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A Global Look into Corporate Cash after the Global Financial Crisis

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A Global Look into Corporate Cash after the Global Financial Crisis

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Abstract

This article investigates the determinants of cash holdings by publicly-traded firms for 20 advanced and emerging countries over the last decade, with a focus on ratios of the firms' aggregate cash to their total assets. Panel-data regressions find that higher cash ratios were associated with fewer non-cash current assets, smaller costs of carry, larger contemporaneous cash inflows, fewer interest-bearing liabilities, greater expected investment opportunities, including research and development projects, greater uncertainty, and the state of corporate governance. Regarding the last result, higher cash ratios were associated with managers with worse ethical behavior, lower accountability to investors and board members, weaker investor protection, harsher auditing and reporting standards, and greater potential to face holdup problems by lending banks. The agency motive was greater than the precautionary and transaction-costs motives in terms of marginal impact while being limited in terms of explanatory power over total variation in the cash ratios.

Keywords: Corporate finance; Cash holdings; Precautionary saving motive; Corporate governance; Agency problem.

JEL classification: C23, E41, G32, G34, H32

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1. Introduction

Why do firms hold more cash than they used to? This question has provided financial economists with suitable opportunities to develop theories and test their predictions. To add to the literature, I attempt to provide global evidence for the relevance of corporate governance to corporate cash holdings since the subprime loan crisis in 2007 and the subsequent collapse of Lehman Brothers in 2008. To do so, I improve the coverage of sample countries and years compared to existing studies, as well as expand the variety of factors reflecting the state of corporate governance, while abstracting from firm-level heterogeneity by focusing on firms' cash-to-assets ratios (CARs) at an aggregate level. This abstraction enables me to use institutional indicators for country-specific levels of corporate governance to examine their relevance to country-specific CARs from a global perspective.

Managers hoard money in preparation of financing needs in the future insofar as they have poor access to bank loans and the corporate bond market. Such a precautionary motive is caused by asymmetric information (Myers and Majluf, 1984; Almeida, Campello, and Weisbach, 2004). Under asymmetric information, publicly-traded companies should have lower CARs because, presumably, they are informationally transparent and have better access to outside debt. As publicly-traded companies tend to be large, they may enjoy economies of scale in managing transaction costs that are attributable to market imperfections and involved in converting non-cash assets into cash for payment; that is, publicly-traded companies are in an advantageous position of saving cash reserves (Miller and Orr, 1966; Mulligan, 1997). Although these companies can be supposed not to have strong precautionary and transaction-costs motives to hold cash, they have increased their CARs in recent years in a number of countries, including the three largest economies – the United States (U.S.), China, and Japan. Furthermore, they continued to do so even long after the turmoil and subsequent depression caused by the global financial crisis ended.

Burgeoning corporate cash balances have also drawn much attention from the popular press as well as skepticism from workers, shareholders, and policy makers who regard a large part of these cash holdings as inefficient or idle, with negative implications for the national macro economy through excessive money demand, under-investment, and low payments to shareholders and workers. In fact, how to encourage large companies to spend their growing profits on increasing business investments and wage payments rather than stockpiling them as cash reserves was one of the central campaign issues in the Japanese general election of October 2017.[1] It is thus obviously important to understand the drivers of aggregate cash holdings.

I take a global look into the importance of this phenomenon by investigating the driving forces behind publicly-traded companies' CARs for 20 advanced and emerging countries over the period 2007–2017. The focus on CARs at an aggregate level across countries differentiates this investigation from previous studies, which generally share an approach of using firm-level data for a specific country, especially the U.S.

A recent seminal study using this approach is Bates, Kahle, and Stulz (2009), who analyze individual listed firms' CARs in the U.S. over the period 1980–2006. They find that the increase in CARs is associated with a decrease in inventories and receivables, an increase in cash flow volatility, and an increased need to execute research and development (R&D) projects. The first association represents substitution between cash and non-cash current assets while the last two are in line with the above-mentioned precautionary motive. They argue that this motive has an important role in explaining the increase in CARs. In spite of Jensen's (1986) argument that the level of cash holdings can be affected by the conflict between shareholders and managers, they do not investigate directly whether or not proxies for the agency motive are related to CARs.[2]

A similar approach is employed for Japanese firm-level CARs by Hori, Ando, and Saito (2010) and Hosono, Miyakawa, and Takizawa (2019). Both of these studies place little focus on the agency motive. Hosono, Miyakawa, and Takizawa (2019), specifically, analyze Japanese firm-level data covering around 400,000 firms, including unlisted small companies, over the period 1994–2016.[3] They report that firms with better financial positions and business

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[1] For example, Asahi Shimbun, one of the five nation-wide newspapers in Japan, argued in an editorial on 7 September 2017 that 210 trillion yen of cash held by Japanese companies as of March 2017 needed to be reduced by raising wages, so as to promote private consumption. In the 2017 election, the Party of Hope, a newly-created opposition party, promoted a similar way of thinking and promised to tax firms' retained profits. The party captured 50 seats and became the second largest opposition party.

[2] Bates, Kahle, and Stulz (2009) conduct three indirect tests to evaluate whether the agency motive can explain increases in CARs in their sample, and conclude that there is no consistent evidence that the agency motive affects CARs. One of their tests abstracts from firm-level heterogeneity and shows that the average CAR tends to be smaller for companies with greater managerial entrenchment, contrary to what the agency motive suggests.

[3] Hori, Ando, and Saito (2010) analyze firm-level CARs of Japanese listed firms over the period 1982–2005. Over the periods 1986–1990 and 2001–2006, when CARs at an aggregate level were on an upward trend, stable determinants of CARs for both manufacturing and non-manufacturing firms included the size of receivables and the size of investments. It appears that, during these periods, cash was a substitute for the former while being the cheapest funding source for the latter.

conditions tended to have larger cash holdings while the precautionary motive was also effective, and stress that motives behind corporate cash holdings are heterogeneous among sample companies.

From the perspective of investigating the determinants of time-series CARs at an aggregate level, this article is related to Graham and Leary (G&L, 2018). They do so for U.S. listed companies over the period 1926–2014. They find that listed firms' CARs were explained well by (i) characteristics of corporate balance sheets, (ii) macroeconomic proxies for investment opportunities, and (iii) the size of contemporaneous cash inflows and investment expenditures, the last of which had the most explanatory power.[4] Their findings are consistent with the precautionary and transaction-costs motives to hold cash. Nevertheless, they do not consider the relevance of the agency motive for U.S. CARs at an aggregate level.

From the perspective of investigating the relevance of the agency motive for CARs, this article is related to Harford, Mansi, and Maxwell (2008), Dittmar, Mahrt-Smith, and Servaes (2003), and Ferreira and Vilela (2004). All of these studies analyze firm-level CARs. They tend to have limited coverage of sample countries and years as well as only a few corporate governance factors, possibly because it is practically difficult to collect data and compute the same indicators for the state of corporate governance of a huge number of individual companies. Harford, Mansi, and Maxwell (2008) examine the relevance of the agency motive for U.S. firm-level CARs only and for just seven years at irregular intervals over the period 1990–2004. They find that U.S. listed firms with weaker corporate governance tended to have larger cash reserves, by considering two corporate governance factors: insider ownership and shareholder rights. Dittmar, Mahrt-Smith, and Servaes (2003) examine the agency motive behind corporate cash holdings at a global level using firm-level data covering listed companies in no less than 45 countries. However, they do so for 1998 only. They consider two corporate governance factors: the strength of shareholder protection and the depth of indirect debt finance. They agree with the common conjecture that investors with less shareholder protection are less able to force managers to disgorge excessive cash. Ferreira and Vilela (2004) come to a similar conclusion by analyzing firm-level data in European Economic and Monetary Union countries over the period 1987–2000.

[4] They also find that the large increase in CARs since 2000 reflected increasing foreign cash holdings in order to avoid repatriation taxes.

Abstracting from firm-level heterogeneity by focusing on CARs at an aggregate level enables me to look at 20 countries in the last ten years and to use six types of institutional indicators for country-specific levels of corporate governance. To my knowledge, this article is the first to provide global evidence on the relevance of the agency motive for country-specific CARs by conducting international panel-data regressions.

In line with the above-mentioned existing studies, I bring forward global evidence to show that the levels of country-specific CARs have been associated with not only the precautionary and transaction-costs motives, but also with the agency motive. On the first two motives, higher national CARs have been associated over the last decade with (i) fewer non-cash current assets, (ii) a smaller cost of carry, (iii) larger contemporaneous cash inflows, (iv) fewer interest-bearing liabilities, (v) greater expected investment opportunities, and (vi) greater uncertainty. Larger contemporaneous cash inflows relate to the transaction-costs motive, fewer interest-bearing liabilities can relate to both the precautionary and agency motives, and greater expected investment opportunities and greater uncertainty relate to the precautionary motive.

My findings also support G&L's (2018) argument at a global level – that macroeconomic indicators are more important explanatory variables than firm-characteristic indicators for U.S. CARs. Important macroeconomic indicators are related to the level of productivity and the sizes of contemporaneous corporate profits and investments in the case of G&L (2018) while being related to the cost of carry, expenditure on R&D projects, business climate, and stock return volatility in my case. In both cases, these indicators represent either the precautionary motive or the transaction-costs motive.

My new findings on the relevance of the agency motive for national CARs are the following. First, the impact of this motive was greater than the other two while having limited explanatory power over the total variation in national CARs. Second, I use six indicators for corporate governance to illustrate the global relevance of the agency motive for national CARs. Higher CARs are associated with managers with (i) worse business ethics, (ii) lower accountability to investors and board members, (iii) weaker investor protection, (iv) harsher auditing and reporting standards, and (v) greater potential of facing holdup problems by lending banks. All of these associations, except for the third, refer to corporate governance factors which the literature has not examined very much yet in relation to CARs. Last, the agency motive is interacted with the other motives. That is, the first three factors make managers less sensitive to the precautionary and transaction-costs motives.

I also report that national CARs were on an upward trend in a majority of the sample countries over the last decade. The U.S. CAR reached 15–20 per cent, a level also achieved by Chinese and Japanese CARs. My international panel-data regression shows that all of the motives mentioned above explained the annual changes in national CARs, and that the most dominant driver was the reduction in interest-bearing liabilities over total assets. What this implies is unclear since it can be related to both the precautionary and agency motives.

This article proceeds as follows. Section 2 shows how large the cash holdings of publicly-traded companies have been in the 20 sample countries over the last decade, after giving a brief account of the data used. Section 3 constructs a panel-data regression model. Section 4 shows the result of estimating the baseline model, checks its robustness in four ways, and makes four extensions. Section 5 concludes with future research suggestions.

2. Data

I use an unbalanced panel dataset covering 20 advanced and emerging countries. In alphabetical order, these countries are Australia (AUS), Canada (CAN), China (CHN), Finland (FIN), France (FRA), Germany (DEU), Hong Kong (HKG), Indonesia (IDN), Ireland (IRL), Italy (ITA), Japan (JPN), Norway (NOR), Portugal (PRT), South Africa (ZAF), South Korea (KOR), Spain (ESP), Sweden (SWE), Thailand (THA), the United Kingdom (GBR), and the United States (USA).[5] The frequency of data is annual.

My dataset can be grouped into two. The first group is composed of country-specific indicators for the state of corporate finance. In addition to relevant macroeconomic variables, I gather corporate financial indicators for listed companies, which are at an aggregate level and scaled by total assets. I calculate these indicators from original indicators calculated by Bloomberg with respect to national stock market indices and their subcomponent indices by industry type. According to Bloomberg, stock market indices with such sub-indices exist only in the 20 sample countries used in this study. Following convention in the literature, I do not consider banking and finance, real estate, and regulated businesses, the last of which includes

[5] The sum of these sample countries' Gross Domestic Products (GDPs) accounted for 71 per cent of world GDP quoted in current U.S. dollars in 2017.

utilities and telecommunication industries. I also exclude industry sub-indices with limited historical data or with disconnected data. I synthesize each country's market-wide stock index consisting of every other sub-index. I construct indicators for corporate finance by dividing "per-share" values by "per-share" total assets for all of the sub-indices. A specific corporate financial indicator (e.g., CAR) for a country's synthesized stock index is defined as the market capitalization weighted average of member industries' indicators (e.g., their industry-level CARs). Appendix A shows the names of national market indices used, the numbers of industry sub-indices by country, and the number of companies aggregated, the last of which increased from 3,827 in 2003 to 5,604 in 2018. Appendix B explains all corporate finance indicators.

The other group consists of country-specific institutional indicators of the state of corporate governance, all of which are detailed in Appendix B. The factors considered include the level of managers' ethical behavior, the accountability of managers to investors and board members, the strength of investor protection, the strength of auditing and reporting standards, and the development of debt finance. All factors, except for the last one, are based upon grades made through corporate questionnaire studies or expert appraisals, taken from Trade and Competitiveness Data 360, managed by the World Bank Group. The grades take specific ranges in which the minimum and maximum mean the worst and best status of corporate governance. I extend the selection of corporate governance indicators by Dittmar, Mahrt-Smith, and Servaes (2003) who consider only two factors: the strength of investor protection and the development of banking. To gauge the development of debt finance, I use commonly used proxies for countries' financial depth, taken from databases of international organizations.

Figure 1 plots the aggregate-level CARs defined as the ratio of aggregate cash and cash equivalents to total assets for publicly-traded non-financial lightly-regulated companies in 20 countries over the period 2003–2018. Four observations arise. First, the level of CARs differs by country. Second, the time-series variation looks broadly similar across countries; in many countries, CARs dropped in 2007 or 2008 and increased thereafter. This can be said to a global average CAR – the average of national CARs. Third, the global average CAR and a majority of national CARs seem to have upward trends. National CARs appear to have no trends for CAN, IDN, and ZAF while having a downward trend for SWE. Last, national CARs were very high over the last five years in the U.S., China, and Japan, reaching 15–20 per cent.

3. A Model of Cash Holdings

To construct a panel-data regression model, I refer to G&L (2018) to control for the state of corporate finance while adding a number of regressors to control for the state of corporate governance. My baseline regression equation is:

$$
\begin{aligned}
CAR_{i,\tau} = {} & h_0 + h_1 TT + h_2 TT^2 + h_3 TT^3 + IE_i + \varepsilon_{i,\tau} \\
& + h_4 Unce1_{i,\tau} + h_5 INVE\_Op1_{i,\tau} + h_6 RTA_{i,\tau} + h_7 CF\_Av_{i,\tau} + h_8 INVE\_Av_{i,\tau} \\
& + h_9 IBL_{i,\tau} + h_{10} CA_{i,\tau-1} + h_{11} CL_{i,\tau} + h_{12} CF_{i,\tau} + h_{13} INVE_{i,\tau} \\
& + h_{14} CC1_{i,\tau} + h_{15} CC2_{i,\tau} + h_{16} Unce2_{i,\tau} + h_{17} Unce3_{i,\tau} + h_{18} INVE\_Op2_{i,\tau} + h_{19} INVE\_Op3_{i,\tau} \\
& + h_{20} CG1_{i,\tau} + h_{21} CG2_{i,\tau} + h_{22} CG3_{i,\tau} + h_{23} CG4_{i,\tau} + h_{24} CG5_{i,\tau} + h_{25} CG6_{i,\tau}, \qquad (1)
\end{aligned}
$$

where *CAR* is the national *CAR* defined above, i stands for an individual sample country, τ stands for the year, hs are coefficients, *TT* is a time-trend, *IE* stands for country i's individual effect, and ε is the residual. Notes are as follows. First, following G&L (2018), I add as regressors TT, TT^2, and TT^3 so as to hedge the risk of a spurious regression generated by the fact that aggregate level-variables tend to be persistent over time. Second, *IE* is heterogeneity attributable to omitted variables and unobservable factors.[6] Third, depending on the nature of *IE*, Eq. (1) can take one of three potential forms: a pooling model represented by dropping *IE* from Eq. (1); a fixed-effects model, in which *IE* is a country-specific constant; and, a random-effects model, in which *IE* is a country-specific stochastic variable.[7] Last, I ignore time effects common to all sample countries (is) in individual sample years (τs) so as to both preserve space and improve the degree of freedom. I will return to verification of this point later.

I follow G&L (2018) in selecting the 16 regressors in the second, third, and fourth lines of Eq. (1). These are related mainly to the precautionary and transaction-costs motives to hold cash. The regressors that are stock variables are year-end values.

The 10 regressors in the second and third lines are corporate financial indicators, all of which are ratios to total assets, except for *RTA*. *Unce1* is a proxy for the uncertainty of future financing needs, represented by the volatility of cash flows, and is calculated as the standard deviation of

[6] One omitted variable could be country-specific industrial structure; that is, the degree of dominance of industries that need to hoard large amounts of cash differs by country. Such differences are assumed to be included in *IE*.

[7] When either a fixed-effects model or a random-effects model is selected, four potential characteristics of the residuals (ε) need to be addressed to obtain asymptotically consistent estimates ($\hat{h}$s). These four characteristics are cross-section heteroscedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation. These can reduce the reliability of t-tests of the estimates.

cash flows for the three years from τ–3 to τ–1. Cash flows are calculated as net income minus expected dividends, where expected dividends at τ are assumed to be the same as those at τ–1. Because volatile cash flows may increase the precautionary motive, then estimate $\hat{h}_4$ should be positive, as G&L (2018) find for U.S. firms' aggregate-level CARs.

INVE_Op1 is the so-called average q, calculated by dividing the market value of assets by the book value of total assets. The market value of assets is the sum of market capitalization and the book value of total liabilities. The average q is a common representation of investment opportunities evaluated in the stock market. If the precautionary motive is strong, then estimate $\hat{h}_5$ should be positive, as in G&L (2018).

RTA is the per-company average of total real assets. I adjust for domestic inflation and convert the figures to U.S. dollars for international comparability. If there are economies of scale in cash management, as predicted by the transaction-costs motive, then estimate $\hat{h}_6$ should be negative, as in G&L (2018).

CF_Av is the average of cash flow for the three years from τ–3 to τ–1. When one regards it as a projection of cash flows for τ, a larger value signals a weaker precautionary motive; therefore, estimate $\hat{h}_7$ should be negative. In G&L (2018), however, an estimate for *CF_Av* is statistically significantly positive, implying an intuitive result: profitable companies are cash-rich.

INVE_Av is the average of investment expenditures for the three years from τ–3 to τ–1. When one regards it as a projection of investment expenditures for τ, then a larger value signals a greater precautionary motive; therefore, estimate $\hat{h}_8$ should be positive. In G&L (2018), however, estimate $\hat{h}_8$ is statistically insignificant. A negative $\hat{h}_8$, instead, would imply that managers who are keen to make business investments hold less cash. This sounds reasonable not only because internal funds are disposable for the managers but also because converting non-cash assets into cash to cover investment expenditures involves transaction costs.

IBL is interest-bearing liabilities. As argued by Ferreira and Vilea (2004), more highly leveraged firms are likely to increase their cash reserves because they run greater risks of default due to the pressure caused by rigid amortization plans on firms' cash management. If this is the case, then estimate $\hat{h}_9$ should be positive. G&L (2018), alternatively, infer that firms with better access to outside debt tend to have less precautionary motive to hold cash. If this reasoning is the case, then estimate $\hat{h}_9$ should be negative. Notably, such a negative association can be related to the agency motive too. The more indebted a firm is, the more efficiently managers may conduct cash management in order to raise funds for repayment (Ozkan and Ozkan, 2004). By splitting *IBL* into short-term and long-term debt in terms of remaining maturity, G&L (2018) find that the estimate is positive for long-term debt but negative for short-term debt. Data availability does not allow me to split *IBL* into these two components.[8]

CA is current assets other than cash. If cash holdings and other current assets look similar to managers, then there will be a high degree of substitution between the two, suggesting that estimate $\hat{h}_{10}$ should be negative, as in G&L (2018). On the other hand, by definition, cash is unique in that it is perfectly liquid and free of transaction costs. When managers value these aspects of cash, they may convert part of increasing non-cash current assets into cash. Such a positive association between the two appears to be in line with the transaction-costs motive. Meanwhile, to hedge the risk of endogeneity, I use *CA* at time τ–1.

CL is current liabilities. This variable controls for a potential maturity-matching pattern that offsets the change in current liabilities by changing the level of cash reserves. If this is the case, then estimate $\hat{h}_{11}$ will be positive, as in G&L (2018).

CF and *INVE* are contemporaneous cash flows and investment expenditures, respectively. These can drive variations in cash reserves. Managers allow their *CAR*s to change over time within an optimal range when they find it costly to adjust cash balances (Bolton, Chen, and Wang, 2011). Such a straightforward accumulation of profits and use of cash holdings would be based upon the transaction-costs motive. If that is the case, then estimated coefficients $\hat{h}_{12}$ and $\hat{h}_{13}$ will be positive and negative, respectively, as in G&L (2018).

The six regressors in the fourth line of Eq. (1) are macroeconomic variables. *CC1* and *CC2* control for the cost of holding cash. G&L (2018) control for this cost by using as regressors (i) ex-post real short-term interest rates (hypothetical interest income in real terms accruing from cash reserves) and (ii) corporate tax costs. They find these factors to be insignificant when in the case where they control for *CF* and *INVE* separately. Because this finding for (i) above is inconsistent with other empirical studies (e.g., Azar, Kagy, and Schmalz, 2016), I improve the analysis by taking into account the opportunity cost of lost investment. *CC1* is the difference

[8] I also abstract from another subtle issue for managers: how should managers select a specific type of debt among bank loans and corporate bonds, both of which have various trade terms? As reported by Rauh and Sufi (2010), the selection of debt type can be complicated by a variety of factors, including simultaneous decisions and credit ratings.

between the expected rate of return minus the ex-post real one-year interest rate. The expected rate of return is measured by the 10-year average annual real GDP growth rate. *CC2* is the corporate tax rate. As larger *CCs* mean that hoarding cash is costlier, their estimates ($\hat{h}_{14}$ and $\hat{h}_{15}$) should be negative. Such a negative association appears to be reasonable, regardless of the precautionary, transaction-costs, and agency motives to hold cash.

Unce2 and *Unce3* are proxies for the uncertainty of future financing needs at the macro level. *Unce2* is the realized volatility of stock market returns – the standard deviation of weekly percentage changes in the price of country *i*'s national stock market index during year τ. G&L (2018) do not find stock price volatility a significant factor. I add *Unce3*, a World Bank indicator for countries' political stability, as an additional proxy for uncertainty. Because I interpret a larger *CC1* and a smaller *CC2* as implying larger uncertainty, their estimates ($\hat{h}_{16}$ and $\hat{h}_{17}$) should be positive and negative, respectively, based upon the precautionary motive.

INVE_Op2 and *INVE_Op3* are proxies for investment opportunities at the macro level. *INVE_Op2* is the expected one-year ahead GDP growth rate. As argued by G&L (2018), business-cycle fluctuations may affect the value of investment opportunities. *INVE_Op3* is the ratio of R&D expenditures to nominal GDP. G&L (2018) do not explicitly control for expenditure on R&D projects, despite the findings by previous studies, such as Almeida and Campello (2007) and Bates, Kahle, and Stulz (2009). These studies suggest that the precautionary motive should be acute for financing R&D projects since intangible R&D assets can often not be used as collateral. Because I interpret a larger *INVE_Op2* and a larger *INVE_Op3* as implying greater investment opportunities, their estimates ($\hat{h}_{18}$ and $\hat{h}_{19}$) should be positive, based upon the precautionary motive.

The six regressors in the fifth line of Eq. (1), or *CG1–CG6*, are country-specific institutional factors representing the state of corporate governance, which is related to the agency motive. Because managerial discretion is often accompanied by agency costs, managers' incentives will not necessarily be aligned with shareholders' incentives (Jensen, 1986). Managers with weaker governance may more easily keep idle money balances for their future private consumption or neglect to spend funds on good investment opportunities, at the expense of shareholders' wealth. *CG1–CG6* stand for the following: the level of managers' ethical behavior (*CG1*), the accountability of managers to investors and board members (*CG2*), the strength of investor protection (*CG3*), the strength of auditing and reporting standards (*CG4*), the depth of indirect debt finance (*CG5*), and the depth of direct debt finance (*CG6*).

Because it is reasonable and in line with the literature to interpret larger *CG1–CG3* as implying better governance, their estimates ($\hat{h}_{20}$, $\hat{h}_{21}$, and $\hat{h}_{22}$) should be negative.[9] Specifically, in the case of *CG3*, Dittmar, Mahrt-Smith, and Servaes (2003) argue that well-governed managers will work for the sake of shareholders without reducing dividend payments to them.

The sign of *CG4* appears to reflect inefficient behavior that managers with weak governance engage in with respect to their cash reserves. If laxer auditing and reporting standards allow them to shirk – neglecting business investments and skimping on payments to shareholders and workers – its estimate ($\hat{h}_{23}$) will be negative. Alternatively, if laxer auditing and reporting standards encourage them to use cash reserves or raise off-the-book funds for their own private consumption, its estimate ($\hat{h}_{23}$) will be positive. Thus, the impact of *CG4* could be ambivalent, depending on the relative dominance of the shirking and private consumption of managers.

CG5 and *CG6* are indicators widely used to represent the stage of countries' financial development with respect to debt finance. *CG5* represents the development of the banking sector, or the outstanding amount of bank loans to the private sector over nominal GDP. *CG6* represents the development of the corporate bond market, or the outstanding amount of corporate bonds over nominal GDP. As long as *IBL* separately controls for the level of debt issued by listed companies, *CG5* and *CG6* make it possible to specify how differences in the level of debt finance development across countries and over time can influence the level of national CARs.[10] In particular, I would like to home in on how differently two managers in different countries with different *CG5*s but the same level of *IBL* will behave.

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[9] It may be appropriate not to handle *CG1* (the level of managers' ethical behavior) on the same footing as *CG2* – *CG4*. The latter three concern the relationship between shareholders (principals) and managers (agents), in which it is necessary for shareholders to set up devices that discourage their managers from shirking and incentivize them to work efficiently for shareholders, such as incentive structures, monitoring mechanisms, and governing structures (Eisenhardt, 1989). Managers who these devices incentivize adequately are likely to behave ethically with respect to their shareholders. Still, *CG1* can be interpreted more broadly because business ethics would be essential for managers to obtain necessary resources and stakeholder support so as to stay in business (Freeman and McVea, 2005). Presumably, to obtain these, a firm may hold cash less as a consequence of making more payments not only to shareholders but also to workers and trading partners as well as paying additional costs for integrating social and environment issues in its business model and internal controls.

[10] *IBL* may be positively correlated with *CG5* and *CG6*. To investigate the risk of multicollinearity caused by this, I calculate the variance-inflation factors (VIFs) between *IBL* and *CG5* and between *IBL* and *CG6* over the sample period for all sample countries. VIF is defined as $1/\{1 - (\text{correlation coefficients})^2\}$. Suffice it here to report that

These differences can relate to the modality of conflict between mangers and their lending banks. In relationship banking, a bank generally monitors informationally opaque borrowers to gather and process private information about them. This activity has the potential to help the borrowers economize their cash holdings through two channels. One is to reduce monitoring costs to be added to loan rates of interest (James, 1987). The other is to improve their governance; that is, bank loans are useful for keeping borrowers of lower observable quality from causing post-lending moral hazard (Diamond, 1991; Boot and Thaker, 1997). These positive consequences should be accompanied by a negative estimated coefficient on *CG5* ($\hat{h}_{24}$).

Monitoring activity, on the other hand, may enable the monitoring bank to extract informational rents from the borrower, or to hold up the borrower (Mayer, 1988; Petersen and Rajan, 1995; Rajan, 1992; von Thadden, 2004). According to this line of thought, managers can be viewed as running the risk of being forced by their own informed banks to borrow excessively and at unfavorable rates in a country in which financing sources other than banks are few. Managers who invest in cash would be a particularly safe debtor for an informed creditor who is basically risk-averse (Yosha, 1995). Such information-rent extraction by banks should be accompanied by a positive estimated coefficient on *CG5* ($\hat{h}_{24}$).[11]

In a bank-based financial system, managers might prefer issuing bonds to save on monitoring costs as well as to avoid the holdup risk. If such a preference for unmonitored debt accompanies managers' reducing cash reserves in a country with a large corporate bond market, then estimate $\hat{h}_{25}$ should be negative.

Finally, all of the dependent and independent variables other than the constant and time-trend terms are standardized by dividing their deviations by their standard deviations. This allows one to compare their estimated marginal impacts, even though they are of different units.

4. Driving Forces behind Cash Holdings

4.1 Baseline Estimation Result

all of the VIFs are much smaller than 10, the criterion proposed by Snee and Marquardt (1984) as defining a negligible risk of multicollinearity.

[11] Japanese banks were accused of such information rent extraction (e.g., Wu and Yao, 2012; Inaba, 2016).

As detailed in Table I, I follow the conventional procedure and select the fixed-effects model.[12] The result of estimating Eq. (1) with the weighted generalized least squares (weighted GLS) method is shown in the middle column of the table and summarized below:

$$\begin{aligned} CAR = &-1.12 + 0.60^{***}TT - 0.09^{***}TT^2 + 0.01^{***}TT^3 \\ &+ 0.11Unce1 + 0.22^{**}INVE\_Op1 - 0.04RTA + 0.07CF\_Av - 0.09INVE\_Av \\ &- 0.53^{***}IBL - 0.33^{***}CA_{-1} - 0.02CL + 0.05^{*}CF - 0.06INVE - 0.14^{***}CC1 + 0.06CC2 \\ &+ 0.09^{***}Unce2 - 0.07Unce3 + 0.14^{*}INVE\_Op2 + 0.45^{***}INVE\_Op3 \\ &- 0.67^{***}CG1 - 0.18^{**}CG2 - 0.25^{***}CG3 + 0.46^{***}CG4 + 0.27^{**}CG5 - 0.12CG6 \\ &(\#\text{ of observations} = 153,\ R_{adj}^2 = 0.94), \end{aligned}$$

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the p-values used are the averages of two cases in which I adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. The fixed-effects estimates which are statistically significant are *INVE_Op1* (+), *IBL* (–), CA_{-1} (–), *CF* (+), *CC1* (–), *Unce2* (+), *INVE_Op2* (+), *INVE_Op3* (+), *CG1* (–), *CG2* (–), *CG3* (–), *CG4* (+), and *CG5* (+). The signs in parentheses are those of the corresponding $\hat{h}$s.

[Table I near here]

The signs of these 13 effective regressors are as expected from the discussion above, save *IBL*, CA_{-1}, *CG4*, and *CG5*. As argued above, the coefficients of these four regressors can be positive or negative, depending on the motive behind the cash holdings. Here, the negative estimated coefficient on CA_{-1} suggests substitution between cash and non-cash current assets. The positive estimated coefficient on *CG4* suggests that strict auditing and reporting standards should discourage managers from using cash reserves or raising off-the-book funds for their own private consumption. The positive estimated coefficient on *CG5* suggests that managers are likely to be concerned more with their banks' information-rent extraction in countries whose financial systems are based more heavily upon banks. Meanwhile, what the negative estimated coefficient on *IBL* implies is elusive in the sense that it suggests two possibilities: one is that managers with better access to outside debt should have less incentive to hold cash for

[12] Random-effects estimation is not feasible because the number of sample countries is less than the number of regressors for the between estimator, which is necessary to estimate the random effects innovation variance.

precautionary motives; the other is that more indebted managers should manage cash more efficiently for repayment.[13]

Because all variables are standardized, the marginal impacts of the statistically significant regressors on *CAR* can be compared, simply by looking at the absolute values of their $\hat{h}$s. With regard to the precautionary motive to hold cash for investment opportunities, the impact is 0.81. This is the sum of three estimates: 0.22 for *INVE_Op1*, 0.14 for *CC1*, and 0.45 for *INVE_Op3*. Regarding the precautionary motive to hold cash for the availability of outside debt, the impact is 0.53: *IBL*'s estimated coefficient. With respect to the precautionary motive to hold cash for uncertainty, it is 0.09: *Unce2*'s estimated coefficient. That is, the total impact of the precautionary motive is 1.43 (= 0.81 + 0.53 + 0.09) in the extreme case where I arbitrarily attribute *IBL* to only the precautionary motive. For the transaction-costs motive to hold cash, the impact is 0.32: *CF*'s estimated coefficient. For the agency motive to hold cash, the impact is 1.83, which is larger than the other two. This impact consists of the sum of five estimates: 0.67 for *CG1*, 0.18 for *CG2*, 0.25 for *CG3*, 0.46 for *CG4*, and 0.27 for *CG5*.

I check the robustness of the baseline estimation result in four ways. The first is to verify the fixed-effects model. To increase the degrees of freedom, I drop insignificant regressors from Eq. (1) and compare the fixed-effects model with the random-effects model by testing the null hypothesis that the *IE*s are uncorrelated with the regressors.[14] A Hausman test statistic rejects the null hypothesis at the one per cent level.

Second, to investigate whether time effects common to all is in each τ are necessary or not, I add to Eq. (1) year-dummies that take one in the given year and otherwise zero and find that none of them is statistically significant. I judge that the time effects are not needed.

Third, I address the risk of spurious regressions as mentioned above. The baseline estimation hedges this risk by using as regressors linear, quadratic, and cubic trend terms (TT, TT^2, and TT^3), all of which are estimated to have statistically significant coefficients. For the same purpose, I conduct a panel co-integration analysis. I drop the constant term and quadratic and cubic trend terms as well as statistically insignificant variables from Eq. (1). I also infer

---

[13] Managers hoarding more cash could find it less necessary to issue debt. Following G&L's (2018) specification, I ignore this risk of endogeneity. When I use the lagged value (IBL_{-1}) as an instrumental variable for *IBL* in estimating Eq. (3), the coefficient on the instrumental variable is not statistically significant.

[14] Random-effects estimators depend on the Swamy-Arora method which uses residuals gained in the within (fixed-effects) and between-means regressions.

that the orders of integration of time-series data of *CAR* and the 13 effective regressors allow these variables to be co-integrated with each other.[15] By running the pooled auxiliary regression with Kao's (1999) method, I find that the residual is stationary.[16] This suggests that, at a global level, these regressors are likely to have had a long-term stable relationship, not a spurious relationship, with *CAR* over the last decade.

The last robustness-check is to address the risk of multicollinearity among *CG1–CG4*. For example, *CG2–CG4* have the potential to affect *GC1* according to Eccles, Ioannou, and Serafeim (2014), who extensively study the effect of corporate sustainability on organizational processes and performance for U.S. companies. I calculate the VIFs (variance-inflation factors) for all pairs of *CG*s for all sample countries, following Snee and Marquardt (1984). Looking at the VIFs in Appendix C, I judge that all of them are too small to cause multicollinearity.[17]

4.2 Four Extensions

To get a better understanding of the baseline estimation result, I make four extensions. First, I analyze the explanatory power of the statistically significant regressors. Following G&L's (2018) approach, I compare R_{adj}^2s obtained by estimating regression equations that increase the

[15] I conduct panel unit-root tests by pegging one for the order of lag and considering both individual effects and individual trend effects. The results are as follows: *CAR* (0^{***}, 0^{**}), *Unce1* (0^{***}, 1^{***}), *INVE_Op1* (1^{***}, 0^{***}), *RTA* (0^{***}, 0^{***}), *CF_Av* (0^{***}, 1^{***}), *INVE_Av* (0^{***}, 0^{***}), *IBL* (0^{***}, 0^{***}), *CA* (0^{***}, 0^{**}), *CL* (0^{***}, 0^{***}), *CF* (0^{***}, 0^{***}), *INVE* (0^{***}, 0^{***}), *CC1* (0^{***}, 0^{***}), *CC2* (0^{***}, 0^{***}), *Unce2* (0^{***}, 0^{***}), *Unce3* (0^{***}, 0^{***}), *INVE_Op2* (0^{***}, 0^{***}), *INVE_Op3* (0^{***}, 0^{***}), *CG1* (0^{***}, 1^{***}), *CG2* (0^{***}, 1^{***}), *CG3* (0^{***}, 1^{***}), *CG4* (0^{***}, 1^{***}), *CG5* (0^{***}, 0^{***}), and *CG6* (0^{***}, 0^{***}). The first and last numbers in parentheses are the orders of integration of the corresponding variables in (i) one case where, for a specific variable, a common unit root process is assumed for all sample countries and (ii) the other case where, for a specific variable, different unit root processes are assumed for different sample countries, respectively. The superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively. I judge their statistical significance with reference to the Levin-Lin-Chu bias-adjusted t statistics and the Pearson-Fisher Chi-Square statistics in the first and last cases, respectively. I also conduct panel unit-root tests by pegging one for the order of lag and considering individual effects but not individual trend effects. The results on the degree of the integration are the same as above, except for *IBL* (0^{***}, 1^{***}), *Unce2* (0^{***}, 1^{***}), *Unce3* (1^{***}, 0^{***}), *INVE_Op3* (0^{***}, 0^{***}), *CG4* (0^{***}, 0^{***}), and *CG6* (0^{***}, 1^{***}).

[16] The order of lag(s) is zero, as selected by the Schwarz criterion. The number of observations is 220. The ADF t-statistic is –5.10 (p-value: 0.00). The null hypothesis that there is no co-integration can be rejected. When dropping the linear time trend, the ADF t-statistic is –5.83 (p-value: 0.00).

[17] I also consider a dynamic adjustment of national *CAR*s by adding as a regressor its lagged-value (CAR_{-1}) to Eq. (1). Appendix D details the result of 1-step GMM estimation of this version of Eq. (1). Suffice it here to report the following three. First, CAR_{-1} is estimated to have a statistically significant coefficient, suggesting a global trend that the present values of national CARs depend on their past values. Second, the signs of statistically significant regressors are broadly the same as in the baseline estimation. Last, standard 2-step GMM estimation is not computable.

number of regressors one by one until I have the full model of Eq. (1). I start with an equation in which national *CAR*s are regressed on a constant term and fixed *IE*s (individual effects). The R_{adj}^2 obtained by estimating this simple equation is 82.5 per cent. Strikingly, country fixed effects have great explanatory power. When estimating an expanded equation which includes linear, quadratic, and cubic trend terms (TT, TT^2, and TT^3, respectively), the R_{adj}^2 is 82.8 per cent. The increase in the explanatory power due to the trend terms is tiny. Next, I add the 9 insignificant regressors, resulting in a R_{adj}^2 of 87.6 per cent. In the final stage, I add each of the 13 effective regressors one-by-one (while keeping the previously-added regressors). Beginning with adding *INVE_Op1*, I obtain a R_{adj}^2 of 88.9 per cent. The increase of the R_{adj}^2 in response to this addition is 1.3 (= 88.9 – 87.6) percentage points (pp). I add other regressors in the following order: *INVE_Op1* (+1.3pp), *IBL* (+0.3pp), CA_{-1} (+0.7pp), *CF* (–0.6pp), *CC1* (+4.2pp), *Unce2* (–4.1pp), *INVE_Op2* (–0.1pp), *INVE_Op3* (+3.9pp), *CG1* (+0.2pp), *CG2* (+0.3pp), *CG3* (–0.4pp), *CG4* (+0.3pp), and *CG5* (+0.6pp). The figures in parentheses indicate the increase in R_{adj}^2 in response to adding the given regressor. For details, see Table II. Apart from country fixed effects, *CC1* (the cost of carry) and *INVE_Op3* (the execution of R&D projects) are likely to have the largest and second largest explanatory power of national *CAR*s; specifically, the latter is related to the precautionary motive. As stressed by G&L (2018), macroeconomic variables are important. The agency motive, by contrast, has limited explanatory power over the total variation in national CARs.

[Table II near here]

The second extension is to look at the explanatory power of the agency motive by placing a focus on the change in the simple average of national CARs from 2007 to 2017. Here, I notate this change in a variable (X) with $\Diamond_{17–07}[X]$. For *CAR* on a standardized basis, I have $\Diamond_{17–07}[CAR]$ which is equal to 0.51. I consider the contributions that the statistically significant regressors make to $\Diamond_{17–07}[CAR]$. Specifically, I calculate $\Diamond_{17\text{-}07}[X]$s for these regressors, including the three time-trend terms, and multiple these $\Diamond_{17–07}[X]$s with the regressors' estimated coefficients ($\hat{h}$s), as shown below:

$$
\begin{aligned}
\Diamond_{17–07}[CAR] &= 0.51 \\
&= \underline{0.60\Diamond_{17–07}[TT]} + \underline{(–0.09)\Diamond_{17–07}[TT^2]} + \underline{0.01\Diamond_{17–07}[TT^3]} \\
&+ \underline{0.22\Diamond_{17–07}[INVE\_Op1]} + \underline{(–0.53)\Diamond_{17–07}[IBL]} + \underline{(–0.33)\Diamond_{17–07}[CA_{-1}]} + \underline{(0.05)\Diamond_{17–07}[CF]}
\end{aligned}
$$

$$
\begin{aligned}
&+ \underline{(-0.14)\Diamond_{17-07}[\mathit{CC1}]} + \underline{0.09\Diamond_{17-07}[\mathit{Unce2}]} \\
&+ \underline{0.14\Diamond_{17-07}[\mathit{INVE\_Op2}]} + \underline{0.45\Diamond_{17-07}[\mathit{INVE\_Op3}]} \\
&+ \underline{(-0.67)\Diamond_{17-07}[\mathit{CG1}]} + \underline{(-0.18)\Diamond_{17-07}[\mathit{CG2}]} + \underline{(-0.25)\Diamond_{17-07}[\mathit{CG3}]} + \underline{0.46\Diamond_{17-07}[\mathit{CG4}]} \\
&+ \underline{0.27\Diamond_{17-07}[\mathit{CG5}]} + \underline{\Diamond_{17-07}[\mathit{MC}]}, \qquad (2)
\end{aligned}
$$

where *MC* is miscellaneous contributions made by the residual (ε) as well as other regressors, whose coefficients are interpreted as zero, in Eq. (1). As underlined for all regressors, a product of $\Diamond_{17-07}[X]$ and its $\hat{h}$ is *X*'s contribution to $\Diamond_{17-07}[CAR]$. Meanwhile, $\Diamond_{17-07}[IE]$ is zero for all sample countries.

I calculate these products as follows: +0.92 for *TT*s (the sum of all terms in the second line of Eq. (2)), –0.06 for *INVE_Op1*, +0.05 for *IBL*, +0.10 for CA_{-1}, –0.03 for *CF*, –0.06 for *CC1*, –0.12 for *Unce2*, –0.06 for *INVE_Op2*, +0.11 for *INVE_Op3*, +0.28 for *CG1*, –0.04 for *CG2*, –0.03 for *CG3*, –0.14 for *CG4*, + 0.02 for *CG5*, and –0.43 for *MC*. Apart from the time-trend terms, an increase in *INVE_Op3* (the execution of R&D projects) and a decline of *CG1* (the measure of managers' ethical behavior) are two major contributors to pushing up $\Diamond_{17-07}[CAR]$. A decrease in *Unce2* (the uncertainty of future financing needs at the macro level) and a decline of *CG4* (the strength of auditing and reporting standards) are two major contributors to pushing down $\Diamond_{17-07}[CAR]$. These suggest that both of the precautionary and agency motives should be important to the increase in the simple average of national CARs from 2007 to 2017, and that so should be macroeconomic variables.

The third extension is to consider the dependence of the precautionary motive on the state of corporate governance as well as the dependence of the transaction-costs motive on the state of corporate governance. I add to Eq. (1) an interaction term made by interacting one of *CG1*–*CG5* with one of the other statistically significant regressors, including *INVE_Op1*, *IBL*, CA_{-1}, *CF*, *CC1*, *Unce2*, *INVE_Op2*, and *INVE_Op3*. Since I add only one interaction term in order to preserve the interpretability of its coefficient, I conduct 40 (5×8) panel-data regressions using the same sample. Table III shows that 11 out of the 40 interaction terms are estimated to have statistically significant coefficients whose signs are shown in parentheses: *CG1×INVE_Op1* (+), *CG1×IBL* (+), *CG1×CC1* (–), *CG1×Unce2* (+), *CG2×CC1* (–), *CG2×INVE_Op3* (+), *CG3×INVE_Op2* (+), *CG3×INVE_Op3* (–), *CG4×Unce2* (+), $CG5\times CA_{-1}$ (+), and *CG5×INVE_Op2* (–). These interaction terms illuminate the following global trends.

[Table III near here]

First of all, *CG1* (the measure of managers' ethical behavior) was interacted with no less than four variables: *INVE_Op1* (+), *IBL* (+), *CC1* (–), and *Unce2* (+). This suggests that ethical managers are likely to have increased the precautionary motive (*INVE_Op1*, *IBL*, and *Unce2*) and the transaction-costs motive (*CC1*).

CG2 (the accountability of managers) was interacted with *CC1* (–) and *INVE_Op3* (+), suggesting a similar global trend that accountable managers are likely to have increased the precautionary motive (*INVE_Op3*) and sensitivity to the cost of carry (*CC1*).

CG3 (the strength of investor protection) was interacted with *INVE_Op2* (+) and *INVE_Op3* (–). The signs of their estimates differ from each other. I interpret these interactions as implying a global trend that, to comply faithfully with shareholder interests, managers are likely to enhance the precautionary motive for short-term expansions of investment opportunities due to an improving business climate but to repress it for long-term expansions of opportunities due to increasing R&D projects.

CG4 (the strength of auditing and reporting standards) was interacted with *Unce2* (+), suggesting that harsher auditing and reporting standards are likely to encourage managers to hold more cash as a precaution in response to high uncertainty.

CG5 (the depth of indirect debt finance) was interacted with CA_{-1} (+) and *INVE_Op2* (–). These appear to imply that managers tended to borrow more money in response to a greater risk of holdup by major lenders, which reduced the attractiveness of perfect liquidity and absence of transaction costs of cash while relaxing their precautionary motive for short-term expansion of investment opportunities due to an improving business climate.

The last extension is to consider the determinants of the annual changes in national CARs. I take the first differences of stock variables, including national *CAR*s, as well as indicators for the state of corporate governance. I keep the other flow variables, a constant term, the three trend terms, as well as the *IE*s unchanged. As detailed in Appendix E, the result of estimating such a first-difference model using the Least Square Dummy Variables (LSDV) method for standardized variables is summarized below:

$$\Delta CAR = 1.32^{***} - 0.60TT + 0.09TT^2 - 0.01TT^3$$
$$- 0.04Unce1 - 0.03\Delta INVE\_Op1 - 0.29^{*}\Delta RTA - 0.08CF\_Av - 0.02INVE\_Av$$

$$
\begin{aligned}
&- 0.56^{***}\Delta IBL + 0.26^{***}\Delta CA_{-1} + 0.08\Delta CL + 0.09^{**}CF - 0.14^{**}INVE \\
&- 0.13CC1 - 0.02CC2 - 0.08Unce2 + 0.47^{***}\Delta Unce3 \\
&+ 0.06\Delta INVE\_Op2 - 0.02\Delta INVE\_Op3 \\
&- 0.09\Delta CG1 - 0.35^{***}\Delta CG2 - 0.06\Delta CG3 + 0.05\Delta CG4 + 0.09\Delta CG5 + 0.06\Delta CG6 \\
&(\#\text{ of observations} = 134,\ R_{\mathrm{adj}}^2 = 0.48), \qquad (3)
\end{aligned}
$$

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the p-values used are the averages of two cases in which I adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately.[18] The fixed-effects estimates which are statistically significant are ΔRTA (–), ΔIBL (–), ΔCA_{-1} (+), *CF* (+), *INVE* (–), $\Delta Unce3$ (+), and $\Delta CG2$ (–). The signs in parentheses are those of their corresponding estimates. The signs for ΔIBL and *CF* are the same as in the baseline estimation. The sign for *INVE* is the same as expected above. *RTA* is estimated to have a statistically insignificant coefficient in the baseline estimation while ΔRTA is estimated here to have a statistically significantly negative coefficient, suggesting that economies of scale should matter for annual changes in national *CAR*s. Notably, CA_{-1} is estimated to have a statistically significantly negative coefficient in the baseline estimation while ΔCA_{-1} is estimated here to have a statistically significantly positive coefficient. This suggests that the attractiveness of cash for managers, namely perfect liquidity and absence of transaction costs, rather than substitution between cash and non-cash current assets, is likely to explain the annual changes in national *CAR*s over the last decade.

As in the baseline estimation of the level of national *CAR*s, the precautionary motive (represented by ΔIBL), the transaction-costs motive (represented by ΔRTA, ΔCA_{-1}, *CF* and *INVE*), and the agency motive (represented by ΔIBL and $\Delta CG2$) jointly explain annual changes in national *CAR*s over the last decade.[19] As in G&L (2018), *CF* and *INVE* are significant

[18] Two technical notes are as follows. First, using $\Delta INVE\_Op3$ as a regressor makes it impossible to calculate cross-section weights (variance) for the GLS method used in the baseline estimation. Last, $\Delta INVE\_Op2$ is not the first difference. *INVE_Op2* is the expected GDP growth rate one-year ahead in the baseline estimation. Here, *INVE_Op2* is the gap between this expectation and expected GDP growth rate for the current year, both of which are as of October of the current year and taken from the International Monetary Fund's *World Economic Outlook* (October). That is, $\Delta INVE\_Op2$ here stands for an expected improvement/deterioration of business climate.

[19] I do not mention here $\Delta Unce3$ as a factor of the precautionary motive because the regressor is estimated to have a statistically significantly positive coefficient, contrary to my expectation.

regressors for these changes. Because I standardize all variables, I can compare the marginal impacts of the effective regressors with the absolute values of their coefficients. Although ΔIBL is estimated to have a statistically significantly negative coefficient, the main reason why managers increased hoarding money after the global financial crisis is still unclear in the sense that the reduction in the interest-bearing debt ratios discouraged them from economizing cash reserves while encouraging them to keep more cash based upon the precautionary motive.

Now, I can analyze the explanatory power of the seven effective regressors by following the same procedure as above. Table IV reports increases in R_{adj}^2 in response to increasing regressors one by one as follows: ΔRTA (+1.9pp), ΔIBL (+18.7pp), ΔCA_{-1} (+5.7pp), CF (+2.6pp), $INVE$ (+3.4pp), $\Delta Unce3$ (+5.0pp), and $\Delta CG2$ (+1.9pp). The main driver of annual changes in national *CAR*s over the last decade is ΔIBL. In line with the first extension, the agency motive represented by $\Delta CG2$ here has limited explanatory power over the changes.

[Table IV near here]

Finally, based upon Eq. (3), I analyze what regressors contribute to the change in the simple average of national ΔCARs on a standardized basis from 2008 to 2017, or $\lozenge_{17-08}[\Delta CAR]$ which is equal to 0.21. By going through the procedure used in the second extension, I obtain the following contributions by regressor: –0.03 for ΔRTA, +0.23 for ΔIBL, +0.02 for ΔCA_{-1}, +0.01 for CF, +0.22 for $INVE$, +0.02 for $\Delta Unce3$, +0.01 for $\Delta CG2$, and –0.26 for MC. A decrease in ΔIBL (annual changes in interest-bearing debt ratios) and a decline of $INVE$ (cash outflows due to business investment) are two major contributors to $\lozenge_{17-08}[\Delta CAR]$. This suggests that the increase in the global average CAR growth of 0.21 is related to the precautionary, transaction-costs, and agency motives. To put it plainly, on a global average basis, managers expanded the annual growth of national CARs in 2017 more than in 2008 because a slowdown in the annual change in interest-bearing debt ratios encouraged the managers to increase the precautionary motive while discouraging them from making prudent cash management, when decreasing business investment made it less necessary for them to spend increasing cash reserves.

5. Concluding Remarks

Through a global examination of CARs of publicly-traded non-financial lightly-regulated firms at an aggregate level in 20 countries over the last decade, I verify theoretical predictions on corporate cash holdings by showing that differences in national CARs among countries and over time are explained by country-specific fixed effects as well as the precautionary, transaction-costs, and agency motives. The standardized impact of the agency motive is greater than the other two while having limited explanatory power over the total variation in county-specific CARs. One caveat is that this finding depends on the relative importance of the precautionary and agency motives behind the significant negative association between national CARs and ratios of interest-bearing debt to total assets.

I contribute to the literature mainly by accumulating global evidence for the relevance of the agency motive to the burgeoning of corporate cash holdings since the global financial crisis. Managers with weaker governance tend to hold more cash and be less sensitive to the precautionary and transaction-costs motives. Managers tend to refrain more from misappropriating and hiding cash in response to harsher auditing and reporting standards. Managers tend to hold more cash as a result of holdup problems with banks in countries whose financial systems are more bank-centered. When one dares to abstract from country-level heterogeneity and takes the simple average of national CARs, an increase in this global average CAR from 2007 to 2017 is explained mainly by the agency motive related to worsening business ethics and the precautionary motive related to increasing R&D projects.

I also contribute to the literature by verifying G&L's (2018) finding for the U.S. at a global level: macroeconomic variables explain aggregate corporate cash holdings more than aggregate corporate financial indicators do. I show that relevant macroeconomic variables are those representing the cost of carry, the execution of R&D projects, the economic climate, and the level of uncertainty, the last three of which relate to the precautionary motive. Meanwhile, the cost of carry and the execution of R&D projects had the most explanatory power, apart from country-specific fixed effects.

I close this article with future research suggestions. First, a significant negative association between the annual change in countries' CARs and the annual change in countries' interest-bearing debt ratios requires scrutiny. This association appears to be the result of the precautionary and agency motives, although these two still merit separate attention. A potential relationship between cash reserves and net worth deserves to be considered because of its effect on debt ratios. Retained profits are a component of net worth. As profits increase, debt ratios decrease as total assets increase. At the same time, CARs will increase if cash reserves function as a major investment destination of the increased profits. On the other hand, buybacks using reserves can reduce CARs while increasing debt ratios through a reduction of net worth.

The second is the question of whether it is necessary to push down national CARs or not. Although the methodology of this study is not ideal for determining country-specific optimal levels of CARs, its finding that the level of and the change in national CARs have been based upon reasonable responses to market and information imperfections suggests that differences in these imperfections among countries should be important. From this perspective, one can argue that weak corporate governance runs the risk of inviting an over-accumulation of corporate cash, and that institutional reforms for improving corporate governance are capable of reducing national CARs significantly.

The last research suggestion is to make clear what inefficient behavior managers engaged in regarding their cash reserves in the case of weak governance. The indicators used are not closely linked with managers' specific actions, such as neglecting good investment opportunities, reducing dividends to shareholders, and amassing wealth for future private consumption, the last of which may be more acute the laxer are auditing and reporting standards.

Appendix A

[Appendix Table A here]

Appendix B

This appendix details definitions and sources of the data used.

- *CAR* stands for cash-to-assets ratio. It is defined as the ratio of aggregate cash and cash equivalents to total assets for publicly-traded non-financial lightly-regulated companies (PTNFLR companies, hereinafter). Per-share year-end cash and cash equivalents are divided by per-share year-end total assets for individual industry sub-indices for each country. The *CAR* for the country is the market-capitalization (m-cap, hereinafter) weighted average of these industry-specific ratios. The data source is Bloomberg (BLM, hereinafter). The unit is per cent (%, hereinafter).

- *Unce1* stands for uncertainty, or the volatility of cash flows. It is defined as the standard deviation of cash flow ratios for PTNFLR companies for the three years from τ–3 to τ–1. Here, cash flows are per-share net income before extraordinary items minus expected per-share dividends, where dividends at τ are assumed to be the same as those at *τ*–1. Cash flow ratios are obtained by dividing the cash flows by per-share year-end total assets. This ratio is calculated for individual industry sub-indices for each country. The national cash flow ratio is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.

- *INVE_Op1* stands for investment opportunities, or average q. The market value of total assets is divided by the book value of total assets, for PTNFLR companies. The former is the sum of the year-end m-cap and the book value of year-end total liabilities. All figures are per-share values. The q ratio is calculated for individual industry sub-indices for each country. The national q ratio is the m-cap weighted average of these industry-specific ratios. The data source is BLM.
- *RTA* stands for per-company average of real assets. It is defined as the inflation-adjusted and U.S. dollar based value of total assets for PTNFLR companies. Per-share year-end total assets of an industry sub-index for each country are deflated with national inflation rates, converted into U.S. dollars with reference to the year-end FX rates in the market, multiplied with the index's divisor, and divided by the number of constituent companies. The *RTA* for the country is the m-cap weighted average of these industry-specific ratios. The data sources are IMF, *World Economic Outlook* (WEO) 2019 April for national inflation rates; and, BLM for other indicators.
- *CF_Av* stands for average cash flows. It is defined as the average of cash flow ratios for PTNFLR companies for the three years from τ–3 to τ–1. Here, cash flow is per-share net income before extraordinary items minus expected per-share dividends, where dividends at τ are assumed to be the same as those at τ–1. Cash flow ratios are obtained by dividing cash flow by per-share year-end total assets. This ratio is calculated for individual industry sub-indices for each country. The national cash flow ratio is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.
- *INVE_Av* stands for average investment expenditures. It is defined as the average of investment cash flow ratios for PTNFLR companies for the three years from τ–3 to τ–1. Investment cash flow ratios are obtained by dividing per-share annual investment cash flow by per-share year-end total assets. This ratio is calculated for individual industry sub-indices for each country. The national investment cash flow ratio is the m-cap weighted average of these industry-

specific ratios. The data source is BLM. The unit is %.

- *IBL* stands for interest-bearing liabilities. It is defined as the ratio of debt to total assets for PTNFLR companies. Per-share year-end debt is divided by per-share year-end total assets for individual industry sub-indices for each country. The *IBL* for a country is the m-cap weighted average of these industry-specific quotients. The data source is BLM. The unit is %.
- *CA* stands for non-cash current assets. It is defined as the ratio of current assets other than cash and cash equivalents to total assets for PTNFLR companies. Per-share year-end non-cash current assets are divided by per-share year-end total assets for individual industry sub-indices for each country. The *CA* for a country is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.
- *CL* stands for current liabilities. It is defined as the ratio of current liabilities to total assets for PTNFLR companies. Per-share year-end current liabilities are divided by per-share year-end total assets for individual industry sub-indices for each country. The *CL* for a country is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.
- *CF* stands for contemporaneous cash flow. It is defined as the cash flow ratio for PTNFLR companies at τ. Here, cash flow is per-share net income before extraordinary items minus expected per-share dividends, where dividends at τ are assumed to be the same as those at τ–1. Cash flow ratios are gained by dividing cash flow by per-share year-end total assets. This ratio is calculated for individual industry sub-indices for each country. The *CF* for a country is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.
- *INVE* stands for contemporaneous investment expenditures. It is defined as the investment cash flow ratio for PTNFLR companies at τ. Investment cash flow ratios are obtained by dividing per-share annual investment cash flow by per-share year-end total assets. This ratio is calculated for individual industry sub-indices for each country. The *INVE* for a country is the m-cap weighted average of these industry-specific ratios. The data source is BLM. The unit is %.
- *CC1* stands for cost of carry, or expected net cost of keeping money in bank accounts. It is defined as the difference between the expected rate of return minus the ex-post real one-year

interest rate. The expected rate of return represents the opportunity cost of hoarding cash, or the cost of hypothetically lost investment, and is measured by the 10-year average of annual real GDP growth rates. The ex-post real one-year interest rate represents interest income arising from the bank accounts and is measured by one-year zero-coupon yields on sovereign bonds at end of year minus annual inflation rates. The data sources are IMF WEO 2019 April for annual real GDP growth rates and inflation rates; and, Bloomberg for the one-year interest rates. The unit is percentage points

- *CC2* stands for cost of carry, or corporate tax cost. It is defined as the ratios of total tax to corporate profits. The data source is World Bank Group (WBG), *Trade and Competitiveness Data 360* (TCdata360), and the original source is World Economic Forum (WEF), *The Global Competitive Report*. The unit is %.

- *Unce2* stands for uncertainty, or stock return volatility, defined as the standard deviations of weekly percentage changes in the national stock market index during τ. See Appendix A for names of national stock market indices. The data source is BLM. The unit is %.

- *Unce3* stands for uncertainty, or political stability. It is an index reflecting measured perception of the likelihood of political instability and/or politically-motivated violence. The data source is the World Bank (WB), *Worldwide Governance Indicators*. Percentile rank among all countries ranges from 0 (least stable) to 100 (most stable).

- *INVE_Op2* stands for investment opportunities, or business climate. It is given by the IMF projections of national real GDP growth rates one-year ahead in October of each year. For Δ*INVE_Op2*, see the footnote 14 in the text. The data source is IMF WEO October in sthe ample years. The unit is %.

- *INVE_Op3* stands for investment opportunities, or the execution of R&D projects. It is defined as the ratio of R&D expenditures to national nominal GDP. The data source is WB, *World Development Indicators* (WDI). The unit is %.

- *CG1* stands for the level of managers' ethical behavior. It is a measured perception of the internationally-compared status of domestic companies' ethical behavior in interactions with public officials, politicians, and other companies. The data source is WBG, TCdata360, and its original source is WEF, *Executive Opinion Survey* (EOS). It ranges from 1 (worst in the world) to 7 (best in the world).

- *CG2* stands for the accountability of managers to investors and board members. It is a measured perception of the internationally-compared extent of that accountability. The data source is WBG, TCdata360, and its original source is WEF, EOS. It ranges from 1 (worst in the world) to 7 (best in the world).
- *CG3* stands for the strength of investor protection. It is a combination of the "Extent of Disclosure Index" (transparency), "Extent of Director Liability Index" (liability for self-dealing), and "Ease of Shareholder Suit Index" (shareholders' ability to sue officers and directors for misconduct). The data source is World Bank Group, TCdata360, and its original source is WBG, *Doing Business: Measuring Regulatory Quality and Efficiency*. It ranges from 1 (worst in the world) to 10 (best in the world).
- *CG4* stands for the strength of auditing and reporting standards. It is a measured perception of the internationally-compared strength of these standards. The data source is WBG, TCdata360, and its original source is WEF, EOS. It ranges from 1 (loosest in the world) to 7 (harshest in the world).
- *CG5* stands for the depth of indirect debt finance (bank loans). It is defined as the ratio of domestic credit to the private sector by banks relative to national nominal GDP. The data source is WB, WDI. The unit is %.
- *CG6* stands for the depth of direct debt finance (corporate bonds). It is defined as debt securities issued by domestic companies in domestic and foreign markets relative to nominal GDP. The data source is the Bank for International Settlements, *Debt Securities Statistics*. The unit is %.

Appendix C

[Appendix Table C here]

Appendix D

This appendix considers a dynamic adjustment of national *CAR*s by adding as a regressor its lagged-value (CAR_{-1}) to Eq. (1). The result of estimating this version of Eq. (1) using panel generalized method of moments (panel GMM) is shown in the right column of Table I and summarized below:

$$
\begin{aligned}
CAR = {} & 0.33^{**}CAR_{-1} + 0.68^{***}TT - 0.10^{***}TT^2 + 0.01^{***}TT^3 \\
& + 0.10Unce1 + 0.13INVE\_Op1 - 0.06RTA + 0.09CF\_Av - 0.17^{*}INVE\_Av \\
& - 0.43^{***}IBL - 0.17CA_{-1} - 0.07CL + 0.07^{**}CF - 0.09^{*}INVE - 0.13^{**}CC1 + 0.05CC2 \\
& + 0.05Unce2 - 0.07Unce3 + 0.16INVE\_Op2 + 0.68^{*}INVE\_Op3 \\
& - 0.40^{**}CG1 - 0.16CG2 - 0.16CG3 + 0.39^{**}CG4 + 0.19CG5 - 0.22CG6
\end{aligned}
$$

(# of observations = 133, J-statistic = 108.0 <p-value: 0.15>),

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the Hansen-test p-value for the J-statistic is not small enough to reject the null hypothesis that the regression equation is valid. Using Arellano-Bond type instrumental variables, I find that the GMM estimates which are statistically significant are CAR_{-1} (+), *INVE_Av* (–), *IBL* (–), *CF* (+), *INVE* (–), *CC1* (–), *INVE_Op3* (+), *CG1* (–), and *CG4* (+). I conduct 1-step GMM estimation because standard 2-step estimation is not computable (e.g., see the last footnote in Table I for details). In general, the 1-step GMM estimates are consistent but are not necessarily efficient. The signs in parentheses are those of the corresponding $\hat{h}$s. CAR_{-1} is estimated to have a statistically significant coefficient, suggesting a global trend that the present values of national CARs depend on their past values. The signs of the other eight effective regressors are the same as in the baseline estimation, save *INVE_Av* and *INVE*, both of which are estimated to have statistically insignificant coefficients in the baseline estimation. The negative estimated coefficient on *INVE_Av* suggests that managers who are keen to make business investments should tend to hold less cash, and this tendency can in part relate to the transaction-costs motive. The negative estimated coefficient on *INVE* suggests the use of cash holdings for investments within an optimal range on the basis of the transaction-costs motive.

Because all variables are standardized, the marginal impacts of the effective regressors on *CAR* are comparable with each other using the absolute values of their $\hat{h}$s. For the transaction-costs motive to hold cash, the impact is 0.33. This is the sum of three estimates: 0.17 for *INVE_Av*, 0.07 for *CF*, and 0.09 for *INVE*. For the agency motive to hold cash, the impact is 0.79, or the sum of two estimates: 0.40 for *CG1* and 0.39 for *CG4*. The agency motive impact is larger than the transaction-costs motive impact as in the baseline estimation.

Whether or not the agency motive impact is larger than the precautionary motive impact depends on how to attribute *IBL* to these two motives. In the extreme case where I arbitrarily attribute *IBL* to the precautionary motive only, the precautionary motive impact is 1.11, or the sum of two estimates: 0.43 for *IBL* and 0.68 for *INVE_Op3*. In another extreme case where I arbitrarily attribute *IBL* to the agency motive only, the agency motive impact increases by 0.43, from 0.79 to 1.22, while the precautionary motive impact decreases by the same amount, from 1.11 to 0.68. Consequently, the agency motive will be larger than the other two as long as the cash-holding motive represented by *IBL* is based mainly upon the agency motive, or as long as debt encourages borrowers to conduct efficient management of cash reserves.

Notably, two macroeconomic variables controlling for the precautionary motive, uncertainty (*Unce2*) and future investment opportunities (*INVE_Op2*), are statistically significant regressors in the baseline estimation but not so in this alternative estimation controlling for CAR_{-1}. An interpretation of this difference is that managers' determination of the level of CAR at the end of the previous year (τ–1) reflected their expectation of a change in their precautionary motive due to macroeconomic conditions during the current year (τ). Part of the simple autoregressive adjustment of national *CAR*s could be driven by the precautionary motive under the influence of macroeconomic conditions and, in this case, the impact of the precautionary motive on national *CAR*s approximated above should be larger with this addition.

Appendix E

[Appendix Table E here]

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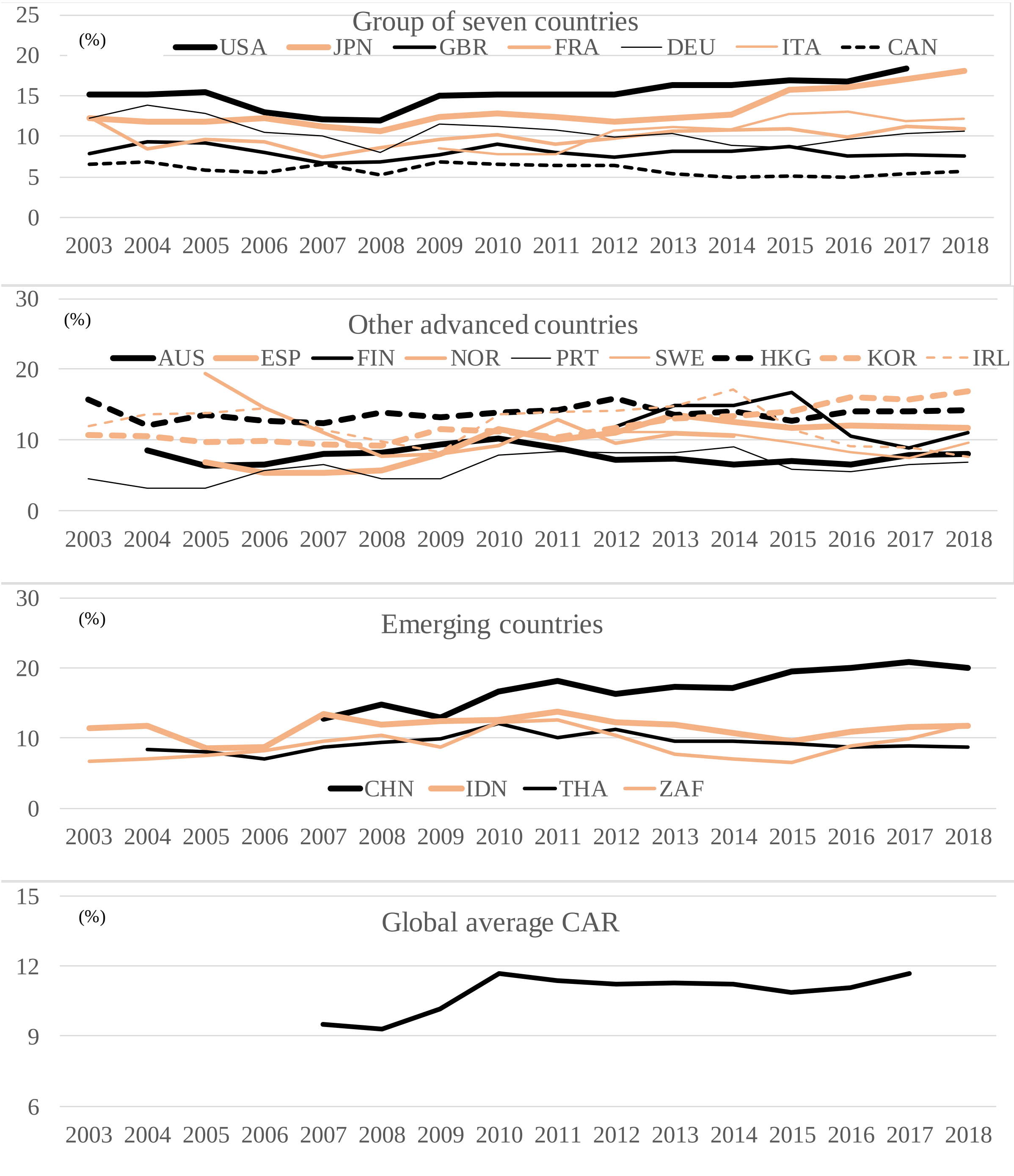
Figure 1. National CARs



This figure plots national CARs: ratios of aggregate cash and cash equivalents to total assets for publicly-listed non-financial lightly-regulated companies. The global average CAR is the average of national CARs, excluding those for FIN, ITA, NOR, and SWE.

Tables

Table I

Results of Estimating Eq. (1)

Dependent variable: ***CAR.*** **# of observations = 153 in A & B. 133 in C.**

Model		**A: Pooling**	**B: Fixed effect**			**C: GMM**
Specification of ***IE***		**No**	**Yes: Constant**			**n.a.**
Estimation method		**OLS**	**LSDV**	**Weighted GLS**		**Arellano-Bond instruments**
				White period	**White cross-section**	**PCSE**
Adjustments on residuals (ε)		-	-	**CSH, PH, & SC are adjusted for.**	**CSH & CCE are adjusted for.**	**CSH & PH are adjusted for.**
Regressors	**Estimates**	$\hat{h}$ s	$\hat{h}$ s	$\hat{h}$ s	$\hat{h}$ s	$\hat{h}$ s
Constant term	*C*	-0.312 [0.431]	-1.100 [0.000]	-1.123 [0.000]	-1.123 [0.000]	n. a. (added to the instrument list)
Lagged value	CAR_{-1}	n. a.	n. a.	n. a	n. a	0.326 [0.031]
Linear time trend	*TT*	0.033 [0.895]	0.626 [0.002]	0.604 [0.001]	0.604 [0.000]	0.681 [0.001]
Quandratic time trend	TT^2	-0.003 [0.954]	-0.096 [0.005]	-0.087 [0.003]	-0.087 [0.000]	-0.103 [0.004]
Cubic time trend	TT^3	0.001 [0.777]	0.005 [0.001]	0.004 [0.005]	0.004 [0.000]	0.005 [0.005]
Uncertainty (volatility of cash flows)	*Unce1*	-0.176 [0.167]	0.054 [0.561]	0.106 [0.301]	0.106 [0.056]	0.098 [0.340]
Investment opportunies (average q)	*INVE_Op1*	-0.104 [0.371]	0.135 [0.190]	0.221 [0.071]	0.221 [0.031]	0.131 [0.260]
Per-company average of real assets	*RTA*	0.146 [0.054]	-0.020 [0.836]	-0.045 [0.608]	-0.045 [0.625]	-0.059 [0.697]
Average cash flow in the past	*CF_Av*	0.116 [0.471]	0.028 [0.805]	0.066 [0.631]	0.066 [0.525]	0.094 [0.438]
Average investment expenditures in the past	*INVE_Av*	-0.097 [0.298]	-0.161 [0.047]	-0.086 [0.178]	-0.086 [0.052]	-0.166 [0.068]
Interest-bearing liabilities	*IBL*	-0.079 [0.407]	-0.445 [0.000]	-0.531 [0.000]	-0.531 [0.000]	-0.426 [0.000]
Non-cash current assets	CA_{-1}	-0.547 [0.000]	-0.352 [0.001]	-0.333 [0.000]	-0.333 [0.000]	0.109 [0.560]
Current liabilities	*CL*	0.154 [0.100]	0.083 [0.336]	-0.023 [0.641]	-0.023 [0.615]	0.074 [0.366]
Contemporaneous cash flows	*CF*	-0.029 [0.620]	0.067 [0.079]	0.050 [0.064]	0.050 [0.078]	0.065 [0.055]
Contemporaneous investment expenditures	*INVE*	-0.145 [0.061]	-0.050 [0.382]	-0.059 [0.148]	-0.059 [0.201]	-0.089 [0.100]
Cost of carry (expected net cost)	*CC1*	-0.012 [0.861]	-0.131 [0.024]	-0.134 [0.007]	-0.134 [0.000]	-0.125 [0.055]
Cost of carry (corporate tax cost)	*CC2*	0.149 [0.059]	0.022 [0.858]	0.057 [0.645]	0.057 [0.482]	0.045 [0.746]
Uncertainty (stock return volatility)	*Unce2*	0.170 [0.028]	0.067 [0.198]	0.091 [0.025]	0.091 [0.004]	0.052 [0.306]
Uncertainty (political stability)	*Unce3*	-0.181 [0.122]	0.066 [0.662]	-0.066 [0.571]	-0.066 [0.332]	-0.069 [0.709]
Investment opportunies (business climate)	*INVE_Op2*	0.482 [0.000]	0.178 [0.101]	0.136 [0.123]	0.136 [0.067]	0.155 [0.132]
Investment opportunies (R&D executions)	*INVE_Op3*	0.468 [0.000]	0.756 [0.010]	0.448 [0.053]	0.448 [0.008]	0.677 [0.100]
The observance of business ethics	*CG1*	0.165 [0.255]	-0.408 [0.032]	-0.671 [0.001]	-0.671 [0.004]	-0.401 [0.042]
The accountability to investors & board members	*CG2*	-0.431 [0.006]	-0.160 [0.259]	-0.186 [0.044]	-0.186 [0.000]	-0.157 [0.373]
The strength of investor protection	*CG3*	0.156 [0.041]	-0.240 [0.028]	-0.255 [0.029]	-0.255 [0.000]	-0.159 [0.283]
The strength of auditing and reporting standards	*CG4*	0.050 [0.731]	0.419 [0.008]	0.463 [0.003]	0.463 [0.000]	0.389 [0.039]
The depth of indirect debt finace (banks)	*CG5*	-0.079 [0.328]	0.215 [0.052]	0.273 [0.003]	0.273 [0.045]	0.192 [0.271]
The depth of direct debt finace (bonds)	*CG6*	-0.212 [0.014]	-0.110 [0.423]	-0.127 [0.279]	-0.127 [0.290]	-0.220 [0.185]
R_{adj}^2		0.672	0.891	0.942		n.a.
F-test on H_0: Pooling model > Fixed-effect model		14.344 [0.000]				n.a.
J-statistic [Hansen-test p value]		n. a.				106.24 [-0.131]

This table shows the results of estimating Eq. (1): $CAR_{i,\tau} = h_0 + h_1TT + h_2TT^2 + h_3TT^3 + h_4Unce1_{i,\tau} + h_5INVE\_Op1_{i,\tau} + h_6RTA_{i,\tau} + h_7CF\_Av_{i,\tau} + h_8INVE\_Av_{i,\tau} + h_9IBL_{i,\tau} + h_{10}CA_{i,\tau-1} + h_{11}CL_{i,\tau} + h_{12}CF_{i,\tau} + h_{13}INVE_{i,\tau} + h_{14}CC1_{i,\tau} + h_{15}CC2_{i,\tau} + h_{16}Unce2_{i,\tau} + h_{17}Unce3_{i,\tau} + h_{18}INVE\_Op2_{i,\tau} + h_{19}INVE\_Op3_{i,\tau} + h_{20}CG1_{i,\tau} + h_{21}CG2_{i,\tau} + h_{22}CG3_{i,\tau} + h_{23}CG4_{i,\tau} + h_{24}CG5_{i,\tau} + h_{25}CG6_{i,\tau} + IE_i + \varepsilon_{i,\tau}$. Notes are as follows. First, ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance. Second, I follow the conventional procedure in specifying the nature of *IE*. I estimate the pooling model using the OLS method and I estimate the fixed-effects model using the Least Square Dummy Variables (LSDV) method. I justify the addition of constant *IE*s by using the F-test to check how much and how significantly that addition reduces the residual sum of squares. If the fixed-effects model is selected, then, to compare it with the random-effects model, it is necessary to use the Hausman test to test the null hypothesis that *IE*s are uncorrelated with explanatory variables. This comparison, however, is not feasible here because the number of countries in the sample is less than the number of regressors for the between estimator to estimate the random effects innovation variance. Third, shading indicates regressors with statistically significant estimates and a specification of *IE* with statistical adequacy. I select the fixed-effects model. Fourth, CSH stands for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors. Using the statistical software package, *EViews 10*, I address these potential irregular aspects of the residuals ($\varepsilon_{i,\tau}$) by using two kinds of adjusted standard errors. *EViews 10*'s option for a panel-data regression, *White period*, is used to obtain standard errors adjusted for the risks of PH and SC, while *White cross-section* is used to obtain those adjusted for the risks of CSH and CCE. In estimating the fixed-effects model, I also use its option *Cross-section weights*, which also makes it possible to control for the risk of CSH. Reed and Ye (2011) demonstrate that estimators gained by using this weighted-GLS method together with each of the two options for adjusted standard errors are excellent in terms of the estimators' asymptotical efficiency and the accuracy of confidence intervals across them. Finally, in the GMM estimation, $CAR_{i,\tau-1}$ is added as a regressor and the Arellano-Bond type instrumental variables include all the other regressors. In order to remove cross-section fixed effects, I apply the first-difference transformation. If the innovations are i.i.d., the transformed innovations follow an integrated MA(1) process. The number of irritations is one; that is, fixed weights are used for the first difference of the i.i.d. innovations in a GMM weighting matrix – 1-step GMM estimation. Unfortunately, standard 2-step GMM estimation is not computable. PH and SC are adjusted for by using SUR (seemingly unrelated regressions) weights. That is, the innovations have the same time-series correlation structure for all cross-sections and I use panel-corrected standard errors, or PCSE.

Table II

Changes in R_{adj}^2 in Response to the Addition of Regressors

	Regression equations	Economic implications of the added regressors	R_{adj}^2
(1)	$CAR_{i,\tau} = a_0 + IE_i + \varepsilon_{i,\tau}$	Individual effects	82.5%
(2)	TT, TT^2, *and* TT^3 are added to (1) above.	Liner, quadratic, and cubic trend terms	82.8%
(3)	$Unce1_{i,\tau}$, $RTAi,\tau$, $CF\_Av_{i,\tau}$, $INVE\_Av_{i,\tau}$, $CL_{i,\tau}$, $INVE_{i,\tau}$, $CC2_{i,\tau}$, $Unce1_{i,\tau}$, $CG6_{i,\tau}$ are added to (2) above	Insignificant regressors in the baseline estimation	87.6%
(4)	$INVE\_Op1_{i,\tau}$ is added to (3) above.	Investment opportunies (average q)	88.9%
(5)	$IBL_{i,\tau}$ is added to (4) above.	Interest-bearing liabilities	89.2%
(6)	$CA_{i,\tau-1}$ is added to (5) above.	Non-cash current assets	89.9%
(7)	$CF_{i,\tau}$ is added to (6) above.	Contemporaneous cash flows	89.3%
(8)	$CC1_{i,\tau}$ is added to (7) above.	Cost of carry (expected net cost)	93.5%
(9)	$Unce2_{i,\tau}$ is added to (8) above.	Uncertainty (stock return volatility)	89.4%
(10)	$INVE\_Op2_{i,\tau}$ is added to (9) above.	Investment opportunies (business climate)	89.3%
(11)	$INVE\_Op3_{i,\tau}$ is added to (10) above.	Investment opportunies (R&D executions)	93.2%
(12)	$CG1_{i,\tau}$ is added to (11) above.	The observance of business ethics	93.4%
(13)	$CG2_{i,\tau}$ is added to (12) above.	The accountability to investors & board members	93.7%
(14)	$CG3_{i,\tau}$ is added to (13) above.	The strength of investor protection	93.3%
(15)	$CG4_{i,\tau}$ is added to (14) above.	The strength of auditing and reporting standards	93.6%
(16)	$CG5_{i,\tau}$ is added to (15) above.	The depth of indirect debt finace (banks)	94.2%

This table shows the changes in R_{adj}^2 when national CARs are regressed on different sets of variables ranging from a coarse set (1) to a full set (16). Notes are as follows. First, I estimate the fixed-effects models by weighted GLS for all equations so as to maintain the comparability. Last, in all estimations, to control for the potential of residuals' cross-section heteroskedasticity, period heteroskedasticity, and serial correlation, I use *EViews 10*'s two options for panel-data regression: *White period* and *Cross-section weights*. Reed and Ye (2011) demonstrate that weighted-GLS estimators obtained by using these two options for adjusted standard errors are excellent in terms of the estimators' asymptotical efficiency and the accuracy of confidence intervals across them.

Table III

Estimated Coefficients to Interaction Terms Added Separately to Eq. (1)

		The observance of business ethics	The accountability to investors & board members	The strength of investor protection	The strength of auditing and reporting standards	The depth of indirect debt finace (banks)
		CG1	*CG2*	*CG3*	*CG4*	*CG5*
Investment opportunies (average q)	*INVE_Op1*	0.125	-0.043	-0.040	-0.114	-0.053
		[0.030]	[0.535]	[0.487]	[0.171]	[0.514]
Interest-bearing liabilities	*IBL*	0.244	-0.007	0.052	0.155	-0.041
		[0.022]	[0.933]	[0.299]	[0.239]	[0.677]
Non-cash current assets	CA_{-1}	0.013	-0.086	0.006	0.041	0.230
		[0.894]	[0.119]	[0.944]	[0.589]	[0.000]
Contemporaneous cash flows	*CF*	0.024	0.026	0.011	0.052	-0.033
		[0.705]	[0.687]	[0.858]	[0.438]	[0.380]
Cost of carry (expected net cost)	*CC1*	-0.106	-0.08	0.010	-0.060	0.04
		[0.000]	[0.053]	[0.812]	[0.243]	[0.123]
Uncertainty (stock return volatility)	*Unce2*	0.063	0.009	0.018	0.052	0.018
		[0.097]	[0.770]	[0.413]	[0.079]	[0.644]
Investment opportunies (business climate)	*INVE_Op2*	-0.129	0.005	0.110	0.048	-0.162
		[0.165]	[0.932]	[0.042]	[0.527]	[0.038]
Investment opportunies (R&D executions)	*INVE_Op3*	-0.054	0.180	-0.171	0.039	0.138
		[0.578]	[0.058]	[0.062]	[0.708]	[0.500]

This table shows the estimated value and statistical significance of coefficients on interaction terms separately added to Eq. (1). Notes are as follows. First, figures in [ ] are p-values. Second, shading indicates interaction terms with statistically significant estimates based upon a 10 per cent level of statistical significance. Third, I estimate the fixed-effects models by weighted GLS for all equations so as to maintain comparability. Last, in all estimations, to control for the potential of residuals' cross-section heteroskedasticity, period heteroskedasticity, and serial correlation, I use *EViews 10*'s two options for a panel-data regression: *White period* and *Cross-section weights*. Reed and Ye (2011) demonstrate that weighted-GLS estimators obtained by using these two options for adjusted standard errors are excellent in terms of the estimators' asymptotical efficiency and the accuracy of confidence intervals across them.

Table IV

Changes in R_{adj}^2 in Response to the Additions of Regressors

	Regression equations	Economic implications of the added regressors	R_{adj}^2
(1)	$\Delta CAR_{i,\tau} = b_0 + b_1 TT + b_2 TT^2 + b_3 TT^3 + IE_i + \varepsilon_{i,\tau}$	Individual effects	-1.1%
(2)	$\Delta Unce1_{i,\tau}$, $\Delta INVE\_Op1_{i,\tau}$, $CF\_Av_{i,\tau}$, $INVE\_Av_{i,\tau}$, $\Delta CL_{i,\tau}$, $CC1_{i,\tau}$, $CC2_{i,\tau}$, $Unce2_{i,\tau}$, $INVE\_Op2_{i,\tau}$, $\Delta INVE\_Op3_{i,\tau}$, $\Delta CG1_{i,\tau}$, $\Delta CG3_{i,\tau}$, $\Delta CG4_{i,\tau}$, $\Delta CG5_{i,\tau}$, and $\Delta CG6_{i,\tau}$ are added to (1) above	Insignificant regressors	8.9%
(3)	$\Delta RTA_{i,\tau}$ is added to (2) above.	Per-company average of real assets	10.8%
(4)	$\Delta IBL_{i,\tau}$ is added to (3) above.	Interest-bearing liabilities	29.5%
(5)	$\Delta CA_{i,\tau-1}$ is added to (4) above.	Non-cash current assets	35.2%
(6)	$CF_{i,\tau}$ is added to (5) above.	Contemporaneous cash flows	37.8%
(7)	$INVE_{i,\tau}$ is added to (6) above.	Contemporaneous investment expenditures	41.2%
(8)	$\Delta Unce3_{i,\tau}$ is added to (7) above.	Uncertainty (political stability)	46.2%
(9)	$\Delta CG2_{i,\tau}$ is added to (8) above.	The accountability to investors & board members	48.1%

This table shows the changes in R_{adj}^2 when the annual changes in national CARs are regressed on different sets of variables ranging from a coarse set (1) to a full set (9). Notes are as follows. First, I estimate the fixed-effects models by weighted GLS for all equations so as to maintain comparability. Last, in all estimations, to control for the potential of residuals' cross-section heteroskedasticity, period heteroskedasticity, and serial correlation, I use *EViews 10*'s two options for a panel-data regression: *White period* and *Cross-section weights*.

Appendix Table A

The Stock Market Indices Referred to

	Stock market indices	# of industry sub-indices synthesized	# of resulting constituent firms	Years when national CARs are available
AUS	S&P/ASX 300	7	184–239	2004–2018
CAN	S&P/TSX Composite Index	7	160–223	2002–2018
CHN	Shanghai Shenzhen CSI 300 Index	7	207–240	2007–2018
DEU	Prime All Share	12	249–327	2003–2018
ESP	Madrid Stock Exchange General Index	4	81–94	2005–2018
FIN	OMX Helsinki All Share Index	7	110–117	2012–2018
FRA	CAC All-Tradable Index	7	197–399	2002–2018
GBR	FTSE All Shares	20	269–427	2002–2018
HKG	Hang Seng Composite Index	1	19–25	2002–2018
ITA	FTSE Italia All-Share Index	7	149–175	2009–2018
IDN	Jakarta Stock Exchange Composite Index	6	225–387	2002–2018
IRL	ISEQ	1	39–54	2002–2018
JPN	TOPIX	25	1165–1579	2003–2018
KOR	KOSPI	13	552–657	2002–2018
NOR	OSE All Share Index	12	141–170	2005–2014
PRT	PSI All-Share Index	5	32–43	2002–2018
SWE	OMX Stockholm All Share Index	7	222–287	2012–2018
THA	Stock Exchange of Thai	14	177–254	2004–2018
USA	S&P 500	80	320–339	2003–2017
ZAF	FTSE/JSE Africa All Share Index	20–21	95–111	2002–2018

This table shows sample countries' stock market indices. The industry sub-indices of these indices are used for calculating national CARs and relevant financial indicators. Notes are as follows. First, financial, real estate, utilities, and telecommunications industries are excluded. Second, the number of industries synthesized differs by sample year for ZAF. Last, the number of resulting constituent companies differs by sample year for all countries.

Appendix Table C

The Risk of Multicollinearity among *CG1–CG4*

	CG1 vs. *CG2*	*CG1* vs. *CG3*	*CG1* vs. *CG4*	*CG2* vs. *CG3*	*CG2* vs. *CG4*	*CG3* vs. *CG4*
AUS	1.1	1.1	1.0	1.6	1.5	1.0
CAN	1.2	1.2	1.3	3.5	3.4	2.1
CHN	1.7	1.0	3.0	1.3	1.5	1.0
DEU	1.2	4.3	1.1	1.8	2.0	1.0
ESP	1.1	2.3	2.4	1.7	1.2	1.1
FIN	4.6	1.1	7.6	1.1	4.7	1.1
FRA	2.8	2.2	1.0	3.4	1.0	1.0
GBR	1.7	2.1	1.2	2.0	3.3	1.1
HKG	1.8	1.7	1.4	1.6	5.3	1.5
ITA	1.2	3.3	1.5	1.0	2.0	1.1
IDN	1.0	1.0	1.0	2.1	1.3	1.0
IRL	2.4	1.2	1.4	2.2	1.3	1.0
JPN	1.1	1.0	1.8	8.9	2.8	1.8
KOR	3.3	2.2	2.4	1.1	10.6	1.0
NOR	3.5	5.3	2.7	2.6	8.3	2.9
PRT	1.0	1.8	4.0	1.4	1.0	4.8
SWE	1.2	1.5	2.9	1.0	1.6	1.1
THA	1.0	1.0	1.0	3.3	1.0	1.0
USA	1.0	1.0	1.0	3.5	3.7	1.4
ZAF	1.4	1.5	1.7	1.0	5.1	1.1

This table shows VIFs (variance-inflation factors) among four kinds of scores on the state of corporate governance: *CG1–CG4*. Notes are as follows. First, a VIF is defined as $1/\{1 - (\text{correlation coefficients})^2\}$. Last, all the VIFs are much smaller than 10, the criterion proposed by Snee and Marquardt (1984) as defining negligible risk of multicollinearity caused by the independent variables. I ignore one exception found between *CG2* and *CG4* for South Korea.

Appendix Table E

Results of Estimating the Determinants of the Annual Change in National CARs

Dependent variable: ΔCAR. # of observations = 134

Model		**A: Pooling**	**B: Fixed effect**	
Specification of *IE*		**No**	**Yes: Constant**	
Estimation method		**OLS**	**LSDV**	
Adjustments on residuals (ε)		-	**White period**	**White cross-section**
			PH, & SC are adjusted for.	**CSH & CCE are adjusted for.**
Regressors	**Estimates**	$\hat{h}$ s	$\hat{h}$ s	$\hat{h}$ s
Constant term	C	0.846	1.320	1.320
		[0.252]	[0.083]	[0.089]
Linear time trend	TT	-0.385	-0.589	-0.589
		[0.298]	[0.168]	[0.110]
Quandratic time trend	TT^2	0.061	0.086	0.086
		[0.300]	[0.229]	[0.142]
Cubic time trend	TT^3	-0.003	-0.004	-0.004
		[0.299]	[0.271]	[0.164]
Uncertainty (volatility of cash flows)	$Unce1$	0.029	-0.037	-0.037
		[0.717]	[0.723]	[0.649]
Investment opportunies 1 (IO1): average q	$\Delta INVE\_Op1$	-0.027	-0.028	-0.028
		[0.795]	[0.710]	[0.721]
Per-company average of real assets	ΔRTA	-0.009	-0.287	-0.287
		[0.965]	[0.053]	[0.098]
Average cash flow in the past	CF_Av	0.053	-0.080	-0.080
		[0.567]	[0.565]	[0.434]
Average investment expenditures in the past	$INVE\_Av$	0.091	-0.020	-0.020
		[0.174]	[0.902]	[0.840]
Interest-bearing liabilities	ΔIBL	-0.635	-0.561	-0.561
		[0.000]	[0.000]	[0.000]
Non-cash current assets	ΔCA_{-1}	0.104	0.257	0.257
		[0.292]	[0.031]	[0.000]
Current liabilities	ΔCL	0.015	0.078	0.078
		[0.884]	[0.517]	[0.447]
Contemporaneous cash flows	CF	0.045	0.092	0.092
		[0.235]	[0.041]	[0.007]
Contemporaneous investment expenditures	$INVE$	-0.042	-0.132	-0.132
		[0.449]	[0.100]	[0.027]
Cost of carry (expected net cost)	$CC1$	-0.055	-0.125	-0.125
		[0.194]	[0.209]	[0.138]
Cost of carry (corporate tax cost)	$CC2$	0.082	-0.020	-0.020
		[0.052]	[0.863]	[0.828]
Uncertainty (stock return volatility)	$Unce2$	-0.053	-0.085	-0.085
		[0.409]	[0.191]	[0.405]
Uncertainty (political stability)	$\Delta Unce3$	0.391	0.473	0.473
		[0.018]	[0.008]	[0.002]
IO2: unexpected business climate change	$\Delta INVE\_Op2$	0.050	0.060	0.060
		[0.501]	[0.563]	[0.246]
IO3: R&D executions	$\Delta INVE\_Op3$	0.385	-0.217	-0.217
		[0.4362]	[0.755]	[0.736]
The observance of business ethics	$\Delta CG1$	-0.188	-0.089	-0.089
		[0.427]	[0.663]	[0.771]
The accountability to investors & board members	$\Delta CG2$	-0.320	-0.347	-0.347
		[0.075]	[0.008]	[0.000]
The strength of investor protection	$\Delta CG3$	-0.040	-0.063	-0.063
		[0.724]	[0.611]	[0.361]
The strength of auditing and reporting standards	$\Delta CG4$	0.165	0.054	0.054
		[0.359]	[0.856]	[0.793]
The depth of indirect debt finace (banks)	$\Delta CG5$	0.075	0.094	0.094
		[0.730]	[0.701]	[0.797]
The depth of direct debt finace (bonds)	$\Delta CG6$	-0.005	0.065	0.065
		[0.976]	[0.603]	[0.302]
R_{adj}^2		0.318	0.481	
F-test on H_0: Pooling model > Fixed-effect model		2.896 [0.001]		

This table shows the results of estimating the following: $\Delta CAR_{i,\tau} = b_0 + b_1 TT + b_2 TT^2 + b_3 TT^3 + b_4 Unce1_{i,\tau} + b_5 \Delta INVE\_Op1_{i,\tau} + b_6 \Delta RTA_{i,\tau} + b_7 CF\_Av_{i,\tau} + b_8 INVE\_Av_{i,\tau} + b_9 \Delta IBL_{i,\tau} + b_{10} \Delta CA_{i,\tau-1} + b_{11} \Delta CL_{i,\tau} + b_{12} CF_{i,\tau} + b_{13} INVE_{i,\tau} + b_{14} CC1_{i,\tau} + b_{15} CC2_{i,\tau} + b_{16} Unce2_{i,\tau} + b_{17} \Delta Unce3_{i,\tau} + b_{18} \Delta INVE\_Op2_{i,\tau} + b_{19} \Delta INVE\_Op3_{i,\tau} + b_{20} \Delta CG1_{i,\tau} + b_{21} \Delta CG2_{i,\tau} + b_{22} \Delta CG3_{i,\tau} + b_{23} \Delta CG4_{i,\tau} + b_{24} \Delta CG5_{i,\tau} + b_{25} \Delta CG6_{i,\tau} + IE_i + \varepsilon_{i,\tau}$. Notes are as follows. First, ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance. Second, I follow the conventional procedure in specifying the nature of *IE*. I estimate the pooling model using the OLS method, and I estimate the fixed-effects model with the Least Square Dummy Variables (LSDV) method. I justify the addition of constant *IE*s by checking with the F-test by how much and how significantly that addition reduces the residual sum of squares. If the fixed-effects model is selected, then, to compare it with the random-effects model, it is necessary to use the Hausman test to test the null hypothesis that *IE*s are uncorrelated with explanatory variables. This comparison, however, is not feasible here because the number of sample countries is less than the number of regressors for the between estimator to estimate the random effects innovation variance. Third, shading indicates regressors with statistically significant estimates and a specification of *IE* with statistical adequacy. I select the fixed-effects model. Fourth, CSH stands for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors. Using the statistical software package, *EViews 10*, I cope with these potential irregular aspects of residuals ($\varepsilon_{i,\tau}$) with reference to two kinds of adjusted standard errors. *EViews 10*'s option for a panel-data regression, *White period*, is used to gain standard errors adjusted for the risks of PH and SC, while *White cross-section* to gain those adjusted for the risks of CSH and CCE. Last, using $\Delta INVE\_Op3$ as a regressor makes it impossible to calculate cross-section weights (variance) for the GLS method used in the baseline estimation of Eq. (1), whose results are shown in Table I.