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Abstract

The role of R&D spending has been assessed in a number of fields including marketing, economics, finance and strategic management. However, this research has been dominated by single-country studies. The differences in country environments in which investors value the company's R&D expenditures have not been examined. We examine the extent to which investors' response to R&D expenditures differs across a broad range of countries. Our analysis is based on data from more than 5,000 companies in 25 countries over 14 years. A hierarchical linear model with latent variables is estimated on this global database. Our analysis reveals that the effects of R&D on stock returns, systematic risk, and idiosyncratic risk vary significantly across countries. The way a country protects investors' interests, the innovativeness of the country and its religious affiliations explain the extent to which R&D expenditures influence stock returns, systematic risk and idiosyncratic risk.

Keywords: R&D investments; Stock Returns; Systematic Risk; Idiosyncratic risk; Cross-country research; Multilevel latent factor models.

Research and development (R&D) is widely recognized as a key source of competitive advantage. The extent to which R&D creates value for firms and investors has therefore been the subject of investigation in various academic disciplines such as economics (Griliches 1981; Hall 1993), finance (Aboody and Lev 2000) or strategic management (Hoskisson and Hitt 1988). In Marketing, such research has been encouraged in a call for developing financial metrics of marketing activities (Srivastava and Reibstein 2005), and McAlister, Srinivasan and Kim (2007) and Joshi and Hanssens (2010) among others have contributed to the understanding of the effects of R&D from a marketing perspective. This research is important if strategic decisions based on value creation (mostly through innovation) vs. value appropriation (e.g., through advertising) influence stock market prices (Mizik and Jacobson 2003). It is even more critical if, in turn, these strategic decisions are based on the expectation of their market effects, even if reliance on stock prices may lead to suboptimal decisions (Chakravarty and Grewal 2011).

One aspect that is still poorly understood is the extent to which investors in different countries respond to R&D investments by corporations. Indeed, the literature is dominated by single-country studies, mostly in the USA (Joshi and Hanssens 2010), UK (Blundell, Griffith and van Reenen 1999), with rare analysis of Taiwanese (Yang and Chen 2003) or Canadian (Johnson and Pazderka 1993) contexts. Furthermore, prior research has paid little attention to the question of why country environments may influence the way in which investors value a company's R&D expenditures. The extant comparative research has mostly focused on the United States vs. Japan (Erickson and Jacobson 1992) or on European countries (Hall and Oriani 2006).

Yet, contextual differences become apparent when one examines the findings from different countries. Yang and Chen (2003) report estimates of R&D coefficients that are lower than the estimates in the US, implying that R&D investment of Taiwanese firms has less impact than that of US companies. Hall and Oriani (2006) found that the effect of R&D investments on

the market value of the firm was nearly three times bigger in the UK than in France and Germany, and even greater for Italy. While these studies indicate differences in the market response to R&D expenditures across countries, they do not provide an explanation for the phenomenon. In addition, the comparison has been limited to large industrialized economies that all have well established financial institutions and capital markets. The relatively homogeneous contexts of these developed countries may not provide sufficient variation for testing any explanation for these differences. A large cross-country analysis with heterogeneous country contexts is required to explain differences in the R&D - firm value relationship.

Several theoretical reasons can be advanced to explain why the R&D-firm value association may not be identical in all countries. The conceptual logic regarding market response to a company's R&D expenditures rests on the information asymmetry and the predictions of agency theory. Contextual differences restrict the applicability of agency theory in some countries (Davis, Schoorman and Donaldson 1997). For example, agency costs are lower when the legal protection of investors is stronger, as is the case for investors from common law countries versus civil law countries (La Porta et al. 1997; 1998). Cross-country studies of innovation also show that individuals' attitudes towards innovation differ across countries: some countries are more risk-tolerant than others (Shane 1993). Therefore, investors are likely to act upon R&D information in a different way depending on country characteristics. Consequently, we address the following questions:

(1) Do innovation activities, as represented by R&D expenditures, impact firm value differently across countries? Are the effects of R&D on stock returns, systematic risk, and idiosyncratic risk different for example in the United States, Turkey, or South Africa?
(2) Why should we expect cross-country differences in the investors' response to innovation expenditures and what factors explain these cross-country differences?

Managers must consider these questions when deciding on how much to spend on R&D activities. Developing a marketing strategy that relies heavily on innovation (and therefore on

R&D spending) requires that its management understands the financial market's perceptions of this spending to justify their strategy to investors and shareholders. To the extent that management takes into account stock market prices in determining the firm's strategy (Luo 2009), the tradeoffs between value creation and value appropriation will depend on the impact of R&D investments on stock market prices (Mizik and Jacobson 2003; Luo and Donthu 2006; McAlister, Srinivasan and Kim 2007). Investments in R&D will be encouraged in environments where investors value such strategies. Furthermore, global firms that can choose among different markets on which to list their company should find greater value in listing the company in countries that value their strategy (Amit and Zott 2004). Knowing what country factors affect the value attributed to the company's shares is therefore important to untangle firm, industry, and country effects in the interpretation of the investors' response to R&D expenditures.

We develop a model of the relationship between R&D and firm value across countries. The effect of R&D expenditures on firm value can be assessed by examining both returns and risk. Institutional theory is advanced to explain the effect that institutions have on investors' responses to R&D expenditures: cross-country differences in investors' responses to R&D expenditures are hypothesized to be moderated by the country's formal and informal institutions. We build an extensive database with a sample of more than 5,000 companies from 25 countries over the period from 1996 to 2009. To test our hypotheses, we proceed in two steps. First, we use the Fama-French-Cahart model to derive measures of stock returns, systematic risk, and idiosyncratic risk. Then, in a second step, we specify a system of multilevel equations. Latent factors are introduced to account for additional unobserved heterogeneity at the firm and country levels, thereby taking advantage of the information available from all companies and countries. We also allow for cross-correlations among the three firm value variables (i.e., stock returns and both measures of risk). Our estimation results show that the relationship between R&D and firm

value varies across countries. We also provide empirical evidence that measures of investor protection, religion and country innovativeness explain in part these country-level differences.

Our study contributes to the literature on investors' response to R&D expenditures by examining differences between countries of different economic development level and different institutional contexts. This contrasts with most prior studies restricted to national or regional focus. With this analysis of a broad sample of nations, we provide a global validation of the value of R&D expenditures. This study also expands the recent research on the marketing-finance interface (Bowman and Gatignon 2009; Srinivasan and Hanssens 2009) to the international level.

In the next section, we develop the conceptual framework based on prior research about the effects of R&D spending on firm value. We then develop a model of the R&D-firm value relationship across countries with our research hypotheses. We describe our data and present our empirical model specification. The subsequent section reports the results and we conclude with a discussion of the research implications, limitations and directions for further research.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

In this section, we review the research regarding the influence of R&D expenditures on various dimensions of firm financial performance, although the empirical evidence is mostly based on single country studies. Then, we develop our thesis regarding key country factors that affect the credibility of R&D expenditures as a strategic signal.

Market Response to R&D Expenditures

Concerning the literature on investors' response to R&D expenditures and consistent with our research purpose, we focus our review on the effects of R&D on stock returns (Aboody and Lev 2000) and firm risk (e.g., McAlister, Srinivasan and Kim 2007).

R&D and Returns. R&D expenditures are expected to result in new products, patents, and/or better production processes and techniques that are designed to increase customer value and ultimately financial performance. Because new products and processes take some time to be imitated by competitors (Bowman and Gatignon 1995), firms investing in R&D are likely to enjoy higher returns than firms that do not (Gatignon and Bowman 2009; Hall 1993). A number of studies have reported positive associations between R&D expenditures and stock returns (e.g., Eberhart et al. 2004; Aboody and Lev 2000). This positive effect implies that financial markets view R&D outlays as investments and account for the level as well as changes in R&D expenditures in their pricing of a firm's stocks.[1]

Differences have nevertheless been observed regarding the positive effect of R&D expenditures on returns. Chan, Lakonishok and Sougiannis (2001) find that, over time, the stock returns of firms that invested in R&D matched the returns of firms with no R&D. Similarly, in the Marketing literature, Erickson and Jacobson (1992) conclude that "once the effects of firm-specific effects and the influence of profitability on discretionary spending are taken into account, neither R&D nor advertising expenditures increase the market value of the firm more than other types of investments or expenditures (p. 1277)." More recently, Mizik and Jacobson (2003) report that increases in emphasis toward value appropriation capability (e.g., advertising) away from value creation capability (e.g., R&D investments) are associated with increases in stock return. In addition, different studies have reported positive effects with coefficients that are different from those reported in the US (e.g., Yang and Chen 2003; Hall and Oriani 2006). Therefore, it is critical to recognize differences across firms, industries and markets. We discuss differences across countries in the next section.

R&D and firm risk. R&D expenditures are risky and this may outweigh the potential benefits of R&D (Kothari, Laguerre, and Leone 2002; Aboody and Lev 2000). This risk stems

from the fact that there is no guarantee that R&D projects (e.g., new drug development), despite the important outlays, will generate new products (Mansfield 1969). It also comes from the fact that the new products obtained from R&D projects may not be successfully marketed to customers; new product failure rates have varied very little over time (Goldenberg, Lehmann and Mazursky 2001). R&D information itself creates information asymmetry between investors and managers. Although investors and analysts can find R&D information in the company's financial reports, they are not fully aware of the actual value of the products and processes being developed. Companies do not report R&D details in large part because they fear to reveal important information to competitors (Aboody and Lev 2000; Gatignon, Anderson and Helsen 1989). Investors are also unwilling to invest in firms with highly specific assets such as R&D intensive firms because they have low liquidation value in the event of a bankruptcy (Kochhar 1996). The secondary market for such assets may not value them as much as the firm itself. Moreover, the intangibility of R&D assets makes their evaluation difficult for investors. This lack of complete knowledge about their present and future value increases the risk (Kochhar 1996). Risk is also increased by the fact that investors have little control over the managers' use of the invested money. They may find it difficult to evaluate R&D benefits for the firm. Researchers studying the R&D-risk relationship distinguish between the influence of R&D on systematic risk and its influence on idiosyncratic or firm-specific risk.

R&D and Systematic risk*:* systematic risk measures the extent to which the stock price follows the volatility of the financial market as a whole. It is commonly measured with the beta (β), which is the regression coefficient linking the rates of return of individual stocks and/or portfolios to the overall stock market rates of return. Firms that are able to protect themselves from market fluctuations have a lower systematic risk. McAlister, Srinivasan and Kim (2007) report a strong effect of R&D expenditures on systematic risk: R&D reduces systematic risk

because it provides the firm with "greater dynamic efficiency and greater flexibility than its competitors" (p. 38). This evidence is not however, universally verified (for example as in Ho, Xu and Yap 2004 or Lantz and Sahut 2005).

R&D and idiosyncratic risk*:* idiosyncratic risk represents the variation in returns that is specific to a stock. Many authors report a positive association between R&D and idiosyncratic risk (e.g., Kothari, Laguerre, and Leone, 2002; Mazzucato and Tancioni 2008). This association partly stems from the fact that uncertainty associated with R&D decreases the predictability of a firm's future income streams. Furthermore, the greater systematic risk associated with R&D-intensive firms is largely attributable to the greater idiosyncratic and operating risks of R&D-intensive firms (Ho et al. 2004). Researchers interested in output measures of innovation reach the same conclusion (e.g. Sorescu and Spanjol 2008).

We now focus on country level differences and propose hypotheses about these cross-country differences in the association between R&D, risk and stock returns.

Explaining Differences in Investors' Responses to R&D Expenditure s across Countries

As depicted in Figure 1, we examine the relationship between R&D expenditures and the three indicators of firm value identified above: (i) (abnormal) stock returns, (ii) systematic risk, and (iii) idiosyncratic risk. The efficient market hypothesis argues that investors do not react to events that they expect to happen. Consistent with this hypothesis, we study the effects of the unexpected R&D expenditures on firm value since only the unexpected R&D expenditures can induce a change in analysts' expectations (Ngobo, Casta, and Ramond 2012; Gu and Wang, 2005) and consequently cause a change in stock price (Eberhart, Maxwell and Siddique 2004).

INSERT FIGURE 1 ABOUT HERE

The core of our model is that investors' response to R&D expenditures reflects the net present value of the cash flows that will eventually result from this R&D investment. However, investing in R&D intensive companies is a risky undertaking. Investors are uncertain that these firms will introduce new products at the end of the process, and, given the high rate of new product failures, they are uncertain that consumers will accept the new products brought to market. Information economics theory (e.g., Milgrom and Roberts 1986) has proven useful in modeling choice situations where the decision maker faces uncertainty and asymmetric information. It suggests that under asymmetric information, decision makers rely on signals (Spence 1973) and the credibility (believability) of the signals conveyed by an input is important for understanding its effect on decision makers (Erdem and Swait 1998). Unexpected R&D spending level represents a signal about the level of a company's future cash flows. The credibility of the signal conveyed by R&D expenditures (about future performance) decreases the risk perceived by investors and ultimately investors' expected utility from buying shares of an R&D intensive company. Because investors are uncertain about the outcomes of R&D projects and information search and processing is costly, the credibility conveyed by R&D expenditures increases the probability that investors will consider buying shares of R&D-intensive companies. Any characteristic of the company (e.g., prior profitability), industry (e.g., industry R&D intensity) or country (e.g., IP rights) that is likely to reinforce the credibility of the R&D signal should reduce the perceived risk associated with R&D spending. Consequently, it should increase the investor's sentiment that R&D expenditures are likely to yield the expected benefits.

Institutional theory has emerged as the leading theoretical foundation for comparing countries with different market-supporting institutions (Hoskisson et al. 2000). Indeed, the quality of national institutions affects financing decisions (e.g., De Jong, Kabir and Nguyen 2008). Institutional theory views a nation's institutions as the humanly devised (economic,

political, social) constraints that shape (enable or restrain) behaviors in a society by designing the rules of the game, which, in turn, structure the incentives in social, economic, and political exchanges (North 1990). Following North (1990), we distinguish between formal (e.g., laws, regulations) and informal institutions (e.g., norms, cultures).

Institutional variables that reflect a national culture, such as religion and language (Stulz and Williamson 2003), and the legal environment (La Porta et al. 1998; 1997) can impact investors' behaviors and, in turn, the firm value (La Porta et al. 2002). The international business literature on direct investments and entry mode considers country risk as a major determinant of these choices (Anderson and Gatignon 1986; Gatignon and Anderson 1988). Measures of country risk are typically built from such institutional variables (Goodnow and Hanz 1972). Institutions can also discourage or encourage innovation (Clarke 2001; Bartholomew 1997), and explain differences in entrepreneurial activities across countries (Bosma et al. 2009). For example, R&D expenditures tend to be lower in countries characterized by a high risk of expropriation, weak rule of law, and more tenuous intellectual property rights (Clarke 2001). Although these studies do not focus on investors' response to R&D per se, they demonstrate that formal and informal institutions influence the investors' responses.

We analyze the moderating role of three institutional characteristics, selected based on their ability to reduce the information asymmetry in a country: (i) investor protection (La Porta et al. 1997), (ii) country innovativeness (Porter and Stern 2002), and (iii) religion (Stulz and Williamson, 2003). Country innovativeness contributes to the firms' ability and likelihood of producing marketable innovations. Furthermore, investors' response to R&D expenditures depends on how sustainable the cash flows from the innovative output are. The cash flows' sustainability is partly influenced by the quality of the investor protection in a country (e.g., IP rights). Finally, we posit that religion affects both the propensity to innovate (as captured by the

country innovativeness), which leads to the generation of the cash flows, and the propensity to appropriate and sustain the cash flows from R&D investments through investor protection.

Investor protection and the valuation of innovation expenditures. Investor protection refers to the content of the laws that protect investors in a country and the quality of their enforcement (La Porta et al. 1997). Investor protection influences the willingness to invest in a company because it determines the right to receive dividends or to sue for damages (La Porta, Lopes-de-Silanes and Shleifer 2006). Our central thesis is that the credibility of the informational signal conveyed by R&D expenditures about the future cash flows varies across countries, in part because of the different ways in which countries protect the investors' interests. Institutionally developed countries offer greater protection through rule of law, accounts disclosure, and intellectual property enforcement. Given that R&D is risky (Aboody and Lev 2000), we expect its effects to vary across countries as well.

In countries where investor protection is weak, there is a greater risk of information manipulation. Leuz, Nanda and Wysocki (2003) found that in countries with poor investor protection, managers have incentives to distort reported information. Annual earnings announcements have more information content in countries with strong investor protection (DeFond and Hung 2007; Hung 2000). In the same line, earnings management is relatively inexistent in countries with strong investor protection (Nabar and Boonlert-U-Thai 2007). Managers in weak investor protection countries are more likely to use income smoothing[2] for opportunistic reasons while managers in strong investor protection countries use it to convey their private information about future earnings (Cahan, Liu and Sun 2008).

These studies suggest that investors may have less confidence in the value of R&D projects conducted by managers in countries with weaker investor protection institutions. This arises because investors have fewer means to curtail opportunistic behaviors when investor

protection is weak. Market participants may thus discount the value of the assets of firms that report R&D in countries with weak investor protection.

Research also indicates that in countries with strong investor protection, the quality of corporate governance is superior to the level that is found in countries with weaker investor protection (DeFond and Hung 2004). Boards of directors in strong investor protection countries encourage managers to report more information to outsiders to reduce information asymmetry and the cost of capital compared to the boards in countries with weak investor protection (Ball, Kothari and Robin 2000; Lambert, Leuz and Verracchia 2011). Thus, with better governance, more information is produced about firms enabling investors to monitor management and insiders more effectively (Bartram, Brown and Stulz 2012).

The connection of these differences with risk and uncertainty follows a straight logic. When institutions can effectively protect investors against managerial opportunism, investors are more willing to assume risks in their transactions with companies that conduct R&D. They are willing to invest in risky companies because institutions and laws decrease the need for monitoring. La Porta, Lopez de Silanes and Shleifer (1999) argue that when the law protects investors' rights, they are willing to pay more for the company's assets because they recognize that more of those profits would come back as dividends. Investors in these countries are exposed to lower degrees of risk. Consequently, they require a lower rate of return and should exhibit a more positive reaction to R&D expenditures than those in countries with poor investor protection.

The above discussion suggests that investor protection should moderate the relationship between R&D and idiosyncratic risk. Investor protection is associated with lower information asymmetries (Chung 2006) and lower volatility of stock returns (Johnson et al. 2000). Other studies also report that stock returns in emerging markets characterized by poor investor protection are less predictable than stock returns in developed markets (Al-Khazali, Ding and

Pyun 2007). This relates to the quality of information disclosure, which makes it harder to accurately forecast the future earnings. Coupled with the uncertainty associated with R&D, we should then expect the association between R&D and idiosyncratic risk to be more positive in countries with poor investor protection than in countries with strong investor protection.

R&D-intensive firms should exhibit higher systematic risk in countries with poor investor protection than in countries with strong investor protection. This proposition is based on prior studies linking investor protection with systematic risk. Morck, Yeung and Yu (2000) found that, in emerging countries characterized by poor investor protection, stock prices move together more than in developed markets, i.e., systematic risk is greater in emerging countries than in developed economies. The rationale, according to these authors, is that in countries with poor investor protection, there is a low degree of voluntary disclosure and corporate transparency. Chan and Hameed (2006) also argue that stock price synchrony in emerging markets results from their poor information disclosure and lack of corporate transparency that increases the cost of collecting firm-specific information. As a result, the share prices of firms in emerging markets are driven less by the firm-specific information but by market-wide effects. In the same line, Garmaise and Liu (2005) found that corruption substantially increases the firm systematic risk, particularly in countries with weak shareholder rights. Jin and Myers (2006) report that firms in countries with better investment environments tended to have lower systematic risk. Coupled with the fact that high R&D intensity firms have higher information asymmetry than low R&D-intensity firms (Ciftci, Lev and Radhakrishnan 2011), we suggest that stocks of R&D-intensive firms in countries with poor investor protection should be subject to more economy-wide fluctuations than similar stocks in countries with good investor protection, which should be driven more by firm-specific information. This means that while R&D investments may reduce systematic risk, it does so to a less extent in countries with poor investor protection. In summary, we propose the

following hypotheses concerning the role of investor protection in explaining country differences in the effect of R&D expenditures on firm value:

H1: The positive effect of unexpected R&D expenditures on stock returns increases as the investor protection in the country increases.
H2: Investor protection in a country is negatively related to the effect of unexpected R&D expenditures on systematic risk.
H3: The positive effect of unexpected R&D expenditures on idiosyncratic risk decreases as the investor protection in the country increases.

Country innovativeness as informal institutional environment. Consumer innovativeness varies across countries, partly because of cultural differences (Steenkamp, Hofstede and Wedel 1999; Tellis, Prabhu and Chandy 2009). While innovativeness has been extensively studied at the consumer level (e.g. Midgley and Dowling 1978), little research has focused on country-level innovativeness (Tellis, Stremersch and Yin 2003). Country innovativeness reflects a country's propensity to develop and adopt new products. This definition is related to the concept of *National innovative capacity* (Porter and Stern 2002) defined as "the country's potential—as both a political and economic entity—to produce a stream of commercially relevant innovations" (p. 5). While this definition focuses on the output of innovative activity, it actually embeds consumer innovativeness in the country. Porter and Stern (2002) argue and show that country innovativeness reflects the fundamental conditions that create the environment for innovation in a particular nation. Among these conditions, customer sophistication is an important factor. They report that buyer sophistication (e.g., the fact that home customers can anticipate the needs of others) is positively associated with the number of patents. Consumers in innovative countries therefore are more open to new ideas and products, and this explains why the penetration rates of new products are higher (Porter and Stern 2002, Gatignon, Eliashberg and Robertson 1989).

Country innovativeness implies that investors in innovative countries are exposed to a lower level of risk compared to those in less innovative countries. They are exposed to a lower

risk because innovation projects have a higher probability of success than similar projects in less innovative countries. Consequently, investors should demand a smaller rate of returns from companies operating in innovative countries compared to less innovative ones. In addition, given that the payoffs from R&D activities are less uncertain in innovative countries, we also expect the perceived risk from a company's R&D activities to be smaller. Investors should be more willing to buy shares of R&D intensive firms in innovative countries compared to similar firms in less innovative ones. Therefore, the effect of unexpected R&D expenditures on stock returns should be higher in innovative countries.

Furthermore, as indicated earlier, R&D increases idiosyncratic risk because it decreases the predictability of future income streams. However, because of the reduced uncertainty associated with R&D projects in innovative countries, R&D should have a smaller negative effect on the predictability of the future income streams. Indeed, investors should be more confident in R&D projects from innovative countries as R&D projects tend to result in new products that are adopted by the market. This means that the increased idiosyncratic risk due to unexpected R&D expenditures is smaller in innovative countries.

Finally, we expect R&D to be more effective in insulating the firm from market changes in countries with a high level of innovativeness (so that firms are less subject to systematic risk). This is likely to occur as R&D projects are more likely to pay off in these countries rather than in less innovative countries where the payoff is more uncertain. Thus, we hypothesize that:

H4: The positive effect of unexpected R&D expenditures on stock returns increases as the level of country innovativeness increases.

H5: The negative effect of unexpected R&D expenditures on systematic risk (less risk) is stronger (more negative) as the level of country innovativeness increases.

H6: The positive effect of unexpected R&D expenditures on idiosyncratic risk (more risk) decreases as the level of country innovativeness increases.

Religion as informal institutional environment: Religion is a key component of culture. Prior studies have investigated the economic effects of religion. Religion is in particular associated with the quality of corporate governance (La Porta, Lopez de Silanes and Shleifer 1999) and creditor rights (Stulz and Williamson 2003). Recently, research has broadened the religion variable to the concept of religiosity, which refers to the tendency to respect the practices of a specific religion. It has been proxied with religious affiliation (e.g., Hilary and Hui 2009).

Religion may influence the propensity to innovate, and consequently the generation of the cash flows from R&D investments through affecting risk aversion and drivers of new product adoption. For instance, religion influences uncertainty avoidance that is a negative predictor of a country's innovativeness because new products are risky for consumers. Furthermore, religions that emphasize inequalities in power distribution are likely to affect innovativeness. Individuals living in countries dominated by such religions are more influenced by leaders with respect to their adoption of innovations than those living in low power distance cultures. Religion also influences conservatism in a society. Yet, adopting new items is one way in which the traditional patterns of behavior are broken and norms are violated (Steenkamp, Hofstede and Wedel 1999).

Therefore, the influence of religion on innovativeness can vary across religious groups to the extent that religions differ in their emphasis on risk aversion and conservatism. Although a number of studies examine this relationship, the empirical evidence is not clear. Some researchers such as Landes (2004) argue that Islam discourages individuals to innovate because it reduces individual freedom and property rights more than other religions do: individuals are viewed as being part of the society at the service of God and Islam is associated with greater conservatism than other religions such as Protestantism. Huang (2005) observed that Catholic countries generally are less risk adverse than Protestant countries. Kumar et al. (2010) find that Protestants are more risk averse than Catholics, while Renneboog and Spaenjers (2012) observe the opposite.

Mansori (2012) reports that Buddhists exhibit significantly lower innovativeness than Muslims, Christians and Hindus in Malaysia. These studies bring support for the effect of religion on innovativeness, even if clear explanatory mechanisms and generalizations are difficult to identify.

Religion could also influence the propensity to appropriate cash flows from R&D investments as religion can lower investor's risk. Indeed, the literature brings empirical evidence for the influence of religion on investor protection (La Porta et al. 1997; Stulz and Williamson 2003). For example, Catholic countries protect the rights of creditors less well than Protestant countries (Stulz and Williamson 2003). Also, Protestant, Catholic and English speaking countries have higher investor protection than other countries. Protestant countries are less corrupt than Catholic, Muslim and Buddhist countries. Furthermore, Protestant and Buddhist countries have a higher repudiation risk, and Protestant and Catholic countries have a higher expropriation index. Based on these effects identified in the literature, we examine empirically the influence of religious affiliation on the effects of R&D spending through differences in investor protection and innovativeness.

DATA

Sample

We collected monthly and annual accounting and financial data on all firms listed in 25 countries from 1995 through 2009 (in U.S. dollars). Company data was obtained from the WORLDSCOPE data via THOMSON ONE Banker, except for the Market Value and Market to Book Value variables that were taken from DATASTREAM, also via THOMSON ONE Banker. T-bill rates are available in the Economics database via DATASTREAM ADVANCE over the same period. More specifically, we used 3-month Treasury bill or interbank rates for each of the

countries. Finally, the market indices come from the Equity Indices via DATASTREAM ADVANCE. Data for 1995 were dropped because there were too few observations. Because the objective is to assess the extent to which R&D investment levels are reflected in stock market prices, firms with no data on R&D were also eliminated.[3] Firms must have available returns data for each month in the observation year. Brazil, Spain, Ireland, the Philippines, and Thailand were removed from the database because of missing data on key variables such as market equity. We also eliminated observations for two firms with a significant decrease in market value (i.e., greater than 90% of their capitalization) or negative Book Equity. Finally, outliers in stock returns were eliminated using the Grubb's test. The resulting primary data set contains 688,132 observations representing 25 countries. The initial number of observations was distributed as follows: Australia (759), Austria (330), Belgium (307), Canada (1263), Denmark (352), Finland (698), France (1552), Germany (2104), Greece (200), India (961), Israel (620), Italy (262), Japan (17996), Malaysia (256), Netherland (477), Norway (237), South Africa (196), Singapore (301), South Korea (2836), Sweden (933), Switzerland (931), Taiwan (4519), Turkey (435), UK (2430), and USA (16452). On average, each firm in the data set is represented for a period of 11.73 years (with a small standard deviation of 3.2). This data set is therefore providing a broad base to derive reliable and generalizable conclusions. Furthermore, a broad representation of industries is contained in the data with fifty-eight SIC-2 level industries.[4]

Measures

Dependent variables. The dependent variables in our hypotheses are derived from the Fama-French-Cahart model that determines (i) abnormal stock returns, (ii) systematic risk, and (iii) idiosyncratic risk. Fama and French (1992) suggested that in addition to the market risk, the average return of a stock can be explained by the size premium and the value premium. Cahart (1997) suggested that adding momentum can improve the predictability of the stock returns. The

Cahart model is being increasingly applied in the marketing context (Osinga et al. 2011; Sood and Tellis 2009). Equation (1) shows our basic specification[5]:

$$R_{ikm} - R^{f}_{km} = \alpha_{ik} + \beta^{M}_{ik} \times (R^{M}_{km} - R^{f}_{km}) + \beta^{Size}_{ik} \times SMB_{km} + \beta^{value}_{ik} \times HML_{km} + \beta^{Mom}_{ik} \times WML_{km} + \upsilon_{ikm} \quad (1)$$

where:

R_{ikm} = Raw returns of stock *i* in country *k* and month *m*,

R^{f}_{km} = Risk-free rate of return for country *k* in month *m*.

$R^{M}_{km} - R^{f}_{km}$ = Excess market return for country *k* in month *m*.

SMB_{km} = Small minus Big capitalization (SMB) stocks factor or the monthly difference between the average returns on the small-stock portfolios and the average returns on the big-stock portfolios,

HML_{km} = "High (book-to-price ratio) Minus Low" factor or the monthly difference between the average returns on the high-BE/ME portfolios and the average returns on the low-BE/ME portfolios.

WML_{km} = Momentum or the return obtained from stocks that have been increasing recently minus the return from stocks that have been decreasing recently.

υ_{ikm} = Residual term, $E[\upsilon_{ikm}] = 0$, $Var[\upsilon_{ikm}] = \sigma^{2}_{\upsilon_i}$

We estimate Equation (1) during the 12 trading months for each firm and year for which the stock returns are calculated.[6] Our measure of abnormal returns is α_{ik} that captures excess returns. α_{ik} should equal 0 under the efficient market hypothesis (Osinga et al. 2011). If a significant α_{ik} is found, it is said that the market initially did not correctly impound the value implications of the signals conveyed by the firm to value the stock (Eberhart, Maxwell and Siddique 2004). These intercepts are assessed by estimating equation (1) for each firm and year. To obtain measures of systematic risk, we estimate equation (1) for each firm *i* in country *k* for each calendar year and use β^{M}_{ik} as the systematic risk measures for firm *i* in country *k* and year (McAlister, Srinivasan and Kim 2007; Bodnar, Dumas and Marston 2004).[7] We compute the idiosyncratic risk as the standard deviation of the residuals from estimation of equation (1).

Independent variables. Different measures of innovation are used in the literature (e.g R&D expenditures, patent counts, and new product counts). Measures of patents are difficult to

obtain for various companies from different countries. Tellis, Prabhu, and Chandy (2009) find that "R&D has a significant effect on market-to-book ratio, even after controlling for radical innovation". Because R&D is considered as an investment in market-based assets (Srivastava, Shervani and Fahey 1998), we use R&D/Assets as a measure of innovation intensity in a company (McAlister, Srinivasan and Kim 2007). Companies with higher scores on this indicator demonstrate a stronger commitment to innovation.

Moderating variables. Investor protection measures developed by La Porta et al. (1997) are perhaps outdated and, being time-invariant, they do not capture the changing institutional conditions in a particular country. The Heritage Foundation and the Wall Street Journal publish measures of investor protection that reflect the situation in a country at the time of publication (www.heritage.org/Index/). Based on statistics from the World Bank, the IMF and the Economist Intelligence Unit, they suggest ten criteria (evaluated on a 100-point scale) reflecting economic freedom in different countries. These criteria are

(1) Business Freedom (e.g., procedures, time and cost to start a business),
(2) Trade Freedom (i.e., absence of tariff and non-tariff barriers),
(3) Monetary Freedom (i.e., absence of inflation and price controls),
(4) Government Size (e.g., government expenditures),
(5) Fiscal Freedom (e.g., overall amount of tax revenue as a percentage of GDP),
(6) Property Rights (e.g., how the laws of the country protect private property rights),
(7) Investment Freedom (e.g., absence of constraints on the flow of investment capital),
(8) Financial Freedom (e.g., government regulation of financial services),
(9) Freedom from Corruption (based on Transparency International scores), and
(10) Labor Freedom (e.g., laws inhibiting layoffs).

We use the *Overall Score*, which is developed as a formative index of the ten components. The higher the score the more the policies adopted in the country are conducive to economic freedom and investor protection. These variables have been recently used by Morgeson et al. (2011). Following prior studies (e.g., La Porta et al. 1997), we consider four main religion variables: (i) the proportion of Catholics, (ii) the proportion of Protestants, (iii) the proportion of

Muslims, and (iv) the proportion of Buddhists. We also control for the influence of legal origin on investor protection in line with La Porta et al (1997). We create a dummy variable where 1 means that the country has a common-law legal system and 0 otherwise. Finally, as previously used in the literature (e.g., Porter and Stern 2002, http://web.worldbank.org), country innovativeness is measured as the average of the normalized values of three indicators: (1) Royalty and License Fees, (2) Patent Applications Granted by the US Patent and Trademark Office for each country, and (3) Scientific and Technical Journal Articles. This measure refers to the outcomes of innovation activity. However, it also reflects individual consumer innovativeness because innovations in a country would not succeed if the customers in that country were not sophisticated and innovative (Porter and Stern 2002).

Control variables. We include the company's size measured as the logarithm of its sales. We also control for company profitability, measured with the Returns on Assets. Profitability is a piece of information that investors consider when they value the company's assets. Company debt can have positive effects on risk and reduce the stock returns. Therefore, we control for the company's debt level with the ratio of the total debt and total assets expressed in percentage.

All explanatory variables (except for the moderators) are specified as unanticipated values from values expected at the previous period, using a first-order autoregressive regression. Moderator variables are standardized for ease of interpretation (see Tables 1 & 2).

INSERT TABLES 1 & 2 ABOUT HERE

MODEL SPECIFICATION AND ESTIMATION

Model Specification

Three aspects must be considered in specifying the model. First, although the stock returns and risk observations are ultimately at the level of the firm, firms can be grouped into supra-ordinate country units. When the data is nested into higher-level units, a multilevel model is the most appropriate methodology (Raudenbush and Byrk 2002; Gatignon, Weitz and Bansal 1990). We adopt a 3-level specification in which repeated measures are nested into firms, which are nested into countries.[8] Second, various factors that are not available in our dataset can influence stock returns and risk, e.g., unobserved effects. Third, stock returns and risk are related both conceptually and by construction. Therefore, we need to take into account the cross-correlations between stock returns and risk and develop a Multilevel Structural Equation Model:

$$AR_{ijkt} = b^{0}_{ijkt} + b^{R\&D}_{ikt} \times \left(\frac{R\&D}{Assets}\right)_{ijkt} + \sum_{p=1}^{P} b^{Z}_{ik,p} \times Z_{ijkt,p} + e_{ijkt} \quad (2)$$

$$SR_{ijkt} = \delta^{0}_{ijkt} + \delta^{R\&D}_{ikt} \times \left(\frac{R\&D}{Assets}\right)_{ijkt} + \sum_{p=1}^{P} \delta^{Z}_{ik,p} \times Z_{ijkt,p} + \mu_{ijkt} \quad (3)$$

$$USR_{ijkt} = \omega^{0}_{ijkt} + \omega^{R\&D}_{ikt} \times \left(\frac{R\&D}{Assets}\right)_{ijkt} + \sum_{p=1}^{P} \omega^{Z}_{ik,p} \times Z_{ijkt,p} + \eta_{ijkt} \quad (4)$$

$\varepsilon_{ijkt} \sim N(0, \sigma_{\varepsilon})$, $\mu_{ijkt} \sim N(0, \sigma_{\mu})$, $\eta_{ijkt} \sim N(0, \sigma_{\eta})$,
$Cov(\varepsilon_{ijkt}, \mu_{ijkt}) \neq 0$, $Cov(\varepsilon_{ijkt}, \eta_{ijkt}) \neq 0$, $Cov(\mu_{ikt}, \eta_{ikt}) \neq 0$,
where:

AR_{ijkt} = Abnormal stock returns for firm *i* in industry *j* in country *k* and year *t*,

SR_{ijkt} = Systematic risk for firm *i* in industry *j* in country *k* and year *t*;

USR_{ikt} = Unsystematic risk for firm *i* in industry *j* in country *k* and year *t*;

$\left(\frac{R\&D}{Assets}\right)_{ijkt}$ = Unexpected R&D/Assets ratio for firm *i* in industry *j* in country *k*in year *t;*

$Z_{ijkt,p}$ = Other factors (*p*) that influence firm value (e.g., size, leverage).

$\beta^{0}_{ijkt}, \delta^{0}_{ijkt}, \omega^{0}_{ijkt}$ = Intercepts that vary across firms, industries, countries and years;

$\beta^{index}, \delta^{index}, \omega^{index}$ = Influence of each variable on the corresponding dependent variable;

$\varepsilon_{ijkt}, \mu_{ijkt}, \eta_{ijkt}$ = Error terms.

Unobserved heterogeneity is modeled by means of random coefficients, to which a factor-analytic structure with latent factors is superimposed:

$$b^0_{ijkt} = b^0 + \sum_{d=1}^{D} g^{cons}_d \times F_{i,d} + \sum_{j=1}^{J} b^0_j \times D_j + \sum_{r=1}^{R} l^{cons}_r \times F_{k,r} + \sum_{v=1}^{V} b^{Inv}_v \times V_{kt,v} + \sum_{m=1}^{M-1} b^{year}_m \times W_m + z^0_{ijkt} \quad (5)$$

$$\beta^{R\&D}_{ikt} = \beta^{R\&D} + \sum_{d}^{D} \gamma^{R\&D}_d \times F_{i,d} + \sum_{r=1}^{R} \lambda^{R\&D}_r \times F_{k,r} + \sum_{v=1}^{V} \beta^{Mod*R\&D}_v \times V_{kt,v} + \zeta^{R\&D}_{ikt} \quad (6)$$

$$\beta^{Z}_{ik,p} = \beta^{Z}_p + \zeta^{Z}_{ik,p} \quad (7)$$

$$\delta^0_{ijkt} = \delta^0 + \sum_{d=1}^{D} \theta^{cons}_d \times F_{i,d} + \sum_{j=1}^{J} \delta^0_j \times D_j + \sum_{r=1}^{R} \varphi^{cons}_r \times F_{k,r} + \sum_{v=1}^{V} \delta^{Inv}_v \times V_{kt,v} + \sum_{m=1}^{M-1} \delta^{year}_m \times W_m + \varsigma^0_{ijkt} \quad (8)$$

$$\delta^{R\&D}_{ikt} = \delta^{R\&D} + \sum_{d=1}^{D} \theta^{R\&D}_d \times F_{i,d} + \sum_{r=1}^{R} \varphi^{R\&D}_r \times F_{k,r} + \sum_{v=1}^{V} \delta^{Mod*R\&D}_v \times V_{kt,v} + \varsigma^{R\&D}_{ikt} \quad (9)$$

$$\delta^{Z}_{ik,p} = \delta^{Z}_p + \varsigma^{Z}_{ik,p} \quad (10)$$

$$\omega^0_{ikt} = \omega^0 + \sum_{d=1}^{D} \kappa^{cons} \times F_{i,d} + \sum_{j=1}^{J} \omega^0_j \times D_j + \sum_{r=1}^{R} \pi^{cons}_r \times F_{k,r} + \sum_{v=1}^{V} \omega^{Inv}_v \times V_{kt,v} + \sum_{m=1}^{M-1} \omega^{year}_m \times W_m + \xi^0_{ijkt} \quad (11)$$

$$\omega^{R\&D}_{ikt} = \omega^{R\&D} + \sum_{d=1}^{D} \kappa^{R\&D}_d \times F_{i,d} + \sum_{r=1}^{R} \pi^{R\&D}_r \times F_{k,r} + \sum_{v=1}^{V} \omega^{Mod*R\&D}_v \times V_{kt,v} + \xi^{R\&D}_{ikt} \quad (12)$$

$$\omega^{Z}_{ik,p} = \omega^{Z}_p + \xi^{Z}_{ik,p} \quad (13)$$

$$V_{kt,v} = \varpi_{0v} + \sum_{q=1}^{Q} \varpi_{q,v} \times L_{kt,q} + \tau_{kt,v} \quad (14)$$

where:

$\beta^0, \delta^0, \omega^0$ = Average abnormal stock returns, systematic risk, and unsystematic risk respectively,

ϖ_{0v} = = the average score for *v* (investor protection, country innovativeness)

ϖ_{qv} = = the influence of religion on investor protection and innovativeness

$\beta^{R\&D}, \delta^{R\&D}, \omega^{R\&D}$ = Base level parameter of the effect of R&D on stock returns, systematic risk and idiosyncratic risk respectively,

β^{Z}_p, δ^{Z}_p, ω^{Z}_p = Base level effect of the *p*-th firm-specific control variable on the three dependent variables,

$F_{i,d}$ = *d*-th vector of latent factor scores for firm *i*, accounting for unobserved firm heterogeneity,

D_j = Vector of dummy variables for each industry,

γ	= Vector of loadings on the heterogeneity factor at the firm level,
$F_{k,r}$	= *r*-th vector of factor scores for country *k*, accounting for unobserved country heterogeneity,
λ	= Vector of loadings on the heterogeneity factor at the country level,
$V_{kt,v}$	= Vector of conditions that influence the credibility of the R&D expenditures (i.e., $v = 1$ for investor protection and $v = 2$ for country innovativeness),
$L_{kt,q}$	= a vector of religion and legal origin variables
$\beta^{Mod*R\&D}$, $\delta^{Mod*R\&D}$, $\omega^{Mod*R\&D}$	= Coefficient of the moderating influence of those conditions,
W_t	= Vector of the year-specific dummies,
ζ, ς, ξ	= i.i.d. random errors.

We account for the dependence between the three equations through the factor loadings. This shared-parameter model implies that there are firm- and country-specific latent variables that jointly influence the stock returns, the systematic risk, and the idiosyncratic risk (Albert and Follmann 2000; Ngobo 2011). In sum, equations (7), (10) and (13) decompose the effects of R&D spending into (1) a base level, (2) firm, (3) industry, (4) country, and (5) sustainable components (Boulding and Staelin 1995). The larger the absolute value of the loadings, the larger unobserved heterogeneity is.

Model Estimation

The models expressed by Equations (3) through (13) were estimated by maximum likelihood using LatentGold 4.5. LatentGold 4.5 solves the integral associated with the continuous factors using the Adaptive Gauss-Hermite numerical integration procedure. The specification with one latent factor at the firm level and one country level factor was sufficient to capture unobserved heterogeneity in the data (R^2 for the latent factor ≥ 0.99).

RESULTS

Table 3 reports the estimated parameters for the retained, moderating-effect models as well as the goodness of fit indices comparing the retained models with their main-effect specifications. The likelihoods as well as the BIC values indicate that the moderating-effect model has a better fit than the main-effect model. Consequently, accounting for the role of investor protection and country innovativeness improves the quality of the model. We present the results in terms of (1) the role of the moderating variables (our hypotheses) (2) unobserved heterogeneity, and (3) the significance of control variables.

INSERT TABLE 3 ABOUT HERE

Explaining Cross-country Differences in the Way R&D Affects Firm Value

The coefficient for the effect of unexpected R&D-to-Assets ratio on abnormal stock returns when the moderators are at their mean value (i.e., 0 since the moderators have been standardized) is negative and statistically significant (-1.164, $p<0.001$). This is by itself difficult to interpret because several moderating factors are significant. However, the association between the unexpected R&D expenditures and stock returns increases as the investor protection in the country increases ($\beta_1^{Mod*R\&D}$ =0.945, $p<0.001$), bringing support for H1. Although the estimate of the country innovativeness is positive, empirical evidence does not support H4 because this coefficient is non-significant (0.308, $p=0.125$). The effect of unexpected R&D on systematic risk when the moderators are at their mean value is positive and statistically significant (0.456, $p=0.016$). This means that in such environments characterized by average moderator values, R&D increases the stock's systematic risk reflecting the information asymmetry. However, the effect of unexpected R&D-assets ratio on systematic risk is influenced negatively by investor

protection ($\delta_1^{Mod*R\&D}$ =-0.434, p=0.010), bringing support to H2. Country innovativeness does not significantly moderate the association between R&D and systematic risk ($\delta_2^{Mod*R\&D}$ =-0.228, p=0.367), as was hypothesized in H5. Finally, we observe that the effect of unexpected R&D on idiosyncratic risk when the moderators are at their mean value is highly positive and significant (7.888, p<0.001) reflecting the fact that R&D makes it difficult to forecast the future earnings. Consistent with H3, we find that investor protection moderates the association between the unexpected R&D-assets ratio and idiosyncratic risk ($\omega_1^{Mod*R\&D}$ =-3.053, p=0.022). Similarly, H6 is supported, as the moderating influence of country innovativeness in the association of R&D with idiosyncratic risk is negative and statistically significant ($\omega_2^{Mod*R\&D}$ =-6.846, p=0.001).

Unobserved Heterogeneity

Even after accounting for investor protection and country innovativeness, there remain some unobserved cross-country differences in the way unexpected R&D-assets ratio influences stock returns ($\lambda^{R\&D}$ =-1.071, p <0.001), systematic risk ($\varphi^{R\&D}$ =1.047, p<0.001), and idiosyncratic risk ($\pi^{R\&D}$ =5.550, p<0.001). This implies that there are other factors than innovativeness and investor protection that might explain these differences in abnormal returns, systematic risk, and idiosyncratic risk. The heterogeneity in the influence of R&D on the three indicators of firm value is greater at the country level, implying that the associations vary more across countries than within countries. Because the firm-level factors and country level factors are standardized, this reflects the differences in the countries' stock market characteristics.

Country mapping. The results reported above show that the role of country level variables hypothesized in the conceptual section is generally supported by the data. However, beyond

these effects the latent country factor also impacts the value of R&D. The estimated values of the country-level factor scores (F_k) indicate that there are three segments of countries:

- A cluster of countries with a negative factor score (i.e., F_k = -1.7321): Austria, Netherlands, Singapore, South Korea, and Turkey.
- A cluster of countries with a factor score of zero (i.e., F_k = 0.000), which are Australia, Canada, Finland, India, Israel, Sweden, Taiwan, and Norway.
- A cluster of countries with a positive factor score: Germany (1.7320), Greece (1.7320), Italy (1.7320), Japan (1.7320), Malaysia (1.7320), Belgium (1.7321), Denmark (1.7321), France (1.7321), South Africa (1.7321), Switzerland (1.7321), UK (1.7321), and the USA (1.7321).

To help understand the nature of these clusters, we compared the means of Hofstede (2001)'s dimensions of "individualism" and "power distance" by cluster.[9] The country grouping that results from the latent factor does not correspond to either of Hofstede's dimensions. While cluster 1 is low on individualism (42), clusters 2 and 3 also have little variation on that dimension (63 vs. 65). Similarly, if power distance is highest in cluster 3 (51), it is almost as high (50 vs. 51) in cluster 1. However, it may be possible to interpret the clusters by combining the two Hofstede's dimensions. Cluster 1 reflects countries that are low on individualism (42) but high on power distance (50), Cluster 3 represents countries that are high on both dimensions and Cluster 2 countries that are high on individualism (63) but low on power distance (39).

Because the coefficient of the latent factor on R&D effect on stock returns is negative ($\lambda^{R\&D}$ =-1.071), countries such as Singapore or Austria in cluster 1 (with a negative factor score) have a higher level of impact of R&D on abnormal stock return. At the opposite extreme of the latent scale, countries such as Germany, France or the USA, have a lower return to R&D. Countries in Cluster 2 with medium level values of the latent factor (e.g., Canada or India) fall in

between. To illustrate the cross-country differences in the way unexpected R&D influences firm value, we plot the total impact of R&D on the three dependent variables for each country. For that purpose, the focus is on the equations below:

$$E\left[\beta_{ikt}^{R\&D}\right] = \hat{\beta}^{R\&D} + \sum_{r=1}^{R} \hat{\lambda}_r^{R\&D} \times \hat{F}_{k,r} + \sum_{v=1}^{V} \hat{\beta}_v^{Mod*R\&D} \times V_{kt,v} \quad (15)$$

$$E\left[\delta_{ikt}^{R\&D}\right] = \hat{\delta}^{R\&D} + \sum_{r=1}^{R} \hat{\varphi}_r^{R\&D} \times \hat{F}_{k,r} + \sum_{v=1}^{V} \hat{\delta}_v^{Mod*R\&D} \times V_{kt,v} \quad (16)$$

$$E\left[\omega_{ikt}^{R\&D}\right] = \hat{\omega}^{R\&D} + \sum_{r=1}^{R} \hat{\pi}_r^{R\&D} \times \hat{F}_{k,r} + \sum_{v=1}^{V} \hat{\omega}_v^{Mod*R\&D} \times V_{kt,v} \quad (17)$$

The total effects of R&D at the country level are computed based on factor score values, level of investor protection, country innovativeness, combined with the relevant parameter estimates reported in Table 3, using Equation (15)-(17). Each country can then be represented by a point on a map reflecting the total impact of R&D on the three dependent variables. Because investor protection and country innovativeness are time-varying variables, we draw a map based on the mean value of the moderators (see Figure 2).

INSERT FIGURE 2 ABOUT HERE

R&D has a large positive impact on the returns of stocks in countries that are in segment I (e.g., Netherlands, Singapore) except for Turkey. The total impact of R&D is smaller in Turkey than in the four (4) other countries in Segment I because Turkey is the country with the least investor protection in the sample and the second worst in terms of country innovativeness. Singapore, however, is among the best in terms of innovativeness and investor protection (i.e., economic freedom). The four countries also appear to be those where companies benefit the most in terms of reducing systematic risk through R&D spending.

R&D has the smallest impact on the returns in such countries as Malaysia, South Africa, Greece, Italy and France. R&D has the largest positive impact on idiosyncratic risk in these

countries as well, meaning that the returns of R&D firms are more difficult in those countries. The impact of R&D on systematic risk is also less negative in those countries. This suggests that it is probably because of the uncertainty associated with their future returns that the stock returns of the R&D-spending firms in the four countries tend to be synchronized with the market-wide fluctuations more than in the other countries.

The role of religious affiliation. Table 3 also reports the results regarding the association between religious affiliation, investor protection and country innovativeness. Beginning with investor protection, we observe that the proportion of Protestants has a positive association with investor protection (0.004, p=0.002) while the other religions have negative associations. The most negatively related to investor protection is the proportion of Muslims in a country (-0.152, p<0.001) followed by the proportion of Catholics (-0.05, p<0.001) and Buddhists (-0.019, p<0.001). This implies that investor protection is best protected in countries with higher proportion of Protestants and least protected in countries with large Muslim populations. These effects are obtained while controlling for Legal origin that is significant as well. Consistent with La Porta et al. (1997), countries of a common-law legal origin have a higher investor protection than non-common law countries (8.572, p<0.001).

The indirect effect through investor protection, of religion on the investors' response to R&D, is calculated as the product of both coefficients. The Sobel test[10] indicates that the proportion of Protestants in a country has an indirect positive influence on stock returns (0.0038, Sobel test statistic =3.51, p=0.0002). The indirect influence on returns is negative for the proportion of Catholics (-0.047, Sobel test = -7.23, p<0.001), the proportion of Muslims (-0.144, Sobel test = -7.27) and the proportion of Buddhists (-0.018, Sobel test = -5.79, p<0.001). The indirect influence of the proportion of Protestants in a country on systematic risk is negative and significant (-0.002, Sobel test = -2.136, p=0.016). The indirect influence of religious affiliation

on systematic risk is significantly positive for the Catholics (0.022, Sobel test = 2.53, p = 0.005), Muslims (0.065, Sobel test = 2.53, p = 0.005), and Buddhists (0.01, Sobel test= 2.44, p = 0.007). Finally, with regard to the idiosyncratic risk, while the indirect influence deceases as the proportion of Protestants in the country increases (-0.012, Sobel test = -1.99, $p<0.05$), the influence increases as the proportion of Catholics (0.153, Sobel test =2.29, $p<0.05$), Muslims (0.464, Sobel test = 2.29, $p<0.05$) or Buddhists (0.058, Sobel test = 2.23, $p<0.05$) increases. Therefore, our results indicate that returns from R&D investments tend to be smaller in countries with a higher proportion of Muslims compared to countries with a higher proportion of Protestants. Similarly, returns are smaller in countries with a higher proportion of Catholics compared to countries with a higher proportion of Protestants. Furthermore, while firms in countries with a higher proportion of Protestants exhibit lower systematic risk from R&D, countries with a higher proportion of Muslims tend to exacerbate this type of risk. The same hold for non-systematic risk.

Table 3 shows that country innovativeness increases as the proportion of Protestants (0.026, $p<0.001$), Buddhists (0.026, $p<0.001$) or Catholics (0.015, $p<0.001$) in a country increases. It decreases as the proportion of Muslims in a country increases (-0.032, $p<0.001$). In terms of indirect influence of religious affiliation, we find that while the proportion of Buddhists (-0.178, Sobel test = -3.38, $p<0.001$), Protestants (-0.144, Sobel test=-3.40, $p<0.001$), and Catholics (-0.103, Sobel test = -3.41) negatively influences the non-systematic risk from R&D investments, the proportion of Muslims positively influences the non-systematic risk from R&D investments (0.219, Sobel test= 3.38, $p<0.001$). These findings suggest that religion influences the variability of the cash flows from R&D investments. This variability increases as the proportion of Muslims increases while it decreases with the proportion of the other religions.

Control variables

Although profitability has a nonsignificant effect on abnormal returns, it is negatively associated to systematic risk (δ_1^Z = -0.004, p<0.001), an indication that profitability insulates from market fluctuations. Profitability also reduces idiosyncratic risk (ω_1^Z =-0.096, p<0.001), reflecting the fact that profitability increases the predictability of future income streams. Leverage negatively influences stock returns (β_2^Z =-0.006, p<0.001), which probably reflects investors' negative response to indebted companies. The last control variable, firm size, is negatively related to the idiosyncratic risk (ω_3^Z =-0.201, p<0.001), as it is easier to forecast the future cash flows of large firms due to, in part, greater information disclosure than in smaller firms. Size also positively influences stock returns (0.083, p<0.001) reflecting a scale effect.

Robustness Tests

We examined how robust our findings are to a number of issues, namely the issue of endogeneity of R&D and measurement of R&D.

Endogeneity. Following McAlister et al. (2007) and Mizik and Jacobson (2003), we investigated the potential endogeneity of R&D by estimating a Granger causality test through a panel Vector Auto Regressive model. The estimation was performed separately for each cluster of countries in order to account for unobserved country heterogeneity. Consistent with the single country analysis of McAlister et al (2007) and Mizik and Jacobson (2003), we found significant effects of stock returns, systematic risk and idiosyncratic risk on unexpected R&D spending but which did not impact the direction and significance of the estimates.

Actual vs. unexpected R&D measures. While we estimated our models using the unexpected R&D to Assets ratio as a measure of innovation, a few studies have used the actual values of R&D to Assets ratio. To make comparisons possible with those studies, we replicated our analyses using R&D-to-Assets as a measure of innovation efforts. The results shown also in

Table 3 lead to very similar results. In the stock returns equation, the effect when the moderators are at their mean value is positive and statistically significant (0.59, $p<0.001$). In addition, the effect of R&D-to-Assets increases as both the country's investor protection (0.49, $p<0.001$) and the country's innovativeness (0.30, $p<0.001$) increase. Turning to the systematic risk, we can see that R&D reduces the systematic risk as the country's investor protection efforts increase (-0.39, $p<0.001$). Finally, the interaction coefficients show that the effect of R&D-to-Assets on idiosyncratic risk decreases as the country's investor protection increases (-2.05, $p=0.01$). Similarly, the effect of R&D-to-Assets on idiosyncratic risk decreases as the country innovativeness increases (-1.76, $p= 0.03$). Therefore, our results are identical with the exception that innovativeness is a positive moderator of the R&D effect on stock returns and the effect of R&D on returns is positive when all moderator variables are at their mean value. A plot of countries like in Figure 2 but with estimates from actual R&D shows little difference.

CONCLUSION

This section summarizes the findings and discusses implications and limitations.

Summary of Findings

Our research reveals that the association between R&D and firm value varies across countries and provides evidence for the role of key explanatory factors. Our analysis leads to some clear conclusions:

- R&D pays more in some countries than in others. More specifically, we observe that there are four types of countries based on the way investors' respond to R&D investments:
    - Segment I includes countries where R&D increases stock returns while reducing both systematic risk and idiosyncratic risk. They are Singapore and the Netherlands. This is

where R&D produces the largest benefits. For example, a 1-point increase in R&D-to-Assets ratio has a mean effect of 4.72 in Singapore and 3.92 in the Netherlands while reducing systematic risk by -2.11 (Singapore) and -1.45 (Netherlands) and the idiosyncratic risk by -4.11 (Singapore) and -0.78 (Netherland).

- Segment II is composed of countries (i.e. Austria, South Korea, Turkey and India) where R&D increases stock returns while reducing systematic risk but increasing the idiosyncratic risk. For example, in Austria, a 1-point increase in the R&D ratio has a positive effect on stock returns (3.51), a negative effect on systematic risk (-1.21) but a positive effect on idiosyncratic risk (1.16). This is where R&D yields the second largest benefits since two of the firm value indicators get favorably impacted by a 1-point increase in the R&D ratio.
- Segment III includes countries that are the third in terms of the benefits of R&D. In these countries (i.e. Australia, Canada, Finland, Sweden, Taiwan, Norway and Israel), while an increase in the R&D ratio yields positive effects on stock returns it also increases systematic risk and particularly idiosyncratic risk. For example, a 1-point increase in the R&D ratio in Canada yields a positive effect of 1.04 on stock returns but it increases systematic risk (0.30) and idiosyncratic risk (7.92). This implies that the returns from R&D come at a cost, which is the increase in risk.
- Segment IV is composed of those countries (i.e. Switzerland, USA, UK, Denmark, Japan, Belgium, Germany, France, Italy, South Africa, Greece, and Malaysia) where a 1-point increase in the R&D ratio results in negative returns, on average, but it increases both systematic risk and idiosyncratic risk. For example, on average, the mean effect on returns in Switzerland is negative at -1.65 while the effect on

systematic risk (1.99) and idiosyncratic risk (15.64) is positive. It must be pointed out that these ranking implies that countries in the first segment are those that benefit the most from their R&D investments, based on effects on the firm value, while countries in the fourth segment are those that benefit the least from R&D spending.

- Institutional differences partly explain the differences in the cross-country effects of R&D on firm value. In contrast to most of the prior studies that limit their investigations to identifying differences, we show that investor protection, country innovativeness, and religion are significant reasons why the R&D valuation differs across countries. While most of our hypotheses are supported, it also appears that R&D is less effective in reducing systematic risk than it is in reducing idiosyncratic risk. Furthermore, consistent with Stulz and Williamson (2003) we find that religion influences investor protection and that investor rights are better protected as the proportions of Protestants increase, followed by the proportion of Buddhists, Catholics and Muslims respectively. Consequently, religion influences the investors' response to R&D spending. Similarly, the influence of R&D on systematic risk and idiosyncratic risk is negative as the proportion of Protestants in a country increases and it increases as the proportion of the other religions increase. Our research also provides new insights regarding the effect of religion on country innovativeness in addition to what has been reported by previous studies such as Steenkamp et al. (1999) and Tellis, Yin, and Bell (2009). It appears that the proportion of Muslims negatively influences the propensity to innovate while the proportion of Buddhists, Protestants, and Catholics has positive effects on the country innovativeness.

Implications for Marketing Strategy

These results have important implications for researchers and managers. First, our study calls for caution about generalizations from single-country studies, especially when interested in

effect sizes. For example, our findings would have been different if we had analyzed companies in the USA or Australia alone. Therefore, researchers and managers should not use results in some countries (e.g. the US) to predict the R&D effects in other countries (e.g. Singapore and Netherlands). Second, we contribute to prior research on the effects of R&D by showing that its effects on firm value depend upon the country's institutional characteristics in addition to industry type (Chan et al. 1990) or firm specific factors (Szewczyk et al. 1996; Hirschey and Spencer 1992). Third, these results have strategic implications in terms of resource allocation and information disclosure, besides from our better understanding of global financial markets. Marketing management pursuing a value creation strategy needs to take into consideration institutional factors to anticipate investors' reactions when financial criteria weight heavily in the boardroom. Indeed, our findings suggest that without the appropriate formal and informal institutional resources, the R&D investments that a firm makes may be undervalued in a particular national or regional economy. Managers must recognize the characteristics of the focal country in terms of innovativeness or religiosity that affect investors' response to their innovation expenditures. Our results can therefore improve strategic R&D investment decision-making. Our research has also implications for the disclosure of R&D expenditures. Investors are more likely to be responsive to unanticipated changes in R&D in countries with strong investor protection, higher levels of innovativeness, and higher levels of religiosity. In the other contexts, managers must find other ways to reveal their strategy based on R&D expenditures. This implies that firms operating in countries with strong investor protection or that are innovative can create additional value by disclosing more information on their R&D activities. Finally, our findings support the three-dimensional analysis of the effect of R&D on firm value: R&D affects stock returns, systematic risk, and idiosyncratic risk. Consequently, managers considering less emphasis on value creation through innovation must consider all possible effects.

Limitations and Additional Research Questions

Our study presents limitations inherent to cross-country studies such as the use of aggregate data like R&D expenditures to reflect the value creation strategy of the firm. In addition, although we control for firm and country heterogeneity, the small number of cases in some industries prevent an estimation of the specific effects for these industries. Although we control for between-country heterogeneity, alternate explanations that would be correlated with measures of investor protection, innovativeness and religiosity cannot be completely excluded. Furthermore, our study focuses on the contemporaneous effects of R&D. Yet, it may be interesting to examine the long-term effects of innovation expenditures on firm value as R&D impact has been found to stay well beyond the accounting period in which R&D is expensed (Eberhart et al. 2004). The need for examining the long-term effects is also justified by the fact that the sensitivity to R&D activities by shareholders may unfold over time. Finally, institutional differences between countries can influence how fast and how long investors can benefit from R&D investments. Finally, the possibility of feedback effects or reversed causality can be raised, even though prior studies of R&D expenses on stock returns did not reveal such effects (Mizik and Jacobson 2003; McAlister, Srinivasan and Kim 2007). Our cross-country analysis complicates such analysis of endogeneity beyond the control inherent to our random coefficient specification and to the autocorrelation corrections performed. The identification of the three clusters of country enabled us however to group countries within each cluster for a cluster specific analysis of endogeneity through a panel-data vector autoregression methodology. The results confirm the effects reported in this study.

Despite these limitations, our research shows that the effects of R&D on stock returns, systematic risk, and idiosyncratic risk vary significantly across countries. The way a country

protects the investors' interests, its innovativeness, and its level of religiosity are significant moderators of the extent to which R&D expenditures influence stock returns, systematic risk and idiosyncratic risk. The significance of a latent country factor indicates that there are other country specific explanations for the value of R&D by investors. Although we explore how to interpret this source of heterogeneity, further research is needed to improve our theory of cross-national differences in investors' strategy valuation.

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FOOTNOTES

[1] Other studies have used output-based measures such as patent counts and citations (Connolly, Hirsch and Hirschey 1986; Bloom and Van Reenen 2002). Although their relative importance (vs. R&D spending) appears to be smaller (Hall, Jaffe and Trajtenberg 2005), the results confirm the same positive effects.

[2] Earnings management is a practice that consists in altering the financial reports to mislead shareholders or other parties in a transactional relationship. Income smoothing consists in using the latitude provided in the interpretation of legal practices to avoid net income fluctuations.

[3] Our results reflect the degree to which stock market prices are affected by R&D expenditures as declared by companies and are, therefore, conditional on non-null R&D expenses. We do recognize, however, that there may be differences across industries and this is reflected in our treatment of heterogeneity across firms, industries, periods and countries. To the extent that some firms do not invest in R&D because the stock market does not value such investment strategies, the stock prices of these firms would respond to different strategic instruments. Consequently, such firms should not be pooled together with firms for which R&D has some degree of relevance to the stock market.

[4] Industries with fewer than 50 cases are regrouped in an "Other" category. We do not report the list of industries for space reasons. They may be obtained from the authors.

[5] We develop country-specific models of stock returns instead of regional or international versions of the Fama-French model. Griffin (2002) found that country-specific models are more useful in explaining average individual stock returns than are world and international versions of the Fama-French model.

[6] WEB Appendix A provides details for the calculations of the Fama-French-Cahart components for each country. Although some of the parameters of this model are published, our database covers countries for which this is not the case. WEB Appendix B discusses the validity of the results and compares them with other published sources.

[7] In order to test the stability of this measure, we used a rolling window regression with 24 to 60 months of data points. For example, to obtain firm-specific estimates of equation (1) for 1997, we used the preceding data for the 12 months of 1996 and the 12 months of 1997. The results show a strong correlation of 0.93 ($p<0.0001$) between the systematic risk obtained over a single year (i.e., 12 months) and the systematic risk calculated on a rolling basis (between 24 and 60 months).

[8] It must be pointed out that we do not specify a 4-level model (i.e. including within-firm, between-firm/within-industry, within-country/between-industry, and between-country variance) because some of the industries have a small number of firms represented in our data. Estimation of a 4-level model in this case may yield unstable results.

[9] The other cultural dimensions from Hofstede as well as additional country variables collected from the World Bank (World Development Indicators) were explored but did not correlate with our latent factor scores.

[10] Although the Sobel test may lack power in general, it is not an issue in this study with a large number of observations. The complexity of the model prevents the use of a bootstrapping procedure to obtain an empirically based distribution of the product term of coefficients.

Table 1: Descriptive statistics across countries

Countries	*Investor protection*	*Innovativeness*	*% protestants*	*% Catholics*	*% Muslims*	*% Buddhists*	*ROA*	*Leverage*	*Firm size*	*Sales*	*RD/ Assets*	*Returns*	*Systematic risk*	*Idiosyncratic Risk*
1. AUSTRALIA	79.33	9.40	36.70	28.10	1.10	1.10	-3.13	14.53	4.64	2322.90	0.14	-0.62	0.53	15.50
2. AUSTRIA	69.22	8.90	5.90	76.60	2.00	0.10	5.02	26.23	5.98	1583.94	0.04	-0.95	0.11	13.09
3. BELGIUM	69.66	9.03	1.30	81.70	3.60	0.20	3.62	22.87	6.33	2284.04	0.06	-0.92	0.57	13.80
4. CANADA	75.80	9.40	20.30	41.90	1.00	0.70	-9.00	10.02	3.37	109.25	0.17	-0.16	0.68	19.75
5. DENMARK	73.60	9.52	88.40	0.60	1.20	0.00	4.17	21.45	7.66	8308.44	0.11	0.09	0.79	13.62
6. FINLAND	71.29	9.60	89.80	0.10	0.20	0.10	6.18	23.14	6.15	2310.24	0.06	-2.26	0.62	13.92
7. FRANCE	61.00	8.75	1.60	82.80	7.00	0.70	2.38	20.88	6.18	5758.27	0.06	0.42	0.95	14.40
8. GERMANY	69.44	9.05	37.20	34.90	4.00	0.10	3.32	17.84	6.25	6098.62	0.06	0.45	0.73	14.69
9. GREECE	59.96	7.60	0.20	0.60	3.30	0.00	5.16	25.05	4.98	786.25	0.02	0.37	0.82	16.08
10. INDIA	89.48	3.91	3.00	1.50	11.90	0.70	12.90	22.37	9.65	60234.27	0.02	1.66	0.78	16.92
11. ISRAEL	64.72	9.45	0.40	2.70	12.20	0.00	-1.01	13.31	5.79	1894.36	0.11	-0.08	0.71	17.23
12. ITALY	62.44	8.17	0.80	97.20	1.10	0.00	4.56	25.13	6.93	9800.68	0.03	-0.49	0.57	11.08
13. JAPAN	70.14	9.28	0.50	0.40	0.10	55.40	2.24	21.58	11.13	296142.80	0.02	0.13	0.80	11.22
14. MALAYSIA	63.23	6.63	3.80	3.20	47.70	6.60	6.52	24.63	7.65	4420.16	0.01	0.29	0.81	11.23
15. NETHERLAND	74.02	9.50	46.6	13.1	0.2	0.9	5.16	22.69	7.20	13402.87	0.05	-1.18	0.02	14.70
16. NORWAY	67.92	9.04	94.40	1.00	1.00	1.40	2.33	20.80	8.39	42649.60	0.05	1.46	0.78	16.36
17. SAFRICA	64.02	6.95	31.10	8.20	2.40	0.10	11.37	16.78	9.31	17038.46	0.01	-0.18	0.49	11.63
18. SINGAPORE	87.70	9.38	4.40	4.00	18.40	14.50	5.39	16.48	5.97	850.50	0.02	-0.72	0.63	14.70
19. SKOREA	68.51	8.53	18.90	7.80	0.20	15.80	5.19	25.43	12.85	2488057.00	0.02	1.23	0.75	18.61
20. SWEDEN	68.90	9.74	94.80	1.90	2.10	0.00	1.67	19.59	7.68	21509.92	0.09	0.61	0.68	15.92
21. SWITZERLAN	78.67	9.88	41.60	44.80	2.50	0.10	6.24	20.89	6.81	5040.57	0.05	0.56	0.64	13.15
22. TAIWAN	70.54	9.19	1.80	1.40	0.40	21.00	7.53	18.21	8.54	19374.35	0.04	1.98	0.98	15.02
23. TURKEY	57.39	5.37	0.10	0.10	97.20	0.10	10.61	22.39	6.09	1952.36	0.01	5.90	0.67	24.47
24. UK	78.37	9.34	53.80	9.60	1.90	0.30	2.63	15.04	4.96	3231.04	0.09	0.84	0.80	13.70
25. USA	78.90	9.53	24.3	21.2	1.4	0.8	-0.80	14.61	5.28	2954.73	0.12	2.39	1.45	18.38
Total	73.49	9.17	14.67	10.75	2.77	28.21	2.15	18.49	7.94	220631.20	0.07	1.10	0.99	15.18

Table 2: Correlation Matrix (coefficients and p-value)

1.														
2.	Stock returns	1.000												
3.	Systematic risk	-0.026 0.000	1.000											
4.	Idiosyncratic risk	-0.132 0.000	0.175 0.000	1.000										
5.	Unexpected R&D to Assets ratio	-0.046 0.000	0.030 0.000	0.067 0.000	1.000									
6.	R&D to Assets ratio	-0.106 0.000	0.085 0.000	0.201 0.000	0.709 0.000	1.000								
7.	Unexpected Leverage	-0.021 0.000	-0.010 0.029	-0.007 0.095	0.035 0.000	-0.009 0.062	1.000							
8.	Unexpected Firm Size	0.003 0.456	0.001 0.780	0.020 0.000	-0.059 0.000	-0.033 0.000	0.008 0.073	1.000						
9.	Unexpected ROA	0.012 0.006	-0.074 0.000	-0.114 0.000	-0.087 0.000	-0.314 0.000	0.012 0.009	-0.057 0.000	1.000					
10.	Investor Protection	-0.232 0.000	0.118 0.000	0.062 0.000	0.092 0.000	0.214 0.000	-0.016 0.000	-0.019 0.000	-0.048 0.000	1.000				
11.	Innovativeness	0.311 0.000	0.050 0.000	-0.031 0.000	0.046 0.000	0.117 0.000	-0.020 0.000	-0.069 0.000	-0.043 0.000	0.019 0.000	1.000			
12.	% of Protestants	-0.374 0.000	-0.028 0.000	0.055 0.000	0.101 0.000	0.205 0.000	0.010 0.050	-0.020 0.000	-0.047 0.000	0.203 0.000	0.170 0.000	1.000		
13.	% of Catholics	-0.216 0.000	-0.031 0.000	0.048 0.000	0.085 0.000	0.167 0.000	0.017 0.001	-0.039 0.000	-0.057 0.000	-0.178 0.000	0.006 0.244	0.089 0.000	1.000	
14.	% of Muslims	-0.266 0.000	-0.007 0.141	0.097 0.000	-0.013 0.026	-0.021 0.000	0.014 0.006	0.046 0.000	0.075 0.000	-0.188 0.000	-0.548 0.000	-0.052 0.000	0.039 0.000	1.000
15.	% of Buddhists	0.686 0.000	0.019 0.000	-0.148 0.000	-0.115 0.000	-0.237 0.000	-0.020 0.000	-0.020 0.000	-0.001 0.856	-0.133 0.000	0.263 0.000	-0.592 0.000	-0.528 0.000	-0.263 0.000	1.000

Table 3: Parameter estimates of unexpected and actual R&D expenditures on firm value

			Unexpected R&D to Assets ratio		*Actual R&D to Assets ratio*	
			Coef.	Std. Err.	Coef.	Std. Err.
Investor protection	<-	Intercept	71,166*	0,088	71.166*	0.100
Investor protection	<-	Proportion of Protestants	0,004*	0,001	0.004*	0.002
Investor protection	<-	Proportion of Catholics	-0,050*	0,001	-0.050*	0.002
Investor protection	<-	Proportion of Muslims	-0,152*	0,002	-0.152*	0.002
Investor protection	<-	Proportion of Buddhists	-0,019*	0,002	-0.019*	0.002
Investor protection	<-	Legal origin (1=common & 0=others)	8,572*	0,077	8.572*	0.102
Country innovativeness	<-	Intercept	7,900*	0,012	8.145*	0.020
Country innovativeness	<-	Proportion of Protestants	0,021*	0,000	0.020*	0.000
Country innovativeness	<-	Proportion of Catholics	0,015*	0,000	0.012*	0.000
Country innovativeness	<-	Proportion of Muslims	-0,032*	0,000	-0.032*	0.000
Country innovativeness	<-	Proportion of Buddhists	0,026*	0,000	0.021*	0.000
Abnormal stock returns	<-	Intercept	2.834*	0.128	-1.088 NS	.608
Abnormal stock returns	<-	Investor protection	-0.082*	0.001	-0.043*	0.001
Abnormal stock returns	<-	Country Innovativeness	0.399*	0.009	0.510*	0.008
Abnormal stock returns	<-	Firm-level Factor Loading γ	-	-	-	-
Abnormal stock returns	<-	Country-level Factor Loading λ	0.768*	0.007	0.866*	0.007
Abnormal stock returns	<-	R&D-to-Assets Ratio	-1.164*	0.150	0.593*	0.082
Abnormal stock returns	<-	R&D-to-Assets Ratio x Firm-level Factor Score γ	-0.779*	0.046	-0.590*	0.042
Abnormal stock returns	<-	R&D-to-Assets Ratio x Country-level Factor Score λ	-1.071*	0.147	-1.713*	0.077
Abnormal stock returns	<-	R&D-to-Assets Ratio x Investor Protection	**0.945***	**0.133**	**0.485***	**0.068**
Abnormal stock returns	<-	R&D-to-Assets Ratio x Country Innovativeness	0.308NS	0.201	**0.299***	**0.072**
Abnormal stock returns	<-	Firm Size	0.083*	0.017	0.203*	0.002
Abnormal stock returns	<-	Leverage	-0.006*	0.001	-0.004*	0.000
Abnormal stock returns	<-	Returns on Assets	0.000 NS	0.000	-0.002*	0.000
Systematic Risk	<-	Intercept	-2.441*	0.161	17.219*	4.975
Systematic Risk	<-	Investor protection	0.033*	0.001	0.033*	0.002
Systematic Risk	<-	Country Innovativeness	0.084*	0.011	0.087*	0.011
Systematic Risk	<-	Firm-level Factor Loading γ	0.007 NS	0.010	0.049*	0.012
Systematic Risk	<-	Country-level Factor Loading λ	0.068*	0.009	0.024*	0.009
Systematic Risk	<-	R&D-to-Assets Ratio	0.456**	0.189	0.536*	0.114
Systematic Risk	<-	R&D-to-Assets Ratio x Firm-level Factor Score γ	0.669*	0.097	0.531*	0.069
Systematic Risk	<-	R&D-to-Assets Ratio x Country-level Factor Score λ	1.047*	0.185	1.056*	0.107

Systematic Risk	<-	R&D-to-Assets Ratio x Investor Protection	**-0.434***	**0.168**	**-0.389***	**0.093**
Systematic Risk	<-	R&D-to-Assets Ratio x Country Innovativeness	-0.228 NS	0.253	-0.047 NS	0.099
Systematic Risk	<-	Firm Size	-0.001 NS	0.021	-0.015*	0.003
Systematic Risk	<-	Leverage	0.002 NS	0.001	0.003*	0.000
Systematic Risk	<-	Returns on Assets	-0.004*	0.000	-0.001*	0.000
Idiosyncratic Risk	<-	Intercept	5.928*	1.142	20.692*	1.534
Idiosyncratic Risk	<-	Investor protection	0.200*	0.012	0.053*	0.014
Idiosyncratic Risk	<-	Country Innovativeness	0.022 NS	0.090	-0.323*	0.088
Idiosyncratic Risk	<-	Firm-level Factor Loading γ	-0.409*	0.050	0.352*	0.066
Idiosyncratic Risk	<-	Country-level Factor Loading λ	-1.507*	0.070	-1.788*	0.075
Idiosyncratic Risk	<-	R&D-to-Assets Ratio	7.888*	1.502	10.102*	0.902
Idiosyncratic Risk	<-	R&D-to-Assets Ratio x Firm-level Factor Score γ	-5.107*	1.255	-2.694*	0.803
Idiosyncratic Risk	<-	R&D-to-Assets Ratio x Country-level Factor Score λ	5.550*	1.467	5.213*	0.848
Idiosyncratic Risk	<-	R&D-to-Assets Ratio x Investor Protection	**-3.053****	**1.331**	**-2.049***	**0.741**
Idiosyncratic Risk	<-	R&D-to-Assets Ratio x Country Innovativeness	**-6.846***	**2.009**	**-1.757****	**0.783**
Idiosyncratic Risk	<-	Firm Size	-0.201 NS	0.168	-0.700*	0.023
Idiosyncratic Risk	<-	Leverage	-0.011 NS	0.008	0.030*	0.004
Idiosyncratic Risk	<-	Returns on Assets	-0.096*	0.003	-0.036*	0.002
		Covariances				
		Abnormal Stock Returns<-> Idiosyncratic Risk	-0.198*	0.033	-0.102*	0.035
		Abnormal Stock Returns<-> Systematic Risk	0.003 NS	0.005	0.027*	0.006
		Idiosyncratic Risk <-> Systematic Risk	2.808*	0.046	2.944*	0.054
		Number of observations		41124	43029	
		MODERATING EFFECT MODEL				
	MODEL FIT	▪ Log-likelihood (LL)		-305108.6	-317568.4	
		▪ Degree of freedom		179	179	
		▪ BIC (based on LL)		612118.95	637046.64	
		MAIN EFFECT MODEL				
		▪ Log-likelihood (LL)		-308169.6	-319388.2	
		▪ Degree of freedom		156	156	
		▪ BIC (based on LL)		618240.95	640686.24	

Notes: Industry and year dummies not reported due to space limitations; * =significant at .01 level; ** =significant at .05 level; NS=non significant.

Figure 1. Conceptual Framework

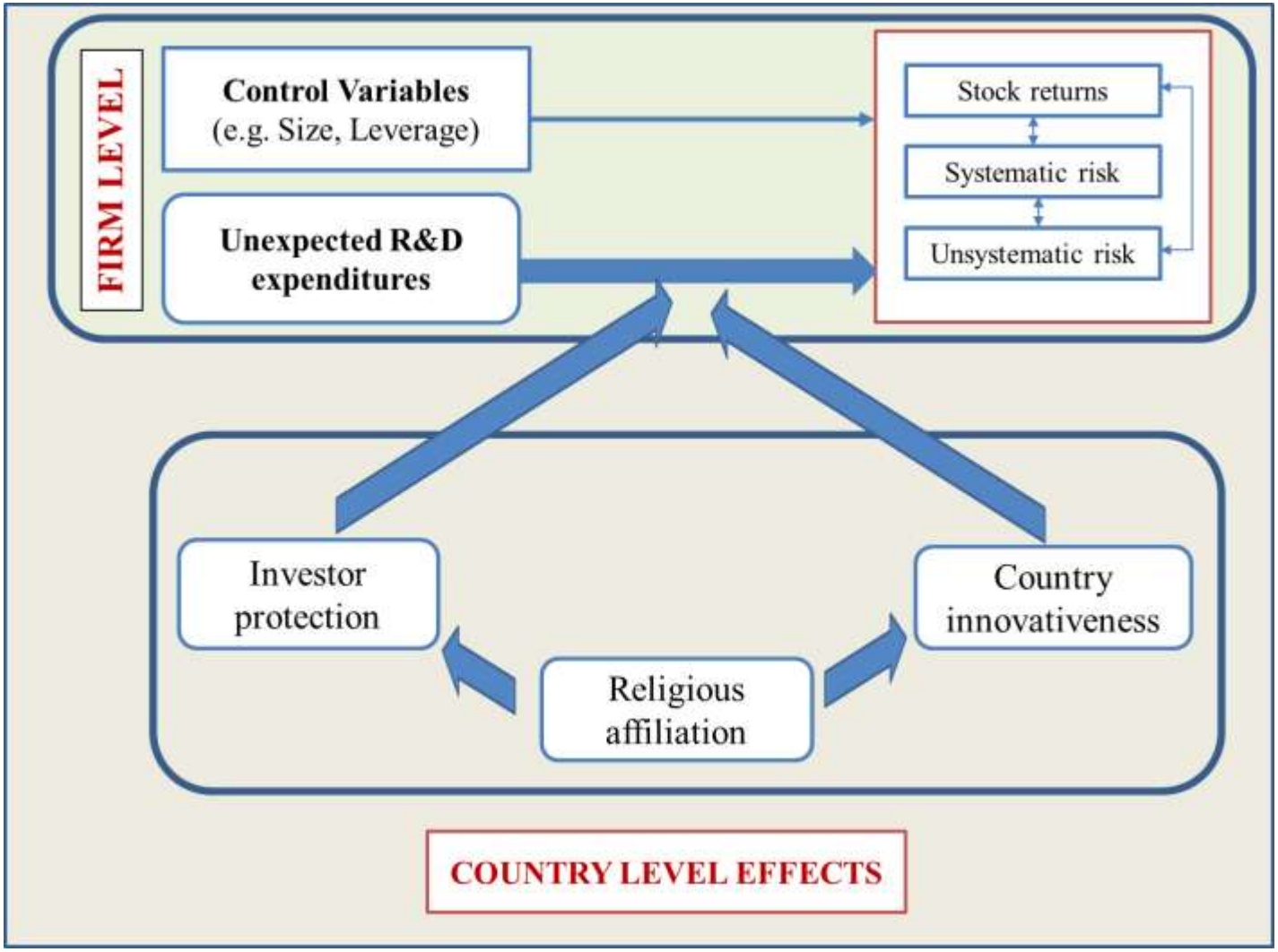
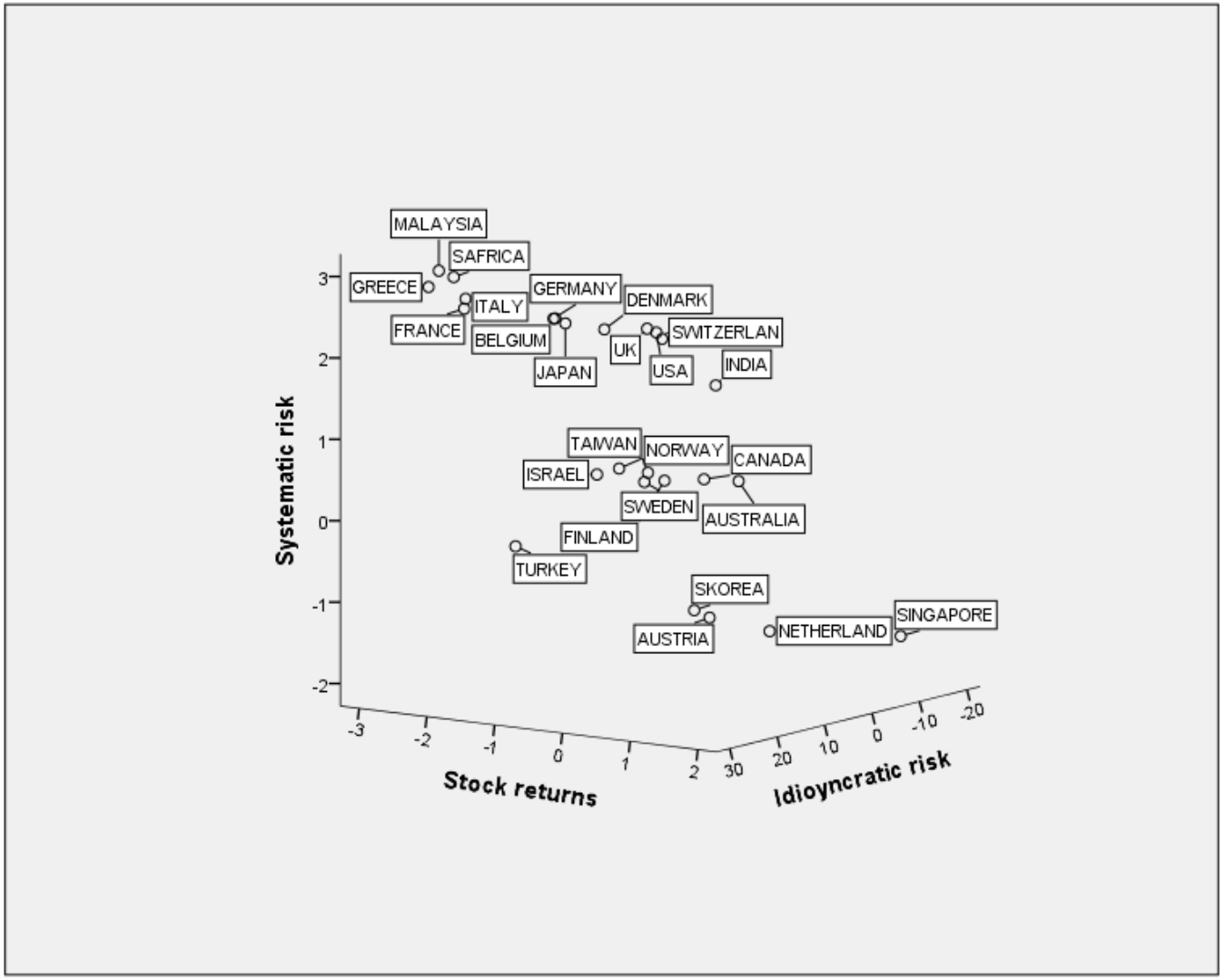


Figure 2: Country mapping of investors' response to **Unexpected** R&D expenditures



WEB APPENDIX A:
PROCEDURES FOR CALCULATING THE FAMA FRENCH CAHART FACTORS

We started by calculating R_{ikm}, the monthly raw returns for stock *i* in country *k* and month *m* (m=1, …, 12). Stock returns include the capital gain (share price change) and the cash dividend received by the investor. It is expressed as follows:

(i) $R_{ikm} = \left[\frac{(P_{ikm} - P_{ikm-1} + D_{ikm})}{P_{ikm-1}} \right]$,

where P_{ikm} and P_{ikm-1} are the stock prices of firm *i* and country *k* at month *m* and *m*-1; D_{ikm} is the cash dividend of firm *i* in country *k* received in month *m*. Dividends are reported annually. To estimate monthly returns, we follow Fama and French (1998) and spread the annual dividend for a calendar year across all months of the year so that compounding the monthly returns reproduces the annual return. R_{km}^{f} is the risk-free rate of return for country *k* in month *m*.

$R_{km}^{M} - R_{km}^{f}$ is excess market return or the difference between the stock market returns (R_{km}^{M}) and the risk-free rate of return (R_{km}^{f}). We could have used the Market returns from Kenneth French's website, namely the country-specific '***Mkt***' data under International Index Portfolios (see http://mba.tuck.dartmouth.edu/ pages/faculty/ ken.french/data_library.html). However, because the KF website does not report the market returns for all the countries (e.g., South Africa, Turkey) and beyond 2007 (at the time of our research), we decided to calculate the market returns ourselves using the following formula:

(ii) $R_{km}^{M} = \frac{(I_{km} - I_{km-1})}{I_{km-1}}$,

where I_{km} and I_{km-1} are the market indices at the end of month *m* and month *m-1* respectively. We calculated the correlation between R_{km}^{M} and the MKT data from Kenneth Fama, for all the countries appearing in both databases, and found a coefficient of 0.9845 ($p<0.001$).

SMB_{kt} measures the additional return that investors obtain by investing in stocks with relatively small capitalization. It is the return from a portfolio for which the stocks whose capitalization is small are bought and stocks for which the capitalization is large are shorted. A positive value means that small capitalizations outperformed large capitalizations while a negative SMB implies that the large capitalizations outperformed the small ones. To compute the SMB, we rank the stocks based on their size (market capitalization) and book-to-market ratio in the previous year (see Table A).

Table A: Framework for computing the SMB and HML components

		Book Equity/Market Equity		
		Low (30%)	Medium (40%)	High (70%)
SIZE	Small (<=50%)	S/L	S/M	S/H
	Big (>50%)	B/L	B/M	B/H

Next, we designate the stocks whose market capitalization is above the 50% size breakpoint or the big firms by *B* and the remaining 50% by *S* for the small firms. Similarly, we designate the stocks above the 70% book-to-market breakpoint as the high firms (H), the middle 40% as the neutral (N), and the firms below the 30% book-to-market breakpoint as the low firms

(L). Then, we form six portfolios, S/L, S/N, S/H, B/L, B/N and B/H as the intersection of size and book-to-market groups. We calculate the monthly returns for the six portfolios each month over the 12 months following portfolio formation. We repeat this procedure every year. Finally, we calculate the SMB (Small minus Big) as the average return on the three small portfolios minus the average return on the three big portfolios:

$$\text{(iii) SMB} = (S/L + S/M + S/H)/3 - (B/L + B/M + B/H)/3$$

Value investors tend to buy stocks with low expectations (i.e. with low price-to-book ratios or high book to price ratios) expecting the market expectations to increase over time. When this occurs, value investors earn a value premium. Stocks of companies with the highest book-to-market ratios are expected to outperform stocks of companies with the lowest book-to-market ratios (called growth stocks or stocks high growth opportunities). Growth investors, on the contrary, tend to buy stocks with high expectations (e.g., with high market to book values or low book equity/Market equity ratios), hoping that these expectations will increase as the company's financial profits keep increasing. In equation (1), *HML* or the "high (book-to-price ratio) minus low" is the additional return received by investors investing in companies with high book-to-market values (i.e. value stocks). At the end of each year, we define value stocks as the top 30% of the stocks with the highest BE/ME (or alternatively with the smallest price-to-book value) and growth stocks as the bottom 30% stocks. Then, we calculate the returns for four portfolios (S/H, B/H, S/L, B/L) every month following the portfolio formation. For example, portfolios formed as of December 1997 will be tracked in 1998. This produces a series of monthly returns during all the period of study. *HML* is the simple average of the returns on the high-B/M portfolios minus the returns on the low-B/M portfolios:

$$\text{(iv) HML} = (S/H + B/H)/2 - (S/L + B/L)/2.$$

WML refers to the return obtained from stocks that have been increasing recently minus the return from stocks that have been decreasing recently. A positive value in a month indicates that value stocks outperformed growth stocks in that month. We create six portfolios based on the market capitalization and the average returns of the stocks. The Small and Big Cap stocks are determined on the basis of the median capitalization in the country during the previous year. Then, we rank stocks on the basis of their average returns over the past six months skipping the most recent month (i.e. over the previous *m-2* and *m-7* period) to avoid the reversal or contrarian effect in returns. We adopt a six-month period (instead of a 12-month period) consistent with prior research (Hong, Lim and Stein 2000; Lee and Swaminathan 2000) that shows that stocks, which have performed well over the past six months, tend to have higher returns over the following six months. In other words, momentum strategies are more likely to pay when based on the last six months because of the slow information diffusion. Therefore, we constructed a momentum variable that reflects the performance of stocks over the prior six months (see Table B).

Table B: Framework for calculating the momentum variable

		Prior returns		
		Losers (30%)	Neutral (40%)	Winners (70%)
SIZE	Small (<=50%)	S/L	S/N	S/W
	Big (>50%)	B/L	B/N	B/W

More specifically, we create the 30% and 70% percentiles of the average stock returns in each country. We define the Winners (*W*) as the stocks in the top 30% of the total stocks with the highest average prior performance. Losers (*L*) are the bottom 30% of the total stocks with the lowest average prior performance. The neutrals are the remaining 40% of the stocks. Next, we calculate equally weighted monthly returns on the six portfolios and repeat the procedure. *WML* (winner minus loser) is the simple average of the returns on the winner-stock portfolios minus the returns on the loser-stock portfolios:

$$\text{(v)}\quad WML = [(S/W - S/L) + (B/L - B/W)]/2$$

WEB APPENDIX B:
ON THE VALIDITY OF THE FAMA-FRENCH-CAHART RESULTS

We estimated different models to assess the validity of the FFC hypotheses on our data. The results (below) show that the Beta or market response coefficient is significant for all the countries, but it is less than one except for the USA. This means that the returns generally follow the market's returns. For the USA, stocks tend to be more volatile than the market. The coefficient for SMB is positive for all the small equity portfolios (S/L and S/H) and becomes negative for all the high market capitalization portfolios (B/L and B/H), thus confirming the existence of the small firm effect. In other words, it pays more to invest in a small capitalization portfolio than in a large cap portfolio. Nevertheless, there is an exception with in some Asian countries. We find that the small firm effect is nonexistent in Japan and Singapore for the high cap stocks (B/L & B/H) and in Hong Kong when we consider the B/H portfolio.

The HML coefficient is negative for the low-book-to-equity portfolios (S/L and B/L) and becomes positive for the high book-to-equity portfolios (S/H & B/H). This confirms the existence of the book-to-market equity effect. This implies that investing in a high BEME stock that is large is less worthy than investing in a high BEME portfolio composed of small stocks. Nevertheless, while the coefficient for HML is positive for the B/H portfolios for most of the countries, it is negative for Japan, Taiwan and the USA. Prior research has reported evidence that value strategies generate more value than growth strategies in the USA (Fama and French 1992), Japan (Chan, Hamao and Lakonishok 1991), but also in different comparative studies (Ding, Chua and Fetherston 2005; Capaul, Rowleya and Sharpe 1993; Fama and French 1998; Bauman, Conover and Miller 1998). Other studies have reported no value premium in Indonesia and Taiwan (Ding, Chua and Fetherston 2005), a negative premium in Thailand (Ding, Chua and Fetherston 2005), and an insignificant value premium for Hong Kong and Singapore (Bauman, Conover and Miller 1998). Our results indicate that overall value strategies pay more than growth strategies except for Taiwan (Ding, Chua and Fetherston 2005), Japan, and the USA (specifically for the B/H portfolios).

Overall, portfolios of stocks in most of the countries behave in line with the findings of Fama and French (1993) and others who observe that small and high book-to-market equity firms have positive slopes on SMB and HML whereas big and low book-to-market-equity firms load negatively on SMB and HML. Small firms and firms with high book-to-market equity on average earn higher returns.

Small/Low BE-ME Portfolio (S/L)

	Australia		Austria		Belgium		Canada	
	Coef.	t	Coef.	t	Coef.	T	Coef.	t
RM	0.499	8.070	0.201	2.470	0.569	6.220	0.720	9.810
SMB	0.898	14.770	0.385	4.970	0.232	3.150	0.640	7.460
HML	-0.460	-5.810	-0.369	-4.670	-0.267	-5.580	-0.570	-6.400
WML	-0.012	-0.230	0.057	1.030	0.174	5.950	-0.170	-2.230
Intercept	2.890	6.480	1.771	2.730	3.210	4.700	3.200	5.420
R^2	0.784		0.358		0.701		0.595	

	Denmark		Finland		France		Germany		Greece	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
RM	0.650	6.430	0.519	8.540	0.734	9.990	0.638	10.250	0.705	8.290
SMB	0.480	8.090	0.496	5.840	0.747	10.250	0.572	6.340	0.634	6.600
HML	-0.530	-6.41	-0.269	-3.900	-0.765	-7.320	-0.597	-6.180	-0.355	-3.900
WML	-0.110	-2.80	-0.185	-2.540	-0.027	-0.320	0.021	0.240	0.101	1.680
Intercept	2.890	4.270	2.602	4.190	4.378	8.750	3.907	7.730	3.369	3.870
R^2	0.650		0.510		0.796		0.653		0.590	

	HongKong		India		Israel		Italy		Japan	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
RM	1.013	12.750	0.664	13.990	0.958	13.200	0.627	10.230	0.631	12.240
SMB	0.976	12.370	0.750	11.230	0.742	9.940	0.674	8.770	1.047	7.400
HML	-0.344	-4.320	-0.390	-4.990	-0.512	-6.420	-0.491	-6.730	-1.337	-7.180
WML	-0.044	-0.720	-0.029	-0.380	0.045	0.660	-0.072	-1.200	0.162	0.900
Intercept	6.416	9.060	5.704	11.970	4.363	7.140	3.002	6.510	2.861	7.560
R^2	0.731		0.771		0.680		0.644		0.736	

	Malaysia		Neverthelands		Norway		South Africa	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
RM	0.617	13.770	0.087	0.720	0.652	6.460	0.406	6.730
SMB	**0.768**	**10.850**	**0.659**	**5.780**	**0.654**	**9.540**	**0.541**	**6.690**
HML	**-0.247**	**-3.520**	**-0.670**	**-5.50**	**-0.788**	**-10.84**	**-0.430**	**-4.14**
WML	-0.016	-0.240	-0.042	-0.50	0.154	3.880	0.080	0.910
Intercept	3.132	5.980	2.730	3.210	5.438	6.250	2.816	4.630
R^2	0.695		0.437		0.841		0.510	

	Singapore		South Korea		Sweden		Switzerland	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
RM	0.559	6.530	0.627	17.350	0.606	9.050	0.495	5.750
SMB	**0.977**	**8.580**	**0.818**	**8.020**	**0.621**	**7.130**	**0.674**	**7.290**
HML	**-0.557**	**-4.970**	**-0.894**	**-7.910**	**-0.420**	**-4.140**	**-0.727**	**-10.140**
WML	-0.041	-0.470	-0.003	-0.040	-0.198	-2.500	0.082	1.340
Intercept	2.392	2.930	4.669	9.400	4.000	6.500	2.571	4.810
R^2	0.498		0.774		0.537		0.656	

	Taiwan		Turkey		UK		USA	
	Coef.	t	Coef.	T	Coef.	t	Coef.	t
RM	0.873	19.220	0.637	8.530	0.653	8.460	1.102	16.340
SMB	**0.515**	**5.710**	**0.348**	**4.280**	**0.795**	**8.420**	**0.912**	**10.760**
HML	**-0.953**	**-7.630**	**-0.517**	**-5.420**	**-0.874**	**-8.170**	**-1.333**	**-7.370**
WML	-0.429	-3.240	0.128	1.750	-0.225	-2.660	-0.784	-6.940
Intercept	4.883	10.070	10.164	8.500	3.486	7.690	4.849	11.220
R^2	0.769		0.517		0.704		0.861	

Small/High BE-ME stocks (S/H)

	Australia		Austria		Belgium		Canada	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.564	8.840	0.202	1.200	0.607	5.580	0.719	8.540
SMB	**0.820**	**13.090**	**0.247**	**1.550**	**1.097**	**12.490**	**0.368**	**3.730**
HML	**0.892**	**10.910**	**1.340**	**8.250**	**0.917**	**16.150**	**0.708**	**6.820**
WML	0.045	0.790	0.138	1.200	-0.180	-5.160	-0.210	-2.370
Intercept	3.074	6.680	1.608	1.210	2.650	3.260	2.274	3.350
R^2	0.700		0.358		0.734		0.529	

	DENMARK		FINLAND		France		Germany	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.611	8.380	0.367	7.770	0.690	11.680	0.541	10.580
SMB	**0.597**	**13.730**	**0.115**	**1.740**	**0.308**	**5.250**	**0.263**	**3.540**
HML	**0.561**	**9.370**	**0.170**	**3.170**	0.149	1.770	0.125	1.580
WML	0.086	2.990	0.087	1.530	-0.044	-0.650	-0.022	-0.300
Intercept	2.560	5.230	1.597	3.310	2.995	7.440	1.707	4.110
R^2	0.712		0.363		0.572		0.500	

	GREECE		HONGKONG		INDIA		ISRAEL	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.902	8.570	0.831	10.560	0.778	12.730	0.934	12.770
SMB	**0.904**	**7.610**	**0.805**	**10.310**	**0.542**	**6.310**	**0.617**	**8.190**
HML	**0.982**	**8.720**	**0.706**	**8.960**	**0.591**	**5.870**	**0.885**	**11.020**
WML	0.135	1.820	-0.019	-0.320	0.040	0.400	-0.083	-1.200
Intercept	3.477	3.230	4.098	5.840	5.265	8.580	2.911	4.720
R^2	0.758		0.665		0.668		0.781	

	ITALY		JAPAN		MALAYSIA		NETHERLANDS	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.533	6.480	0.576	10.980	0.729	12.820	0.175	2.030
SMB	**0.460**	**4.460**	**1.066**	**7.400**	**0.438**	**4.880**	**0.224**	**2.750**
HML	**0.675**	**6.900**	0.074	0.390	**0.934**	**10.500**	0.023	0.270
WML	-0.090	-1.130	0.049	0.270	0.080	0.920	-0.084	-1.420
Intercept	2.456	3.970	2.680	6.950	2.935	4.420	0.857	1.410
R^2	0.487		0.618		0.706		0.100	

	NORWAY		S AFRICA		SINGAPORE		S KOREA	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.779	8.830	0.373	5.930	0.768	7.800	0.565	13.180
SMB	**0.329**	**5.500**	**0.458**	**5.430**	**1.112**	**8.490**	**0.752**	**6.210**
HML	**0.455**	**7.170**	**0.747**	**6.890**	**0.427**	**3.310**	0.260	1.940
WML	0.098	2.850	0.205	2.220	-0.094	-0.940	0.264	2.710
Intercept	3.098	4.080	2.905	4.580	3.244	3.460	3.772	6.400
R^2	0.490		0.480		0.660		0.650	

	SWEDEN		SWITZERLAND		TAIWAN		TURKEY	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t
MR	0.638	11.750	0.513	8.030	0.828	15.850	0.596	10.970
SMB	**0.491**	**6.940**	**0.179**	**2.610**	**0.459**	**4.430**	**0.304**	**5.140**
HML	**0.330**	**4.010**	-0.041	-0.780	0.189	1.310	**0.297**	**4.290**
WML	-0.259	-4.030	-0.020	-0.440	-0.222	-1.460	0.170	3.200
Intercept	3.031	6.070	1.786	4.500	4.271	7.660	5.766	6.630
R^2	0.600		0.368		0.655		0.546	

	UK		USA	
	Coef.	t	Coef.	t
MR	0.759	9.250	0.986	15.590
SMB	**0.697**	**6.950**	**0.844**	**10.610**
HML	0.203	1.780	-0.072	-0.420
WML	-0.054	-0.600	-0.440	-4.150
Intercept	3.311	6.880	3.832	9.460
R^2	0.532		0.797	

The Big/Low BE-ME stocks (B/L)

	Australia		Austria		Belgium		Canada		Denmark	
	Coeff	**T**	**Coeff**	**t**	**Coeff**	**t**	**coeff**	**t**	**Coeff**	**t**
(Constant)	**3.032**	**62.101**	**1.959**	**11.609**	**2.962**	**22.098**	**2.101**	**36.127**	**3.034**	**28.636**
MR	**.588**	**89.788**	**.193**	**9.128**	**.591**	**35.593**	**.683**	**94.415**	**.624**	**40.636**
SMB	-.061	-8.488	-.539	-26.652	-.162	-10.176	-.354	-36.473	-.175	-16.746
HML	-.250	-25.842	.063	3.033	-.274	-25.457	-.317	-31.699	-.291	-20.569
WML	**.095**	**14.422**	**.092**	**6.305**	**.000**	**-.145**	**-.062**	**-7.449**	**-.065**	**-9.295**
R^2	**.528**		**.189**		**0.408**		**.457**		**0.411**	

	Finland		France		Germany		Greece		Hong Kong	
	Coeff	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
(Constant)	**1.959**	**30.750**	**3.142**	**85.792**	**2.493**	**86.547**	**2.984**	**15.032**	**4.665**	**60.187**
MR	**.446**	**71.139**	**.697**	**131.235**	**.626**	**180.085**	**.826**	**43.108**	**.896**	**92.453**
SMB	-.703	-74.582	-.534	-95.186	-.469	-83.478	-.163	-7.362	-.101	-10.041
HML	-.633	-80.548	-.815	-103.161	-.753	-121.021	-.176	-8.357	-.318	-32.292
WML	**-.042**	**-5.289**	**-.055**	**-8.576**	**-.034**	**-6.245**	**.092**	**6.809**	**-.108**	**-14.143**
R^2	**.672**		**.702**		**.721**		**0.57**		**0.585**	

	India		Israel		Italy		Japan		Malaysia	
	Coeff	**T**	**Coeff**	**T**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
(Constant)	**5.124**	**94.131**	**3.078**	**40.102**	**2.652**	**24.154**	**2.765**	**273.756**	**3.325**	**23.997**
MR	**.762**	**140.795**	**.892**	**90.969**	**.572**	**39.893**	**.619**	**441.697**	**.743**	**62.566**
SMB	-.360	-46.437	-.112	-11.063	-.386	-21.127	.079	20.601	-.315	-16.797
HML	-.425	-45.381	-.142	-12.704	-.423	-23.500	-.911	-178.970	-.149	-8.126
WML	**.016**	**1.701**	**.025**	**2.713**	**-.073**	**-4.996**	**.118**	**23.994**	**-.038**	**-2.142**
R^2	**.695**		**.558**		**0.52**		**0.577**		**0.664**	

	Nether lands		Norway		South Africa		Singa pore		South Korea		Sweden	
			Coeff	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
(Constant)	**1.462**	**14.084**	**3.727**	**25.89**	**2.780**	**18.275**	**3.079**	**20.41**	**3.945**	**118.97**	**3.243**	**57.423**
MR	**.171**	**11.776**	**.756**	**47.67**	**.420**	**27.565**	**.770**	**44.09**	**.611**	**224.08**	**.631**	**103.827**
SMB	-.544	-38.23	-.400	-31.76	-.423	-20.56	.164	6.44	-.255	-35.09	-.433	-55.637
HML	-.775	-49.47	-.557	-44.35	-.308	-11.72	-.717	-28.47	-.748	-92.43	-.617	-66.633
WML	**-.128**	**-12.37**	**-.062**	**-8.04**	**.178**	**7.92**	**-.190**	**-10.25**	**.168**	**26.47**	**-.279**	**-37.490**
R^2	**.380**		**.721**		**.525**		**.465**		**.667**		**.692**	

	Switzerland		Taiwan		Turkey		UK		USA	
	Coeff	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
(Constant)	**2.038**	**40.308**	**4.197**	**169.632**	**6.532**	**40.609**	**3.380**	**103.692**	**4.110**	**368.530**
MR	**.522**	**62.636**	**.899**	**344.879**	**.600**	**59.265**	**.731**	**134.772**	**1.043**	**589.926**
SMB	-.573	-61.728	-.291	-47.452	-.540	-45.235	-.238	-34.118	-.124	-54.712
HML	-1.013	-144.198	-.760	-88.023	-.596	-43.792	-.786	-99.467	-1.138	-237.608
WML	**-.135**	**-22.146**	**-.492**	**-53.936**	**.011**	**1.015**	**-.054**	**-8.606**	**-.559**	**-184.500**
R^2	**.786**		**.743**		**.625**		**.591**		**.771**	

Big/High BE-ME portfolio (B/H)

	AUSTRALIA		AUSTRIA		BELGIUM		CANADA	
	Coef.	**t**	**Coef.**	**t**	**Coef.**	**t**	**Coef.**	**t**
MR	**0.499**	**6.730**	**0.207**	**2.010**	**0.526**	**3.740**	**0.703**	**9.460**
SMB	**-0.010**	**-0.140**	-0.462	-4.700	-1.004	-8.860	-0.183	-2.110
HML	0.372	3.920	0.413	4.130	0.599	8.170	0.318	3.480
WML	**-0.006**	**-0.090**	**0.003**	**0.040**	**0.356**	**7.940**	**-0.116**	**-1.480**
_cons	**3.140**	**5.870**	**2.044**	**2.490**	**3.650**	**3.480**	**3.534**	**5.900**
R^2	**0.326**		**0.290**		**0.580**		**0.450**	

	Denmark		Finland		France		Germany	
	Coef.	**t**	**Coef.**	**t**	**Coef.**	**t**	**Coef.**	**t**
MR	**0.655**	**5.400**	**0.581**	**8.200**	**0.734**	**8.360**	**0.703**	**9.410**
SMB	-0.245	-3.380	-0.294	-2.960	-0.080	-0.920	-0.176	-1.620
HML	0.656	6.590	0.882	10.970	0.269	2.150	0.538	4.640
WML	**-0.263**	**-5.500**	**-0.364**	**-4.280**	**-0.038**	**-0.370**	**0.033**	**0.310**
_cons	**3.629**	**4.460**	**3.096**	**4.280**	**4.735**	**7.920**	**4.943**	**8.160**
	0.460		**0.710**		**0.342**		**0.430**	

	Greece		Hong kong		INDIA		ISRAEL		Italy	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t		
(Constant)	3.204	16.175	6.673	69.024	5.539	99.632	4.256	50.249	3.003	26.585
MR	.619	32.394	1.061	87.764	.664	120.096	.885	81.799	.658	44.588
SMB	**-.373**	**-16.858**	**.100**	**7.959**	**-.146**	**-18.477**	-.020	-1.773	**-.158**	**-8.404**
HML	**.489**	**23.297**	**.586**	**47.755**	**.547**	**57.174**	**.409**	**33.254**	**.377**	**20.335**
WML	.051	3.800	-.112	-11.784	-.091	-9.334	.150	14.576	-.074	-4.938
R^2	.584		.580		.641		.611		.493	

	Japan		Malaysia		Netherlands		Norway		South Africa	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.948	284.308	3.542	25.527	3.065	20.269	5.967	26.761	2.709	15.518
MR	.678	471.405	.631	53.111	.095	4.498	.652	26.536	.435	24.877
SMB	**.064**	**16.265**	.013	.697	**-.109**	**-5.254**	**-.131**	**-6.743**	**-.340**	**-14.383**
HML	**-.311**	**-59.602**	**.666**	**36.202**	**.507**	**22.248**	**.269**	**13.831**	**.519**	**17.206**
WML	.245	48.792	-.137	-7.648	-.093	-6.139	.011	.927	.062	2.415
R^2	.565		.675		0.161		0.29		0.458	

	Singapore		South Korea		Sweden		Switzer-land		Taiwan	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.696	18.756	4.797	143.345	4.049	50.566	2.916	40.075	4.696	202.865
MR	.633	38.041	.651	236.813	.595	69.047	.503	41.933	.949	388.786
SMB	**.101**	**4.196**	**-.170**	**-23.195**	**-.328**	**-29.73**	**-.092**	**-6.881**	**-.270**	**-47.039**
HML	**.266**	**11.102**	**.039**	**4.738**	**.634**	**48.294**	**.325**	**32.182**	**-.030**	**-3.764**
WML	-.121	-6.872	-.056	-8.712	-.267	-25.284	-.049	-5.591	-.502	-58.814
R^2	.441		.650		.547		.220		.775	

	Turkey		UK		USA	
	Coeff	t	Coeff	t	Coeff	t
(Constant)	10.573	53.567	3.415	100.926	5.009	389.221
MR	.634	51.088	.627	111.249	1.149	563.177
SMB	**-.494**	**-33.738**	**-.164**	**-22.541**	**-.057**	**-21.913**
HML	**.561**	**33.618**	**.084**	**10.191**	**-.421**	**-76.221**
WML	-.041	-3.234	-.212	-32.612	-.881	-251.804
R^2	.601		.361		.719	

Below we report the results for portfolios formed on the basis of previous returns (momentum). Except for the S/W portfolio in the Netherlands, the coefficients on RM are significantly positive across all the winner and loser portfolios. Winner portfolios have a significantly positive loading on the SMB factor, suggesting winner portfolios tend to hold smaller stocks. Loser portfolios also appear to have a bias towards smaller stocks, i.e. they have positive loadings. The Big Winners have a negative loading (except for Malaysia), reflecting the fact that the Big Winners tend to hold larger stocks. The Small Losers have consistently positive loadings, meaning that the size effect offsets the negative momentum effect. The Big Losers have a negative loading on SMB except for three countries (Australia, Japan, and Singapore). The negative coefficient reflects the fact that the Big Losers tend to hold big stocks not small ones. With regard to HML, it is difficult to make a generalization about value strategies across losers and winners given that the coefficients are country specific.

Momentum strategies are profitable for the small stocks (S/W) except in Belgium, Sweden, Taiwan, the UK, and USA. They do not pay for the big stocks across all the countries, i.e. holding large stocks that performed better in the previous six months will not be a profitable strategy in any country. The small losers have negative loadings on WML, reflecting the fact that the investor is holding stocks that did poorly. Nevertheless, there is a difference in Japan & Turkey, probably reflecting a reversal of the trend over time. Finally, the Big Losers have positive loadings in all the countries (except for Norway). This positive coefficient may reflect the fact that the investor is holding large stocks. The size of the stock may reverse the negative trend.

SMALL/WINNERS

	Australia		Austria		Belgium		Canada		Denmark		Finland	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.611	34.298	1.461	8.856	2.601	10.426	2.241	33.095	1.259	8.503	3.758	39.707
MR	.474	46.405	.092	4.437	.516	16.715	.749	88.883	.589	27.701	.486	52.214
SMB	.813	72.309	.495	25.016	.959	32.337	.643	56.983	.268	18.388	.308	22.018
HML	.232	15.380	.243	11.967	.979	48.787	.116	9.921	-.006	-.308	.059	5.058
WML	.281	27.271	.364	25.609	-.081	-6.967	.047	4.882	.200	13.729	.188	16.025
R^2	.527		.276		.522		.463		.295		.377	

	France		Germany		Greece		Hong kong		India		Israel	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	3.516	68.732	3.236	59.426	3.841	11.204	5.524	46.169	6.036	78.571	2.539	23.376
MR	.677	91.273	.601	91.446	.755	23.117	.827	55.216	.731	95.676	.956	68.849
SMB	.579	73.848	.534	50.323	1.453	37.542	1.133	72.697	.496	45.405	.658	45.806
HML	-.492	-44.578	-.275	-23.396	.970	24.308	-.018	-1.207	.363	27.503	.153	9.680
WML	.080	9.022	.254	24.901	.355	12.521	.092	7.831	.197	14.584	.104	7.852
R^2	.667		.452		.709		.584		.598		.569	

	Italy		Japan		Malaysia		Nether-lands		Norway	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.285	14.873	2.833	230.687	3.470	14.883	2.203	14.157	5.842	16.574
MR	.511	25.446	.612	359.715	.508	23.494	-.054	-2.490	.797	20.085
SMB	.398	15.584	.950	203.768	.603	19.420	.625	29.271	.073	2.369
HML	.317	12.591	-.162	-26.225	.152	4.958	-.555	-23.661	-.652	-21.225

WML	.055	2.678	.337	56.566	.281	9.074	.118	7.578	1.483	79.771
R^2	.315		.543		.288		.348		.850	

	South Africa		Singapore		South Korea		Sweden		Switzer-land	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.717	12.881	2.213	12.284	4.512	99.514	4.028	54.299	2.706	30.577
RM	.353	16.845	.616	28.019	.610	163.589	.566	70.941	.546	37.446
SMB	.466	16.405	1.006	32.963	.732	73.721	.530	51.871	.594	36.535
HML	.414	11.457	-.238	-7.790	-.422	-38.094	.114	9.410	-.390	-31.704
WML	.491	15.775	.159	6.783	.391	45.073	-.041	-4.217	.092	8.636
R^2	.354		.396		.594		.427		.363	

	Taiwan		Turkey		UK		USA	
	Coeff	t	Coeff	t	coeff	t	Coeff	t
(Constant)	4.038	125.582	7.738	29.864	2.917	68.663	3.585	248.104
RM	.884	260.802	.580	35.231	.537	75.884	1.009	440.297
SMB	.355	44.464	.472	24.062	.789	86.629	.912	309.476
HML	-.085	-7.554	.168	7.692	-.329	-31.915	-.863	-139.021
WML	-.439	-36.978	.595	35.595	-.085	-10.426	-.864	-219.847
R^2	.601		.422		.451		.776	

BIG/WINNERS

	Australia		*Austria*		*Belgium*		*Canada*		*Denmark*		*Finland*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	3.010	42.750	1.889	12.215	4.683	20.040	3.046	49.229	3.740	24.356	2.476	25.604
RM	.566	59.933	.104	5.359	.475	16.422	.664	86.321	.632	28.398	.545	57.310
SMB	.002	.194	-.436	-23.531	.054	1.946	-.087	-8.473	-.211	-13.917	-.563	-39.336
HML	.147	10.542	.149	7.820	-.205	-10.933	.098	9.244	.515	25.114	.078	6.536
WML	-.236	-24.763	-.096	-7.242	-.128	-11.822	-.220	-24.834	-.260	-25.716	-.747	-62.322
R^2	.356		.193		.176		.380		.387		.696	

	France		*Germany*		*Greece*		*Hong Kong*		*India*		*Israel*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	4.560	66.429	4.711	89.480	2.351	11.259	7.523	60.588	6.288	95.315	4.533	41.449
RM	.601	60.383	.653	102.745	.657	32.866	1.029	66.267	.787	119.920	.805	57.576
SMB	-.289	-27.477	-.287	-27.929	-.164	-6.959	.019	1.185	-.267	-28.451	-.118	-8.147
HML	-.426	-28.749	.051	4.449	.206	9.332	.167	10.619	-.164	-14.477	.223	14.069
WML	-.378	-31.543	-.219	-22.128	-.158	-11.237	-.408	-33.273	-.302	-26.060	-.225	-16.918
R^2	.262		.366		.496		.451		.613		.383	

	Italy		*Japan*		*Malaysia*		*Never-thelands*		*Norway*		*South Africa*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.710	21.998	3.439	293.111	3.925	16.982	2.458	15.799	4.792	21.722	3.145	17.665
RM	.438	27.382	.679	417.472	.559	28.230	.100	4.613	.769	31.621	.297	16.649
SMB	-.201	-9.893	-.068	-15.265	.070	2.248	-.410	-19.225	-.382	-19.829	-.364	-15.108
HML	-.115	-5.720	-.407	-68.801	.921	30.067	-.458	-19.520	-.221	-11.485	-.128	-4.169
WML	-.121	-7.421	-.442	-77.662	-.283	-9.483	-.489	-31.494	-.006	-.539	-.075	-2.857
R^2	.276		.511		.471		.237		.422		.313	

	Singapore		*South Korea*		*Sweden*		*Switzer-land*		*Taiwan*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.751	16.707	5.272	118.408	4.478	43.860	4.098	36.581	4.681	154.904
RM	.524	27.500	.622	170.058	.497	45.275	.578	31.313	.957	300.430
SMB	.041	1.475	-.272	-27.926	-.408	-29.025	-.584	-28.406	-.508	-67.813
HML	.044	1.607	-.383	-35.231	-.382	-22.828	-.526	-33.820	-.328	-31.082
WML	-.381	-18.863	-.176	-20.692	-.683	-50.756	-1.060	-78.595	-1.083	-97.193
R^2	.321		.505		.444		.599		.709	

	Turkey		*UK*		*USA*	
	Coeff	t	Coeff	t	Coeff	t
(Constant)	8.355	43.319	3.733	72.912	4.393	269.165
RM	.539	44.407	.620	72.784	1.160	448.321
SMB	-.292	-20.406	-.181	-16.465	-.057	-17.190
HML	.199	12.211	-.540	-43.475	-1.037	-147.973
WML	-.205	-16.438	-.624	-63.542	-1.719	-387.301
R^2	.446		.351		.706	

THE SMALL/LOSERS

	Australia		*Austria*		*Belgium*		*Canada*		*Denmark*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.235	25.648	1.484	8.719	2.551	15.950	2.256	24.696	2.328	12.042
RM	.649	55.588	.246	11.584	.747	37.736	.737	64.911	.561	20.033
SMB	.858	66.560	.814	39.882	.502	26.388	.491	32.267	.607	31.818
HML	.236	13.559	.505	24.156	-.079	-6.131	.453	28.826	-.680	-26.300
WML	-.276	-23.467	-.311	-21.212	-.217	-29.187	-.216	-16.497	-.362	-28.428
R^2	.518		.443		.449		.340		.575	

	Finland		*France*		*Germany*		*Greece*		*Hong Kong*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	1.102	12.291	4.234	69.719	2.714	66.022	2.166	8.702	5.145	44.070
RM	.557	63.211	1.035	117.426	.744	150.049	1.020	41.769	1.116	76.422
SMB	.143	10.763	.682	73.277	.602	75.120	.225	8.091	.915	60.147
HML	-.019	-1.686	-.174	-13.322	-.398	-44.893	.249	9.423	.150	10.138
WML	-.083	-7.507	-.402	-37.998	-.458	-59.367	-.077	-4.520	-.412	-35.798
R^2	.366		.604		.618		.558		.585	

	India		*Israel*		*Italy*		*Japan*		*Malaysia*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	3.934	47.315	2.021	17.250	2.122	14.745	2.818	247.033	4.583	26.508
RM	.817	98.836	.998	66.555	.813	43.399	.661	417.932	.982	66.259
SMB	.480	40.566	.861	55.487	.473	19.841	1.189	274.479	.598	25.581
HML	-.014	-.972	.306	17.961	-.110	-4.587	-.628	-109.232	.247	10.787
WML	-.239	-16.365	-.206	-14.383	-.215	-11.209	.096	17.341	-.168	-7.531
R^2	.596		.592		.465		.658		.668	

	Netherlands		*Norway*		*South Africa*		*Singapore*		*South Korea*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	1.860	13.558	2.118	11.321	2.883	12.745	2.402	10.560	3.791	103.177
RM	.272	14.204	.659	31.914	.522	23.297	.888	33.730	.680	225.082
SMB	.510	27.212	.301	18.488	.332	10.918	.777	20.257	.864	107.387
HML	-.036	-1.724	-.198	-12.228	-.092	-2.344	-.347	-8.938	-.206	-22.918
WML	-.205	-15.052	-.134	-13.569	-.068	-1.999	-.471	-16.986	-.160	-22.792
R^2	.205		.462		.295		.393		.691	

	Netherlands		*Norway*		*South Africa*		*Singapore*		*South Korea*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	1.860	13.558	2.118	11.321	2.883	12.745	2.402	10.560	3.791	103.177
RM	.272	14.204	.659	31.914	.522	23.297	.888	33.730	.680	225.082
SMB	.510	27.212	.301	18.488	.332	10.918	.777	20.257	.864	107.387
HML	-.036	-1.724	-.198	-12.228	-.092	-2.344	-.347	-8.938	-.206	-22.918
WML	-.205	-15.052	-.134	-13.569	-.068	-1.999	-.471	-16.986	-.160	-22.792
R^2	.205		.462		.295		.393		.691	

	Sweden		*Switzerland*		*Taiwan*		*Turkey*		*UK*		*USA*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	3.235	37.707	1.783	23.381	4.266	171.942	7.587	26.021	3.431	78.943	5.448	413.403
RM	.845	91.503	.619	49.240	.908	347.308	.591	32.225	.851	117.618	1.204	576.378
SMB	.587	49.689	.319	22.800	1.001	162.632	.196	9.066	.713	76.490	.934	347.600
HML	-.091	-6.500	-.583	-55.019	-.295	-34.001	-.255	-10.331	-.396	-37.559	-.488	-86.185
WML	-.443	-39.199	-.072	-7.835	-.588	-64.197	.087	4.622	-.253	-30.346	-.256	-71.311
R^2	.542		.438		.760		.225		.558		.818	

BIG/LOSERS

	Australia		*Austria*		*Belgium*		*Canada*		*Denmark*		*Finland*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.339	29.135	2.313	9.116	2.587	7.110	2.937	37.124	2.423	18.235	.488	4.486
RM	.636	59.066	.267	8.413	.711	15.773	.773	78.578	.869	45.162	.611	57.085
SMB	.173	14.586	-.798	-26.211	-1.638	-37.870	-.191	-14.447	-.081	-6.195	-.550	-34.129
HML	.098	6.173	.531	17.017	.910	31.089	.035	2.536	-.046	-2.588	-.146	-10.886
WML	.462	42.522	.467	21.349	.624	36.926	.181	16.004	-.004	-.408	.439	32.533
R^2	.417		.273		.475		.326		.367		.377	

	France		*Germany*		*Greece*		*Hong Kong*		*India*		*Israel*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	4.020	56.454	2.052	32.742	3.330	12.052	4.307	35.916	4.263	53.652	3.492	21.744
RM	1.081	104.634	.680	89.930	1.017	38.145	1.093	72.840	.831	105.171	1.080	52.610
SMB	-.359	-32.941	-.716	-58.568	-.406	-13.132	-.065	-4.155	-.281	-24.836	.039	1.816
HML	-.316	-20.564	-.711	-52.517	-.117	-4.004	.220	14.456	-.247	-18.044	.384	16.483
WML	.154	12.407	.436	37.095	.356	19.004	.296	24.987	.235	16.828	.981	50.194
R^2	.459		.398		.558		.449		.541		.538	

	Italy		*Japan*		*Malaysia*		*Nether-lands*		*Norway*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.192	14.493	3.096	251.605	4.030	24.001	2.592	15.531	3.248	17.221
RM	.781	39.519	.728	426.641	.921	64.014	.296	12.668	.700	33.976
SMB	-.383	-15.212	.341	72.890	-.050	-2.186	-.186	-8.125	-.078	-4.788
HML	-.223	-8.997	-.820	-132.276	.088	3.969	.102	4.045	-.212	-13.029
WML	.222	11.059	.805	134.862	.119	5.489	.353	21.199	-.028	-2.824
R^2	.444		.582		.658		.110		.422	

	South Africa		*Singapore*		*South Korea*		*Sweden*		*Switzerland*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	2.297	11.579	4.249	20.445	4.180	104.304	4.188	48.165	1.384	12.034
RM	.454	23.089	.894	37.166	.730	221.467	.917	98.072	.525	27.690
SMB	-.379	-14.217	.145	4.138	-.019	-2.144	-.174	-14.537	-.713	-33.767
HML	.129	3.765	-.140	-4.032	-.294	-30.094	-.386	-27.108	-1.503	-94.157
WML	.299	10.131	.269	10.568	.376	49.016	.163	14.204	.286	20.691
R^2	.403		.339		.645		.531		.547	

	Taiwan		*Turkey*		*UK*		*USA*	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t
(Constant)	4.506	177.216	8.716	17.003	4.415	82.085	6.066	373.637
RM	.980	365.715	.729	22.610	.961	107.310	1.283	498.435
SMB	.125	19.808	-1.813	-47.644	-.092	-7.948	.026	7.834
HML	-.391	-44.005	.056	1.303	-.677	-51.888	-.854	-122.466
WML	.136	14.467	1.313	39.645	.675	65.425	.407	92.252
R^2	.736		.505		.463		.701	

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