7)–(9) and (13)–(15) also include country fixed-effects (not reported). Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.

** Reflects significance at 5% level.

*** Reflects significance at 1% level.

Table 6
The role of economic development.

	Developed countries						Developing countries					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL
Lag1.TVOL				0.67 (0.00)***						0.57 (0.00)***		
Lag1.SVOL					0.52 (0.00)***						0.23 (0.00)***	
Lag1.IVOL						0.66 (0.00)***						0.64 (0.00)***
Privatization progress	−8.55 (0.01)***	−4.38 (0.07)*	−9.68 (0.00)***	−5.93 (0.01)**	−3.06 (0.44)	−5.42 (0.03)**	−17.71 (0.01)***	−18.68 (0.00)***	−13.55 (0.06)*	−13.46 (0.02)**	−20.87 (0.01)**	−9.09 (0.10)*
Investor protection	0.02 (0.03)**	0.01 (0.50)	0.02 (0.03)**	0.00 (0.62)	0.01 (0.50)	0.00 (0.89)	0.01 (0.13)	0.02 (0.12)	0.01 (0.15)	0.00 (0.32)	0.01 (0.18)	0.00 (0.38)
Stock capitalization/GDP	0.02 (0.71)	0.10 (0.14)	0.02 (0.71)	0.08 (0.08)*	0.04 (0.56)	0.08 (0.07)*	0.19 (0.04)**	0.18 (0.02)**	0.20 (0.05)**	0.15 (0.03)**	0.16 (0.04)**	0.10 (0.13)
GDP per capita	0.24 (0.08)*	−0.23 (0.05)**	0.31 (0.03)**	0.18 (0.07)*	0.00 (0.98)	0.18 (0.06)*	0.07 (0.47)	−0.19 (0.08)*	0.11 (0.25)	0.00 (0.98)	−0.16 (0.09)*	−0.01 (0.89)
Volatility of GDP	0.70 (0.13)	0.72 (0.07)*	0.78 (0.09)*	−0.12 (0.70)	0.06 (0.88)	−0.07 (0.81)	0.88 (0.00)***	0.96 (0.00)***	0.82 (0.00)***	0.01 (0.96)	0.58 (0.02)**	−0.07 (0.68)
Industry concentration	−0.95 (0.11)	−0.41 (0.48)	−1.51 (0.02)**	−0.25 (0.64)	−0.41 (0.55)	−0.14 (0.81)	−0.56 (0.13)	−0.11 (0.78)	−0.90 (0.01)***	−1.23 (0.06)*	−1.00 (0.18)	−1.05 (0.07)*
Firm concentration	0.61 (0.41)	0.75 (0.32)	1.18 (0.13)	0.41 (0.64)	1.58 (0.14)	0.09 (0.93)	0.60 (0.30)	−0.01 (0.99)	0.93 (0.15)	1.33 (0.06)*	1.29 (0.10)	1.02 (0.13)
Intensity of liberalization	−0.18 (0.41)	−0.01 (0.97)	−0.20 (0.39)	−0.13 (0.53)	0.06 (0.74)	−0.18 (0.40)	0.39 (0.00)***	0.03 (0.84)	0.41 (0.00)***	0.10 (0.31)	−0.05 (0.73)	0.08 (0.40)
Constant	−2.58 (0.05)*	0.23 (0.84)	−3.43 (0.01)**	−1.83 (0.05)*	−1.35 (0.25)	−1.76 (0.06)*	−1.02 (0.21)	0.54 (0.53)	−1.56 (0.07)*	−0.06 (0.91)	0.71 (0.37)	−0.08 (0.89)
Observations	408	408	408	383	383	383	310	310	310	288	288	288
Adjusted *R*-square	0.622	0.638	0.612	0.801	0.737	0.797	0.629	0.634	0.612	0.803	0.789	0.812

This table reports values from country-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on privatization progress, further including control variables. All variables are defined in Table 1. All regressions include year fixed effects. Regressions (1)–(3) and (7)–(9) also include country-fixed effects. Developed (Developing) countries are high- (low- and middle-) income countries in accordance with the World Bank income classification. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.

** Reflects significance at 5% level.

*** Reflects significance at 1% level.

ownership represents 80% of the stock market in China, 62% in Russia, and 38% in Brazil (The Economist, 2012). Therefore, the government retains de facto a greater discretion of intervention in the markets, so the potential for policy reversal and thus aggregate policy uncertainty is large. Therefore, any credible policy, such as a sustained privatization program, is more likely to impact systematic volatility in countries with significant government ownership, particularly in developing countries, by reducing the aggregate fear of government intervention.

To investigate how privatization affects volatility across developing and developed countries, we divide our sample according to the World Bank income classification, taking high-income countries to be developed countries, and middle- and lower-income countries to be developing. This classification yields 25 developed and 22 developing countries (including emerging countries). We then repeat regression (3) on each subsample. As shown in Table 6, the progress in privatization is associated with lower volatility in both developed and developing countries, but the economic significance of the coefficients is much greater in developing countries. Specifically, privatization progress has a more pronounced impact on idiosyncratic volatility in developed countries, while its impact is stronger for systematic volatility in developing countries. For example, a one standard deviation (i.e., 0.006) increase in privatization progress is associated with a 13.83% (17.60%) decline in systematic (idiosyncratic) volatility, holding the other variables at their mean values, in developed countries, while the same increase in privatization progress leads to a 46.70% (20.33%) decrease in systematic (idiosyncratic) volatility in developing countries.[22] We observe similar patterns when we include the lagged volatility measures, although the significance of most variables drop by one level.

Additional observations in Table 6 are worth noting (see columns 1–3 and 7–9). First, investor protection is positively associated with total and idiosyncratic volatility, but only in developed countries. This result supports Morck et al. (2000), who provide evidence on the existence of a threshold level of institutional development associated with stock price asynchronicity, by showing that idiosyncratic volatility is unrelated to investor protection in developing countries. Second, stock market capitalization and the intensity of liberalization appear to affect volatility mostly in developing countries. This is not surprising as most developed countries in our sample have large stock markets that were fully liberalized before the start of our study period. However, the development and liberalization of capital markets in developing countries increase the investor base and in turn risk-sharing and firm investment in riskier projects, which leads to a higher level of volatility, particularly idiosyncratic volatility.[23] However, like in Table 5, the control of past volatilities seems to eliminate the

[22] The *p*-Values for the difference in the coefficients on privatization progress between developed and developing countries are 0.16, 0.02 and 0.58 for total, systematic and idiosyncratic volatility respectively. This suggests that political risk is of greater importance for systematic volatility in developing countries.

[23] In unreported Tables, we test the role of economic development by using dummy variables. To do so, we construct two dummies measuring the level of economic development. We set High-Development (Low-Development) to one if the country is economically developed (less developed) and zero otherwise. The developing (developed) countries subsample comprises low and middle (high) income countries according to the World Bank income classification. Then, we multiply the privatization progress variable by each of the dummy variables. The coefficients on these new variables assess the effect of privatization in each development level. The impact of privatization progress on volatility is statistically and economically significant, particularly for low development countries, thus supporting the results of Table VI.

impact of most control variables so that the reader should interpret these control variables with caution.

5.4. The role of the method of privatization

Our main privatization variables above (intensity, progress) are constructed using all privatization sales in a country-year. These variables do not distinguish between privatizations through private sales and share issue privatizations (SIPs). While privatizations by either methods should help increase investor confidence, privatization sales via the stock market are more transparent (Megginson, 2010), facilitating assessment of a privatization program. Thus, given greater resolution of policy uncertainty via the stock market, we expect a greater reduction in volatility for SIPs. To disentangle the impact of the methods of privatization, we follow the methodology presented in Section 3.1 to construct privatization progress measures based on private sales versus SIPs. We then estimate Eq. (3) separately for the two variables.

Biais and Perotti (2002) show that SIPs are more likely with right-wing government than with left-wing government. In Biais and Perotti's model, left-wing governments always have the tendency to re-nationalize and redistribute revenues to preferred constituencies. For right-wing government to secure election and re-election, it is necessary to involve the large median class citizens in SIPs, which may be promoted through underpricing. To avoid lost in ownership and revenues, the new shareholders from the median class would want to vote for a right-wing government because a left-wing government will re-nationalize and expropriate shareholders. One implication of this model is confidence building through SIP and under right-wing governments. Indeed, the credibility of the government is viewed as a necessary condition for the success of privatization (see, Bortolotti, Fantini and Siniscalco, 2003). Since confidence building is a key factor in reducing perceived political risk, our regressions control for the impact of such governments on risk perception and thus on volatility. We include a measure of political orientation, which take the value of one if the government in place is right-wing and zero otherwise. The variable of political orientation comes from the World Bank Database of Political Institutions. If right-wing governments induce market confidence, then the political orientation variable should have a negative coefficient. The results are presented in Table 7.

In Panel A, privatization progress for transactions conducted via private sales (PS) does not seem to affect volatility. However, privatization progress for transactions via SIPs (SIP) is associated with lower total, systematic, and idiosyncratic volatility. The *p*-Values for the difference between the coefficients on PS and SIP are 0.04, 0.12, and 0.02 for total, systematic, and idiosyncratic volatility, respectively (see columns 1–3). These results are in line with the view that the credibility of a privatization program is higher for privatization sales conducted through the stock market than for those conducted through private sales, particularly for idiosyncratic volatility. In Panel B we consider the ratio of SIPs to the total number of privatizations, a measure of the intensity of privatization via the stock market. The results show no conclusive evidence on the relation between the proportion of SIPs and systematic volatility. The political orientation variable exhibits the expected sign, but mostly for systematic volatility. In summary, this evidence suggests that the share of firms privatized through the stock market matters less to investors than privatization progress.

5.5. Evidence from initial public offerings and share issue privatizations

The literature reviewed in Section 2 suggests that privatization policy risk is both country-specific and firm-specific, the latter because privatized firms face more risk of government policy reversals than other public firms (e.g., IPOs) (Perotti, 1995). In this section we therefore investigate whether IPO (initial public offering) firms and SIP (share issue privatization) firms have similar exposure to political risk.

To do so, we perform firm-level regressions. We first collect all public firms from Datastream/Worldscope. We then identify IPO and SIP firms from SDC databases. To be included in the sample, a firm must have one of the following identification numbers: Datastream identifier, International Securities Identification Number (ISIN), or Security Exchange Daily Official List (SEDOL). The final sample includes 13,456 IPO firms and 416 SIP firms. Next, we construct a dummy variable for IPO (SIP) firms that takes the value of one if the firm is an IPO (SIP), and zero otherwise, and we multiply these dummy variables by the progress of privatization measure. This procedure sheds light on the differential effect of a privatization program on the volatility of SIP firms versus IPO firms.[24] We present the results in Table 8. As a robustness test, we investigate whether regulated (protected and monopolies) and unregulated industries face similar policy risk.[25] Indeed, as discussed in Section 2, regulated industries should be more sensitive to public policy changes (Perotti, 1995). We define regulated industries as those in the following sectors: utilities, mining (including oil and gas), construction, financial institutions, health care, education and social services. This second sampling gives 4539 regulated firms and 9333 unregulated firms. This classification is not perfect as the intensity of industrial regulation will vary from one country to another. With this caveat in mind, we construct a dummy variable for Regulated (Unregulated) firms that takes the value of one if the firm is in a regulated (unregulated) industry and zero otherwise.

For comparison purposes, in Panel A we report the results using the original progress of privatization measure constructed with all privatization sales (private sales and public offerings). As in Table 3 for the results at the country level, privatization progress is associated with lower total, systematic, and idiosyncratic volatility (the coefficients on privatization progress are significant at least at the 5% level). In Panel B, we separately investigate the impact of privatization progress on volatility for IPO firms and SIP firms. For IPO firms, privatization progress is strongly and negatively related to total and idiosyncratic volatility, while it is only weakly related to systematic volatility (significant at the 10% level, see column 8). As expected, this result suggests that political risk (in particular, the risk that a privatization program will be reversed by the government) might translate into idiosyncratic risk for IPO firms. For SIP firms, privatization progress is associated with lower total, systematic, and idiosyncratic volatility. However, the magnitude of the coefficient on privatization progress is greater for systematic volatility than for idiosyncratic volatility, suggesting that political risk is mostly associated with the systematic volatility of SIP firms. Unreported tests for differences in the coefficients of progress of privatization between IPO and SIP firms have *p*-Values of 0.34, 0.04, and 0.94 for total, systematic, and idiosyncratic volatility, respectively (columns 7–9). The results with additional control for past volatility are statistically similar, although the coefficient for systematic volatility increases in absolute value, and the unreported difference test between SIP and IPO is now significant at the 10% level). Hence, the results show that, at least at a 10% significance level, IPO firms contribute relatively less to the reduction in systematic volatility than SIP firms. The results in Panel C support the argument that firms in the regulated industries are more sensitive to government policies than unregulated industries. For

[24] For studies using similar methodologies, see Giroud and Mueller (2011).

[25] We assume that a great deal of monopolies are regulated and managed by politicians, particularly in developing countries. Thus we define protected industries and monopolies as regulated industries. Further, it is empirically challenging to determine monopolies in each country.

Table 7
The role of the method of privatization.

	Panel A: private sales and public offerings						Panel B: proportion of public offerings					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL
Lag1.TVOL				0.63						0.63		
				(0.00)***						(0.00)***		
Lag1.SVOL					0.48						0.56	
					(0.00)***						(0.00)***	
Lag1.IVOL						0.64						0.63
						(0.00)***						(0.00)***
Privatization progress (PS)	2.24	−15.49	4.98	−0.61	−0.52	−2.40						
	(0.77)	(0.10)*	(0.53)	(0.92)	(0.95)	(0.71)						
Privatization progress (SIP)	−23.62	−21.50	−25.15	−13.94	−17.62	−11.17						
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.02)**						
Proportion of public offerings							−0.02	−0.06	−0.02	0.02	−0.01	0.02
							(0.42)	(0.07)*	(0.56)	(0.38)	(0.86)	(0.48)
Investor protection	0.02	0.01	0.01	0.00	0.00	0.00	0.02	0.01	0.02	0.00	0.00	0.00
	(0.00)***	(0.30)	(0.00)***	(0.50)	(0.79)	(0.43)	(0.00)***	(0.33)	(0.00)***	(0.36)	(0.89)	(0.32)
Stock capitalization/GDP	0.22	0.37	0.22	0.11	0.17	0.11	0.18	0.28	0.18	0.09	0.11	0.09
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.03)**	(0.00)***
GDP per capita	−0.08	−0.45	−0.04	0.01	−0.24	0.01	−0.07	−0.30	−0.04	0.05	−0.13	0.06
	(0.28)	(0.00)***	(0.58)	(0.77)	(0.00)***	(0.79)	(0.31)	(0.00)***	(0.63)	(0.48)	(0.01)**	(0.36)
Volatility of GDP	0.67	1.04	0.61	−0.00	0.20	0.01	0.73	1.80	0.67	0.07	0.51	0.08
	(0.00)***	(0.00)***	(0.00)***	(0.99)	(0.50)	(0.95)	(0.00)***	(0.00)***	(0.00)***	(0.66)	(0.07)*	(0.58)
Industry concentration	−0.27	−0.16	−0.50	−0.21	0.05	−0.28	−0.24	−0.31	−0.47	−0.05	0.15	−0.14
	(0.18)	(0.53)	(0.01)**	(0.39)	(0.87)	(0.23)	(0.22)	(0.28)	(0.03)**	(0.82)	(0.65)	(0.52)
Firm concentration	0.33	0.74	0.35	0.59	0.80	0.54	0.33	1.29	0.34	0.46	0.98	0.43
	(0.12)	(0.00)***	(0.16)	(0.00)***	(0.00)***	(0.00)***	(0.14)	(0.00)***	(0.18)	(0.02)**	(0.00)***	(0.02)**
Intensity of liberalization	0.14	−0.15	0.10	−0.05	−0.14	−0.07	0.09	0.02	0.05	−0.13	−0.03	−0.15
	(0.14)	(0.24)	(0.28)	(0.55)	(0.29)	(0.43)	(0.32)	(0.88)	(0.58)	(0.20)	(0.77)	(0.22)
Political Orientation	0.01	−0.01	0.01	−0.01	−0.02	−0.00	0.01	−0.02	0.01	−0.01	−0.02	−0.00
	(0.59)	(0.68)	(0.61)	(0.74)	(0.52)	(0.94)	(0.81)	(0.47)	(0.80)	(0.65)	(0.43)	(0.84)
Constant	−0.29	2.50	−0.68	−0.28	1.27	−0.29	−0.28	0.78	−0.68	−0.65	0.17	−0.75
	(0.60)	(0.00)***	(0.24)	(0.37)	(0.04)**	(0.36)	(0.61)	(0.13)	(0.24)	(0.19)	(0.69)	(0.13)
Observations	718	718	718	671	671	671	718	718	718	671	671	671
Adjusted *R*-square	0.652	0.743	0.624	0.789	0.809	0.784	0.642	0.682	0.613	0.789	0.793	0.785

This table reports values from country-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on privatization progress, further including control variables. All variables are defined in Table 1. All regressions include year fixed effects. Regressions in columns (1)–(3) and (7)–(9) also include country-fixed-effects. Panel A uses the measures of privatization progress constructed with privatization sales through private sales (PS) and through public offerings (SIP), and Panel B uses the proportion of public offerings – that is, the ratio of firms privatized through public offering to the total number of privatized firms. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.
** Reflects significance at 5% level.
*** Reflects significance at 1% level.

regulated industries (REG), privatization progress is significantly related to all volatility measures (the highest *p*-Value is 2%). For unregulated industries (UNREG), privatization progress is significantly and negatively related to total and idiosyncratic volatility, while it is only weakly related to systematic volatility. The tests for differences in the coefficients of progress of privatization between REG and UNREG industries have *p*-Values of 0.001, 0.09, and 0.004 for total, systematic, and idiosyncratic volatility, respectively. These *p*-Values become 0.02, 0.19 and 0.03, respectively, when controlling for past volatilities (see columns 16–18). Thus, following a credible privatization program, regulated industries contribute relatively more to the reduction in the volatility measures than unregulated industries. Overall, these result supports the view that privatized and regulated firms are more exposed to government policy reversals than other public firms.

6. Robustness tests

6.1. Endogeneity

Our results above suggest that privatization affects volatility. However, we cannot rule out the possibility that governments time the introduction of a privatization program so that the sales take place during hot markets, to maximize favorable investor sentiment and in turn privatization proceeds (Megginson, 2010). Further, the decision to privatize may be affected by unobservable country characteristics that also explain volatility. Privatization is thus likely to be endogenously determined. While we address endogeneity concerns using country fixed effects in our analyses above, here we further mitigate such concerns by performing change model regressions and instrumental variable (IV) regressions.

First, for the change model, we take the four-year difference ($\Delta 4$) of the dependent and independent variables.[26] If privatization progress affects volatility, then the change in privatization progress should be associated with changes in volatility. We present the results in Table 9. In columns (4)–(6) of Table 9, we further control for past changes in the volatility measures. The coefficients on the change in the progress of privatization are negative and statistically significant in all regressions. Further, the change in the control variables exhibits similar patterns like in the previous Tables, particularly when controlling for past changes in volatility.

Second, for the instrumental variable (IV) model, we instrument privatization using the lagged ratio of privatization

[26] We thank an anonymous reviewer for suggesting this model. Due to the slow progress of privatization, a first-difference of the privatization measure will not have much variation, and thus it will not incorporate enough information about the government's past commitment. The gradual evolution of privatization is the path to commitment, not the instantaneous variation.

Table 8
Evidence from IPO Firms vs. SIP firms, and regulated vs. unregulated firms.

	Panel A: privatization progress						Panel B: privatization progress for IPOs and SIPs						Panel C: privatization progress for Regulated and Unregulated firms					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL	(13) TVOL	(14) SVOL	(15) IVOL	(16) TVOL	(17) SVOL	(18) IVOL
Lag1.TVOL				0.49						0.50						0.50		
				(0.00)***						(0.00)***						(0.00)***		
Lag1.SVOL					0.33						0.33						0.33	
					(0.00)***						(0.00)***						(0.00)***	
Lag1.IVOL						0.48						0.49						0.49
						(0.00)***						(0.00)***						(0.00)***
Privatization progress	−6.74	−8.73	−6.63	−5.74	−9.27	−5.40												
	(0.00)***	(0.04)**	(0.00)***	(0.01)**	(0.03)**	(0.01)**												
Privatization progress (IPO)							−6.88	−7.99	−7.11	−5.69	−9.00	−5.48						
							(0.01)***	(0.07)*	(0.00)***	(0.01)**	(0.04)**	(0.01)**						
Privatization progress (SIP)							−8.48	−14.56	−6.98	−6.40	−11.83	−5.47						
							(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.01)***	(0.01)**						
Privatization progress (REG)													−9.28	−10.92	−9.01	−6.98	−10.78	−6.58
													(0.00)***	(0.01)**	(0.00)***	(0.00)***	(0.02)**	(0.00)***
Privatization progress (UNREG)													−5.66	−7.39	−5.97	−4.87	−8.29	−4.71
													(0.02)**	(0.09)*	(0.01)***	(0.03)**	(0.06)*	(0.03)**
SIP dummy							0.01	−0.01	0.01	−0.01	−0.03	−0.01						
							(0.80)	(0.77)	(0.75)	(0.56)	(0.39)	(0.71)						
REG dummy													0.04	0.20	0.03	−0.04	0.04	−0.03
													(0.51)	(0.03)**	(0.61)	(0.44)	(0.68)	(0.54)
Investor protection	0.01	−0.00	0.01	0.01	0.00	0.01	0.01	−0.00	0.01	0.01	0.00	0.01	0.01	−0.00	0.01	0.01	0.00	0.01
	(0.13)	(0.58)	(0.05)**	(0.14)	(0.82)	(0.13)	(0.14)	(0.56)	(0.05)*	(0.16)	(0.85)	(0.14)	(0.14)	(0.59)	(0.05)*	(0.16)	(0.82)	(0.14)
Stock capitalization/GDP	0.18	0.17	0.16	0.10	0.06	0.09	0.17	0.17	0.15	0.10	0.06	0.08	0.17	0.17	0.15	0.10	0.06	0.08
	(0.00)***	(0.01)***	(0.00)***	(0.04)**	(0.34)	(0.08)*	(0.00)***	(0.01)***	(0.00)***	(0.06)*	(0.35)	(0.11)	(0.00)***	(0.01)***	(0.00)***	(0.06)*	(0.34)	(0.11)
GDP per capita	0.03	−0.05	0.05	−0.01	−0.01	0.00	0.04	−0.05	0.05	−0.00	−0.01	0.00	0.04	−0.05	0.05	−0.00	−0.01	0.00
	(0.39)	(0.35)	(0.18)	(0.79)	(0.82)	(0.99)	(0.18)	(0.34)	(0.11)	(0.99)	(0.81)	(0.93)	(0.18)	(0.34)	(0.12)	(0.99)	(0.80)	(0.93)

(*continued on next page*)

Table 8 (*continued*)

	Panel A: privatization progress						Panel B: privatization progress for IPOs and SIPs						Panel C: privatization progress for Regulated and Unregulated firms					
	(1) TVOL	(2) SVOL	(3) IVOL	(4) TVOL	(5) SVOL	(6) IVOL	(7) TVOL	(8) SVOL	(9) IVOL	(10) TVOL	(11) SVOL	(12) IVOL	(13) TVOL	(14) SVOL	(15) IVOL	(16) TVOL	(17) SVOL	(18) IVOL
Volatility of GDP	0.57	1.16	0.41	0.08	0.56	0.02	0.70	1.16	0.53	0.19	0.56	0.12	0.70	1.16	0.53	0.19	0.56	0.12
	(0.00)***	(0.00)***	(0.04)**	(0.69)	(0.10)*	(0.93)	(0.00)***	(0.00)***	(0.01)**	(0.35)	(0.10)	(0.56)	(0.00)***	(0.00)***	(0.01)**	(0.35)	(0.10)*	(0.56)
Intensity of liberalization	0.08	0.01	0.12	0.19	0.06	0.22	0.06	0.02	0.11	0.18	0.07	0.21	0.06	0.01	0.11	0.18	0.06	0.21
	(0.54)	(0.97)	(0.33)	(0.11)	(0.79)	(0.07)*	(0.65)	(0.93)	(0.41)	(0.14)	(0.76)	(0.09)*	(0.64)	(0.97)	(0.40)	(0.14)	(0.79)	(0.09)*
Product market concentration	0.04	0.07	0.02	0.03	0.06	0.02	0.04	0.07	0.02	0.03	0.06	0.02	0.04	0.07	0.02	0.03	0.06	0.02
	(0.04)**	(0.03)**	(0.24)	(0.03)**	(0.05)**	(0.20)	(0.03)**	(0.03)**	(0.18)	(0.03)**	(0.05)**	(0.17)	(0.03)**	(0.03)**	(0.18)	(0.03)**	(0.05)**	(0.16)
Total assets	−0.06	0.06	−0.08	−0.03	0.04	−0.04	−0.06	0.06	−0.08	−0.03	0.04	−0.04	−0.06	0.06	−0.08	−0.03	0.04	−0.04
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
PPE/assets	−0.19	−0.23	−0.19	−0.10	−0.15	−0.10	−0.19	−0.23	−0.19	−0.10	−0.15	−0.10	−0.19	−0.23	−0.19	−0.10	−0.15	−0.10
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
RD/assets	0.26	0.36	0.22	0.14	0.19	0.12	0.21	0.35	0.17	0.10	0.19	0.09	0.21	0.35	0.17	0.10	0.19	0.09
	(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.06)*	(0.00)***	(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.06)*	(0.00)***	(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.06)*	(0.00)***
Cash/assets	0.02	0.04	0.02	0.01	0.03	0.01	0.02	0.04	0.02	0.01	0.03	0.01	0.02	0.04	0.02	0.01	0.03	0.01
	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.01)**	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.01)**
Market-to-book	0.02	0.03	0.01	0.01	0.02	0.01	0.01	0.03	0.01	0.01	0.02	0.01	0.01	0.03	0.01	0.01	0.02	0.01
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Gross profit margin	−0.05	−0.05	−0.05	−0.03	−0.03	−0.04	−0.05	−0.05	−0.05	−0.03	−0.03	−0.03	−0.05	−0.05	−0.05	−0.03	−0.03	−0.03
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Leverage	0.32	0.05	0.35	0.22	0.06	0.24	0.33	0.04	0.36	0.23	0.06	0.25	0.33	0.05	0.36	0.23	0.06	0.25
	(0.00)***	(0.09)*	(0.00)***	(0.00)***	(0.01)***	(0.00)***	(0.00)***	(0.11)	(0.00)***	(0.00)***	(0.01)**	(0.00)***	(0.00)***	(0.10)*	(0.00)***	(0.00)***	(0.01)***	(0.00)***
Dividend dummy	−0.27	−0.29	−0.27	−0.14	−0.20	−0.15	−0.27	−0.29	−0.27	−0.14	−0.20	−0.15	−0.28	−0.29	−0.27	−0.15	−0.20	−0.15
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Constant	−2.42	−3.88	−2.65	−1.24	−2.92	−1.39	−2.56	−3.87	−2.71	−1.30	−2.92	−1.37	−2.56	−3.88	−2.71	−1.31	−2.93	−1.38
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Observations	78 058	78 058	78 058	65 052	65 052	65 052	78 058	78 058	78 058	65 052	65 052	65 052	78 058	78 058	78 058	65 052	65 052	65 052
Adjusted *R*-square	0.398	0.224	0.419	0.552	0.304	0.563	0.400	0.224	0.423	0.558	0.304	0.571	0.400	0.224	0.423	0.558	0.304	0.571

This table reports values from firm-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on progress of privatization variables, further including country, industry-, and firm-level control variables. All variables are defined in Table 1. All regressions include year fixed effects. Columns (1)–(3), (7)–(9), and (13)–(15) also include country and industry, effects. Panel A uses the original progress of privatization variable; Panel B disentangles the impact of privatization progress on initial public offering firms (IPO) and share issue privatization firms (SIP). Panel C compares the impact of privatization on regulated (REG) vs. unregulated (UNREG) industries. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.

** Reflects significance at 5% level.

*** Reflects significance at 1% level.

Table 9
Privatization and Volatility: change model regression.

	(1) Δ4.TVOL	(2) Δ4.SVOL	(3) Δ4.IVOL	(4) Δ4.TVOL	(5) Δ4.SVOL	(6) Δ4.IVOL
*Lag1.*Δ*4.*TVOL				0.59		
				(0.00)***		
*Lag1.*Δ*4.*TVOL					0.48	
					(0.00)***	
*Lag1.*Δ*4.*TVOL						0.60
						(0.00)***
Δ*4.*Privatization progress	−7.72	−7.54	−7.25	−5.47	−7.76	−4.69
	(0.02)**	(0.03)**	(0.05)**	(0.01)***	(0.00)***	(0.01)**
Δ*4.*Investor protection	0.01	0.02	0.01	0.00	0.01	0.00
	(0.04)**	(0.07)*	(0.05)*	(0.49)	(0.12)	(0.79)
Δ*4.*Stock capitalization/GDP	0.17	0.21	0.16	0.10	0.13	0.10
	(0.00)***	(0.01)***	(0.00)***	(0.00)***	(0.02)**	(0.00)***
Δ*4.*GDP per capita	−0.13	−0.25	−0.08	−0.03	−0.12	−0.02
	(0.14)	(0.02)**	(0.39)	(0.61)	(0.11)	(0.81)
Δ*4.*Volatility of GDP	0.46	0.81	0.41	−0.20	0.01	−0.19
	(0.07)*	(0.00)***	(0.13)	(0.19)	(0.97)	(0.24)
Δ*4.*Industry concentration	−0.23	0.12	-0.41	0.26	0.54	0.19
	(0.32)	(0.75)	(0.11)	(0.22)	(0.24)	(0.37)
Δ*4.*Firm concentration	0.19	0.16	0.26	0.34	0.57	0.28
	(0.24)	(0.43)	(0.17)	(0.00)***	(0.01)***	(0.07)*
Δ*4.*Intensity of liberalization	−0.34	−0.23	−0.41	−0.12	−0.02	−0.16
	(0.03)**	(0.30)	(0.02)**	(0.17)	(0.92)	(0.19)
Constant	−0.20	−0.33	−0.14	−0.03	−0.09	−0.03
	(0.02)**	(0.00)***	(0.09)*	(0.64)	(0.23)	(0.61)
Observations	530	530	530	483	483	483
Adjusted *R*-square	0.298	0.335	0.259	0.615	0.518	0.603

This table reports values from firm-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on progress of privatization and control variables. All variables are expressed in four-year differences (e.g. *Δ4.variable(i) = variable(i) – lag 4 of variable(i)*). All variables are defined in Table 1. All regressions include year fixed effects. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.

** Reflects significance at 5% level.

*** Reflects significance at 1% level.

proceeds to GDP (i.e., privatization intensity) and a measure of market sentiment, namely, the Chicago Board options exchange market volatility index, or VIX.[27] Both variables are valid instruments that strongly relate to the endogenous variable.[28] By construction, the lagged privatization intensity is related to privatization progress, since the latter is obtained by taking the temporal average of the former. The VIX, often referred to as "the market fear gauge" (see Baker and Wurgler, 2007), measures the implied volatility of options on Standard and Poor's 500 stock index. More specifically, it measures the market expectation of stock market volatility over the next month. Since a large number of share privatization issues involve foreign investors, we expect that a government's decision to privatize is affected by the hotness of foreign stock markets, particularly those in the United States.[29]

We begin by estimating Eq. (3) using two-stage least squares (2SLS) regressions. The first stage is devoted to a regression of privatization progress on lagged privatization intensity and the current VIX; the fitted values are used in the second stage along with control variables. The results, presented in Table 10, Panel A, support our findings above. In particular, we find that in comparison with Table 3, total and idiosyncratic volatility are now significant at the 5% level, while systematic volatility remains significant at the 1% level.[30] Overall, these results suggest that endogeneity issues do not drive the relation between privatization and volatility.[31]

In Panels B, we further investigate whether the results are affected by world as well as local market risks, as privatization could reflect overall world and/or local market sentiment about risk. To capture local market risk we use Jin and Myers' (2006) measure of local market variance, and to capture world risk we construct a measure of world return variance using the MSCI World return index.[32] The results show that the local market variance is positively related to systematic as well as idiosyncratic volatilities. The world variance does not seem to affect the relation between privatization and the systematic volatility measure. The inclusion of the local market variance slightly attenuates the magnitude of the coefficients on privatization progress, but does not affect the statistical significance. The inclusion of the past volatility measures in the regressions affects the privatization–volatility relation, which is now significant at 5% level for systematic volatility and only 10% level for idiosyncratic volatility. This analysis suggests that privatization progress is not merely a proxy for differences in market

[27] In unreported tests, we replace the US VIX by country-level or regional VIXs when available. We find similar results.

[28] We test the validity of our instruments by regressing the residuals of the second stage on the instruments. The results show that the instruments are jointly unrelated to the residuals (further, the robust score test of over-identifying restrictions does not reject the null hypothesis that the instruments are valid). The *F*-statistic of the first-stage regression is above 57.54 for all regressions (total, systematic, and idiosyncratic volatility), suggesting that the instruments are also strong.

[29] We obtain similar results if we take two lags of privatization intensity.

[30] The results for total volatility are similar to those of idiosyncratic volatility and not reported for the sake of brevity.

[31] In further unreported tests, we address the endogeneity issue through a dynamic panel model with fixed effects. We implement the system-GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). The system-GMM procedure exploits the level equations to derive additional moment conditions that supplement the usual Arellano and Bond type of orthogonality conditions. In addition to the moment conditions based on the level equations, we instrument privatization with four exogenous variables obtained from Bortolotti, Fantini, and Siniscalco (2003). However, these exogenous variables appear as weak instruments for privatization. Therefore, in another test, we have excluded them. Overall, privatization remains significantly and negatively related to volatility.

[32] We thank Geert Bekaert for suggesting this test.

Table 10
Instrumental variable regressions, market volatility, Fama–French and momentum factors.

	Panel A				Panel B				Panel C lagged CAPM factors				Panel D Fama–French and momentum			
	(1) SVOL	(2) IVOL	(3) SVOL	(4) IVOL	(5) SVOL	(6) IVOL	(7) SVOL	(8) IVOL	(9) SVOL	(10) IVOL	(11) SVOL	(12) IVOL	(13) SVOL	(14) IVOL	(15) SVOL	(16) IVOL
Lag1.SVOL			0.51				0.42				0.60				0.56	
			(0.00)***				(0.00)***				(0.00)***				(0.00)***	
Lag1.IVOL				0.63				0.60				0.64				0.63
				(0.00)***				(0.00)***				(0.00)***				(0.00)***
Privatization progress (*instrumented*)	−19.16	−16.79	−10.50	−7.05												
	(0.00)***	(0.04)**	(0.03)**	(0.02)**												
Privatization progress					−7.09	−7.85	−4.32	−3.14	−13.76	−9.65	−7.43	−8.10	−12.52	−9.11	−9.78	−9.42
					(0.00)***	(0.00)***	(0.04)**	(0.06)*	(0.00)***	(0.01)**	(0.02)**	(0.01)***	(0.00)***	(0.03)**	(0.01)***	(0.03)**
Investor protection	0.01	0.01	0.00	0.00	0.01	0.01	-0.00	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.00
	(0.14)	(0.01)**	(0.80)	(0.25)	(0.41)	(0.02)**	(0.74)	(0.10)*	(0.31)	(0.00)***	(0.58)	(0.09)*	(0.12)	(0.02)**	(0.33)	(0.48)
Stock capitalization/GDP	0.27	0.24	0.15	0.12	0.23	0.20	0.11	0.11	0.25	0.21	0.10	0.11	0.24	0.20	0.11	0.12
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.00)***
GDP per capita	−0.34	−0.10	−0.14	−0.09	−0.32	−0.07	−0.09	0.05	−0.29	−0.11	−0.09	0.00	−0.29	−0.08	−0.09	0.11
	(0.00)***	(0.22)	(0.01)***	(0.06)*	(0.00)***	(0.39)	(0.12)	(0.47)	(0.00)***	(0.14)	(0.06)*	(0.99)	(0.00)***	(0.49)	(0.06)*	(0.47)
Volatility of GDP	1.11	0.64	0.18	−0.11	0.41	0.50	0.06	−0.04	0.76	0.60	0.08	−0.07	0.69	0.71	0.09	0.08
	(0.00)***	(0.00)***	(0.39)	(0.39)	(0.16)	(0.01)***	(0.77)	(0.77)	(0.01)***	(0.00)***	(0.66)	(0.63)	(0.01)**	(0.00)***	(0.64)	(0.65)
Industry concentration	0.44	−0.37	0.22	−0.04	−0.19	−0.44	0.13	−0.31	−0.51	−0.35	0.15	−0.14	−0.53	−0.66	0.02	0.07
	(0.12)	(0.10)	(0.46)	(0.86)	(0.45)	(0.04)**	(0.69)	(0.20)	(0.07)*	(0.25)	(0.58)	(0.45)	(0.01)**	(0.02)**	(0.94)	(0.76)
Firm concentration	1.08	0.36	0.86	0.01	0.97	0.18	0.72	0.36	1.15	0.58	0.65	0.59	1.09	0.82	0.70	0.70
	(0.00)***	(0.30)	(0.00)***	(0.96)	(0.00)***	(0.51)	(0.06)*	(0.12)	(0.00)***	(0.09)*	(0.01)**	(0.00)***	(0.00)***	(0.03)**	(0.01)***	(0.02)**
Intensity of liberalization	0.16	0.09	0.02	−0.06	0.12	0.07	−0.06	−0.15	−0.01	0.12	−0.03	0.01	0.02	0.27	0.01	−0.08
	(0.22)	(0.34)	(0.84)	(0.53)	(0.36)	(0.42)	(0.59)	(0.22)	(0.94)	(0.16)	(0.74)	(0.89)	(0.84)	(0.14)	(0.88)	(0.42)
World return variance					1.35	4.22	−0.12	0.81								
					(0.23)	(0.00)***	(0.78)	(0.05)*								
Local market return variance					0.81	0.19	0.12	0.03								
					(0.00)***	(0.00)***	(0.00)***	(0.00)***								
Constant	0.79	−0.75			0.35	−1.14	−0.38	−1.66	−0.68	−1.98	−0.58	−1.26	−0.81	−2.53	−0.70	−2.03
	(0.17)	(0.28)			(0.63)	(0.19)	(0.63)	(0.09)*	(0.16)	(0.00)***	(0.10)*	(0.01)***	(0.09)*	(0.02)**	(0.06)*	(0.13)
Observations	671	671	671	671	718	718	671	671	718	718	671	671	718	718	671	671
Adjusted *R*-square	0.727	0.633	0.805	0.810	0.764	0.630	0.834	0.800	0.756	0.634	0.851	0.815	0.754	0.576	0.843	0.720

This table addresses the potential endogeneity in Panel A via 2SLS of privatization progress using two instruments: the lag of the intensity of privatization and the market volatility index (VIX), which measures the US market sentiment and thus accounts for the timing of privatization sales. Panels B controls for the impact of World and local market return variances. In Panels C and D we use two augmented CAPM, Fama–French and momentum factors, respectively, to calculate systematic and idiosyncratic volatility measures. The control variables are defined in Table 1. All regressions include year fixed effects. Regressions in columns (1), (2), (5), (6), (9), (10), and (13), (14) include country-fixed effects. Standard errors are clustered by country; numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.
** Reflects significance at 5% level.
*** Reflects significance at 1% level.

risk, and that it is the resolution of policy uncertainty that drives the results.

6.2. The choice of the market model

In this section we investigate whether our findings are driven by the choice of the market model that was used to compute volatility measures. We again focus on systematic and idiosyncratic volatilities as total volatility does not vary with market models (see Eq. (1)).

6.2.1. The CAPM models

Betas' estimates can severely be biased if stocks do not trade frequently (Dimson, 1979). To solve this problem, we follow Jin and Myers (2006) by adding to Eq. (2) two leads and two lags for local and world market return indices to control for such non-synchronous trading. We run the following international market model,

$$r_{ijt} = \alpha_i + \beta_{1,i} r_{j,t} + \beta_{2,i} r_{world,t} + \beta_{3,i} r_{j,t-1} + \beta_{4,i} r_{world,t-1} + \beta_{5,i} r_{j,t+1} + \beta_{6,i} r_{world,t+1} + \beta_{7,i} r_{j,t-2} + \beta_{8,i} r_{world,t-2} + \beta_{9,i} r_{j,t+2} + \beta_{10,i} r_{world,t+2} + e_{it}, \quad (4)$$

With systematic and idiosyncratic volatilities computed from Eq. (4), the coefficients on privatization from regression model (3) are negative and significant (see the results in Panel C of Table 9). Further, regressions analogue to those in Table 5 show that the measure of privatization progress is associated with lower political risk measures whose predicted values are negatively related to systematic and idiosyncratic volatilities.

6.2.2. The Fama–French and momentum factors

Next, we use a different version of Eq. (4) to decompose total volatility into systematic and idiosyncratic volatilities. Specifically, we use the risk factors as proposed by Fama and French (1993) and Cahart (1997). Following Bartram, Brown and Stulz (2012), the international market model is as follows,[33]

$$r_{ijt} = \alpha_i + \beta_{1,i} r_{j,t} + \beta_{2,i} r_{j,t-1} + \beta_{3,i} r_{j,t+1} + \beta_{4,i} r_{world,t} + \beta_{5,i} r_{kSMB,t} + \beta_{6,i} r_{kHML,t} + \beta_{7,i} r_{kMOM,t} + \beta_{8,i} r_{wSMB,t} + \beta_{9,i} r_{wHML,t} + \beta_{10,i} r_{wMOM,t} + e_{it}, \quad (5)$$

Like in Eqs. (2) and (4), r_{ijt} is the week t return for stock i in country j, r_{jt} is the week t market return index for country j, and $r_{world,\,t}$ is the week t world index. We include one lag and one lead of weekly country j's returns to control for infrequent trading. Small-minus-big (SMB), high-minus-low (HML) and one-year momentum (MOM) factors are constructed for each region k and at the global level w.[34] The use of regions helps reduce the bias that could occur in several countries where only few stocks with relevant returns or financial data are available to construct the factors. The results in panel D of Table 10 support those in Table 5.

Overall, the use of other market model specifications does not invalidate the findings that credible privatization is associated with lower equity market volatility.

6.3. Other robustness tests

To ensure that our findings are not affected by the omitted variables, we consider several additional control variables. In Table 11 we present results for systematic and idiosyncratic volatility only, since total volatility results are similar to those for idiosyncratic volatility. In Panel A we control for market liquidity. Market liquidity could be a proxy for noise trading (see Baker and Wurgler, 2007; Bloomfield, O' Hara, and Saar, 2009). Noise traders usually react in the same direction as news. De Long, Shleifer, Summers, and Waldmann (1990) claim that a larger proportion of noise traders relative to informed traders could trigger higher systematic volatility. We measure market liquidity using stock market turnover, defined as the ratio of a country's annual trading volume to the total number of shares outstanding.

We also control for the synchronicity of firms' fundamentals, because a market's systematic volatility may be high if firms' fundamentals move together. This could be the case if conglomerates comprise a large proportion of listed firms in the country, if ownership is intercorporate (via cross-shareholdings or pyramids), or if related firms are involved in intercorporate transactions (Morck et al., 2000). Following Morck et al. (2000), we measure the synchronicity of firm-level fundamentals using the earnings co-movement index. To construct this measure, we first regress firm-level ROA (return on assets) on the weighted-average ROA in a country:

$$ROA_{i,j,t} = \alpha_i + \beta_i ROA_{j,t} + e_{it}, \quad (6)$$

where i, j, and t index the firm, country, and time period, respectively. For each period, the regression is run over the five-year window ($t-4$, t). We then obtain earnings co-movement by taking the weighted average of firms' R-squares from regression (6):

$$Earnings\ co-movement\ index_j = \sum_i R^2_{ij}(ROA) \times SST_{ij}(ROA) \Big/ \sum_i SST_{ij}(ROA) \quad (7)$$

Finally, we control for innovation. The literature suggests that the effect of innovation varies across firms (Kogan, Papanikolaou, and Stoffman, 2013). Indeed, Bartram et al. (2012) argue that innovation increases firm-specific risk by creating both winners and losers. We would therefore expect innovation to be associated with volatility, particularly its idiosyncratic component. To capture innovation we use the country average of research and development to sales (R&D).

We include all the additional control variables above in the regression. We are not concerned about potential multicollinearity as the objective is to isolate the impact of privatization on volatility. We find that while this specification affects the coefficients on some variables, it does not qualitatively change our previous findings. In particular, stock market turnover and R&D are not statistically significant when controlling for past volatilities. Importantly, however, the inclusion of these variables does not affect the importance of privatization progress for volatility.

In Panel B, Table 11, we use an alternative measure for property rights protection. In particular, we use the *good government index* of Morck et al. (2000), which covers other aspects of investor protection than our earlier measures, such as corruption, contract repudiation, and government expropriation. The authors argue that countries with weak property rights protection may have synchronous stock prices. Since higher values of the *good government index* indicate property rights protection, we expect this index to be associated with lower systematic volatility. Because the index was discontinued in 1997, the values of *good government index* are fixed over the study period. As a consequence, we cannot run fixed effects regressions. We therefore perform Fama–MacBeth regressions. Following Jin and Myers (2006), we correct the Fama–MacBeth standard errors for serial correlation of the year-by-year regression coefficients. We obtain values of the *good government index* from Jin and Myers (2006). This index is not available for seven

[33] Bartram, Brown and Stulz (2012) do not have a momentum factor in their international market model. However, we find similar results when we exclude this factor from the model.

[34] We identify the regions using the World Bank classification: East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, North America, South Asia, Sub-Saharan Africa.

Table 11
Additional control variables.

	Panel A: OLS with country fixed effects				Panel B: Fama–McBeth regressions			
	(1) SVOL	(2) IVOL	(3) SVOL	(4) IVOL	(5) SVOL	(6) IVOL	(7) SVOL	(8) IVOL
Lag1.SVOL			0.48					
			(0.00)***					
Lag1.IVOL				0.65				
				(0.00)***				
Privatization progress	−12.07	−10.00	−8.89	−6.57	−11.00	−7.75	−11.02	−7.64
	(0.00)***	(0.00)***	(0.04)**	(0.03)**	(0.01)***	(0.02)**	(0.00)***	(0.05)**
Investor protection	0.01	0.02	0.01	0.01	−0.00	0.01	−0.00	0.01
	(0.06)*	(0.00)***	(0.42)	(0.10)*	(0.53)	(0.01)**	(0.83)	(0.01)**
Good government index					−0.02	−0.01	−0.03	−0.02
					(0.03)**	(0.46)	(0.01)***	(0.12)
Stock capitalization/GDP	0.24	0.19	0.15	0.13	0.08	−0.07	0.08	−0.00
	(0.00)***	(0.00)***	(0.01)***	(0.00)***	(0.15)	(0.37)	(0.29)	(1.00)
GDP per capita	−0.37	−0.10	−0.16	−0.01	0.00	−0.06	−0.04	−0.09
	(0.00)***	(0.23)	(0.01)**	(0.78)	(0.98)	(0.08)*	(0.39)	(0.12)
Volatility of GDP	1.22	0.66	0.43	0.03	1.73	0.94	1.51	1.28
	(0.00)***	(0.00)***	(0.08)*	(0.84)	(0.00)***	(0.01)***	(0.01)***	(0.00)***
Industry concentration	0.15	−0.18	0.00	−0.28	0.23	−0.25	0.39	−0.38
	(0.74)	(0.55)	(1.00)	(0.26)	(0.64)	(0.00)***	(0.42)	(0.00)***
Firm concentration	1.25	0.20	0.96	0.41	0.29	0.06	−0.09	−0.43
	(0.00)***	(0.45)	(0.00)***	(0.06)*	(0.68)	(0.84)	(0.90)	(0.40)
Intensity of liberalization	0.12	0.26	−0.04	−0.00	−0.27	−0.05	0.07	0.00
	(0.48)	(0.01)**	(0.77)	(0.98)	(0.13)	(0.65)	(0.66)	(0.99)
Stock market turnover	0.09	0.06	0.05	0.02			0.13	−0.04
	(0.02)**	(0.05)**	(0.19)	(0.45)			(0.08)*	(0.23)
Earnings co-movement index	0.14	0.03	0.14	0.01			0.28	0.17
	(0.05)*	(0.54)	(0.02)**	(0.87)			(0.21)	(0.13)
Research and development	0.24	0.08	0.11	0.07			0.03	0.13
	(0.00)***	(0.18)	(0.12)	(0.13)			(0.73)	(0.12)
Constant	1.28	0.09	0.25	−0.19	−1.20	−0.24	−1.18	0.13
	(0.01)**	(0.91)	(0.60)	(0.55)	(0.00)***	(0.29)	(0.00)***	(0.72)
Observations	666	666	619	619	612	612	583	583
Adjusted *R*-square	0.752	0.642	0.812	0.796	0.323	0.103	0.374	0.158

This table reports values from country-level regressions of the logarithm of either total volatility (TVOL), systematic volatility (SVOL), or idiosyncratic volatility (IVOL) on privatization progress, further including control variables. All variables are defined in Table 1. Panel A controls for stock market turnover, earnings co-movement, and research and development. Panel B controls for the good government index (a measure of property rights). Regressions in Panel A are OLS with year fixed effects, country-fixed effects (only in columns (1) and (2)), and with standard errors clustered by country. Regressions in Panels B use the Fama–McBeth method with Newey–West correction for serial correlation of the year-by-year coefficients. Numbers in parentheses are *p*-Values.

* Reflects significance at 10% level.
** Reflects significance at 5% level.
*** Reflects significance at 1% level.

developing countries and one developed country in our sample. We find that the *good government index* is negatively related only to systematic volatility. More importantly, inclusion of this variable does not affect the impact of privatization progress on systematic or idiosyncratic volatility.

In Panel B we find that inclusion of all additional variables in the Fama–MacBeth regression does not change our results. Further robustness tests (VIF; unreported) reveal that GDP per capita and the intensity of liberalization may cause multicolinearity problems. However, when we drop one or both of these variables, our results remain qualitatively similar to those in previous tables.[35] Further, like in Section 5.3, we control for a country's political orientation as left wing governments are less likely to privatize than right wing governments (Bortolotti et al., 2003). We obtain data on political orientation from the World Bank Database of Political Institutions (see also Beck et al., 2001). We find that controlling for political orientation does not change the main findings (unreported).

7. Conclusion

In this paper we investigate whether market-oriented reforms such as privatization affect stock return volatility. The literature suggests that privatization reforms that are maintained over time increase investor confidence and gradually resolve political risk (in particular, policy reversal risk), reducing volatility. We document that privatization progress (i.e., the sustainability of the privatization program) is associated with lower systematic as well as idiosyncratic volatility. Further, we show that privatization affects volatility through its impact on political risk. Indeed, we find that the component of political risk explained by privatization progress reduces systematic and idiosyncratic volatility.

We also find that the level of economic development influences the privatization–volatility relation. In particular, the decrease in volatility associated with privatization progress is more pronounced in developing countries. This is not surprising, as it is well known that emerging stock markets exhibit higher volatility and greater reaction to political risk than developed markets. Further, in developing countries the systematic component explains most of the decline in volatility, while in developed countries the volatility effect stems largely from the idiosyncratic component.

With respect to the method of privatization, we find that privatization via the stock market greatly reduces systematic and idiosyncratic volatility, while privatization via the private sector only slightly reduces systematic volatility. Finally, we show that the risk of government policy reversal does not affect firms equally. Specifically, increased privatization progress generally

[35] Unreported results are available from the authors upon request.

reduces the volatility of all public firms but the reduction is greater for privatized firms.

Our findings have several implications. First, by reducing policy uncertainty (and thus systematic volatility), maintaining a privatization program over time should increase the level of investment in a country. Second, from an investor's perspective, credible privatization reduces idiosyncratic risk and in turn the number of stocks an investor needs to hold to hedge against this risk (Campbell et al., 2001). Finally, investor confidence-building through credible share issue privatization and, more generally, reliable government policies should enhance stock market development. In summary, our findings suggest that governments that develop and implement privatization programs should commit to these programs over time to foster investor confidence.

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