JOURNAL OF INTERNATIONAL ACCOUNTING RESEARCH
Vol. 2
2003
pp. 39–68

Who Is Miss World in Cosmetic Earnings Management? A Cross-National Comparison of Small Upward Rounding of Net Income Numbers among Eighteen Countries

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ABSTRACT: Using a sample of approximately 87,000 earnings observations from almost 22,000 firms in 18 countries for the five-year period 1995–1999, we document firms' tendency to exercise cosmetic earnings management (CEM) worldwide. Following prior studies in the area (Thomas 1989, among others), we define CEM by small upward rounding of reported net income that generates more than expected zeros and less than expected nines as second digit of earnings numbers. We partition our sample into positive and negative earnings to see whether the anomalous frequencies are reversed in negative earnings (losses) relative to positive earnings (profits), as predicted by CEM. In addition, we analyze net sales as a control variable. We find that, due to more ample opportunities to accounting manipulation, upward rounding is much more significant on the bottom line than on the top of an income statement. Consistent with prior studies, we find a reversed pattern of CEM for net losses. In addition, we find evidence for our expectation that CEM covaries with some institutional factors. We report that CEM decreases with spending on auditing, whereas it increases with the latitude of country's GAAP, its cultural values (power distance), and the importance of management bonus schemes. Contrary to our expectation, we do not find significant relationships between CEM and some factors commonly considered in related recent studies, such as the degree of shareholder protection or the alignment of financial and tax accounting.

Keywords: financial accounting; auditing; cosmetic earnings management; institutional factors; Benford's law; national culture.

JEL Classification: G15, G30, G38, M41.

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The authors are grateful to Peter Wysocki, Pontus Troberg, Tapani Lehtonen, Lucy Nottingham, Göte Nyman, Risto Juurmaa, Lasse Niemi, Hannu Ojala, Seppo Ikäheimo, the participants of the AFAR workshop in Vaasa (April 2002), the participants of the accounting research seminar of the Helsinki School of Economics (October 2002), and the IAAER World Congress of Accounting Educators (Hong Kong, November 2002) for their helpful comments on earlier versions of this paper, as well as to the editor, an associate editor, and two anonymous reviewers for their benevolent comments and constructive suggestions. The authors also gratefully acknowledge financial support from Marcus Wallenberg Foundation (Finland) for this project.

Submitted December 14, 2002
Accepted May 6, 2003

I. INTRODUCTION

During the past few years, empirical research on earnings management behavior of firms has grown into one of the main streams in the field of financial accounting. Statistics from the ARN[1] working paper and accepted paper announcements indicate that while keywords *earnings management* had a hit rate of 11.5 percent among the 130 announcements published in 1996, the corresponding percentage was 19.4 percent for 2001 (221 announcements). Some of the most recent studies in the area have broken national boundaries by measuring earnings management around the world so as to find institutional settings that are associated with such behavior (Bhattacharya et al. 2003; Leuz et al. 2002). Furthermore, the research stream has matured to literature reviews and commentaries on the area (see e.g., Healey and Wahlen 1999; Parfet 2000; Beneish 2001; Stolowy and Breton 2000).

In this paper, we focus on *cosmetic earnings management* (hereafter CEM) around the world. By earnings management being cosmetic we mean a firm's tendency to do small upward rounding of reported net income, when such rounding yields an earnings number that seems abnormally larger than would be the case otherwise. For example, if the net income of a firm for a given year without rounding is $2.96 billion, then the firm exercises CEM by using discretionary accounting choices so that a net income number of, say, $3.01 billion is reported. The increase in reported earnings is only $0.05 billion (or 1.7 percent), but the resulting earnings number is perceived to be significantly larger because it is now in the "class" of $3 billion instead of $2 billion.[2] If the net income were smaller, say $2.68 billion, then the incentive to exercise earnings management of similar magnitude would be much smaller because it would yield an earnings number of only $2.73 billion, which remains in the same "class" of $2 billion.

Thus, CEM is expected to take place when the *second* digit of the unmanaged earnings number is nine. Then a small increase in earnings will suffice to increase the *first* digit of the earnings number by one, thus creating the intended cosmetic effect. Consequently, we can expect CEM to generate earnings numbers where there are a "deficit" of nines and a "surplus" of zeros as second digits.

Previous empirical studies have shown that firms in some countries do engage in this kind of CEM. The phenomenon was first detected by Carslaw (1988) in a sample of New Zealand firms. He reported a higher frequency of zeros and a lower frequency of nines as the second digit of reported earnings than could be expected under randomness. Subsequently, Thomas (1989) documented the same phenomenon from a large sample of U.S. firms. He also found that the frequency of second digits was reversed for negative net income numbers; when firms reported net losses, there were more nines and less zeros than could be expected. In addition, Niskanen and Keloharju (2000) analyzed earnings numbers of Finnish firms operating in a tax-driven financial accounting setting. Contrary to expectation, they found cosmetic earnings management to take place even in conditions where taxable income was based on reported earnings. This is somewhat surprising given that the alignment of financial and tax accounting makes upward rounding of earnings costly. More recently, Van Caneghem (2002) found evidence of CEM in U.K. firms. He documents that companies tend to round up reported earnings by increasing the first digit by one when they are faced with a nine as the second left-most digit. Consistent with expectation, such rounding could not be found for earnings before discretionary accruals.[3]

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[1] Accounting Research Network, a division of SSRN.

[2] A reverse tendency, known as the '99' phenomenon, is very commonly seen in the pricing of consumer goods and services.

[3] In addition, there is evidence from the U.S. suggesting that firms also tend to round up earnings per share (EPS) numbers (Thomas 1989; Das and Zhang 2003). The evidence supports the notion that the rounding-up takes place in the last digit (cent) of reported EPS rather than in the second digit from the left.

Carslaw (1988, 321–322) attributes the anomalies in the frequency of second digits to a psychological theory on cognitive reference points (see also, Van Caneghem [2002, 168], and the references cited therein). It suggests that human beings (users of financial statements) use yardsticks that are factors of ten in their assessment of numbers. Accordingly, a person tends to round an observed number to the nearest reference point in judging its magnitude. However, as the memory of human beings is limited and the process of rounding up is more complex than rounding down, people tend to store the most relevant information by assigning the largest weight to the first digit, then to the second, and so on, decaying through the other digits of the number. Thus, in human information processing and storing an earnings number of $2.96 billion is rounded down to $2.9 billion or $2 billion rather than up to its mathematical reference point of $3 billion.

Being aware of this psychological behavior of financial statement users, some firms may utilize it by managing earnings upward when the second digit of unmanaged earnings is nine. Thomas (1989, 773–774) argues that such small upward rounding can have a disproportionately large effect on the perceived profitability and value of the firm. This may provide managers with an incentive to exercise CEM. A small amount of earnings cosmetics may thus allegedly have a significant indirect economic impact.

Thomas (1989, 774) notes that CEM can also be motivated by contractual considerations parallel to the bonus scheme and debt covenant hypothesis of the positive accounting theory (Watts and Zimmerman 1986). When managers' bonus schemes, firms' debt covenants or internal budgets are defined in terms of round earnings numbers, large cash flow effects may be triggered by small-scale CEM. The explicit contractual linkages between round earnings numbers and firms' cash flows can thus provide a direct economic incentive for CEM.

Using a sample of 86,944 earnings observations from 21,662 firms in 18 countries for the five-year period 1995–1999, we document that, with a few exceptions, CEM tends to be a worldwide phenomenon. Following prior studies in the area, we measure CEM by the anomalous frequency of zeros and nines as second digits of earnings numbers. In addition, we partition our sample into positive and negative earnings to see whether the anomalous frequencies are reversed in negative numbers (losses) relative to positive numbers (profits), as suggested by Thomas (1989).

Unlike most prior studies, we use net sales as a control variable. We expect that cosmetic management of net sales numbers is less pronounced and less significant than management of earnings numbers. This is simply because the latitude in reporting net sales on the top line of an income statement through accounting method choices is presumably more restricted than the latitude in reporting net income on the bottom line. Apart from account receivables that relate to sales revenues, most accounting choices concerning discretionary current and noncurrent accruals (such as the valuation of inventories, or the accounting for goodwill amortization) have an impact only below the top line of the income statement.[4]

We hypothesize that the degree of CEM in individual countries is related to their institutional settings. Following Ali and Hwang (2000) and Leuz et al. (2002) among others, we examine shareholder protection, the alignment of financial and tax accounting, and the spending on auditing services as potential country-specific factors. In addition, we consider the idiosyncrasy of GAAP (using the International Accounting Standards as a benchmark), the importance of management bonus schemes, relative firm size, the value relevance of earnings, as well as the economic growth of our sample countries. Unlike any other related study, we also look at variables measuring certain dimensions of cultural values.

[4] We do not argue that cosmetic management of net sales numbers is not possible or that firms do not at all engage in it. In addition to timing of sales transactions, their recognition and allocation to reporting periods (e.g., through the choice of the percentage of completion or the completed contract method) provide opportunities to actively manage reported net sales numbers. In addition, the incentives to such behavior can be similar to those of cosmetic earnings management.

Our overall findings suggest that *Miss World in Cosmetic Earnings Management* is Spain, and the runners-up are Hong Kong and Singapore. While the order of other runners-up varies somewhat depending on the specific measure of CEM used, the general picture is very clear; the firms in these three countries clearly dominate the contest. At the other extreme of the continuum are Sweden, the U.K., and Norway; in these countries, among some others, CEM proves to be small and insignificant.

The results do not lend support to our expectation that the degree of CEM is associated with legal environment (shareholder protection) or the alignment of financial and tax accounting. We find no evidence to suggest that CEM is associated with either the value relevance of earnings or economic growth of our sample countries. Instead, we do find some support for the notion that CEM covaries with the latitude in country's GAAP, spending on auditing, the importance of management bonus schemes, and with cultural values (power distance). In an additional test, we find that our CEM variables are correlated with more traditional measures of earnings management, for example income smoothing.

In the following section of the paper, we describe the institutional factors we expect to be associated with the cross-country variation in CEM. The data and methods used in our empirical tests are explained in Section III, followed by our report of the empirical results in Section IV. Here we first report the aggregate results from each country, and then we document the findings from firm-specific tests and report the results from the tests concerning the associations of CEM with hypothesized institutional factors. We conclude with a brief summary of our main findings and their implications in Section V.

II. INSTITUTIONAL FACTORS

We expect several institutional factors to be associated with the variation of cosmetic earnings management across countries. The factors we consider relate to shareholder protection, properties of GAAP, taxation, the role of auditing, importance of management bonus schemes, firm size, as well as certain dimensions of national culture. In addition, we consider potential consequences of CEM such as the value relevance of earnings and the economic growth of a country. We now elaborate our expectations on these factors.

Shareholder Protection

Recent studies document that the jurisdictional arrangements and corporate governance systems in a country have an important role to play as a determinant of corporate finance decisions and the properties of financial accounting information. For example, LaPorta et al. (1997) suggest that the origin of the legal system and the degree of shareholder protection are significant explanatory variables for external market capitalization of firms' equity and for the intensity of initial public offerings. LaPorta et al. (2000) also document that these factors relate to dividend policies followed in different countries. In addition, the findings provided by Ball et al. (2000) and Ali and Hwang (2000) suggest that institutional factors relating to the legal environment (common versus code law system), sources of GAAP (governmental versus private sector standard-setting bodies), and the accounting cluster (continental versus British-American) are significant determinants of certain properties of accounting numbers, such as conservatism and value relevance. As regards value relevance, Hung (2001) provides evidence consistent with the notion that this attribute of accounting earnings is positively associated with shareholder protection.

More importantly, Leuz et al. (2002) find empirical support for their "profit diversion" hypothesis suggesting that the degree of earnings management decreases with the level of investor protection. The reasoning behind this relationship is that strong investor protection effectively restricts insiders' profit diversion (private rent-seeking) and thus reduces their incentive to conceal these activities. In contrast, under weak investor protection, insiders' profit diversion activities are likely to be high, and because there is something to hide, the likelihood of earnings management increases.

Following Leuz et al. (2002), we hypothesize that in countries characterized by weak shareholder protection managers may have more incentives to hide their (earnings decreasing) profit diversion activities through earnings management. More precisely, we hypothesize that when earnings fall just below a critical yardstick (that is a factor of ten) because of profit diversion, managers may have incentive to hide these activities by exercising upward CEM.[5] This managerial behavior may accentuate in settings where the litigation risks associated with private rent-seeking are high. Overall, we thus expect a negative relation between shareholder protection and the degree of CEM. Following LaPorta et al. (1997) and Hung (2001), we measure shareholder protection with an index describing the number of antidirector rights in the corporate governance system.[6]

Latitude in GAAP

A necessary (but not sufficient) condition for earnings management is that the accounting rules followed by firms include some amount of latitude. It allows firms discretionary choices with respect to the recognition of revenues and expenses and their allocation to financial reporting years. Some prior studies on earnings management behavior outside the Anglo-Saxon world indicate that when local accounting rules differ significantly from the International Accounting Standards (now International Financial Reporting Standards), they also provide a lot of opportunities for discretionary choices in the determination of annual net income (see Kinnunen et al. 1995; Kasanen et al. 1996).

Thus, we have grounds to expect that the degree of CEM is positively correlated with the latitude in national GAAP. As a proxy for the latitude in accounting rules, we use an index measuring the number of accounting rules and disclosure requirements that are missing from the country's national GAAP. We construct the index for our sample using the recent GAAP 2000 Survey (see Nobes 2000). For 53 countries around the world, it lists the accounting measures, treatments, and disclosure requirements that are prescribed by International Accounting Standards but are absent from the national accounting standards.[7]

Alignment of Financial and Tax Accounting

A potential factor that restrains firms from any upward earnings management is the cost incurred in the form of increased taxes. If financial and tax accounting systems are aligned so that taxable income is essentially based on net income reported in the financial statements, then this linkage provides an incentive to systematically use earnings-reducing accounting choices. Empirical findings from an institutional setting (Finland) with high alignment of financial and tax accounting are consistent with this view (see Kasanen et al. 1996).

Because of the tax cost, we expect that (upward) cosmetic earnings management has a negative relationship with the alignment of financial and tax accounting. Following Alford et al. (1993), we use a dichotomous variable to classify our sample into high and low financial-tax alignment countries.[8]

Spending on Auditing

Findings of prior studies are consistent with the intuitively appealing view that the degree of earnings management is negatively related to audit quality. For example, using the Big 6/non-Big 6 dichotomous variable as a proxy for audit quality, Becker et al. (1998) document that non-Big 6

[5] For example, if the number of unmanaged earnings (after insiders' profit diversion activities) is, say, 49 million dollars thus falling marginally below the "critical" level of 50 million, insiders may have incentives to exercise CEM to conceal profit diversion.

[6] For details of the shareholder protection index, see LaPorta et al. (1997, 1134) and Hung (2001, 416).

[7] The benchmark used in the GAAP 2000 Survey are some 60 accounting measures and disclosure requirements as prescribed by the International Accounting Standards at the end of 2000.

[8] The source data for this variable is obtained from Alford et al. (1993, Table 1) for all countries except Finland and Spain, and from Hung (2001, Table 2) for these two countries.

clients tend to report income-increasing discretionary accruals more than the clients of Big 6 auditors. In addition, Ali and Hwang (2000) document that the role of auditing, as measured by total spending on auditing services, is positively related to the value relevance of earnings.

Given that the level of auditing is reflected in earnings quality, we expect that the degree of CEM is negatively related to the level of auditing: other things being equal, in countries with high (low) level of auditing, a relatively low (high) level of CEM can be expected. Following Ali and Hwang (2000) and Francis et al. (2001), we measure the audit level by total fees of country's ten largest accounting firms as a percentage of the country's gross domestic product.

Management Bonus Schemes

It is reasonable to assume that contractual factors such as management bonus schemes might have a role to play as an incentive for CEM (see Thomas 1989). This is plausible when the variable bonus component of managers' total compensation is determined (at least in part) by the achievement of target earnings, which are defined in terms of round numbers. For example, achieving target earnings of $2.0 million can trigger a large extra bonus to the manager compared to reported earnings of $1.9 million. In such circumstances, the existence of bonus schemes presumably provides a strong motive for management to exercise CEM.[9]

Based on the worldwide total remuneration survey by Towers Perrin,[10] we measure the importance of management bonus schemes by chief executive officers' (CEOs') variable bonus component in 1996 (expressed as a percentage of annual basic compensation). Assuming that CEOs' variable bonus component serves as a reasonable proxy for the importance of managers' bonus schemes in each country, we expect that the degree of CEM is increasing with the relative proportion of the variable bonus component.

Relative Firm Size

The well-known political cost hypothesis of positive accounting theory predicts that the larger the firm, the more likely it is to choose income-decreasing accounting procedures (Watts and Zimmerman 1986). The rationale for this prediction is based on the assumption that, being politically more vulnerable, large firms face relatively larger political costs in the form of taxes, social pressure, and regulatory actions by governmental authorities, and therefore have incentives to engage in income-decreasing earnings management. Thus, we have grounds to expect that CEM is decreasing with firm's relative size.

However, we also have grounds for the opposite expectation. In some economies, firms operating in the core sector may have more predisposition and more opportunities to manage reported earnings (Kinnunen et al. 1995). In particular, this can be the case under a relatively tight alignment between financial and tax accounting where the government and tax authorities responsible for accounting standard setting may have incentives to create accounting rules that allow firms to smooth reported net income.[11] The general objective of creating such accounting rules is to provide firms with means to counteract cyclical fluctuations in the economy and to make their profitability and economic development more stable, thereby increasing the predictability of governmental tax revenues.[12]

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[9] While we are not aware of how commonly bonus thresholds are defined in terms of *round* numbers, the evidence provided by Murphy (1999) suggest that in large U.S. corporations CEOs' incentive plans are based on absolute (dollar value) earnings targets more commonly than on returns on capital (ROE or ROI), cash flow or EVA.

[10] Towers Perrin is one of the world's largest global management consulting firms. It provides comparative statistics of CEOs' compensation structures for all except three countries (Denmark, Finland, and Norway) in our sample, see http://www.towers.com/towers/.

[11] Typically, income smoothing in these settings is attained through various untaxed reserves and flexibility in accounting for depreciation, among others.

[12] For mixed evidence of the economy sector hypothesis on earnings management behavior, see Belkaoui and Picur (1984), Albrecht and Richardson (1990), and Kinnunen et al. (1995).

Given these conflicting arguments, we do not specify any particular direction for the relationship between firms' relative size and CEM; it therefore remains to be shown by the empirical results. As a proxy of relative size, we use the median net sales of the sample firms as a percentage of Gross Domestic Product.

Dimensions of National Culture

Prior studies suggest that the attributes of accounting system and the properties of accounting information is a complex function of not only economic and jurisdictional determinants, but also societal values. For example, Gray (1988) argues that "accounting values" such as professionalism versus statutory control, uniformity versus flexibility, conservatism versus optimism, and secrecy versus transparency depend on certain dimensions of national culture that reflect the societal values of a country. The cultural dimensions considered by Gray (1988) include those originally examined by Hofstede (1980) in his seminal work on culture's consequences. They include power distance, uncertainty avoidance, individualism, and masculinity.

Recently, Jaggi and Low (2000) examined the impact of these cultural dimensions on financial disclosures in three common law countries (Canada, the U.K., and the U.S.) and three code law countries (France, Germany, and Japan). While they found support for the hypothesis that higher degrees of financial disclosure are associated with firms from common law countries, their findings on the impact of cultural dimensions were inconclusive within the two country groups; no significant association was documented between financial disclosures and cultural values in common law countries, whereas the corresponding findings for code law countries were mixed.

We consider two cultural factors potentially associated with the degree of CEM. The first is the cultural dimension of *power distance* (PD). It is the extent to which individuals accept the unequal distribution of power in organizations and institutions (see Hofstede 1984, 65–109; Gray 1988, 7; Jaggi and Low 2000, 497). Individuals in countries characterized by large PD are more inclined to accept the hierarchical order where all have their places that need no further justification. In contrast, individuals in small PD countries feel more uncomfortable with unequal power distribution, ask for its justification, and fight for power equalization.

Gray (1988) argues that PD as a cultural value is increasing with accounting values such as statutory control (as opposed to professionalism) and secrecy (as opposed to transparency). Given these attributes of PD coupled with the assumption that powerful individuals and organizations strive to maintain or increase their control over the less powerful (Hofstede 1984, 71), we have grounds to expect that firms in countries imbued with large PD are more likely to use income-increasing accounting choices, and hence to exercise CEM, than firms in societies that are less impregnated with individuals' striving for the preservation and enhancement of their hierarchical power within organizations.

The second dimension of national culture we consider is *masculinity*. As Gray (1988, 7) puts it, masculinity "stands for a preference in society for achievement, heroism, assertiveness, and material success." He argues that these cultural values are negatively related to conservatism (as opposed to optimism) because emphasis on individual and organizational achievement is likely to foster a less conservative approach to accounting measurements (Gray 1988, 10).

In conclusion, we expect that firms' propensity for income-increasing earnings management is positively related to the degree of masculinity. In particular, the more goal achievement is esteemed in a society, the more likely firms engage in CEM to report net income that is perceived to be on an "abnormally" higher level than would be the case otherwise. Following Jaggi and Low (2000), we adopt the index values originally developed by Hofstede (1980) for measuring the cultural dimensions of power distance and masculinity in the sample countries.[13]

[13] A problem with these indices is that Hofstede (1980) extracted their values from his data more than 20 years ago, and thus the index values may be obsolete. However, as we are not aware of any other (more recent) indices, we use Hofstede's (1980) indices on the assumption that societal and cultural values are likely to change slowly, and therefore the *relative standings* of different countries on these cultural dimensions have remained unchanged during the past two decades.

Finally, we consider the value relevance of earnings and economic growth as potential attributes of countries on which CEM may have an impact.

Value Relevance of Earnings

Healy and Wahlen (1999, 374 and 376) note that although much of the evidence on the stock market effects indicates that the market is not "fooled" by earnings management, some studies, especially those examining initial public offerings (IPOs) and seasoned equity offerings, have challenged the view that investors are able to see through earnings management. While research findings on the stock market consequences are mixed, we expect that earnings management behavior by firms, broadly speaking, undermines the quality of financial statement information and thereby decreases the value relevance of earnings. Partial support for our expectation is given by Kinnunen et al. (2000), who provide evidence consistent with the view that earnings numbers based on accounting rules that provide firms with numerous opportunities for discretionary choices (and, hence, for earnings management) are significantly less informative to international investors than are earnings based on less slack standards, such as the IAS.

As a measure of value relevance of earnings in the sample countries, we adopt the metric constructed by Hung (2001). It is based on the portfolio-returns approach where the value relevance of earnings is measured by the total return on a portfolio that could have been earned if the earnings numbers were known in advance, divided by the total return on a portfolio based on perfect foresight of market prices. Both portfolios are equally weighted hedge portfolios that take long (short) positions in stocks with the highest (lowest) 40 percent of net income change and adjusted stock return, respectively.[14]

Economic Growth

Leuz et al. (2002, 22) note that in related prior literature the economic growth in a country (as measured by GDP per capita) has been found to be an important factor that explains firms' financial and ownership structures as well as their dividend policies. They also document a marginally significant negative relationship between traditional earnings management measures (e.g., income smoothing) and economic growth. A potential explanation for this relationship is that investments in countries with lower level of earnings management, and hence with higher transparency of earnings information, are more effective than in countries where investment decisions by equity and debt holders are based on more opaque information.

Given this reasoning, we have grounds to expect that a country's economic growth is negatively associated with the degree of CEM. We use GDP per capita in 1997 (expressed in U.S. dollars) for measuring the economic growth in the sample countries.

III. DATA AND METHODS

Table 1 summarizes the institutional settings in the 18 countries we selected for this study. The large cross-country variation in these settings allows us to see whether cosmetic earnings management covaries with the background factors. The countries examined are largely the same that have been analyzed in some prior related studies on international accounting differences and properties of earnings (see e.g., Alford et al. 1993; Ali and Hwang 2000; Ball et al. 2000; Jaggi and Low 2000; Hung 2001), as well as in recent studies on cross-country differences in earnings management (Leuz et al. 2002; Bhattacharya et al. 2003).

[14] As noted by Hung (2001, 410) the portfolio-returns approach has statistical superiority over the more commonly used regression approach.

TABLE 1
Institutional Factors of the Sample Countries

Country	Shareholder Protection	Latitude in GAAP	Financial-Tax Alignment	Spending on Auditing	Management Bonus Schemes	Relative Firm Size	Power Distance	Masculinity	Value Relevance of Earnings	GDP Per Capita
Australia	4 (2)	8 (8)	Low	0.420 (4)	30 (4)	0.035 (11)	36 (11)	61 (7)	33.9 (5)	21204 (15)
Belgium	0 (17)	9 (6)	High	0.120 (11)	25 (9)	0.039 (10)	65 (4)	54 (9)	4.7 (18)	24037 (10)
Canada	4 (2)	3 (16)	Low	0.350 (6)	35 (3)	0.031 (12)	39 (9)	52 (10)	30.7 (7)	20661 (16)
Denmark	3 (6)	8 (8)	Low	0.380 (5)	NA	0.048 (7)	18 (18)	16 (15)	24.0 (12)	32058 (4)
Finland	2 (10)	12 (3)	High	0.060 (13)	NA	0.102 (3)	33 (15)	26 (14)	12.0 (16)	23314 (12)
France	2 (10)	10 (5)	High	0.140 (9)	20 (13)	0.005 (15)	68 (2)	43 (12)	33.6 (6)	23758 (11)
Germany	1 (15)	11 (4)	High	0.010 (14)	25 (9)	0.005 (15)	35 (12)	66 (4)	28.5 (9)	25622 (9)
Hong Kong	4 (2)	8 (8)	Low	0.004 (17)	29 (6)	0.088 (4)	68 (2)	57 (8)	26.2 (11)	27418 (6)
Italy	0 (17)	9 (6)	High	0.100 (12)	26 (8)	0.030 (13)	50 (7)	70 (2)	30.1 (8)	19913 (17)
Japan	3 (6)	8 (8)	High	0.010 (14)	21 (11)	0.007 (14)	54 (6)	95 (1)	22.6 (13)	33192 (3)
The Netherlands	2 (10)	7 (12)	Low	0.600 (1)	21 (11)	0.058 (5)	38 (10)	14 (16)	27.4 (10)	23100 (13)
Norway	3 (6)	4 (15)	High	0.140 (9)	NA	0.045 (8)	31 (16)	8 (17)	5.3 (17)	34778 (2)
Singapore	3 (6)	5 (14)	Low	NA	36 (2)	0.110 (1)	74 (1)	48 (11)	36.2 (3)	25754 (7)
Spain	2 (10)	13 (2)	High	0.010 (14)	30 (4)	0.044 (9)	57 (5)	42 (13)	21.4 (14)	13531 (18)
Sweden	2 (10)	6 (13)	High	0.300 (7)	20 (13)	0.052 (6)	31 (16)	5 (18)	17.9 (15)	25735 (8)
Switzerland	1 (15)	18 (1)	High	0.500 (3)	27 (7)	0.104 (2)	34 (14)	70 (2)	48.6 (1)	36120 (1)
United Kingdom	4 (2)	0 (18)	Low	0.540 (2)	20 (13)	0.005 (15)	35 (12)	66 (4)	34.1 (4)	21979 (14)
United States	5 (1)	3 (16)	Low	0.240 (8)	39 (1)	0.001 (18)	40 (8)	62 (6)	38.0 (2)	30276 (5)

Shareholder protection = number of antidirector rights; scale: 0–5 (LaPorta et al. 1997; Hung 2001);
Latitude in GAAP = index of missing national accounting rules and disclosure requirements with respect to selected IAS (GAAP 2000);
Financial-tax alignment = level of alignment of financial and tax accounting (Alford et al. 1993; Ali and Hwang 2000);
Spending on auditing = total fees of the country's ten largest accounting firms as percentage of gross domestic product for 1990 (Ali and Hwang 2000; Francis et al. 2001);
Management bonus schemes = CEOs' variable bonus as a percentage of annual basic compensation in 1996 (worldwide total remuneration survey by Towers Perrin);
Relative firm size = median net sales of sample firms in 1997 as percentage of gross domestic product in 1997 (Worldscope database; The Statistical Office of Finland);
Power distance = dimension of national culture measuring the degree to which institutional and organizational authority is accepted by individuals in the society (Hofstede 1984; Gray 1988; Jaggi and Low 2000);
Masculinity = dimension of national culture measuring preference for achievement, assertiveness, heroism, and financial success (Hofstede 1984; Gray 1988; Jaggi and Low 2000);
Value relevance of earnings = cumulative market-adjusted return of hedge portfolios based on perfect knowledge of net income, as a percentage of market-adjusted return of hedge portfolios based on highest and lowest market-adjusted returns (Hung 2001); and
GDP per capita = gross domestic product USD per capita in 1997 (source: The Statistical Office of Finland).

In each column, the rank orders are in parentheses.

It is reasonable to assume that the earnings measures that are potential targets for earnings cosmetics vary from one country to another. However, because of the difficulties in determining the most plausible targets of CEM for each of the 18 sample countries, and in order to preserve comparability across the countries examined, we choose a single earnings measure for the empirical tests. Prior studies in the area examining individual countries have used a number of different earnings variables such as ordinary income or earnings before extraordinary items and discontinued operations (Carslaw 1988; Thomas 1989), pre-tax income (Van Caneghem 2002), net income (Carslaw 1988; Niskanen and Keloharju 2000), and earnings per share (Thomas 1989; Das and Zhang 2003). Thus, there is no unanimity in prior literature on the most plausible target for earnings cosmetics, and some amount of CEM has been found for all earnings variables examined.

The earnings variable we examine in this study is *net income available to common* (i.e., after preferred dividends) expressed in the original local currency of each country. We use this aggregate earnings variable rather than earnings per share (EPS) for a number of reasons. (1) Aggregate earnings rather than EPS clearly dominate earnings news headlines in the media in many sample countries, especially those with less-developed equity markets (for example the Nordic countries). (2) Prior studies suggest that aggregate earnings are potential targets for earnings cosmetics also in countries where EPS otherwise has an important role (for the U.S., see Thomas 1989; for the U.K., see Van Caneghem 2002). (3) There is evidence that even in large U.S. industrial corporations, dollar value earnings are used as performance measures for CEOs' annual incentive plans more commonly than returns or EPS (Murphy 1999).[15] (4) Prior findings from U.S. firms suggest that analyzing second digits and using Benford's law (Benford 1938, see below) for expected frequencies are not appropriate for EPS numbers (Thomas 1989, 781). (5) There is no reasonable control variable (net sales per share) available for EPS.

In conclusion, the tests we report in this paper are based on the assumption that the bottom line (net income) numbers have importance in all countries and therefore are potential targets for earnings cosmetics. Although this assumption may lack descriptive validity for some of the countries examined, especially those with developed equity markets where there is emphasis on EPS among financial analysts (for example, the U.S.), the assumption turns out to be useful *a posteriori* as indicated by the general findings reported below.

Earnings data for the sample countries was extracted from the Worldscope database (update 56, December 2000). The data includes all 86,944 net income and 85,809 net sales observations for 21,662 firms available from the database for the five-year period 1995–1999. A summary of the sample firms with statistics on their market capitalization, net sales, and net income for 1999 can be seen in Table 2. (To preserve comparability, the statistics in Table 2 are expressed in million U.S. dollars.)

Almost half of the sample firms are from the U.S. (10,275 firms), followed by Japan (3,428 firms) and the U.K. (2,095 firms). The sample size is smallest for Finland (163 firms) and Belgium (183 firms). In terms of market capitalization, the largest median firm comes from Italy (U.S.$410 million in 1999) followed by Switzerland (U.S.$325 million). The net sales for 1999 give a similar picture; the largest median firm is Italian (with a net sales of U.S.$321 million) followed by Japanese (U.S.$306 million) and Swiss firms (U.S.$278 million). Overall, the distribution statistics in Table 2 shows an inverse relationship between sample size and average firm size across the countries; in

[15] Murphy (1999, Table 2) indicates that the most important accounting performance measures used in 125 large U.S. industrial corporations for executives' incentive plans are based on aggregate dollar values (44 percent of firms) rather than on margins or returns (20 percent), or per share values (19 percent). Growth rates in dollar values (10 percent), in margins or returns (1 percent), or in per share values (6 percent) are less common. However, in finance and insurance companies and in utilities per share performance measures are more common (26 percent and 34 percent, respectively) than in industrial companies, but nevertheless they are dominated by dollar value and margin/return measures.

TABLE 2
Sample Statistics by Country

Country	Number of Firms	Market Capitalization 1999 (million U.S. dollars)				Net Sales 1999 (million U.S. dollars)				Net Income 1999 (million U.S. dollars)			
		Average	Median	Lower Quartile	Upper Quartile	Average	Median	Lower Quartile	Upper Quartile	Average	Median	Lower Quartile	Upper Quartile
Australia	373	1285	225	83	591	794	114	29	532	46	10	2	31
Belgium	183	1168	159	52	714	1002	121	21	406	77	7	1	32
Canada	680	1301	180	50	742	950	156	27	682	44	5	−2	33
Denmark	235	521	44	17	212	431	81	25	364	28	3	1	19
Finland	163	2473	166	42	611	839	86	36	624	80	7	1	26
France	979	1787	86	22	351	1556	79	23	362	55	3	0	19
Germany	1049	1834	144	46	534	2087	133	25	762	56	3	0	19
Hong Kong	416	1455	107	44	331	470	120	36	306	98	6	−5	30
Italy	265	3559	410	110	2011	2426	321	67	1532	117	13	2	68
Japan	3428	1720	149	55	575	1703	306	130	877	14	3	0	12
The Netherlands	271	3564	218	61	1018	2395	220	44	931	129	12	2	55
Norway	213	367	95	30	258	501	79	29	288	16	3	−2	15
Singapore	254	740	133	64	407	315	102	37	240	29	6	1	23
Spain	206	2468	267	63	906	1246	205	45	750	90	16	4	69
Sweden	322	1418	134	48	524	847	116	30	427	64	5	0	29
Switzerland	255	3092	325	90	1122	1988	278	92	913	182	17	3	57
United Kingdom	2095	1758	101	26	427	942	55	12	292	63	3	0	16
United States	10275	2098	91	20	520	978	63	12	356	52	1	−4	15
Sample Total	21662	1907	117	32	530	1186	113	23	494	51	3	−1	18

countries where the sample size is relatively small (like Italy, Spain, and Switzerland) the firms are, on average, larger than in countries with large sample sizes (like the U.S., Japan, the U.K., and Germany).[16]

We summarize net sales and net income observations by country in Table 3. Since we have 21,662 firms in our sample, the theoretical number of observations from the five-year period 1995–1999 is 108,310. However, as many firms have missing observations in the Worldscope database for some of the sample years, the actual number of observations is smaller; for net sales the sample coverage is 79.2 percent of the theoretical maximum, and for net income the corresponding coverage is 80.3 percent. As regards individual countries, the coverage ratios are highest for Hong Kong (93.2 percent for net sales and 93.3 percent for net income) and lowest for the U.S. (74.2 percent and 75.8 percent).

Table 3 also shows the distribution of net income observations into positive (net profit) and negative (net loss) numbers. In the aggregate sample, the 86,944 net income observations include 64,188 (or 73.8 percent) profit numbers and 22,756 (26.2 percent) loss numbers. The proportion of net losses is highest for the U.S. (34.0 percent) and lowest for the Finnish sample (8.2 percent).

To measure the occurrence of CEM, we first count the frequencies of zeros, ones, twos, etc., as second left-most digits in the net sales and net income variables. Following the prior studies (Carslaw 1988; Thomas 1989; Niskanen and Keloharju 2000), we compare the observed relative (percentage) frequencies with their expected values under randomness assuming that no systematic CEM takes place and the second digit is determined only by chance. Contrary to the intuitively appealing view of equally distributed second digits, the expected relative frequency of second digit, *SD*, is given by the Benford's law as follows (see, for example, Thomas 1989, 774):

$$\text{Prob}(SD) = \sum_{FD=1}^{9}\left[Log_{10}\left(FD+\frac{SD+1}{10}\right)-Log_{10}\left(FD+\frac{SD}{10}\right)\right] \quad (1)$$

where:

SD = the second digit of a number (*SD* = 0, 1, 2,…,or 9); and

FD = the first digit of a number (*FD* = 1, 2,…,or 9).

According to the above formula, the expected (percentage) frequencies of zeros, ones, and twos, etc., as the second digits are the following:

	Second Digit (SD)									
	0	1	2	3	4	5	6	7	8	9
Prob(SD)	11.97%	11.39%	10.88%	10.43%	10.03%	9.67%	9.34%	9.04%	8.76%	8.50%

Thus, even in the absence of any intentional upward rounding implied by CEM, we can expect more zeros (11.97 percent) than nines (8.50 percent) as second digits of net income and net sales numbers.[17]

[16] Although the largest firms in the U.S., Japan, and the U.K. are certainly larger than the largest firms in, say, Italy or Spain, the much larger number of sample firms from the former countries explains why their firms are, on average, smaller.

[17] An intuition behind Benford's law is the following: Assume that a firm reports an earnings number of $1000 million where zero appears as the second digit from the left. Now, an earnings increase of at least 10 percent (or earnings of $1100 million) is required to change the second digit from zero to one. Correspondingly, the earnings increase must be at least 9.1 percent to change the second digit from one to two (from $1100 to $1200 million), 8.3 percent to change the second digit from two to three (from $1200 to $1300 million), and so on. Finally, an earnings increase of only 5.3 percent is needed to change the second digit from nine back to zero (from $1900 to $2000 million). Thus, lower second digits (for example, zero and one) "sustain" higher growth rates in earnings than higher second digits (for example, eight and nine), and therefore the likelihood of their appearance is also higher. It is noteworthy that Benford's law is approximate and it applies to numbers used in everyday factual life (earnings is just one example), not to artificially generated random numbers. In addition, it is important to note that the application of Benford's law makes our tests more conservative, because the rejection of the null hypothesis (no CEM) is less likely than under a uniform distribution of second digits.

TABLE 3
Net Sales and Net Income Observations by Country

Country	Number of Firms	Number of Observations from 1995–1999							
		Net Sales	%[a]	Net Income	%[a]	Net Profit	%[b]	Net Loss	%[b]
Australia	373	1445	77.5	1521	81.6	1275	83.8	246	16.2
Belgium	183	739	80.8	752	82.2	636	84.6	116	15.4
Canada	680	2532	74.5	2656	78.1	1853	69.8	803	30.2
Denmark	235	1044	88.9	1062	90.4	948	89.3	114	10.7
Finland	163	689	84.5	683	83.8	627	91.8	56	8.2
France	979	4030	82.3	4024	82.2	3336	82.9	688	17.1
Germany	1049	4247	81.0	4175	79.6	3281	78.6	894	21.4
Hong Kong	416	1939	93.2	1940	93.3	1427	73.6	513	26.4
Italy	265	1134	85.6	1142	86.2	983	86.1	159	13.9
Japan	3428	14770	86.2	14838	86.6	11621	78.3	3217	21.7
The Netherlands	271	1203	88.8	1210	89.3	1097	90.7	113	9.3
Norway	213	883	82.9	900	84.5	686	76.2	214	23.8
Singapore	254	1133	89.2	1135	89.4	923	81.3	212	18.7
Spain	206	890	86.4	892	86.6	808	90.6	84	9.4
Sweden	322	1306	81.1	1310	81.4	1080	82.4	230	17.6
Switzerland	255	1120	87.8	1133	88.9	1018	89.8	115	10.2
United Kingdom	2095	8598	82.1	8647	82.5	6899	79.8	1748	20.2
United States	10275	38107	74.2	38924	75.8	25690	66.0	13234	34.0
Total	21662	85809	79.2	86944	80.3	64188	73.8	22756	26.2

[a] Number of observations/(number of firms * five years per firm).

[b] Number of observations/number of net income observations.

To test whether the deviation of observed frequency for any digit class *i* from its expected frequency is statistically significant, we use the following standard normal z-statistic (cf. Thomas 1989, 775):

$$z_{SD} = \frac{f_{SD}^{observed} - nProb(SD)}{\sqrt{nProb(SD)[1 - Prob(SD)]}} \quad (2)$$

where:

$f_{SD}^{observed}$ = observed frequency of second digit *SD*; and

n = the sample size.

Correspondingly, to test the statistical significance of the whole distribution of observed second digits against its expectation under randomness (see above), we use the following Chi-square statistic with 9 degrees of freedom (cf. Carslaw 1988, 323):

$$\chi^2 = \sum_{SD=0}^{9} \frac{\left[f_{SD}^{observed} - nProb(SD)\right]^2}{nProb(SD)} . \quad (3)$$

Finally, to test the association between the degree of cosmetic earnings management and the institutional factors across the sample countries, we use the following CEM measures for each country:

$$CEM1 = \frac{f_{SDP0}^{observed}}{n_P} - Prob(SDP0) \quad (4a)$$

$$CEM2 = \frac{f_{SDP0}^{observed}}{n_P} - Prob(SDP0) + Prob(SDP9) - \frac{f_{SDP9}^{observed}}{n_P} \quad (4b)$$

$$CEM3 = \frac{f_{SDP0}^{observed}}{n_P} - Prob(SDP0) + Prob(SDP9) - \frac{f_{SDP9}^{observed}}{n_P} + \frac{f_{SDN9}^{observed}}{n_N} - Prob(SDN9) + Prob(SDN0) - \frac{f_{SDN0}^{observed}}{n_N} \quad (4c)$$

where:

SDP0 and *SDP9* = second digits *zero* and *nine*, respectively, for positive net income numbers (net profits);

SDN9 and *SDN0* = second digits *nine* and *zero*, respectively, for negative net income numbers (net losses);

n_P = the sample size of positive net income observations; and

n_N = the sample size of negative net income observations.

These metrics differ from each other with respect to the "breadth" of CEM measurement. The first measure (*CEM1*) considers only the proportional (percentage unit) surplus of *zeros* as second digit in positive net income numbers without regard to deficits in any particular digit class from which the upward rounding to zero in the second digit may have taken place.

The second measure (*CEM2*) takes into account also the deficit of *nines* in positive net income numbers by adding to *CEM1* the difference between expected and observed proportions of nines. Thus, this measure is based on the assumption that cosmetic earnings management for positive net income numbers is exercised especially by rounding nines up to zeros.

The third measure (*CEM3*), in turn, considers also negative net income numbers. It adds to *CEM2* the surplus of *nines* and the deficit of *zeros* as second digits of net losses. This measure assumes that CEM is exercised in a reverse form for net losses so that negative net income with zeros as second digits are rounded up to nines, as this will give an impression of a significantly *less unprofitable* firm.

IV. EMPIRICAL RESULTS

Degree of Cosmetic Earnings Management

The overall results on the observed frequencies of the second digits aggregated across the sample countries and years are shown in Table 4 on the next page. The broad tenor of our findings is consistent with the notion that cosmetic earnings management through small upward rounding of earnings numbers is widely spread around the world.

As regards positive net income numbers (net profit), we observe significantly *more zeros* and significantly *fewer nines* as second digits than what could be expected by mere chance according to Benford's law. Of the 64,188 positive net income observations in the data, we found 8,516 earnings numbers (13.27 percent) where the second digit was *zero*, while under randomness we could expect only 11.97 percent (or 7,683 earnings numbers). Thus, the percentage unit deviation between the observed and expected proportion is +1.30 percent. Given the large sample size, the deviation is extremely significant with a z-value of 10.14. It is noteworthy that the percentage unit deviation of 1.30 percent implies that approximately 10 percent (= 1.30%/13.27%) of all zeros reported as second digits of positive net income numbers can be suspected to be an outcome of CEM. Furthermore, if we look at the results for the digit *nine*, we document significantly fewer nines than could be expected under Benford's law. The percentage unit deviation is –0.61 percent and it is also very significant with a z-value of –5.53.

Interestingly, we also find a significant positive deviation (+0.27%) for fives. This is consistent with the notion that firms do small upward rounding not only to increase the first digit of earnings number by one (for example from $3.9 million to $4.0 million), but also to report earnings of, say, $3.5 million instead of $3.4 or $3.3 million. A plausible explanation for such behavior is that the resulting earnings number, when rounded mathematically to the first digit only, increases by one.[18] Furthermore, the deviations for sixes and sevens turn out significantly negative (–0.29 percent and –0.27 percent, respectively). This is suggestive of these numbers (in addition to nines) being rounded upward in order to have an increase of one in the first digit.

The aggregate results from the 22,756 negative net income observations in our data in the bottom panel of Table 4 are consistent with the prediction that CEM is reversed for net losses; we find *more nines* and *fewer zeros* as second digits than could be expected under randomness. The percentage unit deviations (+0.46 percent and –0.39 percent for nines and zeros, respectively) are, however, smaller and less significant than what was found for net profit numbers. In addition, according to the Chi-square statistic, we cannot reject the null hypothesis of identical distributions for observed and expected frequencies at conventional levels (the marginal significance of the Chi-square is 16.3 percent). Nevertheless, the broad tenor of the findings clearly suggests that the upward rounding implied by CEM tends to produce reversed patterns in the frequencies of zeros and nines when earnings are negative.

Finally, the results from using net sales as a control variable (see the top panel of Table 4) are in line with our general expectation that, due to a more restricted opportunity set for accounting choices, the tendency toward small upward rounding of reported numbers is less pronounced on the top line than on the bottom line. This is indicated by the deviations of zeros (+0.35 percent) and nines (–0.22 percent), which are clearly smaller and less significant than the corresponding statistics obtained for net profit numbers. Nevertheless, as the aggregate frequency distribution of the second digits of net sales numbers does differ from that expected under Benford's law (the Chi-square is significant at 3 percent level, see the total column on the right of Table 4), there is clear evidence of some management of net sales numbers taking place.

Given that almost a half of our earnings observations are from U.S. firms, we split our data to U.S.- and non-U.S.-based observations.[19] The results concerning the percentage deviations of second digits from their expectations are shown graphically for the two subsamples in Figure 1.

[18] For example, 3.4 million is rounded to 3 million, whereas 3.5 million is rounded to 4 million.

[19] As shown in Table 3, approximately 47 percent (= 10,275/21,662) of the sample firms and 44 percent (= 38,924/86,944) of the net income observations are from the U.S.

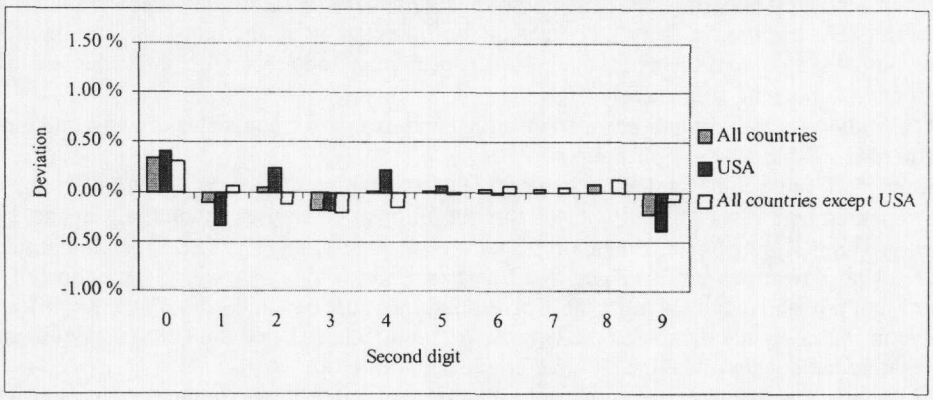
TABLE 4
Summary Statistics of Cosmetic Earnings Management across the Sample Firms and Countries

	Second Digit										
All 18 Countries	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Expected Percentage	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50	100.00
Net sales											
Number of observations	10568	9676	9371	8788	8623	8302	8028	7776	7575	7102	85809
Observed percentage	12.32	11.28	10.92	10.24	10.05	9.67	9.36	9.06	8.83	8.28	100.00
Percentage unit deviation	0.35	–0.11	0.04	–0.19	0.02	0.01	0.02	0.03	0.07	–0.22	0.00
z-value/Chi-square	3.138	–1.040	0.365	–1.837	0.176	0.069	0.188	0.276	0.733	–2.347	18.433
Prob(z/Chi-square)	0.002 **	0.298	0.715	0.066	0.860	0.945	0.851	0.783	0.463	0.019 *	0.030 *
Net profit											
Number of observations	8516	7380	6873	6620	6311	6377	5806	5628	5612	5065	64188
Observed percentage	13.27	11.50	10.71	10.31	9.83	9.93	9.05	8.77	8.74	7.89	100.00
Percentage unit deviation	1.30	0.11	–0.17	–0.12	–0.20	0.27	–0.29	–0.27	–0.01	–0.61	0.00
z-value/Chi-square	10.141	0.865	–1.419	–0.991	–1.678	2.288	–2.540	–2.360	–0.125	–5.534	140.083
Prob(z/Chi-square)	0.000 ***	0.387	0.156	0.322	0.093	0.022 *	0.011 *	0.018 *	0.901	0.000 ***	0.000 ***
Net loss											
Number of observations	2635	2573	2492	2406	2261	2141	2118	2038	2053	2039	22756
Observed percentage	11.58	11.31	10.95	10.57	9.94	9.41	9.31	8.96	9.02	8.96	100.00
Percentage unit deviation	–0.39	–0.08	0.07	0.14	–0.10	–0.26	–0.03	–0.08	0.26	0.46	0.00
z-value/Chi-square	–1.806	–0.390	0.334	0.691	–0.478	–1.325	–0.153	–0.416	1.413	2.490	12.997
Prob(z/Chi-square)	0.071	0.697	0.738	0.490	0.633	0.185	0.878	0.677	0.158	0.013 *	0.163

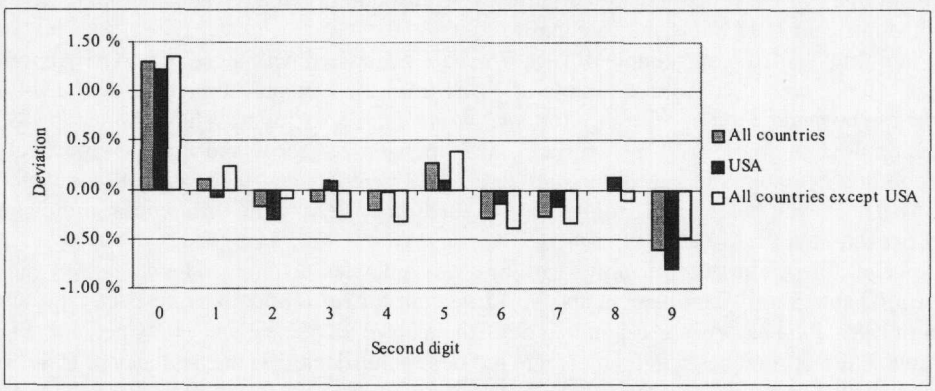
Expected percentage = expected percentage proportion of the second left-most digit under randomness according to Benford's law;
Percentage unit deviation = observed percentage minus expected percentage under randomness;
z-value = in the digit columns, the standard normal statistic for the equality of observed and expected frequency of second digits;
Chi-square = in the total column, the Chi-square statistic for equal observed and expected distributions with 9 degrees of freedom; and
Prob(z/Chi-square) = marginal two-tailed significance level of z-value/Chi-square: * (at least 5%), ** (at least 1%), *** (at least 0.1%).

FIGURE 1
Deviations of Second Digits from Benford's Law

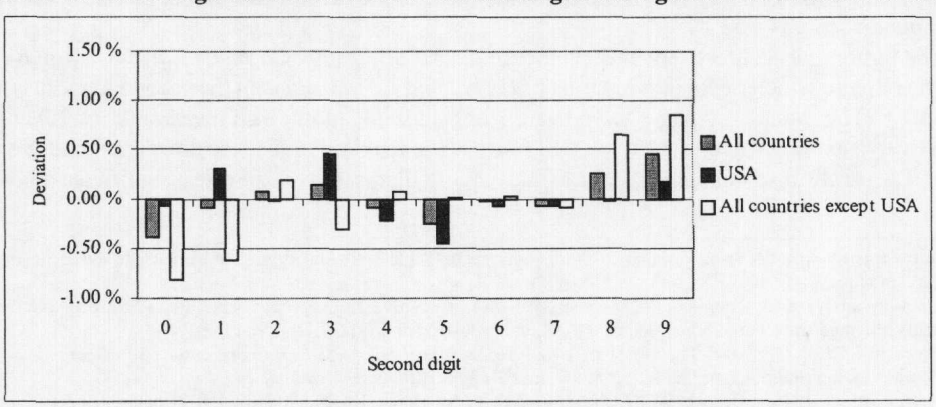
Panel A: Percentage Unit Deviations of Second Digits in Net Sales Numbers



Panel B: Percentage Unit Deviations of Second Digits in Positive Net Income Numbers



Panel C: Percentage Unit Deviations of Second Digits in Negative Net Income Numbers



The overall finding from this partitioned data suggests that the tendency toward the cosmetic management of net sales numbers is very similar in the U.S. and non-U.S. firms (see Figure 1, Panel A), as is also the tendency toward CEM in positive net income numbers (see Figure 1, Panel B). With respect to negative net income, however, the findings from non-U.S. firms are indicative of more significant tendency toward reversed patterns for frequencies of zeros and nines than what can be seen in the U.S. sample. In fact, the percentage unit deviations in the non-U.S. sample are +086 percent and –0.83 percent for nines and zeros, respectively, and are significant at the levels of 0.3 percent and 1.3 percent, respectively.

The findings on differences between observed and expected frequencies of zeros and nines are summarized in Table 5 by sample country.[20]

Panel A of Table 5 shows that the percentage unit deviation of *zeros* as second digit in positive net income numbers is significantly positive in the following countries: Australia, Canada, France, Germany, Hong Kong, Japan, Singapore, Spain, Switzerland, and the U.S. For almost all other countries, the deviations are also positive (the exception is Norway with a deviation of –0.16 percent), but not statistically significant. Correspondingly, the deviation of *nines* is significant and negative in Spain, Switzerland, and the U.S. Apart from Denmark and the U.K., the deviations are also negative but not significant in all other countries.

As regards negative earnings numbers (see Panel B of Table 5), we find only two countries with significant deviations. These are Hong Kong and Singapore, where the observed frequencies of *zeros* are lower than expected under randomness. In addition, the deviation is negative but not significant in 12 of the remaining 16 countries. Correspondingly, the deviation of *nines* is positive and not significant in 15 out of the 18 countries.

When findings from our sample of U.S. firms are contrasted with those previously reported by Thomas (1989), who used a large sample of firms from the Compustat database,[21] the following remarks can be made. First, the findings for *positive earnings* are similar. While Thomas (1989, 776) documents deviations of +1.09 percent and –0.76 percent for *zeros* and *nines*, respectively, the corresponding deviations found in our study are +1.22 percent and –0.80 percent (see Panel A of Table 5). These results are surprisingly close to each other despite the differences in the earnings variables examined.[22]

However, the findings for negative earnings are somewhat different. The deviations shown in Panel B of Table 5 are –0.07 percent and +0.17 percent for *zeros* and *nines*, respectively, whereas Thomas (1989, 777) reports corresponding deviations of –0.58 percent and +0.94 percent. Taken at face value, these differences suggest that there has been some decline in the tendency of U.S. firms to manage negative earnings from the first half of 1980s examined by Thomas (1989) to the latter half of the 1990s covered in our study.

Finally, we summarize our three measures of CEM (see Expressions (4a)–(4c) above) for each sample country in Figure 2. The figure draws on the CEM measures and country rankings shown in the Appendix.

The figure reveals that the overall winner of the *Miss World in Cosmetic Earnings Management* contest is Spain, which ranks first in terms of *CEM2* and *CEM3* and is in the second place according to *CEM1*.[23] The runners-up prove to be Hong Kong and Singapore, with mean ranks of 2.0 and 3.7, respectively, computed across the three CEM measures. In addition to these three countries, Switzerland and Australia also rank high. Swiss firms, in particular, seem to exercise a significant amount of

[20] Detailed country-specific results similar to those reported in Table 4 for the aggregate sample are available from the authors on request.

[21] The sample analyzed by Thomas (1989) consists of 68,738 positive earnings numbers and 11,359 negative earnings numbers obtained from the 1986 edition of the Annual Industrial and OTC Compustat files.

[22] As noted in Section III above, Thomas (1989) analyzed *earnings before extraordinary items and discontinued operations*, whereas the findings reported in this study are based on *net income available to common*.

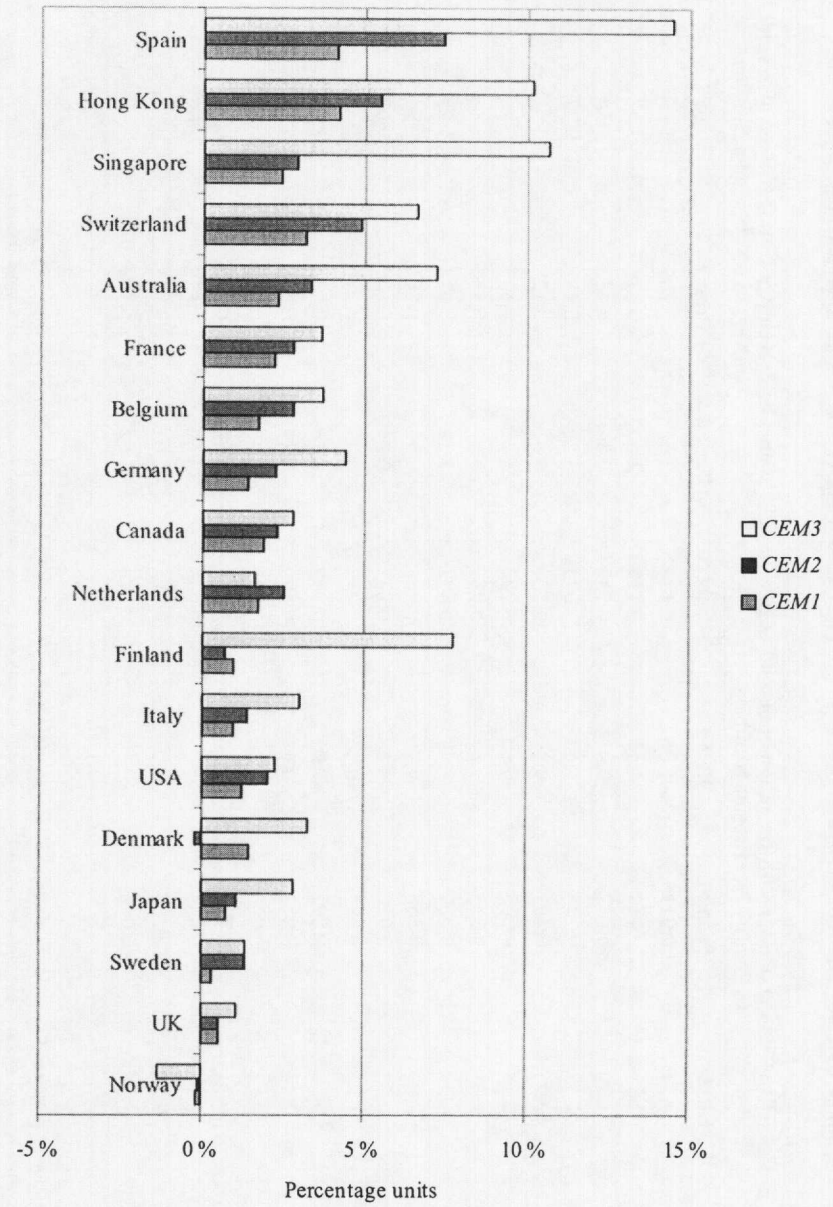
[23] It is noteworthy that the difference of *CEM1* between Spain and Hong Kong is marginal (4.12 percent and 4.22 percent, respectively; see Table 5).

TABLE 5
Percentage Unit Deviations of Zeros and Nines as Second Digits in Positive and Negative Net Income Numbers

	Panel A: Percentage Unit Deviation of Second Digits In Positive Net Income Numbers				Panel B: Percentage Unit Deviation of Second Digits in Negative Net Income Numbers			
Country	**Digit 0**	**Prob(z)**	**Digit 9**	**Prob(z)**	**Digit 0**	**Prob(z)**	**Digit 9**	**Prob(z)**
Australia	2.31	0.011	–1.05	0.179	–2.62	0.206	1.26	0.480
Belgium	1.71	0.184	–1.11	0.315	2.69	0.373	3.57	0.168
Canada	1.90	0.012	–0.41	0.532	0.86	0.453	1.34	0.174
Denmark	1.43	0.175	1.63	0.073	–3.20	0.293	0.27	0.917
Finland	0.95	0.463	0.27	0.807	–6.61	0.127	0.43	0.908
France	2.18	0.000	–0.62	0.202	–1.21	0.327	–0.36	0.735
Germany	1.41	0.013	–0.85	0.081	–0.67	0.537	1.46	0.119
Hong Kong	4.22	0.000	–1.28	0.082	–3.39	0.018	1.25	0.311
Italy	0.95	0.358	–0.46	0.602	–0.65	0.801	0.93	0.673
Japan	0.78	0.010	–0.30	0.247	–0.84	0.142	0.92	0.062
The Netherlands	1.71	0.082	–0.84	0.317	–0.46	0.879	–1.42	0.588
Norway	–0.16	0.897	–0.05	0.966	0.18	0.935	–1.02	0.591
Singapore	2.44	0.022	–0.48	0.599	–4.89	0.028	2.82	0.141
Spain	4.12	0.000	–3.30	0.001	–6.02	0.089	1.02	0.737
Sweden	0.35	0.725	–1.00	0.239	0.64	0.765	0.63	0.732
Switzerland	3.16	0.002	–1.72	0.049	–0.66	0.826	1.07	0.682
United Kingdom	0.54	0.166	0.02	0.945	–0.01	0.988	0.54	0.419
United States	1.22	0.000	–0.80	0.000	–0.07	0.792	0.17	0.471

The percentage unit deviations reported in this table are differences between observed percentages for each country and expected percentages under Benford's law (see Table 4).
Prob(z) = marginal two-tailed significance level of standard normal z-value for equality of observed and expected frequency of second digits.

FIGURE 2
Cosmetic Earnings Management Measures by Country



CEM1 = percentage unit surplus of zeros in second digits of positive net income numbers;
CEM2 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers; and
CEM3 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers plus percentage unit surplus of nines plus deficit of zeros in second digits of negative net income numbers.
Note: The country ranking in the figure is based on mean ranks across the three CEM measures for each country.

CEM in positive earnings numbers (*CEM1* and *CEM2*). Apart from these five countries, CEM is less apparent in the other sample countries. For example, the Nordic countries (Finland, Denmark, Sweden, and Norway) exhibit consistently low degrees of CEM.[24] In addition, the CEM measures for the U.S. and the U.K., as well as for Japan, indicate relatively low values. Overall, the country rankings do not show any remarkable geographical patterns, as indicated by the top-five and the bottom-five countries in Figure 2.

The Association between Institutional Factors and CEM

Following Ali and Hwang (2000), we use Spearman rank correlations to measure cross-country covariation between institutional factors and CEM.[25] Estimated correlations are reported in Table 6.

Our results indicate some dependence between accounting-related institutional characteristics and the degree of CEM. At conventional levels, we find significant relationships between one CEM measure (*CEM3*) and two accounting-related factors, namely, latitude in GAAP and spending on auditing. The signs of the estimated correlations for both of these variables are consistent with our expectations. However, we do not find significant correlations between any of our three CEM measures and the other two accounting-related institutional factors, the alignment between financial and tax accounting and the value-relevance of earnings. In addition, the estimated correlations do not lend support to our expectation that CEM is related to firms' relative size or to economic growth of countries as measured by GDP per capita.

Instead, we find evidence that CEM increases with management bonus schemes. The significant positive correlations for this variable suggest that firms tend to exercise CEM more extensively in countries where the CEOs' variable bonus is relatively important. We also find some support for our expectation that the degree of CEM is associated with certain cultural dimensions of a country. In particular, we find that the power distance (PD) index has a significant positive correlation with the CEM measures. Somewhat surprisingly, however, the results do not provide evidence for the masculinity of a country being correlated with its tendency toward CEM.

As many of the institutional factors are correlated with each other,[26] we follow Ali and Hwang (2000) who use principal component analysis to see whether the variables measuring institutional factors reflect only one underlying dimension and whether this dimension is associated with properties of earnings numbers (CEM in our case). We find that the first principal component extracted from the institutional factors has an eigenvalue of 3.1, and it captures approximately one-third (31.0 percent) of the total variance in the data.[27]

Given the estimated loadings of individual institutional factors on this principal component, we interpret it as an overall measure of *institutional aversion to CEM*.[28] Consistent with this interpretation, we find negative correlations between this principal component and our CEM measures, in particular for *CEM3* where the estimated correlation is –0.486 (see the last row in Table 6). This result is in line with our overall expectation concerning the role of institutional settings as a determinant of firms' tendencies toward small upward rounding in reported earnings numbers.

[24] The high value of *CEM3* for Finland (7.72 percent) is obviously an outcome of the small sample size of negative net income observations for this country (see Table 3).

[25] The primary reason for not estimating multiple regressions between the CEM measures and institutional factors is the relatively small sample size (18 countries) which, given the number of independent variables (ten factors), does not leave enough degrees of freedom for parameter estimation.

[26] For example, the rank correlations of latitude in GAAP and financial-tax alignment with shareholder protection are –0.713 and –0.749.

[27] Ali and Hwang (2000, 9) report an explanatory power of 84.9 percent for the principal component extracted from the data for 16 countries on domestic firms-to-population ratio, sources of GAAP, accounting cluster, financial-tax alignment, and spending on auditing.

[28] The variable loadings on the principal factor are the following: shareholder protection, 0.826; latitude in GAAP, –0.675, financial-tax alignment, –0.890; spending on auditing, 0.635; management bonus schemes, 0.425; relative firm size, –0.143; power distance, –0.557; masculinity, –0.003; value relevance of earnings, 0.508; and GDP per capita, 0.003.

TABLE 6
Spearman Correlations between Cosmetic Earnings Management Measures and Variables Representing Country-Specific Institutional Factors

			CEM1		CEM2		CEM3	
Variable	**Nobs**	**Expected Sign**	**Spearman**	**Prob(S)**	**Spearman**	**Prob(S)**	**Spearman**	**Prob(S)**
Shareholder protection	18	–	.004	.493	–.117	.322	–.187	.229
Latitude in GAAP	18	+	.386	.057	.387	.056	.653	.002
Financial-tax alignment	18	–	–.259	.150	–.065	.399	.065	.399
Spending on auditing	17	–	–.066	.400	–.150	.283	–.483	.025
Management bonus schemes	15	+	.534	.020	.483	.034	.512	.025
Relative firm size	18	?	.304	.219	.238	.341	.395	.104
Power distance	18	+	.560	.008	.628	.003	.439	.034
Masculinity	18	+	.110	.333	.167	.253	.136	.295
Value relevance of earnings	18	–	.340	.084	.281	.129	.065	.399
GDP per capita	18	–	–.150	.277	–.220	.190	–.135	.296
Principal component	14	–	–.178	.271	–.292	.155	–.486	.039

CEM1 = percentage unit surplus of zeros in second digits of positive net income numbers;
CEM2 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers;
CEM3 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers plus percentage unit surplus of nines minus deficit of zeros in second digits of negative net income numbers;
Prob(S) = one-tailed (two-tailed) significance level of the Spearman correlation for variable with (without) expected sign;
Shareholder protection = number of antidirector rights;
Latitude in GAAP = index of missing national accounting rules and disclosure requirements with respect to selected IAS;
Financial-tax alignment = 1 if the level of alignment of financial and tax accounting is high, 0 otherwise;
Spending on auditing = total fees of the country's ten largest accounting firms as percentage of gross domestic product for 1990;
Management bonus schemes = CEOs' variable bonus as a percentage of annual basic compensation in 1996;
Relative firm size = median net sales of sample firms in 1997 as percentage of gross domestic product in 1997;
Power distance = dimension of national culture measuring the degree to which authority is accepted by individuals in the society;
Masculinity = dimension of national culture measuring preference for achievement, assertiveness, heroism, and financial success;
Value relevance of earnings = cumulative market-adjusted return of hedge portfolios based on perfect knowledge of net income, as a percentage of market-adjusted return of hedge portfolios based on highest and lowest market-adjusted returns;
GDP per capita = gross domestic product USD per capita in 1997; and
Principal component = variable representing overall institutional aversion to CEM (extracted from the data on the above institutional factors).

Additional Tests

Differences between High versus Low CEM Countries

As the rank correlation tests reported in the preceding section may lack statistical power due to relatively small number of observations (the country sample varies from 14 to 18 observations in Table 6), we perform additional tests by comparing institutional factors in top three (five) CEM countries to those in bottom three (five) CEM countries.[29] The overall findings (not reported in detail) from independent sample Mann-Whitney tests indicate four institutional factors that have statistically significant differences between the high and low CEM countries. These factors are latitude in GAAP (one-tailed significance of 5.3 percent in a Mann-Whitney test), spending on auditing (4.2 percent), management bonus schemes (1.2 percent) and the cultural value of power distance (1.9 percent). Consistent with rank correlations, these Mann-Whitney tests were not able to reveal other factors with significant differences between the high and low CEM countries.

Firms' Persistence in CEM

In addition to examining earnings observations pooled across sample firms and years (see the preceding section), we analyze firms' persistence in CEM. For that purpose, we first screen our sample to find firms that report positive net income throughout the five-year period 1995–1999. From our total sample of 21,662 firms, we find 6,504 firms that fulfill this selection criterion.[30] Next, for each firm in the screened sample, we count the frequencies of zeros and nines as second digits in the firm-specific earnings time-series. Our findings from this analysis are shown in Table 7.

Assuming that the second digits of earnings numbers reported by a firm over time are identically and independently distributed according to Benford's law, then the binomial probability of finding a firm that persistently reports a sequence of *zeros* as second digit throughout the five-year period is 0.1197^5. Given our sample size of 6,504 firms, we expect no such firms to be found under randomness ($0.1197^5 * 6{,}504 = 0.16 \approx 0$). In fact, we find two firms (see Panel A of Table 7).[31] In contrast, we do not find a single firm reporting *nines* as second digit consistently throughout the five-year period (see Panel B of Table 7).

At the other extreme, we find 3,227 firms that have no *zeros* as second digit in any year of the sample period (see Panel A of Table 7). This is significantly less than could be expected under randomness. Correspondingly, the number of firms with persistent aversion to *nines* is significantly larger than expected (see Panel B).

Overall, the findings from these firm-specific tests clearly suggest that significant numbers of firms exhibit over time a persistent attraction to *zeros* (rather than to *nines)* and a persistent aversion to *nines* (rather than to *zeros*) as second digits of earnings numbers. While this result is consistent with our prediction of CEM behavior and thus corroborates the general findings we reported in the preceding section, it also falls in line with the notion that some firms are systematic "*zero lovers*" and/or *"nine detesters."*

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[29] The authors are grateful to an associate editor for suggesting this additional test. The top five countries based on average ranking across CEM measures (see Figure 2) are Spain, Hong Kong, Singapore, Switzerland, and Australia, and the bottom five countries are Denmark, Japan, Sweden, the U.K., and Norway.

[30] Of the 21,662 firms in the sample, there were 10,631 firms that reported net loss in at least one year and 4,527 firms with at least one missing earnings observation during 1995–99, thus leaving 6,504 firms with positive net income throughout the sample period.

[31] These firms are *N.V. Nederlandse Gasunie* and *Societa Elettrica Sopraceberina.* Both firms are power suppliers; the former's business is to purchase, transmit, and distribute natural gas in The Netherlands and elsewhere in Europe, and the latter is a Swiss electricity power supply company.

TABLE 7
Firm Persistence in Cosmetic Earnings Management of Positive Net Income Numbers

Panel A: Number of Years in Which Zero Reported as Second Digit during 1995–1999

	5 Years	4 Years	3 Years	2 Years	1 Year	0 Years	Total
Binomial probability	0.00 %	0.09 %	1.33 %	9.77 %	35.94 %	52.87 %	100.00 %
Observed number of firms	2	10	117	722	2426	3227	6504
Expected number of firms	0	6	86	636	2338	3438	6504
Difference	2	4	31	86	88	–211	0
z-value/Chi-square	4.603	1.701	3.309	3.603	2.285	–5.247	62.91
Prob(z/Chi-square)	0.000	0.089	0.001	0.000	0.022	0.000	0.000

Panel B: Number of Years in Which Nine Reported as Second Digit during 1995–1999

	5 Years	4 Years	3 Years	2 Years	1 Year	0 Years	Total
Binomial probability	0.00 %	0.02 %	0.51 %	5.53 %	29.79 %	64.15 %	100.00 %
Observed number of firms	0	0	39	309	1833	4323	6504
Expected number of firms	0	2	33	360	1938	4171	6504
Difference	0	–2	6	–51	–105	152	0
z-value/Chi-square	–0.170	–1.246	0.964	–2.765	–2.835	3.918	20.88
Prob(z/Chi-square)	0.865	0.213	0.335	0.006	0.005	0.000	0.000

Binomial probability = probability of a firm reporting k zeros (upper panel) or nines (lower panel) during 1995–1999 given by:

$$\binom{5}{k} p^k (1-p)^{5-k}$$

where $k = 5, 4, \ldots, 0$, and p = .1197 and .085 for zeros and nines, respectively, under Benford's law;

Expected number of firms (under randomness) = binomial probability × total number of firms;

z-value = in the year columns, the standard normal statistic for the equality of observed and expected number of firms;

Chi-square = in the total column, the Chi-square statistic for equal observed and expected distributions with 5 degrees of freedom; and

Prob (z/Chi-square) = marginal two-tailed significance level of z-value/Chi-square.

The Association of CEM with Other Dimensions of Earnings Management

To see whether CEM behavior is associated with more conventional dimensions of earning management such as income smoothing, we estimate Spearman correlations between our CEM measures and a number of other measures recently analyzed by Leuz et al. (2002). As earnings management takes place through the manipulation of current and noncurrent accruals relative to cash flows, the traditional measures typically estimate the magnitude, volatility, or correlation of firm's accruals in relation to its operating cash flows.

The statistics in Table 8 indicate that our measures of CEM have significant correlations with three of the earnings management measures considered by Leuz et al. (2002). The first is a measure of income smoothing defined by the ratio of the standard deviation of operating income to the standard deviation of cash flow from operations (*LNW1*). The lower the temporal volatility of operating income relative to that of cash flow, the more a firm exercises income smoothing in the accrual-based operating income series. The significant negative Spearman correlations with our CEM measures suggest that in countries where income smoothing is relatively large (i.e., the *LNW1* ratio is small), firms are more inclined toward CEM. Our results for *LNW2* (correlation between changes in accruals and changes in cash flows from operations) are consistent with this conclusion.

We also find that the CEM variables have significant positive correlations with *LNW4*, which measures the asymmetry between the frequencies of small positive earnings relative to small negative earnings. Since the ratio basically captures firms' loss-avoidance behavior, it is conceptually close to our CEM measures. Therefore, the significant correlations that *LNW4* has with the CEM variables are not surprising; rather than providing any new insights into the phenomenon, they corroborate the general findings we document above on CEM behavior across the countries.

V. CONCLUSIONS

Using a sample of nearly 87,000 earnings observations from almost 22,000 firms in 18 countries, we focus on a particular kind of earnings management behavior depicted by firms' tendency toward small upward rounding of reported net income numbers (cosmetic earnings management or CEM). The economic importance of CEM lies in the direct and indirect impacts it allegedly may have on a firm's *perceived* profitability and on cash flows triggered through contracts based on round earnings numbers.

We document that CEM is widespread around the world. During the research period 1995–1999, we observed significant CEM in approximately half of the countries examined. According to our measures of CEM, the "winner" of the CEM contest is Spain, and the runners-up are Hong Kong and Singapore. At the opposite extreme are Scandinavian countries (Denmark, Sweden, and Norway) and the U.K. where CEM proves to be quite small and not significant.

More importantly, we find evidence for our expectation that the degree of CEM covaries across countries with certain institutional factors. In particular, we document that CEM decreases with spending on auditing and increases with the importance of management bonus schemes and with specific societal values favoring such behavior, such as power distance. In addition, we find some evidence that CEM increases with the latitude of a country's GAAP. Surprisingly, however, we do not find support for our expectation that CEM is associated with the degree of shareholder protection, the alignment of financial and tax accounting, or the value relevance of earnings. Our nonsignificant findings on these factors can, of course, be attributed to small sample size (18 countries), noisy measures for institutional factors, or both.

In an additional test, we find that many firms exercise CEM persistently over time. In addition, we report that our CEM measures have significant correlations with firms' tendency toward loss avoidance (conceptually close to CEM), as well as with income smoothing, which is perhaps the most traditional dimension of earnings management.

TABLE 8
Spearman Correlations between Cosmetic Earnings Management Measures and Variables Representing Other Dimensions of Earnings Management

Variable	Nobs	Expected Sign	*CEM1*		*CEM2*		*CEM3*	
			Spearman	Prob(S)	Spearman	Prob(S)	Spearman	Prob(S)
LNW1	18	–	–.509	.016	–.472	.024	–.593	.005
LNW2	18	–	–.280	.131	–.162	.260	–.432	.037
LNW3	18	+	.112	.328	.104	.340	.319	.099
LNW4	18	+	.393	.053	.424	.040	.474	.024

CEM1 = percentage unit surplus of zeros in second digits of positive net income numbers;
CEM2 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers;
CEM3 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers plus percentage unit surplus of nines minus deficit of zeros in second digits of negative net income numbers;
LNW1 = median (stdev (operating income)/stdev (CFO)) (Leuz et al. 2002, Table 2);
LNW2 = correl (change in accruals; change in CFO) (Leuz et al. 2002, Table 2);
LNW3 = median (abs(accruals)/abs(CFO)) (Leuz et al. 2002, Table 2);
LNW4 = # of small profits/# of small losses (Leuz et al. 2002, Table 2); and
Prob(S) = one-tailed significance level of the Spearman correlation.

Overall, our study contributes to the growing literature on the importance of different institutional settings for the properties of accounting information. Our main findings suggest that there are systematic differences across countries in the specific (cosmetic) type of earnings management. Given that earnings quality is an important issue to regulators of accounting information, our findings support the notion that the discretion allowed in accounting principles, as well as the role of auditing, are potentially important factors to be taken into account if earnings cosmetics is to be decreased. In addition, there are some other factors beyond regulators' control, such as management's incentive structures and cultural values that might also have an impact on firms' propensity to exercise CEM.

Finally, our findings give rise to showing a warning flag for the users of financial statement information: if you ever happen to see a beautiful Miss, be aware; some parts of her beauty may be attributable to silicone. Likewise, if you ever happen to see a firm reporting a zero as the second digit of an earnings number, be aware, the zero may result from deliberate earnings cosmetics and may therefore be a fake. The aggregate statistics from our cross-national comparison of 18 countries suggest that the probability of this being the case is approximately 10 percent.

APPENDIX
Summary of Cosmetic Earnings Management Measures by Country

Country	*CEM1*	Rank	*CEM2*	Rank	*CEM3*	Rank	Mean rank
Australia	2.31%	(5)	3.36%	(4)	7.24%	(5)	(4.7)
Belgium	1.71%	(8)	2.82%	(6)	3.70%	(8)	(7.3)
Canada	1.90%	(7)	2.31%	(9)	2.79%	(13)	(9.7)
Denmark	1.43%	(10)	–0.20%	(18)	3.27%	(10)	(12.7)
Finland	0.95%	(14)	0.68%	(15)	7.72%	(4)	(11.0)
France	2.18%	(6)	2.80%	(7)	3.65%	(9)	(7.3)
Germany	1.41%	(11)	2.26%	(10)	4.39%	(7)	(9.3)
Hong Kong	4.22%	(1)	5.50%	(2)	10.14%	(3)	(2.0)
Italy	0.95%	(13)	1.41%	(12)	2.99%	(11)	(12.0)
Japan	0.78%	(15)	1.08%	(14)	2.84%	(12)	(13.7)
The Netherlands	1.71%	(9)	2.55%	(8)	1.59%	(15)	(10.7)
Norway	–0.16%	(18)	–0.11%	(17)	–1.31%	(18)	(17.7)
Singapore	2.44%	(4)	2.92%	(5)	10.63%	(2)	(3.7)
Spain	4.12%	(2)	7.42%	(1)	14.46%	(1)	(1.3)
Sweden	0.35%	(17)	1.35%	(13)	1.34%	(16)	(15.3)
Switzerland	3.16%	(3)	4.88%	(3)	6.61%	(6)	(4.0)
United Kingdom	0.54%	(16)	0.52%	(16)	1.07%	(17)	(16.3)
United States	1.22%	(12)	2.02%	(11)	2.26%	(14)	(12.3)

CEM1 = percentage unit surplus of zeros in second digits of positive net income numbers;
CEM2 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers; and
CEM3 = percentage unit surplus of zeros plus deficit of nines in second digits of positive net income numbers plus percentage unit surplus of nines plus deficit of zeros in second digits of negative net income numbers.

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