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The internal workings of internal capital markets: Cross-country evidence ☆

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ABSTRACT

We derive empirical predictions from the standard investment-cash flow framework on the functioning of internal capital markets (ICM), but circumvent its criticism by focusing on *parent* cash flow and investment opportunities. We test these predictions using a unique dataset of parent firms and their listed and unlisted subsidiaries in 90 countries over the period 1995–2006. We find that company and country institutional structures matter. (1) Ownership participation of the parent firm in the subsidiary plays a crucial role for the proper functioning of ICMs. The larger the ownership stake of the parent, the better the functioning of the ICM. (2) The best functioning cross-border ICMs can be found in the sub-sample of firms with parents from a country with "strong" institutions and subsidiaries from a country with "weak" institutions. (3) Unlisted subsidiaries are much more dependent on the ICMs their parents provide than listed subsidiaries. Thus, ICMs are not per se "bright" or "dark", their proper functioning depends on how they are set up.

1. Introduction

The literature stresses two opposing effects of internal capital markets (ICMs) on the investment performance of group firms or group segments. On the one hand, ICMs may substitute for missing external capital markets (ECMs), especially in less developed countries (Desai et al., 2004; Khanna and Palepu, 1999; Khanna and Yafeh, 2007). In the presence of capital market imperfections, subsidiaries/segments are able to access the funds that parents provide (Inderst and Mueller, 2003), and they benefit from the access to finance from other affiliates within the multinational network (Stein, 2003). Parents may also impose discipline on subsidiaries/segments by reallocating funds to those with investment proposals with a positive net present value but low internal cash flows (Stein, 2002). On the other hand, the redistribution of capital between subsidiaries or segments may weaken managerial incentives and lead to wasteful business activities (Milgrom and Roberts, 1988; Meyer et al., 1992). Under the conditions of soft budget constraints, ICMs allocate too many resources to firms with bad investment opportunities and too few to firms with good investment opportunities (Lamont, 1997; Rajan et al., 2000; Shin and Stulz, 1998). Some authors explain ICM inefficiency by poor corporate governance (Ozbas and Scharfstein, 2010; Sautner and Villalonga, 2010; Scharfstein and Stein,

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1990, 2000). Others claim that the evidence of ICM misallocations is an artifact of measurement error in Tobin's q used as a proxy for investment opportunities (Whited, 2001).

We take a neutral view and analyze the factors which contribute to the proper or ill-functioning of internal capital markets. Our empirical analysis builds on the familiar asymmetric information hypotheses on the relationship between internally generated cash flows and company investment (see e.g. Gugler et al., 2004a, 2004b or Stein, 2002). We extend this investment-cash flow framework to derive testable hypotheses on the workings of ICMs. We show that in proper functioning ICMs the subsidiary investment is positively related to parent firm cash flow and negatively related to parent firm investment opportunities.

We construct a unique dataset of parent firms and their listed and unlisted subsidiaries in 90 countries over the period 1995–2006. The cross country/cross firm variation in our dataset allows us to test various novel hypotheses on the effects of the nature of the parent–subsidiary relation (tightness of control, relatedness of assets etc.), country governance, and financial development on the functioning of ICMs. We seek to contribute to the literature on ICMs in at least three ways.

First, most papers on ICMs use firm segment data that introduce measurement errors in the main variables. For example, one cannot directly measure investment opportunities by Tobin's q because divisions have no independent market value, thus papers typically use the q-ratios of stand-alone firms in the same industry as a proxy for division's investment opportunities. This approach was criticized on the grounds that average qs of stand-alone firms do not proxy well for the investment opportunities of divisions (Whited, 2001). Some authors try to resolve the problem of measurement errors constructing a measurement-error consistent estimator (Whited, 2001) or using plant-level data (Maksimovic and Phillips, 2002). Our paper uses subsidiary data. Subsidiaries are separate legal entities and provide balance sheet and income statements. Thus, we do not need to rely on segment data and can directly control for the investment opportunities of the subsidiaries, e.g. measured by (subsidiary) Tobin's q or sales growth.

Second, a large literature has examined the link between internally generated cash flows and company investment, interpreting the investment-cash flow sensitivity as a sign of financial constraints. For example, Bond et al. (2003) study the role of financial factors in investment spending in four countries in Western Europe and present evidence that financial constraints are relatively severe in the more market-oriented U.K. financial system. Love (2003) examines cash flow coefficients across countries and tests whether they vary with measures of financial development. Recently, Becker and Sivadasany (2010) focus on the effects of financial development on company financing constraints in European countries over the period 1998–2002. Both papers find that financial development can mitigate financial constraints.

This literature was criticized on the grounds that cash flow may merely proxy for future investment opportunities, and thus a positive investment-cash flow coefficient does not say much about cash constraints (see the discussion between Fazzari et al., 1988, 2000 and Kaplan and Zingales, 1997, 2000). This paper partly circumvents this critique by focusing on the *parent* firm cash flow influence on *subsidiary* investment. *Parent* cash flows should be less likely to proxy for *subsidiary* investment opportunities. Moreover, we systematically utilize the cross country/cross firm/cross time nature of our panel, and stress the *differences* across firms and countries. Large and significant parent cash flow coefficients found in ICMs for some firms or countries and insignificant cash flow coefficients found for others are a sign of the workings/non-workings of the ICMs and not differing investment opportunities.[1]

Finally, in recent years a great deal of research focused on the role of institutions in determining company performance. It demonstrated that there are significant differences in performance across firms that are related to the corporate governance and legal institutions of the country in which a company is located, the identity of the controllers of a firm, and the degree of entrenchment of those in control.[2] We add significantly to this evolving literature by testing for the effects of institutional structures on ICMs.

Our study is related to a recent paper by Carlin et al. (2008), who examine the effects of ownership and financial development on investment behavior in 69 countries in 1994–2005. We analyze simultaneously listed *and* unlisted subsidiaries of (listed) parents. Carlin et al. (2008) focus on listed subsidiaries only and present evidence in favor of the existence of ICMs that reallocate finance to member firms with superior investment opportunities. However, unlisted subsidiaries far outweigh listed subsidiaries in economic importance and presumably, one of the main reasons why ICMs exist is to substitute for missing ECMs. Unlisted subsidiaries are more likely to face cash constraints, and should benefit most from the workings of ICMs. We discuss the similarities to and differences from Carlin et al. (2008) more in depth in the body of the text.

We find mixed evidence for the functioning of ICMs. On the one hand, we find evidence that ICMs alleviate cash constraints if ECMs are under-developed. Parent firms do re-allocate cash flows, and the subsidiaries with better investment opportunities get a higher share of the pie (i.e. there is a "ranking" of subsidiaries competing for valuable funds). Investment of unlisted subsidiaries is much more sensitive to parent firm cash flow than the investment of their listed counterparts. Subsidiaries from "weak" institution countries or from countries with badly developed financial markets, are more dependent on ICMs than their counterparts in "strong" institution countries or countries with well developed financial markets. All this is consistent with the "bright side" of ICMs.

On the other hand, ICMs are "costly" in the sense that a large ownership stake of the parent is an important factor for their working. Moreover, it appears to be necessary that the parent firm stems from a country with strong institutions and/or ECMs for proper functioning ICMs. If the parent stems from a "weak" country, one should not expect functioning ICMs. Thus, there is also a "dark side" of ICMs.

The rest of the paper is structured as follows. Section 2 discusses our hypotheses and the econometric modeling. Section 3 describes the data and sample characteristics. Section 4 analyzes the econometric results and Section 5 provides conclusions.

[1] See, for example, the discussion in Bond et al. (2003).

[2] See e.g. Claessens et al. (2002), Demirgüç-Kunt and Maksimovic (1998), Faccio et al. (2001), Gugler and Peev (2010), Gugler et al. (2003, 2004a, 2008), La Porta et al. (1997, 2000a, 2000b), Morck et al. (1988), Mueller and Peev (2007), and Mueller et al. (2003).

2. Hypotheses on internal capital markets

2.1. The inner workings of internal capital markets

The Modigliani and Miller (1958) approach to corporate finance when extended to FDI would imply that ownership and country institutional structures are irrelevant for investment decisions.[3] In Fig. 1, with perfect capital markets, the supply of funds, *S*, is a horizontal line at *r*, the risk-adjusted market rate of interest. Internal and external funds are perfect substitutes. The demand for capital investment is assumed downward sloping. In the neoclassical theory, a firm's investment depends only on this demand and its cost of capital, and is independent of the size of its cash flow. A neoclassical firm invests where the expected marginal profitability of investment equals its marginal cost.

In contradiction to the neoclassical theory, imperfect external capital markets and corporate governance problems are major determinants of investment behavior.[4] If the firm faces a rising cost of capital schedule once it enters the external capital market e.g. due to transaction costs or asymmetric information,[5] the supply of capital, *S*, is dependent on the level of cash flows. Fig. 1 depicts a subsidiary (on the left part of the figure), which has good investment opportunities but a steeply upward sloping external cost of funds schedule, and a parent (to the right), which is much larger and is also depicted as having an upward sloping external cost of funds schedule.[6] If ICMs work perfectly, the parent firm uses own cash flow and available external funds and redistributes them to the subsidiary until risk adjusted returns across both firms (or more generally across all firms in the group) are equalized, i.e. until $r^S = r^P$. It follows that the subsidiary can profitably invest more in the ICM, $I^S_{a\ ICM}$, than as a standalone firm, I^S_a, and the parent invests less.[7]

Fig. 2 depicts the effects of an increase in parent cash flows, shifting its cost of funds schedule to the right. Not surprisingly, by alleviating the *group's* cash constraints, this shift increases both subsidiary and parent investment, if the ICM works smoothly.

Smooth functioning of ICMs also implies that the parent firm allocates its funds across subsidiaries depending on the relative value of each subsidiary's investment opportunities. Thus, increasing investment opportunities of the parent firm (or more generally, the entire group except the particular subsidiary) will decrease the subsidiary's investment, holding the subsidiary's investment opportunities constant. In Fig. 3, we analyze this situation as a shift of the parent demand for capital schedule to the right. The parent invests more and the subsidiary less after this shift (given the budget constraint of the group).

In sum, proper functioning ICMs imply that the investment of *subsidiaries* is positively affected by the cash flows of the *parent* firm and negatively affected by the investment opportunities of the *parent* firm.

2.2. Determinants of the functioning of ICMs

The functioning of ICMs may differ according to (1) the tightness of the internal incentive and control structure between parent and subsidiary, and (2) the external constraints faced by the parent and the subsidiary.

Regarding (1), the *ownership stake of the parent* in the subsidiary determines the financial interest/incentive the parent has in funding profitable investment opportunities of the subsidiary as well as its ability to control the operations of the subsidiary (e.g. via management selection, supervisory board representation and the like). In fact Figs. 1–3 were drawn under the assumption that the parent has a 100% ownership stake in the subsidiary. Only in this case should we expect full equalization of risk-adjusted marginal returns on investment across group firms. If the parent had, e.g., only a 50% stake in the subsidiary, it might prefer a lower marginal return project conducted internally, where it gets all of the benefits, to a higher marginal return project conducted by the subsidiary, where it only gets 50% of the returns. There are also a number of legal and tax reasons to expect that ICMs work better the larger the ownership stake of the parent, and in particular when it is 100%. E.g. wholly owned subsidiaries are tax advantaged in their dividend payments in the US and many other countries as opposed to partially owned subsidiaries, in partially owned subsidiaries minority shareholder rights might complicate ICMs.[8] Thus, the functioning of ICMs depends on the parent firm's ownership stake in the subsidiary: the larger this stake, the better the ICM should function. Thus, we have:

Hypothesis 1. The larger the parent stake, the larger the parent's cash flow effect, and the more negative the parent's investment opportunities effect.

Regarding (2), external constraints, *country level factors*, such as the legal system, law enforcement, corruption, and the development of external capital markets, co-determine on the one hand how easy it is to set up functioning ICMs for the parent and on the other hand how easy it is for the subsidiary to raise capital externally (either external debt or equity) and therefore the

[3] See also Miller (1988).

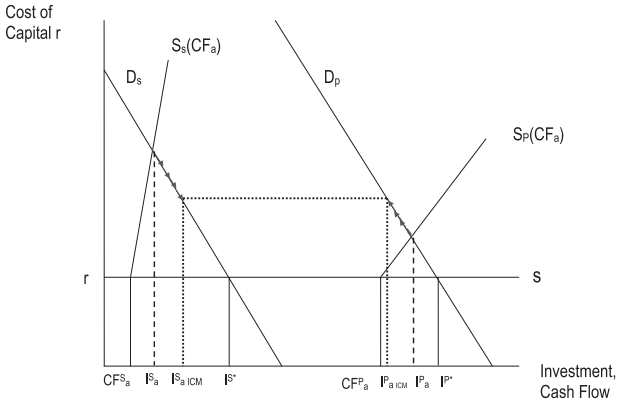
[4] See e.g. Degryse and de Jong (2006), Fazzari et al. (1988), Gugler and Peev (2010), Gugler et al. (2004b), and Stein (2003).

[5] Myers and Majluf (1984) posit that firms may be cash-constrained because outside investors have less information than the owner-managers about the true value of assets or investment opportunities. Cash-constrained managers maximize incumbent shareholder wealth by foregoing some positive NPV projects rather than issuing equity which is currently undervalued due to asymmetric information. Adverse selection can also lead to credit rationing (Stiglitz and Weiss, 1981). Uncollateralized credit could be denied to firms if adverse selection of loan applicants leads banks to choose an interest rate at which the market does not clear. See Fazzari et al. (1988) for the first empirical tests.

[6] For the basic argument of redistribution of funds to the subsidiary with better projects it does not matter whether the parent has also a rising cost of capital schedule or not.

[7] If the parent has a flat cost of capital schedule, its investment would not be affected by the ICM and it would remain at I^{P*}.

[8] See also Samphantharak (2006).



Notes:
Figure 1 shows the workings of an ICM between a subsidiary (left part) and a parent (right part).

Variable Description:

r	the risk-adjusted market rate of interest
D_S	the subsidiary demand for capital investment
D_P	the parent demand for capital investment
$S_S(CF_a)$	the constrained subsidiary's supply given cash-flow CF_a^S
I^{S^*}	the unconstrained subsidiary investment under S
I_a^S	the subsidiary investment under $S_S(CF_a)$ (constrained)
I_{aICM}^S	the subsidiary investment under $S_S(CF_a)$ (constrained but with ICM)
$S_P(CF_a)$	the parent market supply given cash-flow CF_a^P
I^{P^*}	the unconstrained parent investment under S
I_a^P	the parent investment under $S_P(CF_a)$ (no ICM)
I_{aICM}^P	the parent investment under $S_P(CF_a)$ (with ICM)

Fig. 1. Equalization of risk-adjusted returns in an efficient ICM.

value of ICMs. La Porta et al. (1997, 1998) sparked a huge literature in law and finance analyzing country effects worldwide. These studies emphasize the importance of a country's legal institutions in protecting shareholders improving company investment performance and external capital market development. Other studies focus on the quality of country governance and argue that companies have better investment performance in countries with strong property rights enforcement, independent judiciaries, and strong contract enforcement.[9] Acemoglu and Johnson (2005) present evidence on the importance of the protection of property rights in explaining differences in the sizes of external capital markets and GDP per capita. However, there are few studies analyzing the influence of country factors on the workings of ICMs in a cross-country setting.[10]

High quality governance institutions in a country should increase company investment performance by reducing the transaction costs of writing and enforcing contracts, of obtaining licenses and permits, and more generally of conforming to the laws and regulations of the country. Some of the benefits a parent company obtains from operating in a country with high quality institutions might be passed on to its subsidiaries. For example, good institutions in a parent's country may lower the transaction costs of writing and enforcing contracts with its subsidiaries. Good institutions in a parent's country may facilitate the transfer of technology, know how, and good management practices to subsidiaries. Cash constraints are then lower and more profitable investment projects can be financed by the subsidiary using the internal capital market. Thus, ICMs may function better, if the parent operates in a country with a good institutional environment.

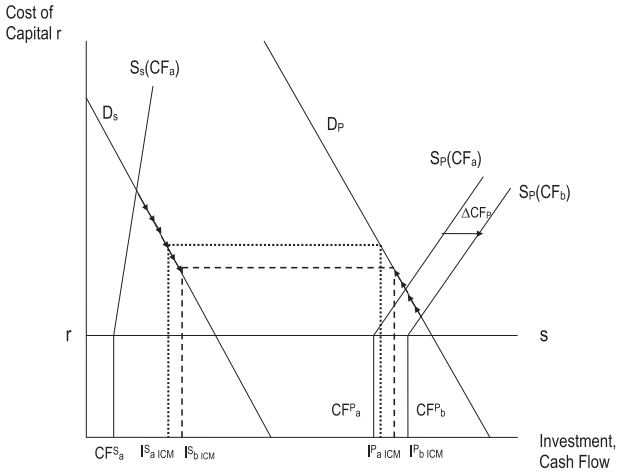
We expect that when *parent* firms stem from countries with high institutional quality and developed ECMs, they can provide better monitoring and finance profitable investment opportunities. On the other hand, *subsidiaries* in countries with high institutional and/or ECM development may not need ICMs to finance their investment but can obtain funding from functioning ECMs, while subsidiaries in countries with low institutional quality need ICMs as substitutes for the lack of developed ECMs.[11] Thus, we expect

Hypothesis 2. The positive effect of the parent's cash flow and the negative effect of the parent's investment opportunities on subsidiary investment are stronger for subsidiaries in countries with underdeveloped financial markets and parent firms from countries with developed financial markets than for subsidiaries from countries with other parent–subsidiary pairs.

[9] See e.g. Besley (1995) and Johnson et al. (2002). Previous research presents evidence on the positive association between protection of shareholder rights and property rights, on the one hand, and the size of the external capital market, on the other hand. However, separating the effects of legal institutions and the quality of country governance on performance is a difficult task. Acemoglu and Johnson (2005), for example, discuss the difficulty in constructing pure "property rights" measures, and show that one of their proxies for property rights institutions in fact incorporates information closely related to legal institutions.

[10] See e.g. Carlin et al. (2008).

[11] Rossi and Volpin (2004) examine the interaction effects of the institutional quality of countries of acquirer and target firms in their study on determinants of cross-country mergers and acquisitions.



Notes:
Figure 2 shows the effects of an increase in parent cash-flow, shifting the parent cost of funds schedule to the right.

Variable Description:

r	the risk-adjusted market rate of interest
D_S	the subsidiary demand for capital investment
D_P	the parent demand for capital investment
$S_S(CF_a)$	the constrained subsidiary supply given cash-flow CF_a^S
I_{aICM}^S	the subsidiary investment under $S_S(CF_a)$ (constrained but with ICM)
I_{bICM}^S	the subsidiary investment if parents cash flow increases
CF_a^P is lower than CF_b^P	two different cash-flow situations for the parent
$S_P(CF_a)$	the parent market supply given cash-flow CF_a^P
I_{aICM}^P	the parent investment under $S_P(CF_a)$ (with ICM)
$S_P(CF_b)$	the parent market supply given cash-flow CF_b^P
I_{bICM}^P	the parent investment under $S_P(CF_b)$ (with ICM)

Fig. 2. The effects of an increase in parent cash flow in an efficient ICM.

Hypothesis 3. The positive effect of the parent's cash flow and the negative effect of the parent's investment opportunities on subsidiary investment are stronger for subsidiaries in countries with "*weak*" country governance and financial systems and parent firms from "*strong*" systems than for subsidiaries from countries with other parent–subsidiary pairs.

Whether the subsidiary is listed or not can be categorized as lying in between internal and external constraints. *Listing* entails a dispersion of ownership, so listed firms move away from the wholly owned subsidiary. Listing on a stock exchange also means minority shareholder rights and much stricter transparency. The legal form of a listed subsidiary usually is a joint stock corporation, which gives it much more autonomy in decision making vis a vis the parent (e.g. it is not bound by directives). Thus, we expect a much looser relation between parents and listed subsidiaries than between parents and unlisted subsidiaries. Moreover, listing may also affect the external constraints faced by the subsidiary: Listed subsidiaries do not need ICMs as much as unlisted subsidiaries do, since ECMs substitute for them. It is very likely that the asymmetry of information for listed subsidiaries is much lower than for unlisted subsidiaries: their shares are traded daily on the stock exchange, they are covered by a number of analysts, they provide quarterly company reports, and they are on average much larger than their unlisted counterparts. Moreover, unlisted firms have not gone to the stock exchange in the first place, because, presumably, asymmetry of information is particularly severe for them so that under-pricing of assets would occur. Thus, we expect that ICMs play a larger role for unlisted subsidiaries than for listed subsidiaries.

Hypothesis 4. The positive effect of the parent's cash flow and the negative effect of the parent's investment opportunities on subsidiary investment are stronger for *unlisted* subsidiaries than for *listed* subsidiaries.

2.3. Econometric modeling

We test these predictions by estimating accelerator models of investment augmenting them with subsidiary and parent cash flow and parent Tobin's q terms similar to those used by Carlin et al. (2008), Chevallier (2004), and Shin and Stulz (1998):

$$I_{st} = \alpha + \rho I_{st-1} + \beta_s SG_{st} + \beta_p SG_{pt} + \gamma_p Q_{pt} + \delta_s CF_{st-1} + \delta_p CF_{pt-1} + \mu_s + \varepsilon_{st}. \quad (1)$$

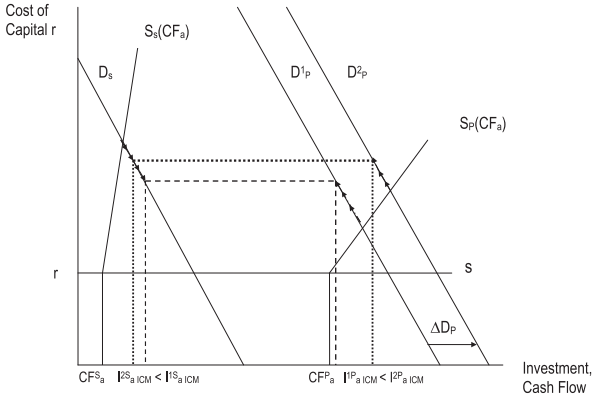
Whereby, I_{st} is the investment of the subsidiary in time t divided by beginning of year total assets; I_{st-1} is the lagged investment rate; SG_{st} is the sales growth rate of the subsidiary from $t-1$ to t; SG_{pt} is the sales growth rate of the parent; CF_{st-1} is the cash flow of the subsidiary in $t-1$ divided by total assets, and CF_{pt-1} is the cash flow of the parent in $t-1$ divided by total assets, Q_{pt} reflects the Tobin's q of the parent in t, and the μ_s denotes (subsidiary) firm fixed effects. We measure investment as the change in fixed assets plus depreciation, cash flow as the net profit/loss of a firm plus depreciation, Tobin's q as market capitalization plus long term debt over total assets, and sales growth as the log difference between sales from one period to the next.

The coefficients of main interest are γ_p and δ_p. A negative γ_p implies a ranking of subsidiaries, such that if the investment opportunities of the whole group go up relative to the investment opportunities of the subsidiary s, the investment of the subsidiary should go down, since funds are redistributed within the group. A positive δ_p implies that parent funds are used to finance subsidiary investment.

The problems in measuring investment opportunities are well known. Studies usually apply Tobin's q (defined as the ratio of the market value of the firm to the replacement costs of the firm's capital stock). However, Tobin's q reflects expected returns on investment only if the firm is a price taker in competitive markets, there are constant returns to scale and the stock market value of the firm correctly measures the fundamental expected present value of the firm's future net cash flows (Hayashi, 1982). There are also problems to measure the replacement costs of assets due to the lack of disclosure requirements in most European countries (Goergen and Renneboog, 2001). Theoretically, marginal q should be used as the proxy of present and expected future investment opportunities but since marginal q is unobservable, most studies use average q as a proxy.

Since the largest part of our sample consists of unlisted subsidiaries for which we cannot control for investment opportunities via subsidiary Tobin's q, we have to be very careful controlling for investment opportunities. Eq. (1) therefore includes a number of variables controlling for them. First, lagged investment controls for possible dynamic effects and adjustment processes in the investment behavior of the subsidiary. The sales growth rates are included to control for accelerator effects on investment, which may also originate in the parent company. Subsidiary cash flow controls for investment opportunities, if current (own) cash flow proxies for investment opportunities. Finally, we include subsidiary firm fixed effects controlling for time invariant investment opportunities. For the sub-sample of listed subsidiaries we can and do control for investment opportunities by including (also) subsidiary Tobin's q.

We measure parent's cash flows and sales subtracting the subsidiary's values, however, we cannot apply the same procedure to parent's q, since most subsidiaries are not listed. We do not, however, expect any negative relationship between subsidiary investment and parent's q to be driven by this mis-measurement. First, parent firms are much larger than subsidiaries on average, thus any mis-measurement is likely to be minor (see Table 2). Second, and more importantly, if we include part of the subsidiary's



Notes:
Figure 3 shows the effects of an increase in parent investment opportunities, shifting the demand for capital to the right.

Variable Description:

r	the risk-adjusted market rate of interest
D_S	the subsidiary demand for capital investment
$S_S(CF_a)$	the constrained subsidiary supply given cash-flow CF_a^S
I_{aICM}^{1S}	the subsidiary investment if parent has lower investment opportunities
I_{aICM}^{2S}	the subsidiary investment if parent has higher investment opportunities
D_P^1 is below D_P^2	a change in investment opportunities for the parent
D_P^1	the parent demand for capital investment with lower investment opportunities
D_P^2	the parent demand for capital investment with higher investment opportunities
$S_P(CF_a)$	the parent supply given cash-flow CF_a^P
I_{aICM}^{1P}	the parent investment with lower investment opportunities
I_{aICM}^{2P}	the parent investment with higher investment opportunities

Fig. 3. The effects of an increase in parent investment opportunities in an efficient ICM.

investment opportunities in our parent q measure, its coefficient should be biased *upward*. Thus, if we find a *negative* relation between subsidiary investment and parent q, the true relation should be even more negative.

As mentioned in the Introduction, the literature is concerned that the interpretation of cash flow coefficients may be ambiguous, if cash flows proxy for future investment opportunities (see the discussion between Fazzari et al., 1988, 2000 and Kaplan and Zingales, 1997, 2000). We focus on the *parent* firm cash flow influence on *subsidiary* investment, which should be less likely to proxy for subsidiary investment opportunities. Moreover, we carry out a cross-country study and to the extent that the link between current cash flows and future investment opportunities is similar across countries, one may argue that large and significant country differences in the parent cash flow coefficients are likely to proxy for differences in the workings of ICMs across countries.

3. Data

We construct a unique dataset containing data from three databases, Amadeus and Osiris, provided by Bureau van Dijk electronic publishing and Worldscope by Thompson Reuters. Bureau von Dijk and Thompson Reuters combine several information sources, like company registers, annual reports, stock exchanges etc., to establish a corporate database. Amadeus and Osiris assign unique identification numbers to each company. Using this identification key, it was possible to interlink the two databases. Amadeus contains ownership and financial firm-level data for mainly unlisted companies from 38 European countries, while Osiris contains ownership and financial firm-level data for listed companies for around 120 countries. We use the ownership structure provided by Osiris and add financial data for unlisted subsidiaries from Amadeus, and so construct a panel using both databases for the years 1995–2006. Additionally we link the Worldscope database using the isin code for listed firms to augment missing values in the dataset.[12] Thus, we are able to identify listed parent firms, listed and unlisted subsidiaries.

We evaluate the quality of country governance using the Worldwide Governance Indicators (WGI) of the World Bank. We average the six indexes: (1) voice and accountability, (2) political stability, (3) government effectiveness, (4) regulatory quality, (5) rule of law, and (6) control of corruption. The indicators are constructed using the unobserved components methodology described in Kaufmann et al. (2005). The indicators are measured in units ranging from −2.5 to +2.5, with higher values corresponding to better governance.

We measure the financial development of a country by the ratio of private credit lent by deposit money banks to GDP. We think that this measure most accurately reflects the external constraints faced by most of our firms, since bank credit is the most important source of external funds and most of our firms are unlisted. Alternatively, one may measure external financial market development by the ratio of stock market capitalization to GDP (see Beck et al., 2000). Since results are similar we report only the first set of results.

Table 1 provides descriptive statistics by countries. For any country we present the number of listed and unlisted subsidiaries, number of parent firms and the country average institutional quality index and financial market indicators. Subsidiaries are defined as firms when the parent is (at least) a majority owner, i.e. where the parent holds more than 50% of the equity. On average, parent firms have around six subsidiaries, around 4% of all subsidiaries are listed, a bit more than half of all subsidiaries are foreign.

Table 2 presents descriptive statistics of the main variables by parent firms, listed and unlisted subsidiaries. On average, the investment ratio is higher for listed than unlisted subsidiaries. Internally generated cash flow is 7.4% of assets in listed, 7% in unlisted subsidiaries, and 6.6% in parent firms. While average sales growth is smaller for parent firms than for either type of subsidiary, parents' average Tobin's q is larger than for listed subsidiaries. Parents are on average around 25 times as large as their unlisted subsidiaries (in terms of number of employees) and three times as large as their listed subsidiaries. Parents on average hold around 2/3 of the equity in listed, and 90% in unlisted subsidiaries.

4. Empirical evidence

4.1. Main results on internal capital markets

Eq. (1) includes a lagged dependent variable as well as firm fixed effects, additionally, we cannot exclude possible endogeneity between the left and some right hand side variables (e.g. reverse causality between investment and cash flow). Therefore, estimation by OLS would give us biased estimates. We address these issues by applying the General Method of Moments (GMM) estimator. The GMM model estimates Eq. (1) using the systems GMM estimator developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). This estimator eliminates (subsidiary) firm fixed effects by first-differencing as well as controls for possible endogeneity of current explanatory variables. Endogenous variables lagged two or more periods will be valid instruments provided that there is no second-order autocorrelation in the first-differenced idiosyncratic error terms.[13]

Table 3 displays our main results. We include only subsidiaries where the parent firm owns more than 50% of the equity, so these are “true” subsidiaries and they are consolidated with the parent firm. We further distinguish between listed and unlisted

[12] Osiris and Worldscope have similar information regarding financial variables for listed firms. Detailed information regarding the match between the two databases is available from the authors upon request.

[13] Of course, it would be preferable to use a set of truly independent instrumental variables (IV) instead. It was, however, impossible for us to identify and collect a set of IVs that varies across firms and time and that is uniformly valid for all countries in the sample.

Table 1
Number of parent and subsidiary firms per country and country indices. The table shows the number of parent and subsidiary firms by country for which we observe all financial variables needed for estimation at least once and the parent is a majority owner of the subsidiary firm with at least 50% ownership stake. The ownership structure was constructed using the complete set of listed parent firms and their corresponding subsidiaries from *Bureau van Dijk Osiris* database, augmenting it with financial information about subsidiaries from *Bureau van Dijk Amadeus* database and *Worldscope* database. In addition country averages measuring institutional quality, *World Governance Index* (*WGI*) and financial market development, *Private Credit over GDP* (*PCRD*) and *Stock Market Capitalization over GDP* (*STMKT*) provided by the World Bank are shown.

	Parents	Subsidiaries				Country		
	Listed	All	Listed	Unlisted	Listed	WGI	PCRD	STMKT
				Foreign	Foreign			
Australia	29	15	15	0	9	1.592	0.719	0.758
Austria	42	160	2	123	0	1.617	0.941	0.153
Belgium	104	1,803	11	1,199	8	1.374	0.646	0.621
Bulgaria	0	26	0	26	0	0.125	0.301	0.055
Canada	48	13	13	0	6	1.639	0.937	0.782
China	7	12	12	0	0	−0.439		0.223
Croatia	3	61	1	48	1	0.154	0.390	0.166
Czech Republic	8	321	9	293	5	0.774	0.502	0.218
Denmark	79	558	2	341	0	1.766	0.715	0.445
Finland	100	766	0	299	0	1.855	0.670	0.842
France	513	6,832	60	2,476	12	1.203	0.861	0.553
Germany	314	1,239	58	611	20	1.538	1.036	0.359
Greece	139	562	26	172	5	0.750	0.431	0.420
Hong Kong	28	12	12	0	2	1.094	1.471	2.670
Hungary	14	221	3	198	3	0.892	0.333	0.173
India	16	36	36	0	31	−0.192	0.256	0.289
Ireland	24	162	0	151	0	1.528	0.837	0.607
Israel	26	9	9	0	1	0.594	0.674	0.454
Italy	160	1,810	19	1,065	2	0.787	0.633	0.318
Luxembourg	13	33	3	16	0	1.779	1.019	1.531
Netherlands	106	562	6	507	3	1.753	1.708	0.947
Norway	104	835	2	498	0	1.707	0.943	0.326
Poland	24	426	5	358	4	0.620	0.189	0.110
Portugal	34	409	3	208	0	1.208	0.885	0.291
Romania	0	195	1	194	1	−0.027	0.079	0.051
Russian Federation	9	17	17	0	1	−0.671	0.130	0.205
Singapore	26	20	20	0	8	1.547	1.109	1.428
Slovakia	2	43	1	42	1	0.553	0.416	0.073
Slovenia	3	12	0	6	0	0.926	0.302	0.134
Spain	108	2,127	13	1,374	2	1.185	0.860	0.493
Sweden	201	1,725	8	850	1	1.727	1.056	0.832
Switzerland	113	43	8	8	5	1.791	1.587	1.707
Taiwan	35	15	15	0	1	0.862		0.927
United Kingdom	519	3,766	11	2,313	8	1.579	1.192	1.281
United States	679	50	50	0	17	1.417	1.652	1.064
Rest	422	555	424	122	205			
Total	4,053	25,452	875	13,498	362			
Ownership								
Percentage		89.21	65.79	87.69	65.94			

subsidiaries. In the regressions, we can include 22,503 unlisted subsidiaries controlled by 3,262 parent firms (70,262 observations) and 736 listed subsidiaries controlled by 330 parent firms (3,095 observations), respectively. The Sargan tests do not suggest rejection of the over-identifying restrictions at conventional levels. While there is evidence of first order serial correlation in the residuals, the AR(2) test statistics reveal the absence of second order serial correlation in the first differenced errors. Our GMM estimates therefore use variables lagged by three or more periods as instruments.

The coefficients on the control variables are reasonable. The coefficient on the lagged dependent variable is positive and significant for unlisted subsidiaries, indicating dynamic adjustment processes of investment. The accelerator terms are all positive and two out of four are significant indicating important accelerator effects.

Turning to our variables of main interest, *parent cash flow* displays a positive, sizeable, and significant coefficient for unlisted subsidiaries pointing to a financial relation between them and their parents. Moreover, *parent Tobin's q* has a negative and significant coefficient: the larger the investment opportunities of the parent firm, the lower the investment rate of the unlisted subsidiary. Both coefficients together imply that funds for investment are redistributed within the group, and this redistribution of funds is responsive to investment opportunities. We do not find significant effects for listed subsidiaries. The larger coefficient of parent cash flow for unlisted subsidiaries (0.264) compared to listed subsidiaries (0.010) and the more negative Tobin's q effect (−0.028 versus −0.011) imply that ICMs are—as expected in Hypothesis 4—much more important for unlisted than for listed subsidiaries.

Table 2
Descriptive statistics by firm type. The table shows the descriptive statistics for variables used in the estimations. *Investment* is the change in fixed assets plus depreciation over total assets for the subsidiary firm. *Cash flow* is profit/loss plus depreciation divided by total assets of the firm. *Sales growth* is the change in sales over last period sales for the firm. *Tobin's q* is market capitalization plus total liabilities divided by total assets of the listed firm. *Number of employees* is the average number of fulltime employees. *Ownership* measures the direct ownership percentage the parent holds in the subsidiary firm. All variables are shown for the sample where the parent is a majority owner of the subsidiary firm and holds at least 50% of ownership stake. All variables are trimmed for outliers at the 2% level.

		Unlisted subsidiaries	Listed subsidiaries	Listed parents
Investment	Mean	0.058	0.074	0.070
	Median	0.031	0.060	0.058
	Min	−0.304	−0.301	−0.010
	Max	0.524	0.523	0.208
Cash flow	Mean	0.070	0.074	0.066
	Median	0.072	0.075	0.069
	Min	−0.671	−0.650	−0.270
	Max	0.398	0.397	0.245
Sales growth	Mean	0.178	0.159	0.140
	Median	0.082	0.088	0.101
	Min	−0.702	−0.702	−0.408
	Max	4.464	4.423	1.501
Tobin's q	Mean		1.547	1.642
	Median		1.345	1.441
	Min		0.063	0.027
	Max		6.711	6.828
Number of employees	Mean	533	4,620	13,847
	Median	69	919	2,121
	Min	1	1	1
	Max	139,484	182,000	2,100,000
Ownership %	Mean	90.1	65.8	
	Median	100.0	61.0	
	Min	50.0	50.0	
	Max	100.0	100.0	
Number of firms		25,452	875	4,053

Table 3
Main results. GMM estimation: shows subsidiary investment depending on subsidiary variables and its corresponding parent firm variables. *Sub: Investment lagged* is the change in fixed assets plus depreciation over total assets for the subsidiary firm lagged by one period. *Sub: Sales growth* is the change in sales over last period sales for the subsidiary firm. *Par: Sales growth* is the change in sales over last period sales for the parent firm. *Sub: Tobin's q* is market capitalization plus total liabilities divided by total assets of the subsidiary firm (only available for listed subsidiaries). *Par: Tobin's q* is market capitalization plus total liabilities divided by total assets of the parent firm. *Sub: Cash flow* is profit/loss plus depreciation divided by total assets of the subsidiary firm lagged by one period. *Par: Cash flow* is profit/loss plus depreciation divided by total assets of the parent firm lagged by one period. The sample period covers 1996 until 2006 and uses only subsidiary firms for which data with at least 5 consecutive observations are available. The parent is a majority owner of the subsidiary firm and holds at least 50% ownership stake. The sample of subsidiaries includes domestically and foreign owned firms. Instruments for the predetermined variables include subsidiary investment lagged by at least 3 periods or earlier. The strictly exogenous regressors ordinarily instrument themselves. The first column shows the results for unlisted subsidiary firms, whereby the second column shows the results for listed subsidiary firms. All estimations include year dummies and incorporate subsidiary firm fixed effects. Parent firms are all listed firms. All variables are measured in U.S. dollars, at the beginning of the year and are trimmed at 2%. Standard errors are robust, clustered by firm and shown in brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. AR 1 (p) and AR 2 (p) show the p-value of the test statistic for first and second order autocorrelation in the residuals. Sargan (p) shows the p-value for the Sargan statistic testing for the exogeneity of the endogenous variables.

Subsidiary type	1	2
	Unlisted	Listed
Sub: Investment lagged	0.206**	0.002
	(0.078)	(0.147)
Sub: Sales growth	0.014	0.268***
	(0.015)	(0.077)
Par: Sales growth	0.396**	0.159
	(0.146)	(0.090)
Par: Tobin's q	−0.028***	−0.011
	(0.008)	(0.009)
Sub: Cash flow	0.085***	0.287***
	(0.006)	(0.064)
Par: Cash flow	0.264***	0.010
	(0.058)	(0.068)
Sub: Tobin's q		0.000
		(0.009)
AR 1 (p)	0.00	0.00
AR 2 (p)	0.24	0.77
Sargan (p)	0.81	0.21
Subsidiary firms	22,503	736
Parent firms	3,262	330
Observations	70,262	3,095

In sum, we do find that ICMs are at work for unlisted subsidiaries. Parent cash flows positively affect subsidiary investment and parents "rank" their subsidiaries according to investment opportunities in the face of an overall group capital budget constraint.

4.2. Tightness of control and internal capital markets

Table 4 analyzes whether the size of the equity stake of the parent firm matters. Hypothesis 1 states that the larger the percentage holdings of the parent in the subsidiary, the better the ICM works, since fewer incentive and control (and legal and tax) problems arise. The extreme case is a 100% owned subsidiary: the residual claimant (i.e. the parent) gets all the benefits and bears all the costs of its actions (e.g. funding and monitoring), so there is no corporate governance problem. The table presents regressions again for unlisted and listed firms using interaction terms of parent Tobin's q and the cash flow terms (as well as subsidiary Tobin's for listed firms) with parent ownership stake. This specification assumes a continuous and linear relation. Note, that we include *all* firms, i.e. also those firms where the parent has an ownership stake of less than 50%. While one may not call them "subsidiaries" but rather equity participations, we do this deliberately because we want to *test* whether an ICM exists for minority controlled firms at all, or to put it differently, we want to determine the *thresholds* of ownership when ICMs start to work.

The results are striking. The interaction term of parent ownership and parent cash flow is significantly positive in the unlisted sub-sample: The larger the equity interest of the parent in the unlisted subsidiary, the more parent cash flow is used for funding subsidiary investment. The impact of parent cash flow is always positive and significant for unlisted subsidiaries, and reaches its

Table 4
Ownership results. GMM estimation: shows subsidiary investment depending on subsidiary variables and it's corresponding parent firm variables. *Sub: Investment lagged* is the change in fixed assets plus depreciation over total assets for the subsidiary firm lagged by one period. *Sub: Sales growth* is the change in sales over last period sales for the subsidiary firm. *Par: Sales growth* is the change in sales over last period sales for the parent firm. *Sub: Tobin's q* is market capitalization plus total liabilities divided by total assets of the subsidiary firm (only available for listed subsidiaries). *Sub: Tobin's q∗Ownership* is an interaction term between subsidiaries' Tobin's q and the ownership stake the parent firm holds in the subsidiary (only available for listed subsidiaries). *Par: Tobin's q* is market capitalization plus total liabilities divided by total assets of the parent firm. *Par: Tobin's q∗Ownership* is an interaction term between parent firms' Tobin's q and the ownership stake the parent firm holds in the subsidiary. *Sub: Cash flow* is profit/loss plus depreciation divided by total assets of the subsidiary firm lagged by one period. *Sub: Cash flow∗Ownership* is an interaction term between subsidiaries' cash flow and the ownership stake the parent firm holds in the subsidiary. *Par: Cash flow* is profit/loss plus depreciation divided by total assets of the parent firm lagged by one period. *Par: Cash flow∗Ownership* is an interaction term between parent firms' cash flow and the ownership stake the parent firm holds in the subsidiary. The sample period covers 1996 until 2006 and uses only subsidiary firms for which data with at least 5 consecutive observations are available. The sample of subsidiaries includes domestically and foreign owned firms. Asset holdings via funds are excluded. Instruments for the predetermined variables include subsidiary investment lagged by at least 3 periods or earlier. The strictly exogenous regressors ordinarily instrument themselves. Column 1 shows the results for unlisted subsidiary firms, whereby the column 2 shows the results for listed subsidiary firms. All estimations include year dummies and incorporate subsidiary firm fixed effects. Parent firms are all listed firms. All variables are measured in U.S. dollars, at the beginning of the year and are trimmed at 2%. Standard errors are robust, clustered by firm and shown in brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. AR 1 (p) and AR 2 (p) show the p-value of the test statistic for first and second order autocorrelation in the residuals. Sargan (p) shows the p-value for the Sargan statistic testing for the exogeneity of the endogenous variables.

Subsidiary type	1	2
	Unlisted	Listed
Sub: Investment lagged	0.170*	0.100
	(0.074)	(0.109)
Sub: Sales growth	0.009	0.340***
	(0.014)	(0.038)
Par: Sales growth	0.323**	0.110*
	(0.110)	(0.046)
Par: Tobin's q	−0.023***	−0.002
	(0.006)	(0.003)
Par: Tobin's q∗Ownership	−0.00001	0.00008
	(0.00002)	(0.00012)
Sub: Cash flow	0.094***	0.210*
	(0.011)	(0.112)
Sub: Cash flow∗Ownership	0.00001	0.007**
	(0.00012)	(0.003)
Par: Cash flow	0.181***	0.004
	(0.041)	(0.035)
Par: Cash flow∗Ownership	0.001*	−0.001
	(0.00012)	(0.001)
Sub: Tobin's q		0.009
		(0.006)
Sub: Tobin's q∗Ownership		−0.001**
		(0.0002)
AR 1 (p)	0.00	0.00
AR 2 (p)	0.27	0.47
Sargan (p)	0.95	0.51
Subsidiary firms	26,871	7,729
Parent firms	3,718	1,224
Observations	77,823	15,180

maximum of around 0.3 for wholly owned subsidiaries. In contrast, the effect of parent cash flow is insignificant for listed firms. Moreover, the interaction term of parent q and ownership stake has the right sign (negative) but is insignificant for unlisted firms. We again do not find such an effect for listed subsidiaries.

In sum, our results are consistent with agency theory, in that the efficiency of the ICM crucially depends on the incentives and the control means of the parent. The larger its equity interest in the subsidiary, the tighter the ICM and the better it functions. This confirms Hypothesis 1. It also implies that proper functioning ICMs are "costly" in the sense that the parent must have a sizeable stake in the subsidiary.

We now turn to country determinants of the workings of ICMs. Hypotheses 2 and 3 essentially stated that firms operate under a set of constraints depending on the quality of country institutions and the development of ECMs, and therefore the workings of ICMs should differ accordingly. In particular, we hypothesized that both parent and subsidiary country institutions and/or ECMs matter. Parent firms in countries with "good" institutions/ECMs decide on better investment projects and are more capable of monitoring their investments, and subsidiaries in "bad" countries are more in need of ICMs. In contrast, parents from "bad" countries probably also do bad investments, and subsidiaries in "good" countries have ECMs and are not so much in need of parent funds. Thus, ICMs should work "best" if the parent stems from a "good" country and the subsidiary stems from a "bad" country. We conduct two sets of tests for the effects of the quality of country institutions/ECMs on the workings of ICMs. First, we test for the influence of financial market development. Second, we use the overall World Bank Index of country governance constructed by Kaufmann et al. (2005). Since our tests involve a four way split of the sample, we were not able to sensibly estimate the quite data demanding GMM methodology for listed subsidiaries. Thus, we report only the results for unlisted subsidiaries.

4.3. Financial market development and internal capital markets

As Hypothesis 2 predicted Table 5 confirms that the best functioning ICMs are found in the sub-sample "strong/weak" (parent firms from countries with private credit to GDP ratio above the median value of 1.016; subsidiaries from countries with private credit to GDP ratio below the median). The parent cash flow coefficient is largest (0.16) in this sub-sample of subsidiaries where the parent company comes from a country with a well-developed ECM, and subsidiaries coming from less well developed ECMs. Moreover, the "ranking" of subsidiaries according to investment opportunities is most pronounced in this sub-sample.

Table 5
Country private credit. GMM estimation: shows subsidiary investment depending on subsidiary variables and its corresponding parent firm variables. *Sub: Investment lagged* is the change in fixed assets plus depreciation over total assets for the subsidiary firm lagged by one period. *Sub: Sales growth* is the change in sales over last period sales for the subsidiary firm. *Par: Sales growth* is the change in sales over last period sales for the parent firm. *Sub: Tobin's q* is market capitalization plus total liabilities divided by total assets of the subsidiary firm (only available for listed subsidiaries). *Par: Tobin's q* is market capitalization plus total liabilities divided by total assets of the parent firm. *Sub: Cash flow* is profit/loss plus depreciation divided by total assets of the subsidiary firm lagged by one period. *Par: Cash flow* is profit/loss plus depreciation divided by total assets of the parent firm lagged by one period. The sample period covers 1996 until 2006 and uses only subsidiary firms for which data with at least 5 consecutive observations are available. The parent is a majority owner of the subsidiary firm and holds at least 50% ownership stake. The sample of subsidiaries includes only foreign owned and unlisted firms. For a country specific credit market measure we use the ratio *Private Credit over GDP* of the World Bank. Countries are classified into strong and weak using this financial market measure, and are called "Strong" if the average country ratio is higher than the median ratio, "Weak" if the average country ratio is lower than the median ratio. This results in four sub-samples of subsidiary country–parent country pairs. Instruments for the predetermined variables include subsidiary investment lagged by at least 3 periods or earlier. The strictly exogenous regressors ordinarily instrument themselves. All estimations include year dummies and incorporate subsidiary firm fixed effects. Parent firms are all listed firms. All variables are measured in U.S. dollars, at the beginning of the year and are trimmed at 2%. Standard errors are robust, clustered by firm and shown in brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. AR 1 (p) and AR 2 (p) show the p-value of the test statistic for first and second order autocorrelation in the residuals. Sargan (p) shows the p-value for the Sargan statistic testing for the exogeneity of the endogenous variables.

	1	2	3	4
Parent's country/ Subsidiary's country	Strong/Weak	Strong/Strong	Weak/Weak	Weak/Strong
Sub: Investment lagged	0.29**	0.00	0.19	0.44
	(0.10)	(0.31)	(0.19)	(0.24)
Sub: Sales growth	0.02	0.21*	−0.06	−0.05
	(0.05)	(0.11)	(0.07)	(0.12)
Par: Sales growth	0.30*	−0.07*	−0.21	0.04
	(0.14)	(0.03)	(0.14)	(0.03)
Par: Tobin's q	−0.02**	−0.01	0.02	−0.00
	(0.01)	(0.00)	(0.01)	(0.01)
Sub: Cash flow	0.16***	0.20*	0.11	0.07
	(0.04)	(0.08)	(0.10)	(0.08)
Par: Cash flow	0.16**	0.12***	−0.03	0.08*
	(0.05)	(0.04)	(0.10)	(0.04)
AR 1 (p)	0.00	0.01	0.00	0.00
AR 2 (p)	0.11	0.65	0.67	0.15
Sargan (p)	0.17	0.14	0.79	0.22
Subsidiary firms	3,530	6,477	413	1,153
Parent firms	385	1,053	55	164
Observations	15,685	29,837	1,573	5,082

Subsidiaries in countries with better functioning ECMs are less dependent on ICMs. As already mentioned, results using stock market capitalization as discriminatory device are similar.

4.4. Quality of country governance and internal capital markets

Table 6 uses the average WGI index of the World Bank to differentiate among four sub-samples, namely: (1) quality of both parent and subsidiary country governance and financial system is "strong", (2) quality of parent governance and financial system is "strong" and of subsidiary financial system "weak", (3) quality of parent governance and financial system is "weak" and of subsidiary governance and financial system "strong", and (4) quality of both parent and subsidiary governance and financial system is "weak". Countries are separated on the basis of whether the WGI index is larger or smaller than one.

Hypothesis 3 stated that ICMs are most relevant in case (2), where the parent system is strong, thus the parent should be able to fund profitable investments and exert monitoring, but where the subsidiary system is weak, thus the subsidiary needs an ICM because of a lack of good ECMs. We indeed get the strongest results in the (2) subsample "strong/weak" in so far as the parent cash flow coefficient is largest (0.26) and significant, and parent Tobin's q is significantly negative. ICMs appear to break down when the parent company stems from a "weak" institution country.

To summarize, our results using the most commonly used direct measures of financial market development accord well with the results using the World Bank WGI index of institutional development. One common picture emerging from these results is that ICMs become more important (1) the better the system of the parent company, thus the parent must be *able* to perform financing and monitoring functions and (2) the worse the system of the subsidiary country, thus the subsidiary must *need* these financing and monitoring functions. If the parent stems from a "weak" country, one should not expect functioning ICMs.

4.5. Additional robustness checks and comparison to Carlin et al. (2008)

4.5.1. Horizontal versus non-horizontal subsidiaries

The GMM methodology already controls for a number of econometric problems in the estimation of Eq. (1), such as consistent estimation in the presence of both a lagged dependent variable and firm fixed effects as well as consistent estimation in the

Table 6
World Governance Index. GMM estimation: shows subsidiary investment depending on subsidiary variables and its corresponding parent firm variables. *Sub: Investment lagged* is the change in fixed assets plus depreciation over total assets for the subsidiary firm lagged by one period. *Sub: Sales growth* is the change in sales over last period sales for the subsidiary firm. *Par: Sales growth* is the change in sales over last period sales for the parent firm. *Sub: Tobin's q* is market capitalization plus total liabilities divided by total assets of the subsidiary firm (only available for listed subsidiaries). *Par: Tobin's q* is market capitalization plus total liabilities divided by total assets of the parent firm. *Sub: Cash flow* is profit/loss plus depreciation divided by total assets of the subsidiary firm lagged by one period. *Par: Cash flow* is profit/loss plus depreciation divided by total assets of the parent firm lagged by one period. The sample period covers 1996 until 2006 and uses only subsidiary firms for which data with at least 5 consecutive observations are available. The parent is a majority owner of the subsidiary firm and holds at least 50% ownership stake. The sample of subsidiaries includes only foreign owned and unlisted firms. For a country specific institutional quality measure we use the *World Governance Index* of the World Bank. Countries are classified into strong and weak using this institutional index, and are called "Strong" if the average country index is higher than the median index, "Weak" if the average country index is lower than the median index. This results in four sub-samples of subsidiary country–parent country pairs. Instruments for the predetermined variables include subsidiary investment lagged by at least 3 periods or earlier. The strictly exogenous regressors ordinarily instrument themselves. All estimations include year dummies and incorporate subsidiary firm fixed effects. Parent firms are all listed firms. All variables are measured in U.S. dollars, at the beginning of the year and are trimmed at 2%. Standard errors are robust, clustered by firm and shown in brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. AR 1 (p) and AR 2 (p) show the p-value of the test statistic for first and second order autocorrelation in the residuals. Sargan (p) shows the p-value for the Sargan statistic testing for the exogeneity of the endogenous variables.

	1	2	3	4
Parent's country/ Subsidiary's country	Strong/Weak	Strong/Strong	Weak/Weak	Weak/Strong
Sub: Investment lagged	0.29**	0.23	0.11	0.66*
	(0.10)	(0.12)	(0.17)	(0.27)
Sub: Sales growth	0.04	0.11	0.04	0.07
	(0.06)	(0.07)	(0.08)	(0.20)
Par: Sales growth	0.30*	0.09	−0.06	0.06
	(0.14)	(0.16)	(0.15)	(0.43)
Par: Tobin's q	−0.02***	−0.02*	0.00	−0.02
	(0.01)	(0.01)	(0.02)	(0.05)
Sub: Cash flow	−0.10**	−0.12**	0.11*	0.05
	(0.03)	(0.04)	(0.06)	(0.08)
Par: Cash flow	−0.26***	0.21**	0.09	0.14
	(0.05)	(0.07)	(0.05)	(0.11)
AR 1 (p)	0.00	0.00	0.00	0.00
AR 2 (p)	0.19	0.33	0.83	0.22
Sargan (p)	0.16	0.42	0.52	0.31
Subsidiary firms	4,602	4,792	1,521	1,478
Parent firms	728	621	263	211
Observations	22,303	21,920	7,290	6,438

presence of endogeneity. One may however still criticize our approach on the grounds that parent cash flow may proxy for group wide investment opportunities and thus also for subsidiary investment opportunities, and thus that our estimated positive effect is not identifying parent fund transfers but simply investment opportunities of the subsidiary.[14] If so, however, we would expect this to be the case predominantly for horizontal subsidiaries and less so for non-horizontal subsidiaries.

Table 7 reports estimates of our basic equation for the sub-samples of horizontal (parent and subsidiary operate in the same 2-digit industries) and non-horizontal (parent and subsidiary operate in different 2-digit industries) subsidiaries. Around 40% of subsidiaries are horizontal subsidiaries, 60% are non-horizontal. Additionally, we split by stock exchange listing. For unlisted subsidiaries, while the coefficient on parent cash flow is larger for horizontal subsidiaries, it remains positive and significant for non-horizontal subsidiaries. This is reassuring and it is an indicator that the parent cash flow coefficient does not pick up (unlisted) subsidiary investment opportunities, but measures the workings of the ICM.

4.5.2. Comparison to Carlin et al. (2008)

Since Carlin et al. (2008) is close in spirit to our paper and since some of our results are similar but others differ markedly, it is justified to take a closer look at the possible reasons for the differences. Carlin et al. (2008) obtain a negative effect of parent Tobin's q on subsidiary investment, and this association is stronger when (1) parent ownership is *lower*, (2) the geographic distance between subsidiary and parent is greater, or (3) the differences between the financial development of the subsidiary and parent countries are *smaller*. In what follows we compare our results on (1) and (3) to Carlin et al. (2008), we do not analyze (2), geographic distance.

Ad (1): We also get a negative effect of parent Tobin's q, so it appears a robust finding of the two papers that multinationals rank their subsidiaries according to investment opportunities and ICMs fund accordingly. For the listed sub-sample, we also get a positive interaction term of parent Tobin's q and parent ownership, and a negative interaction term of parent cash flow and parent ownership although our coefficients are insignificant. Thus for listed firms our results match with Carlin et al. (2008).

For unlisted subsidiaries, however, our results differ. We get a significantly *negative* interaction term of parent Tobin's q and parent ownership. We interpret this as being consistent with the theory that in closer ICMs the parent has more incentives and means to distribute funds according to investment opportunities. Carlin et al. (2008), however, only analyze listed subsidiaries. Our explanation is further strengthened by the positive coefficients of the interaction terms of parent ownership and cash flow for unlisted firms. Carlin et al. (2008) get a negative coefficient (for listed subsidiaries). But why should a parent distribute less cash if its ownership stake increases? After all, as explained in the theory section, the tighter the relation between parent and subsidiary the more is the parent the residual claimant of investment decisions (funding, monitoring). The extreme case is a wholly owned subsidiary where parent and subsidiary funds should be perfect substitutes. Thus, it appears that listed and unlisted firms are fundamentally different at least what concerns the functioning of ICMs.

Ad (3): Concerning financial market development, Carlin et al. (2008) find that the negative effect of parent Tobin's q on subsidiary investment is stronger if the differences between the financial development of the subsidiary and parent countries are *smaller*, moreover if these differences get smaller, the parent cash flow effect also diminishes. We find potentially different results, the two sets of results cannot, however, be directly compared. First, the methods are not directly comparable. Carlin et al. (2008) use interaction terms, we estimate in the four sub-samples “strong/weak”, “strong/strong”, “weak/weak”, and “weak/strong” on good theoretical grounds, see above. Second, the variable used by Carlin et al. (2008), i.e. the ratio of the private credit to GDP ratio of the subsidiary divided by the parent country ratio is problematic. An increase in this ratio indicates a *smaller* difference in financial market development *only* if the parent company starts out with a *better* developed market. If the subsidiary has the better system to start with, an increase of this index indicates even more difference. We realize that this may not be a large problem in the sample used by Carlin et al. (2008), since most of their parents stem from countries with high financial development (see their Table 10), however in our sample this would be a problem. Third, and probably more relevant, the variable used by Carlin et al. (2008) cannot accommodate our four way classification. We explicitly hypothesize that ICMs function best when the parent stems from a good system *and* the subsidiary stems from a bad system, since the parent is then capable of setting up a good ICM and the subsidiary needs it. This is not possible with the Carlin et al. (2008) measure. For example, their measure would take on similar values for our categories “strong/strong” and “weak/weak” (two strong countries with say 130% private credit to GDP ratio would get a ratio of one, however also two weak countries with say 50% get a ratio of one).

To summarize, several of our results match with Carlin et al. (2008), the most important one is that multinationals rank their subsidiaries according to investment opportunities. Other results differ, most importantly our results on the tightness of control. The most plausible explanation is a different construction of the sample, in particular that we also analyze unlisted firms. The results on financial market development cannot be directly compared, since we use a different—in our view more appropriate—empirical strategy.

[14] Note, that we do not have this potential problem with parent Tobin's q, since the hypothesized coefficient is negative. *If* we get a negative coefficient of parent Tobin's q, we can be sure that this measures a ranking of subsidiaries within the group. If parent Tobin's q would predominantly proxy for group wide investment opportunities and therefore also for subsidiary firm investment opportunities, we would expect a positive coefficient.

Table 7
Industry relatedness of subsidiary–parent firm pairs. GMM estimation: shows subsidiary investment depending on subsidiary variables and its corresponding parent firm variables. *Sub: Investment lagged* is the change in fixed assets plus depreciation over total assets for the subsidiary firm lagged by one period. *Sub: Sales growth* is the change in sales over last period sales for the subsidiary firm. *Par: Sales growth* is the change in sales over last period sales for the parent firm. *Sub: Tobin's q* is market capitalization plus total liabilities divided by total assets of the subsidiary firm (only available for listed subsidiaries). *Par: Tobin's q* is market capitalization plus total liabilities divided by total assets of the parent firm. *Sub: Cash flow* is profit/loss plus depreciation divided by total assets of the subsidiary firm lagged by one period. *Par: Cash flow* is profit/loss plus depreciation divided by total assets of the parent firm lagged by one period. The sample period covers 1996 until 2006 and uses only subsidiary firms for which data with at least 5 consecutive observations are available. The parent is a majority owner of the subsidiary firm and holds at least 50% ownership stake. The sample of subsidiaries includes domestically and foreign owned firms. Instruments for the predetermined variables include subsidiary investment lagged by at least 3 periods or earlier. The strictly exogenous regressors ordinarily instrument themselves. The first columns show the results for unlisted subsidiary firms split by non-horizontal and horizontal subsidiary–parent pairs, whereby columns 3 and 4 show the results for listed subsidiary firms, split by non-horizontal and horizontal subsidiary pairs. Subsidiary–parent pairs are classified into non-horizontal and horizontal using the 2-digit NAICS code. Whereby subsidiaries are classified as "horizontal" if they have the same 2 digit NAICS code as their parent firm, else as "non-horizontal". All estimations include year dummies and incorporate subsidiary firm fixed effects. Parent firms are all listed firms. All variables are measured in U.S. dollars, at the beginning of the year and are trimmed at 2%. Standard errors are robust, clustered by firm and shown in brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. AR 1 (p) and AR 2 (p) show the p-value of the test statistic for first and second order autocorrelation in the residuals. Sargan (p) shows the p-value for the Sargan statistic testing for the exogeneity of the endogenous variables.

	1	2	3	4
Subsidiary type	Unlisted		Listed	
Subsidiary–parent pair	Non-horizontal	Horizontal	Non-horizontal	Horizontal
Sub: Investment lagged	0.252**	0.242*	−0.169	0.053
	(0.093)	(0.100)	(0.180)	(0.147)
Sub: Sales growth	0.031	0.013	0.093	0.226**
	(0.078)	(0.071)	(0.065)	(0.071)
Par: Sales growth	0.196	0.241*	0.276**	0.136
	(0.106)	(0.124)	(0.085)	(0.094)
Par: Tobin's q	−0.018***	0.020**	−0.019	−0.005
	(0.005)	(0.007)	(0.015)	(0.010)
Sub: Cash flow	0.080*	0.098**	0.053	0.398***
	(0.041)	(0.031)	(0.077)	(0.067)
Par: Cash flow	0.187***	0.234***	0.012	−0.032
	(0.038)	(0.049)	(0.066)	(0.098)
Sub: Tobin's q			0.017	−0.003
			(0.010)	(0.009)
AR 1 (p)	0.00	0.00	0.00	0.00
AR 2 (p)	0.61	0.65	0.92	0.14
Sargan (p)	0.18	0.28	0.18	0.20
Subsidiary firms	13,242	8,511	373	373
Parent firms	1,936	1,284	177	182
Observations	41,547	29,989	1,315	1,738

5. Conclusions

In this paper, for a unique cross-country panel of firms, we systematically collect evidence for the inner workings of internal capital markets. Subsidiaries are separate legal entities and provide balance sheet and income statement data, which obviates the need to rely on segment or imputed data, and thus allows one to directly control for the investment opportunities of the subsidiary. Moreover, by focusing on *parent* cash flows, we avoid many of the problems that plague the interpretation of conventional investment-cash flow regressions.

We show that parent firms are involved in cash flow re-allocation activities and that subsidiaries with better investment opportunities get a larger share of the pie. We find (1) compelling evidence for the hypothesis that the tightness of control of the parent firm in the subsidiary plays a crucial role for the smooth functioning of ICMs. The larger the ownership stake of the parent, the better the functioning of the ICM. The ownership stake of the parent must be quite substantial for ICMs to work properly. (2) Unlisted subsidiaries make much more use of ICMs than listed subsidiaries. Apparently better access to external capital markets diminishes the importance of internal capital markets. (3) The country institutional environment matters. Using a number of indicators for country governance and financial development, we find that the best functioning ICMs can be found in the sub-sample of firms with parents from countries with high institutional development or well developed ECMs and subsidiaries from countries with low institutional development or badly developed ECMs.

This paper sheds some light on the discussion of whether ICMs are "bright" or "dark". Our answer is "it depends". ICMs are not a priori good or bad, their proper functioning depends on the internal control structure between parent and subsidiary and on the external constraints the two types of firms face.

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