Determinants of International Differences in Asymmetric Cost Behavior

Rajiv D. Banker*
Dmitri Byzalov*
Lucas Threinen*

*Fox School of Business, Temple University

May 1, 2013
Determinants of International Differences in Asymmetric Cost Behavior

ABSTRACT

Since costs are a major component of earnings, understanding the impact of country-level factors on earnings through asymmetric cost behavior is important. We posit that countries with a more efficient judicial system and a higher level of development should exhibit greater cost stickiness at the firm level, because these factors facilitate long-term resource commitments by managers. By contrast, strong shareholder protection laws should reduce cost stickiness, because such laws deter empire-building behavior by managers. We test these predictions using Global Compustat data for both developed and developing economies from 1988-2008. The results strongly support our hypotheses, and indicate that these country-level factors are highly economically significant in explaining cross-country variation in asymmetric cost and earnings behavior that remains after controlling for the known firm-level determinants of sticky costs.

Keywords: Sticky costs, country institutions, judicial efficiency, shareholder protection, development, resource adjustment, managerial decisions.

JEL Classification: M41, L23.
1. Introduction

Research in international accounting has focused on how differences in country-level factors influence the behavior of earnings reported by firms in different countries. Because costs are a major component of earnings, insights into cost behavior can contribute to better understanding of the properties of both realized earnings and analysts’ earnings forecasts. Recent research in cost accounting (e.g., Anderson et al. 2003; Weiss 2010) documents that many costs are “sticky”—they rise to a greater extent in the case of sales increases than they fall for equivalent sales decreases. Anderson et al. (2003) attribute this phenomenon to deliberate resource commitment decisions by managers facing adjustment costs, such as hiring and firing costs for labor resources. Existing research has identified the main firm-level drivers of asymmetric cost behavior, including the magnitude of adjustment costs, managerial incentives and managerial optimism and pessimism, and has documented the impact of these firm-level factors on the degree of cost stickiness. In this paper, we argue that because firms interact with the environment of the country they operate in, country-level characteristics are likely to have an important effect on managers’ operating decisions, leading to substantial differences in asymmetric cost behavior across countries. Therefore, understanding the role of country-level factors is key to gaining new insights into cost behavior within a broad international context.

Prior studies have documented the impact of country characteristics on companies’ financial reporting decisions, including the extent of earnings management (Leuz et al. 2003) and conditional conservatism (Bushman and Piotroski 2006), and on macro-level financial system outcomes, such as capital markets development and ease of access to financing (La Porta et al. 1997, 1998). Unlike these studies, we focus on the role of country-level factors in managers’ operating decisions that drive cost behavior. Anderson et al. (2003) argue that many costs arise
because managers make a deliberate decision to commit resources, and asymmetries in cost behavior reflect asymmetries in the underlying resource commitments. Because managers have to consider both firm-level and country-level factors in making operating decisions, both types of factors are likely to play a role in cost behavior.

Country characteristics are likely to affect the degree of asymmetry in cost behavior through two important channels. First, when firms make resource commitments that are costly to reverse, they will exhibit greater cost stickiness (Anderson et al. 2003). Therefore, country characteristics that influence managers’ willingness to commit resources will affect the degree of cost stickiness at the firm level. In particular, the efficiency of the country’s legal system and the country’s level of development are likely to facilitate major resource commitments, leading to increased cost stickiness. Second, when they have the latitude to do so, managers will engage in opportunistic behavior such as empire-building, which tends to increase the degree of cost stickiness (Chen et al. 2012). Therefore, country characteristics that deter opportunistic behavior by managers, such as strong shareholder protection laws and regulations, are likely to be associated with lower cost stickiness at the firm level.

We test these predictions using a broad-based international sample from Global Compustat for the years 1988-2008, combined with data on country characteristics from other sources. In preliminary analysis, we document that while sticky cost behavior is pervasive globally, there is substantial variation in the degree of cost stickiness across countries. Further, firm-level factors from prior research account for only 25 percent of this variation, leaving 75 percent unexplained, which underscores the importance of understanding the role of country-level factors. The empirical results lend strong support to our predictions. We find that higher judicial efficiency and higher development level of a country are associated with a significantly higher degree of
cost stickiness at the firm level, in agreement with our argument that these country-level factors encourage resource commitments by managers. By contrast, strong shareholder protection laws and regulations are associated with significantly lower cost stickiness, supporting our argument that such laws restrain managers’ ability to engage in empire-building. All of our findings for the country-level factors hold even after controlling for the firm-level determinants of cost stickiness identified in prior studies, including firm-level proxies for adjustment costs, managers’ expectations, and managers’ incentives for opportunistic behavior. The impact of country characteristics is also highly economically significant. For example, holding all other variables constant, the impact of a one standard deviation increase in the judicial efficiency (shareholder protection) index on the degree of cost stickiness is equivalent to 56 percent (48 percent) of the total cross-country variation in cost stickiness, and the impact of a similar change in the development index is equivalent to 78 percent. We also show that these country-level variables have a large impact on the degree of asymmetry in earnings behavior.

Our analysis offers two important new insights into the drivers of cost behavior. First, we show that strong legal institutions have two opposing effects: whereas a more efficient judicial system, serving all stakeholders, increases the degree of cost stickiness, stronger laws and regulations that protect shareholders act to diminish stickiness. A broader implication of this finding is that a one-dimensional measure of the ‘quality’ of legal institutions would not be adequate in studies of the institutional drivers of managerial decisions and their implications for firm performance. Second, we show that a country’s supply of human capital, proxied by the Human Development Index, has a major impact on asymmetric cost behavior. While prior studies of sticky costs have examined the drivers and cost implications of managers’ demand for resources, this finding highlights the importance of understanding the role of supply-side factors
for key activity resources and their impact on managers’ operating decisions.

The remainder of this paper is organized as follows. In Section 2, we develop our hypotheses regarding the impact of country characteristics on cost stickiness. In Section 3, we describe the data and the empirical models. Section 4 presents our empirical findings, and Section 5 concludes.

2. Hypothesis Development

In this section, we develop theoretical predictions regarding the relationship between country-level factors and cost stickiness. We focus on two types of factors that are likely to play a primary role in asymmetric cost behavior—the country’s legal environment and the country’s level of development.

While the traditional model of cost behavior assumes a symmetric linear relationship between sales and costs, recent research (e.g., Anderson et al. 2003; Weiss 2010; Banker et al. 2013a, 2013b; Banker and Byzalov 2013; Kama and Weiss 2013) has documented important asymmetries in cost behavior between cases of sales increases versus decreases. These findings contradict the traditional model, and they support an alternative view of cost behavior that emphasizes managerial discretion and resource adjustment costs. Anderson et al. (2003) argue that when sales decrease, managers opt to retain some of the unused resources to avoid incurring adjustment costs associated with cutting resources, such as disposal costs for equipment or severance payments to dismissed workers. Therefore, the decrease in costs will be less than commensurate with the decrease in sales. By contrast, when sales increase sufficiently, managers have less discretion—they must add resources to accommodate the increased sales. This asymmetry in managerial discretion leads to cost stickiness: on average, costs fall less when
sales decrease than they rise in response to an equivalent sales increase. Further, the greater are
the adjustment costs that firms face, the more willing will managers be to retain slack capacity to
avoid these costs. Therefore, the asymmetry in cost behavior should be increasing in the
magnitude of adjustment costs.

Anderson et al. (2003) and numerous subsequent studies, using data from the US and a few
other countries, document the empirical prevalence of sticky costs and demonstrate that the
degree of cost stickiness varies across firms and over time in ways consistent with the theory.
However, existing studies have focused primarily on the implications of the theory for firm-level
characteristics, overlooking the interaction of firm-level operating decisions with external,
country-level factors.¹ Unlike these studies, we use a broad-based international setting to
examine the impact of country-level environment on cost behavior of firms operating within that
environment.

We first consider how two key dimensions of a country’s legal system—the consistency and
efficiency with which laws in general are enforced, and the strength of the particular laws and
regulations that apply to shareholder protection—should affect the cost behavior of firms
operating under that legal system. We argue that, because managers of firms that operate in a
country with a more efficient judicial system are likely to be more willing to make major
resource commitments that are costly to reverse, such firms will exhibit increased cost stickiness.
By contrast, managers facing strong shareholder protection laws and regulations are less likely to
be able to engage in wasteful empire-building behavior that contributes to inefficiently large
sticky costs (Anderson et al. 2003, Chen et al. 2012), leading to a reduction in cost stickiness.

¹ An exception is Banker et al. (2013a), who use cross-country differences in employment protection legislation as a
proxy for labor adjustment costs in tests of the economic theory of sticky costs.
Judicial efficiency is widely recognized to have important effects on a country’s business environment. Previous research (e.g., La Porta et al. 1997, 1998) has found that firms operating in a country with high judicial efficiency will operate with greater confidence that contracts will be enforced with fairness and alacrity, and they will consider outright illegal or extra-legal expropriation to be less likely. The resulting higher confidence by managers of such firms make them more willing to undertake major commitments of resources that have high adjustment costs (i.e., are difficult and costly to reverse on short notice), including deployment of skilled indirect labor and physical capital, and investment in human capital of workers. Therefore, firms in countries with high judicial efficiency will have higher resource adjustment costs, reflecting a different mix of committed resources that places less emphasis on retaining the ability to unwind these commitments in the short run. Because the degree of cost stickiness is increasing in the magnitude of resource adjustment costs (Anderson et al. 2003, Banker et al. 2013a), higher judicial efficiency at the country level will be associated with greater cost stickiness at the firm level.

**Hypothesis 1:** The degree of a firm’s cost stickiness is increasing in its country’s judicial efficiency.

The strength of a country’s shareholder protection laws and regulations should also affect the degree of cost stickiness. Resource adjustment decisions that lead to cost stickiness are made by managers whose interests are not perfectly aligned with those of the shareholders. Therefore, asymmetric cost behavior is likely to reflect not only optimal resource planning decisions, which

---

2 To the best of our knowledge, this prediction is new to the literature.
aim to avoid incurring inefficiently large resource adjustment costs, but also the effects of agency problems such as empire-building behavior (Anderson et al. 2003, Chen et al. 2012).

In particular, empire-building managers will be eager to expand resources under their control when sales increase, and they will be reluctant to cut resources when sales decrease. This may lead to cost stickiness even in the absence of resource adjustment costs. Strong corporate governance is likely to constrain managers' ability to engage in empire-building, reducing the extent of excessive cost stickiness induced by overspending. Consistent with this argument, Chen et al. (2012) document that stronger corporate governance at the firm level, achieved through effective monitoring and well-conceived managerial incentives, is associated with lower cost stickiness.\(^3\) Strong shareholder protection laws and regulations at the country level are likely to have a similar effect, nudging managers away from empire-building behavior, and thereby lowering the degree of cost stickiness.

**Hypothesis 2:** The degree of a firm’s cost stickiness is decreasing in the strength of its country’s shareholder protection laws and regulations.

Notably, Hypotheses 1 and 2 imply that a one-dimensional measure of the ‘quality’ of a country’s legal system would not be adequate. This is because an improvement in one element of a country’s legal environment (judicial efficiency) is expected to *increase* cost stickiness, while an improvement in the other element (shareholder protection) is expected to *decrease* cost stickiness.

---

\(^3\) Related studies by Dierynck et al. (2012) and Kama and Weiss (2013) find that when managers face strong incentives to meet an earnings target, they will cut resources aggressively when sales decrease and constrain resource expansion when sales increase, even though such aggressive cost-cutting is not necessarily in the best interests of the shareholders. We control for this effect in estimation.
Second, we consider the impact of a country’s level of development on cost stickiness. Firms in more developed countries tend to have better access to human capital (Galor and Moav 2004), and labor adjustment costs are likely to be higher when workers possess more human capital. Human capital intensive jobs tend to entail more complex tasks and skills. Therefore, a firm will have to expend more effort searching for a job candidate with the appropriate skills and will have to invest more in a worker’s firm-specific training before that worker can perform his/her job competently, both of which increase adjustment costs associated with hiring workers. Additionally, when a skilled worker is laid off, the firm loses its investment in that worker’s firm-specific training and work experience, which raises adjustment costs associated with firing workers. Therefore, firms operating in a more developed country are likely to face greater labor adjustment costs, leading to greater cost stickiness.

Hypothesis 3: The degree of a firm’s cost stickiness is increasing in the level of its country’s development.

3. Sample Selection and Empirical Models

3.1 Data

We test our hypotheses using a broad-based international sample from the Global Compustat database. Global Compustat covers a wide range of countries, including high-income developed economies and low- and medium-income emerging economies. While most of the extant

---

4 When hiring costs are higher, managers are more willing to retain slack labor resources in response to current sales decreases, because they take into account expected future hiring costs that they will have to incur in case sales rebound in near future (Banker et al. 2013a). Therefore, similar to firing costs, higher hiring costs are likely to increase cost stickiness.

5 Anderson et al. (2003) show that cost stickiness is increasing with employee intensity and asset intensity, reflecting two major inputs in the production process. Our argument highlights the role of a third type of input intensity—human capital intensity. To the best of our knowledge, our predictions regarding the impact of development on cost stickiness are entirely new to the literature.
literature has relied on US data, the use of Global Compustat data allows us to examine whether the phenomenon of sticky costs is pervasive globally and to investigate the role of country-level factors in asymmetric cost behavior. We focus on the behavior of operating costs in testing our hypotheses.

We use annual data from the Compustat Global Fundamentals database for the years 1988-2008,\(^6\) supplemented with data for US and Canadian firms from Compustat North America over the same period. We start by drawing the full sample for the 20 countries with the largest number of firm-year observations.\(^7\) We then discard invalid observations for which sales or operating costs are missing or negative for the current or prior year, and extreme observations for which the ratio of operating costs to sales is less than 0.1 or greater than 10. To correct for inflation, we deflate sales and costs using the GDP deflator for the respective currency.\(^8\) We also discard 1 percent extreme observations on each tail for continuous regression variables. The resulting sample comprises 213,937 firm-year observations in 20 countries.

To test Hypotheses 1 and 2, we merge this sample with two country-level indexes of legal environment: a measure of judicial efficiency (La Porta et al. 1998) and a measure of shareholder protection (Djankov et al. 2008). The judicial efficiency index (*JUDEFF*) assesses the “efficiency and integrity of the (country’s) legal environment as it affects businesses”, representing “investors’ assessments of conditions in the country”. We measure shareholder protection (*SHPROT*) using the composite anti-self-dealing index of Djankov et al. (2008),

---

\(^6\) For most countries in Global Compustat, data is available only starting in 1988.

\(^7\) The results are robust to inclusion of additional countries. Because we rely on country-specific estimates of cost stickiness to characterize the degree of total cross-country variation in asymmetric cost behavior, the inclusion of countries with a small number of observations would reduce the precision of these inferences.

\(^8\) For European firms reporting in Euros, we use a country-specific GDP deflator for the Euro. Most Euro zone firms switched from local currencies to the Euro in late 1990s. In computing log-changes in sales and costs during the transition year for such firms, we correct for the change in currency.
which captures the strength of various legal requirements intended to prevent corporate insiders from engaging in transactions that effectively expropriate minority shareholders. Both indexes are scaled from 0 to 1, with a higher value corresponding to greater judicial efficiency or stronger shareholder protection, respectively. We exclude Chinese firms from the sample because our sources for the judicial efficiency and shareholder protection indexes do not include values for China. Our final sample in this analysis contains 202,404 firm-year observations for 19 countries.

To test Hypothesis 3, we use the United Nations’ Human Development Index (HDI) for each country. The HDI is based on three component measures: an index for health, based on life expectancy; an index for education, based on school enrollment and adult literacy; and an index for economic well-being, based on GDP per capita. Each of the component indexes captures a distinct but important dimension of human capital. The education index reflects accumulation of human capital by way of formal schooling. The health index captures two aspects of human capital accumulation. First, greater life expectancy leads to a greater willingness to invest in human capital (Ben-Porath 1967, Murphy and Topel 2006, Jayachandran and Lleras-Muney 2009, Dorsey et al. 2012). Second, better health is associated with better educational outcomes for a given number of years of schooling, because better health is associated both with better attendance and with more efficient learning for a given level of attendance (Glewwe and Miguel 2008). Economic well-being improves access to high-quality educational resources and learning infrastructure, which is likely to add to the effects of formal education and health. The HDI figures are for 2000, the year nearest the middle of our sample for which data are available.

---

index has been scaled so that it varies from 0 to 1,\textsuperscript{10} with a higher value corresponding to a higher level of development.\textsuperscript{11} We exclude Taiwanese firms from the sample because the UN does not calculate an HDI for Taiwan. Our final sample in this analysis contains 207,432 firm-year observations for 19 countries.\textsuperscript{12}

The variable definitions are summarized in Table 1. We present the descriptive statistics for each country in Table 2. The countries in our sample are widely heterogeneous. For example, the judicial efficiency index $JUDEFF$ ranges from a low of 0.25 for Indonesia and 0.33 for Thailand to a high of 1.00 for Australia, Hong Kong, Japan, Singapore, Sweden, Switzerland, the UK and the US, on a scale from 0 to 1. The shareholder protection index $SHPROT$ ranges from 0.27 in Brazil and Switzerland to 1.00 in Singapore, on a scale from 0 to 1.\textsuperscript{13} Notably, the correlation between judicial efficiency and shareholder protection is just 0.06, insignificantly different from zero, indicating that these two indexes reflect two distinct, and largely orthogonal, dimensions of the legal system. The human development index $HDI$ ranges from a low of 0.46 for India to a high of 0.91 for Australia and the US, on a scale from 0 to 1. The correlation between $HDI$ and $JUDEFF$ is 0.71, significant at the 1 percent level, and the correlation between $HDI$ and $SHPROT$ is -0.17, insignificantly different from zero, indicating that more developed countries tend to have a more efficient judicial system but do not have stronger shareholder protection.

The average annual GDP growth over the sample period ranges from 1.5 percent for Japan and 1.7 percent for Switzerland and Germany to 7.5 percent for India and 9.8 percent for China.

\textsuperscript{10} We demean all three country-level indexes, along with continuous firm characteristics, during estimation to improve the interpretability of main coefficients in models with interaction terms involving these variables.
\textsuperscript{11} In robustness checks, we use each of the three component indexes individually, yielding similar results.
\textsuperscript{12} The results continue to hold when we conduct both analyses using a common sample that excludes both China and Taiwan. We use two separate samples (and two separate models) to maximize the sample size in each analysis.
\textsuperscript{13} Djankov et al. (2008) note that Switzerland is an unusual case—while it has highly developed capital markets, the laws and regulations that pertain to shareholder protection are “extremely friendly to insiders and hostile to outside shareholders.”
The average annual growth rate for firm-level deflated log-sales ranges from 0.008 for Malaysia to 0.126 for India. Likewise, the average proportion of year-on-year sales increases ranges from 55 percent for Indonesia and Malaysia to 73 percent for India. Managers’ expectations for future sales play a key role in sticky cost behavior (Banker et al. 2013b), so these cross-country differences in growth patterns may lead to substantial cross-country variation in cost stickiness (which differences we control for in estimation).

3.2 Empirical Models

We test Hypotheses 1 and 2 using the following model, which is based on the standard Anderson et al. (2003) stickiness model and extended to incorporate country characteristics along with an extensive set of firm-level controls:

Model A

\[
\Delta \ln C_{n,i,t} = \beta_0 + \left( \beta_1^{JUDEFF} + \beta_1^{SP \text{ SHPROT}} + \beta_1^{COMMONLAW} + \beta_1^X X_{n,i,t} \right) \Delta \ln S_{n,i,t} \\
+ \left( \beta_2^{JUDEFF} + \beta_2^{SP \text{ SHPROT}} + \beta_2^{COMMONLAW} \right) DEC_{n,i,t} \Delta \ln S_{n,i,t} + \varepsilon_{n,i,t}
\]  

where \( \Delta \ln C_{n,i,t} = \ln C_{n,i,t} - \ln C_{n,i,t-1} \) is the log-change in deflated operating costs for firm \( i \) from country \( n \) in year \( t \), \( \Delta \ln S_{n,i,t} \) is the log-change in deflated sales, \( DEC_{n,i,t} \) is a dummy variable equal to one if sales decreased in year \( t \) and zero otherwise, \( JUDEFF_n \) is the judicial efficiency index for country \( n \), \( SHPROT_n \) is the shareholder protection index for country \( n \), \( COMMONLAW_n \) is a

\(^{14}\) The correlation between \( JUDEFF \) and the human development index \( HDI \) is 0.71, which may lead to multicollinearity. Therefore, we estimate the effects of development (Hypothesis 3) using a separate model. Because the data on \( JUDEFF \) is not available for China and the data on \( HDI \) is not available for Taiwan, this approach also maximizes the sample size in each analysis. The (untabulated) results are similar when we include both measures within the same model.
dummy variable equal to one for countries with a common law tradition and zero otherwise, $X_{n,t}$ is a vector of firm-level control variables, and $\varepsilon_{n,i,t}$ is an error term. We estimate Model A for the pooled sample with clustering by firm (Rogers 1993).

We include the firm-level controls $X_{n,i,t}$ to ensure that our country-level results are not driven by differences across countries in the distribution of known firm-level determinants of cost stickiness. These controls are: asset intensity $ASINT_{n,i,t}$ (an empirical proxy for adjustment costs, following Anderson et al. 2003); dummy variables for prior period sales increases and decreases $INC_{n,i,t-1}$ and $DEC_{n,i,t-1}$ (proxies for managers’ optimism and pessimism, following Banker et al. 2013b); GDP growth $GDP_{n,t}$ (an additional proxy for managers’ expectations, following Anderson et al. 2003); dummy variables for small positive earnings and small increases in earnings $AVOIDLOSS_{n,i,t}$ and $AVOIDDEC_{n,i,t}$ (proxies for managers’ incentives to avoid losses and earnings decreases, following Kama and Weiss 2013 and Dierynck at al. 2012); and prior period free cash flow scaled by assets $FCF_{n,i,t-1}$ (a proxy for empire-building incentives, following Chen et al. 2012).

Following La Porta et al. (1997) and Banker et al. (2013a), we also include the common law dummy $COMMONLAW_n$, which is likely to be associated with greater cost stickiness given that common law countries have been shown to have legal environments more conducive to long-term resource commitments (La Porta et al. 1998).

The sum of the terms multiplying $\Delta lnS_{n,i,t}$ (i.e., $\beta_1^1 JUDEFF_n + \beta_1^{SP} SHPROT_n +$...
\( \beta_1^{CL} \text{COMMONLAW}_n + \beta_1^X X_{n,t} \) represents the percentage change in costs for a concurrent one percent increase in sales. The sum of the terms multiplying \( \text{DEC}_{n,i,t} \Delta \ln S_{n,i,t} \) (i.e., \( \beta_1^{JUDEFF} \text{JUDEFF}_n + \beta_2^{SP} \text{SHPROT}_n + \beta_2^{CL} \text{COMMONLAW}_n + \beta_2^X X_{n,i,t} \)) represents the degree of asymmetry in cost response when sales are decreasing rather than increasing.\(^{18}\) A negative value for this sum indicates that costs are sticky—they decline less during a sales decrease than they grow during an equal sales increase. Each of the coefficients in this sum indicates how a particular factor influences the degree of cost stickiness. Hypothesis 1 predicts that the coefficient \( \beta_1^I \) is negative, meaning that the degree of cost stickiness is increasing with the judicial efficiency index \( \text{JUDEFF}. \)\(^{19}\) Hypothesis 2 implies that the coefficient \( \beta_2^{SP} \) is positive, indicating that cost stickiness is decreasing with the shareholder protection index \( \text{SHPROT}. \)

We test Hypothesis 3 using the following model for the pooled sample:

**Model B**

\[
\Delta \ln C_{n,i,t} = \beta_0 + (\beta_1^{HDI} \text{HDI}_n + \beta_1^X X_{n,i,t}) \Delta \ln S_{n,i,t} + (\beta_2^{HDI} \text{HDI}_n + \beta_2^X X_{n,i,t}) \text{DEC}_{n,i,t} \Delta \ln S_{n,i,t} + \varepsilon_{n,i,t} \tag{2}
\]

where \( \text{HDI}_n \) is the Human Development Index for country \( n \), and the remainder of variables was defined previously. Hypothesis 3 predicts that \( \beta_2^{HDI} \) is negative, meaning that cost stickiness is increasing with the development index.

---

\(^{18}\) All control variables enter both the main slope for sales increases and the incremental slope for sales decreases because these variables could potentially affect both the proportion of variable costs and the degree of cost stickiness.

\(^{19}\) A negative coefficient \( \beta_2^I \) means that the incremental slope for sales decreases is becoming more negative, corresponding to increased stickiness.
4. Empirical Results

As a preliminary step in the analysis, we verify that cost stickiness is a pervasive global phenomenon and examine the extent of unexplained cross-country variation in cost stickiness that remains after controlling for known firm-level drivers of asymmetric cost behavior. We estimate the following model for the pooled sample:

\[
\Delta \ln C_{n,t} = \beta_0 + (\beta_{1n} + \beta_1^X X_{n,i,t}) \Delta \ln S_{n,i,t} + (\beta_{2n} + \beta_2^X X_{n,i,t}) DEC_{n,i,t} \Delta \ln S_{n,i,t} + \varepsilon_{n,i,t} \tag{3}
\]

where \(\beta_{1n}\) is the country-specific slope coefficient for sales increases in country \(n\), \(\beta_{2n}\) is the country-specific cost stickiness coefficient, and the remainder of terms was defined previously. The country-specific coefficients \(\beta_{2n}\) capture the combined effect of all sources of cross-country variation in cost stickiness—including legal environment and development variables—that is observed after controlling for differences in firm characteristics \(X_{n,i,t}\) across countries.

The estimates are presented in Table 3. The cost stickiness coefficient \(\beta_{2n}\) has the expected negative sign for all 20 countries in the data, and 19 of these estimates are significant at the 1 percent level (Panel A), indicating that cost stickiness is pervasive across countries.\(^{20}\) The estimates also reveal substantial cross-country variation in the degree of cost stickiness, observed after controlling for firm characteristics in each country, with \(\beta_{2n}\) ranging from -0.058 for Brazil to -0.255 for Australia.\(^{21}\)

The average degree of cost stickiness for firms in country \(n\) is equal to \(STICKY_n \equiv \beta_{2n} + \beta_2^X X_n^{-}\), where \(X_n^{-}\) denotes average firm characteristics in that country, and the estimates of \(\beta_2^X\) are

\(^{20}\) We normalize the continuous firm characteristics in \(X_{n,i,t}\) to have mean zero in the pooled sample. Therefore, the coefficient \(\beta_{2n}\) is directly interpretable as the degree of cost stickiness for a firm with average characteristics.

\(^{21}\) These results are consistent with the country-by-country estimates in Banker and Byzalov (2013). We also examine country-by-country estimates of the basic Anderson et al. (2003) model without controls for firm characteristics. Similar to our main estimates, this untabulated robustness check indicates that cost stickiness is both pervasive and highly heterogeneous across countries: all of the cost stickiness coefficients are negative, ranging from -0.049 to -0.237, and most of them are significant at the 1 percent level.
presented in panel B of Table 3. The variance of $STICKY_n$ measures the total magnitude of cross-country variation in cost stickiness. We decompose this total cross-country variation into two parts: variation explained by cross-country differences in average firm characteristics $\bar{X}_n$, and ‘unexplained’ variation captured by the country-specific coefficients $\beta_{2,n}$. We find that firm characteristics account for only 25 percent of the total cross-country variation, leaving 75 percent unexplained.\textsuperscript{22} This suggests that country-level factors identified in Hypotheses 1-3 could potentially play a major role in explaining cross-country differences in asymmetric cost behavior.

We test Hypotheses 1 and 2 using Model A. The estimation results are presented in Table 4. As expected (Hypothesis 1), the coefficient $\beta_{2,1}$ is negative and significant at the 1 percent level ($t = -4.69$), indicating that a higher level of the judicial efficiency index $JUDEFF$ is associated with a significantly greater degree of cost stickiness. The coefficient $\beta_{2,SP}^2$, on the other hand, is positive and significant at the 1 percent level ($t = 3.09$), meaning that a higher level of the shareholder protection index $SHPROT$ is associated with significantly lower cost stickiness, supporting Hypothesis 2. Notably, both results hold even after controlling for an extensive set of firm-level determinants of cost stickiness identified in prior studies which, as shown above, account for a sizable fraction (25 percent) of total cross-country differences in asymmetric cost behavior.\textsuperscript{23} As expected, the degree of cost stickiness is also significantly higher in common law countries ($COMMONLAW_n=1$) than in civil law countries.

The impact of judicial efficiency and shareholder protection on cost stickiness is highly

\textsuperscript{22} We compute the proportion of ‘unexplained’ variation as $Var(\beta_{2,n})/Var(STICKY_n)$, and interpret the remainder as explained variation, using an approach similar to the computation of regression $R^2$.

\textsuperscript{23} Further, some of the firm-level variables may be directly affected by country characteristics. For example, because high judicial efficiency increases managers’ willingness to make major resource commitments, it may increase asset intensity (which in turn would increase stickiness). Our results show that high judicial efficiency increases stickiness (and strong shareholder protection reduces stickiness) even after controlling for such indirect effects.
economically significant. For example, the impact of a one standard deviation increase in the judicial efficiency (shareholder protection) index on the degree of cost stickiness is equivalent to 56 percent (48 percent) of the total standard deviation of $STICKY_n$ across countries.\(^{24}\) Thus, differences in legal environment are a key source of cross-country differences in cost behavior.

The coefficients on all of the control variables have the expected signs. For example, we observe significant stickiness in the optimistic case following a prior period sales increase ($INC_{n,i,t-1}=1$) and significant anti-stickiness in the pessimistic case following a prior sales decrease ($DEC_{n,i,t-1}=1$), consistent with Banker et al. (2013b). The degree of cost stickiness is increasing significantly with asset intensity ($ASINT_{n,i,t}$) and GDP growth ($GDP_{n,t}$), in agreement with Anderson et al. (2003). Cost stickiness is significantly lower when managers face strong incentives to avoid losses and earnings decreases ($AVOIDLOSS_{n,i,t}=1$ and $AVOIDDEC_{n,i,t}=1$, respectively), as predicted by Kama and Weiss (2013) and Dierynck et al. (2012). The degree of cost stickiness is also increasing significantly with lagged free cash flows ($FCF_{n,i,t-1}$), consistent with the empire-building argument of Chen et al. (2012).

We test Hypothesis 3 using Model B. The estimation results are presented in Table 5. The coefficient $\beta_2^{HDI}$ is negative and significant at the 1 percent level, indicating that the degree of cost stickiness of a firm is increasing with the Human Development Index of the country the firm is operating in, consistent with Hypothesis 3. This finding holds even after controlling for the firm-level determinants of cost stickiness, many of which may be affected by the development level. In untabulated robustness checks, we obtain similar results when we control for legal environment variables, and when any single component of the HDI is substituted in its place in

\(^{24}\) In this comparison, we measure total cross-country variation in cost stickiness using the standard deviation (rather than variance), because the standard computation of the marginal effect of a regression variable yields units of measurement that are compatible with the standard deviation (but are incompatible with variance).
Model B. The coefficients on all of the control variables have the expected signs.

The impact of the country-level development index is highly economically significant. For example, the impact of a one standard deviation increase in this index on the degree of cost stickiness is equivalent to 78 percent of the total standard deviation of $STICKY_n$ across countries. Notably, this effect is larger in magnitude than the effect of changes in judicial efficiency and shareholder protection. Thus, although differences in development across countries have drawn less attention in international accounting research than differences in countries’ institutions, our results pinpoint the development level as one of the primary drivers of international differences in cost behavior.

When we combine all of the country characteristics within a single model, the proportion of unexplained cross-country variation in cost stickiness is 37 percent, considerably less than the 75 percent of variation that remained unexplained after controlling for firm characteristics alone in equation (3). In other words, our country-level variables contribute more to explaining cross-country variation than do all of the firm-level factors from prior studies, and these variables reduce unexplained variation almost by half. These results demonstrate that recognizing the impact of country-level characteristics is essential for gaining insights into cross-country differences in asymmetric cost behavior (which, by extension, also have implications for forecasting and understanding earnings behavior).

We conduct several additional robustness checks (untabulated). To address recent claims that

---

25 In another, less direct, illustration of the economic significance of our country-level variables, we regress the estimates of the ‘unexplained’ component of cross-country variation in cost stickiness, $\beta_{2,n}$, from equation (3), on our set of country characteristics. This regression yields an $R^2$ of 64 percent, confirming that these variables account for a large fraction of the total cross-country variation that is not explained by the known firm-level factors.
the log-log specification of Anderson et al. (2003) may lead to distorted estimates,\textsuperscript{26} we repeat the analysis using a linear specification in which the change in costs $\Delta C_{n,i,t}$ on the left hand side and the change in sales $\Delta S_{n,i,t}$ on the right hand side are scaled by lagged sales $S_{n,i,t-1}$. The results in this robustness check support all of our main findings. In particular, the estimates for the linear version of equation (3) confirm that cost stickiness is both pervasive globally (19 out of 20 country-specific cost stickiness coefficients are negative, and only 3 of those are insignificant) and highly heterogeneous across countries (the degree of cost stickiness ranges from 0.006 to 0.172). The estimates for the linear version of Model A confirm that the degree of cost stickiness is increasing with the judicial efficiency index ($\beta_2^J = -0.165, t = -3.82$) and decreasing with the shareholder protection index ($\beta_2^{SP} = 0.160, t = 2.62$), while the results for the linear version of Model B corroborate our findings that the degree of cost stickiness is increasing with the development index ($\beta_2^{HDI} = -0.353, t = -5.17$), lending further support to Hypotheses 1-3. The results are also similar when we use the percentage change specification of the same models. In a further robustness check, we estimate Models A and B after adding controls for IFRS adoption, which is relevant for many of the countries in our sample and which may be correlated with the country-level characteristics that we focus on. Additionally, we re-estimate Models A and B using only data through 2004 to avoid the effects of both IFRS adoption and the onset of the financial crisis in 2007-2008. In all cases, these robustness checks yield results that are similar to our main findings.

The estimates for the linear specification above allow us to directly illustrate the impact of

\textsuperscript{26} Recent working papers by Anderson and Lanen and by Balakrishnan, Labro and Soderstrom claim to show that the standard cost stickiness model may lead to spurious findings. Banker et al. (2011) demonstrate that these claims are based on econometric errors and are severely flawed both theoretically and empirically, and show that after correcting these flaws, the estimates lend strong and robust support to the standard framework of sticky costs, refuting these contrary claims.
asymmetric cost behavior and country characteristics on earnings behavior. Because earnings = sales – costs, the relevant coefficients for earnings in the linear model can be computed directly from the coefficients for costs.\textsuperscript{27} In the linear version of equation (3), the average estimate of the country-specific slope for sales increases $\beta_{1,n}$ is 0.852, and the average estimate of the country-specific cost stickiness coefficient $\beta_{2,n}$ is -0.095. These figures imply that operating income rises by 14.8 cents (=1-0.852) for a one dollar increase in sales but falls by 24.3 cents (=1-0.852+0.095) for a one dollar decrease in sales. In other words, because of the asymmetry in cost behavior, earnings are on average 64 percent ($=24.3/14.8-1$) more sensitive to sales decreases than to sales increases.\textsuperscript{28}

The (untabulated) estimates for the linear versions of Models A and B reveal that country characteristics have a large impact on this asymmetry in earnings behavior. For example, a one standard deviation increase in the judicial efficiency (shareholder protection) index increases (reduces) the degree of asymmetry for earnings by 41 percent (42 percent) of its average magnitude, and a one standard deviation increase in the development index raises the degree of asymmetry by 52 percent of its average magnitude. Thus, each of the three country characteristics we focus on is essential for understanding international differences in earnings behavior.

\textsuperscript{27} For example, the linear version of equation (3), $\frac{\Delta C_{n,t}}{s_{n,t-1}} = \beta_0 + (\beta_{1,n} + \beta_1^X X_{n,t}) \frac{\Delta S_{n,t}}{s_{n,t-1}} + (\beta_{2,n} + \beta_2^X X_{n,t}) DEC_{n,t} \frac{\Delta S_{n,t}}{s_{n,t-1}}$, implies that the change in earnings $\Delta E_{n,t} \equiv \Delta S_{n,t} - \Delta C_{n,t}$ follows $\frac{\Delta E_{n,t}}{s_{n,t-1}} = -\beta_0 + (1 - \beta_{1,n} - \beta_1^X X_{n,t}) \frac{\Delta S_{n,t}}{s_{n,t-1}} + (-\beta_{2,n} - \beta_2^X X_{n,t}) DEC_{n,t} \frac{\Delta S_{n,t}}{s_{n,t-1}}$.

The derivations for Models A and B are similar. Because we demean the continuous variables in $X_{n,t}$, the coefficients $\beta_{1,n}, \beta_{2,n}$ correspond to the relevant slopes for an average firm in the pooled sample.

\textsuperscript{28} Because earnings represent a relatively small gap between sales and costs, the relative asymmetry in earnings behavior is amplified relative to that in cost behavior.
5. Conclusion

In this paper, we developed new predictions regarding the impact of country-level characteristics on firm-level asymmetric cost behavior. We predicted that a country’s legal environment affects cost stickiness in two ways. First, because managers in a country with a well-functioning legal system are more willing to make long-term resource commitments, the degree of firms’ cost stickiness should increase in the judicial efficiency of the country in which they operate. Second, because strong shareholder protection laws and regulations restrict managers’ ability to engage in wasteful empire-building behavior, the degree of cost stickiness should be lower in countries with strong shareholder protection. We further predicted that, because economic development is associated with greater human capital intensity, firms in more developed countries face higher labor adjustment costs and, therefore, should exhibit a greater degree of cost stickiness.

We tested these predictions using a broad-based international sample from Global Compustat, including both developed and developing economies. Our preliminary analysis demonstrated that while cost stickiness is pervasive globally, there is considerable variation in the degree of cost stickiness across countries. Further, cross-country differences in the distribution of known firm-level determinants of asymmetric cost behavior explain only 25 percent of this total variation. This suggests that country-level factors, which have not been examined in prior research, are likely to be key to understanding international differences in cost behavior. Additionally, due to the relationship between costs and earnings, gaining insight into the causes of cross-country differences in cost behavior can contribute to better understanding of international differences in the properties of both realized earnings and analysts’ earnings forecasts.
In our main analysis, we examined the impact of country characteristics on firm-level cost behavior after controlling for the firm-level factors that are known to affect cost stickiness. We found strong support for all three of our hypotheses, indicating that both the legal environment and the level of development play a central role in asymmetric cost behavior. Further, these country-level variables are highly economically significant in explaining the sizable cross-country variation in the degree of asymmetry in cost and earnings behavior that remains after controlling for differences in firm characteristics.

The evidence on sticky cost behavior from US firms has provided new insights into financial accounting issues such as conservatism (Banker et al. 2012), earnings management (Dierynck et al. 2012; Kama and Weiss 2013) and analysts’ earnings forecasts (Weiss 2010). Similarly, our evidence on sticky cost behavior in a global context is likely to contribute to further research on key issues in international accounting, including studies of the impact of IFRS adoption on earnings behavior and research on the drivers of cross-country differences in earnings quality.29

---

29 Variation in the degree of stickiness can affect standard empirical proxies for some of the fundamental properties of earnings, including measures of earnings smoothing, skewness of the earnings distribution, correlation between earnings and accruals, and asymmetric timeliness of earnings. Banker et al. (2012) show that because many of the drivers of conditional conservatism also affect cost stickiness, and both phenomena manifest themselves as asymmetry in earnings, the prevalence of sticky costs leads to substantial biases in conservatism research. Similarly, because many of the country- and firm-level determinants of earnings quality likely affect (or are correlated with the drivers of) cost stickiness, variation in cost stickiness can be mistaken for variation in financial reporting quality. Therefore, recognizing the likely effects of cost stickiness is essential both for avoiding potentially important empirical biases and for generating new insights in research on the properties of earnings.
References


Table 1. Variable definitions

\( \Delta \ln C_{n,i,t} \) – log-change in deflated operating costs of firm \( i \) from country \( n \) in year \( t \). Operating costs are computed as sales less operating income (Compustat mnemonics SALE–OIADP).

\( \Delta \ln S_{n,i,t} \) – log-change in deflated sales (mnemonic SALE) of firm \( i \) from country \( n \) in year \( t \).

**Control variables** \( X_{n,i,t} \) (known economic determinants of the degree of cost stickiness):

- \( DEC_{n,i,t} \) – dummy variable equal to 1 if deflated sales of firm \( i \) decreased in year \( t \), zero otherwise.

- \( INC_{n,i,t} \) – dummy variable equal to 1 if deflated sales of firm \( i \) increased in year \( t \), zero otherwise.

- \( ASINT_{n,i,t} \) – asset intensity of firm \( i \) in year \( t \), computed as the log-ratio of total assets to sales (\( \ln(\text{AT}/\text{SALE}) \)).

- \( GDP_{n,t} \) – GDP growth in country \( n \) in year \( t \).

- \( AVOIDLOSS_{n,i,t} \) – a dummy variable equal to 1 if the ratio of net income of firm \( i \) in year \( t \) to its market value at the end of year \( t-1 \) is between 0 and 0.01, zero otherwise.

- \( AVOIDDEC_{n,i,t} \) – a dummy variable equal to 1 if the ratio of the change in net income of firm \( i \) in year \( t \) to its market value at the end of year \( t-1 \) is between 0 and 0.01, zero otherwise.

- \( FCF_{n,i,t} \) – free cash flows of firm \( i \) in year \( t \), computed as cash flows from operating activities (OANCF) less common and preferred dividends (DVC and DVP, respectively), scaled by lagged total assets (AT).

**Country characteristics:**

- \( JUDEFF_n \) – an index of judicial efficiency in country \( n \) from La Porta et al. (1998), with a higher value indicating a more efficient judicial system.

- \( SHPROT_n \) – an index of the strength of the laws and regulations pertaining to shareholders’ rights in country \( n \) (the anti-self-dealing index from Djankov et al. 2008), with a higher value indicating stronger shareholder protection.

- \( COMMONLAW_n \) – a dummy variable equal to 1 if country \( n \) has a common law tradition, zero otherwise.

- \( HDI_n \) – an index of the level of development in country \( n \) from the United Nations Human Development Index (HDI), with a higher value indicating a higher level of development.
Table 2. Descriptive statistics

<table>
<thead>
<tr>
<th>Country</th>
<th>Judicial efficiency index</th>
<th>Shareholder protection index</th>
<th>Human development index</th>
<th>Average log-change in sales $\Delta lnS$</th>
<th>Average log-change in costs $\Delta lnC$</th>
<th>Proportion of sales increases $INC$</th>
<th>Average GDP growth $GDP$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.000</td>
<td>0.757</td>
<td>0.914</td>
<td>0.081</td>
<td>0.079</td>
<td>0.642</td>
<td>3.4%</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.575</td>
<td>0.274</td>
<td>0.669</td>
<td>0.037</td>
<td>0.033</td>
<td>0.609</td>
<td>3.1%</td>
</tr>
<tr>
<td>Canada</td>
<td>0.925</td>
<td>0.642</td>
<td>0.887</td>
<td>0.084</td>
<td>0.086</td>
<td>0.652</td>
<td>2.8%</td>
</tr>
<tr>
<td>China</td>
<td>–</td>
<td>–</td>
<td>0.590</td>
<td>0.100</td>
<td>0.119</td>
<td>0.695</td>
<td>9.8%</td>
</tr>
<tr>
<td>France</td>
<td>0.800</td>
<td>0.379</td>
<td>0.853</td>
<td>0.058</td>
<td>0.058</td>
<td>0.650</td>
<td>2.0%</td>
</tr>
<tr>
<td>Germany</td>
<td>0.900</td>
<td>0.282</td>
<td>0.870</td>
<td>0.053</td>
<td>0.053</td>
<td>0.634</td>
<td>1.7%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>1.000</td>
<td>0.963</td>
<td>0.815</td>
<td>0.083</td>
<td>0.093</td>
<td>0.672</td>
<td>4.4%</td>
</tr>
<tr>
<td>India</td>
<td>0.800</td>
<td>0.579</td>
<td>0.463</td>
<td>0.126</td>
<td>0.129</td>
<td>0.731</td>
<td>7.5%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.250</td>
<td>0.653</td>
<td>0.540</td>
<td>0.019</td>
<td>0.029</td>
<td>0.551</td>
<td>3.9%</td>
</tr>
<tr>
<td>Japan</td>
<td>1.000</td>
<td>0.499</td>
<td>0.878</td>
<td>0.037</td>
<td>0.041</td>
<td>0.667</td>
<td>1.5%</td>
</tr>
<tr>
<td>Korea</td>
<td>0.600</td>
<td>0.469</td>
<td>0.839</td>
<td>0.063</td>
<td>0.068</td>
<td>0.674</td>
<td>4.6%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.900</td>
<td>0.950</td>
<td>0.712</td>
<td>0.008</td>
<td>0.022</td>
<td>0.549</td>
<td>5.3%</td>
</tr>
<tr>
<td>Singapore</td>
<td>1.000</td>
<td>1.000</td>
<td>0.826</td>
<td>0.062</td>
<td>0.072</td>
<td>0.629</td>
<td>5.9%</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.600</td>
<td>0.813</td>
<td>0.622</td>
<td>0.065</td>
<td>0.063</td>
<td>0.687</td>
<td>3.5%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.000</td>
<td>0.333</td>
<td>0.903</td>
<td>0.081</td>
<td>0.076</td>
<td>0.667</td>
<td>2.6%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1.000</td>
<td>0.267</td>
<td>0.882</td>
<td>0.047</td>
<td>0.048</td>
<td>0.643</td>
<td>1.7%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>0.675</td>
<td>0.565</td>
<td>–</td>
<td>0.092</td>
<td>0.102</td>
<td>0.697</td>
<td>4.0%</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.325</td>
<td>0.813</td>
<td>0.625</td>
<td>0.040</td>
<td>0.046</td>
<td>0.610</td>
<td>4.0%</td>
</tr>
<tr>
<td>UK</td>
<td>1.000</td>
<td>0.950</td>
<td>0.841</td>
<td>0.064</td>
<td>0.065</td>
<td>0.649</td>
<td>2.5%</td>
</tr>
<tr>
<td>US</td>
<td>1.000</td>
<td>0.654</td>
<td>0.907</td>
<td>0.064</td>
<td>0.068</td>
<td>0.641</td>
<td>2.9%</td>
</tr>
</tbody>
</table>
Table 3. Estimates of total cross-country variation in cost stickiness

The estimation equation is

$$\Delta \ln C_{n,t} = \beta_0 + (\beta_{1,n} + \beta_{1} X_{n,t}) \Delta \ln S_{n,t} + (\beta_{2,n} + \beta_{2} X_{n,t}) DEC_{n,t} \Delta \ln S_{n,t} + \epsilon_{n,t}$$

where $\Delta \ln C_{n,t}$ is the log-change in deflated operating costs, $\Delta \ln S_{n,t}$ is the log-change in deflated sales, $DEC_{n,t}$ is the sales decrease dummy, and $X_{n,t}$ are the control variables. The variable definitions are provided in Table 1. For brevity, we do not report the country-specific slopes $\beta_{1,n}$.

Panel A: Country-specific cost stickiness coefficients $\beta_{2,n}$

<table>
<thead>
<tr>
<th>Country</th>
<th>$\beta_{2,n}$</th>
<th>Country</th>
<th>$\beta_{2,n}$</th>
<th>Country</th>
<th>$\beta_{2,n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>-0.255***</td>
<td>Germany</td>
<td>-0.213***</td>
<td>Korea</td>
<td>-0.191***</td>
</tr>
<tr>
<td></td>
<td>(-9.57)</td>
<td></td>
<td>(-6.81)</td>
<td></td>
<td>(-8.44)</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.058</td>
<td>Hong Kong</td>
<td>-0.202***</td>
<td>Malaysia</td>
<td>-0.163***</td>
</tr>
<tr>
<td></td>
<td>(-1.03)</td>
<td></td>
<td>(-8.00)</td>
<td></td>
<td>(-7.77)</td>
</tr>
<tr>
<td>Canada</td>
<td>-0.205***</td>
<td>India</td>
<td>-0.109***</td>
<td>South Africa</td>
<td>-0.183***</td>
</tr>
<tr>
<td></td>
<td>(-9.92)</td>
<td></td>
<td>(-5.46)</td>
<td></td>
<td>(-3.79)</td>
</tr>
<tr>
<td>China</td>
<td>-0.219***</td>
<td>Indonesia</td>
<td>-0.162***</td>
<td>Singapore</td>
<td>-0.216***</td>
</tr>
<tr>
<td></td>
<td>(-9.17)</td>
<td></td>
<td>(-5.49)</td>
<td></td>
<td>(-8.56)</td>
</tr>
<tr>
<td>France</td>
<td>-0.188***</td>
<td>Japan</td>
<td>-0.242***</td>
<td>Sweden</td>
<td>-0.188***</td>
</tr>
<tr>
<td></td>
<td>(-7.73)</td>
<td></td>
<td>(-16.25)</td>
<td></td>
<td>(-5.15)</td>
</tr>
</tbody>
</table>

The values in parentheses are the $t$-statistics with clustering by firm.

Panel B: Coefficients on firm characteristics

<table>
<thead>
<tr>
<th></th>
<th>Exp. sign</th>
<th>Estimate</th>
<th>$t$-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td></td>
<td>0.006***</td>
<td>15.07</td>
</tr>
<tr>
<td>Interactions with $\Delta \ln S_{n,t}$ ($\beta_{1}$):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$DEC_{n,t-1}$</td>
<td>-0.198***</td>
<td>-31.96</td>
<td></td>
</tr>
<tr>
<td>$GDP_{n,t}$</td>
<td>0.004***</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>$ASINT_{n,t}$</td>
<td>-0.047***</td>
<td>-13.55</td>
<td></td>
</tr>
<tr>
<td>$AVOIDLOSS_{n,t}$</td>
<td>0.014</td>
<td>1.12</td>
<td></td>
</tr>
<tr>
<td>$AVOIDDEC_{n,t}$</td>
<td>0.076***</td>
<td>12.82</td>
<td></td>
</tr>
<tr>
<td>$FCF_{n,t-1}$</td>
<td>0.383***</td>
<td>30.97</td>
<td></td>
</tr>
<tr>
<td>Interactions with $DEC_{n,t-1} \Delta \ln S_{n,t}$ ($\beta_{2}$):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$DEC_{n,t-1}$</td>
<td>+</td>
<td>0.338***</td>
<td>33.95</td>
</tr>
<tr>
<td>$GDP_{n,t}$</td>
<td>-</td>
<td>-0.004*</td>
<td>-1.74</td>
</tr>
<tr>
<td>$ASINT_{n,t}$</td>
<td>-</td>
<td>-0.135***</td>
<td>-24.49</td>
</tr>
<tr>
<td>$AVOIDLOSS_{n,t}$</td>
<td>+</td>
<td>0.089***</td>
<td>4.27</td>
</tr>
<tr>
<td>$AVOIDDEC_{n,t}$</td>
<td>+</td>
<td>0.141***</td>
<td>5.44</td>
</tr>
<tr>
<td>$FCF_{n,t-1}$</td>
<td>-</td>
<td>-0.217***</td>
<td>-8.33</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td></td>
<td>0.7211</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>213,937</td>
<td></td>
</tr>
</tbody>
</table>

*, **, *** indicate significance at 10%, 5% and 1%, respectively. The $t$-statistics are clustered by firm. We omit the prior sales increase dummy $INC_{n,t-1}$ because its effect is absorbed by the slope coefficients $\beta_{1,n}, \beta_{2,n}$. 
The estimation equation is Model A

\[ \Delta \ln C_{n,i,t} = \beta_0 + (\beta_1 JUDEFF_n + \beta_2 SHPROT_n + \beta_3 COMMONLAW_n + \beta_4 X_{n,i,t}) \Delta \ln S_{n,i,t} + (\beta_5 JUDEFF_n + \beta_6 SHPROT_n + \beta_7 COMMONLAW_n + \beta_8 X_{n,i,t}) DEC_{n,i,t} \Delta \ln S_{n,i,t} + \epsilon_{n,i,t} \]

where \( \Delta \ln C_{n,i,t} \) is the log-change in deflated operating costs, \( \Delta \ln S_{n,i,t} \) is the log-change in deflated sales, \( DEC_{n,i,t} \) is the sales decrease dummy, \( JUDEFF_n \) is the judicial efficiency index, \( SHPROT_n \) is the shareholder protection index, \( COMMONLAW_n \) is the common law dummy, and \( X_{n,i,t} \) are the control variables. The variable definitions are provided in Table 1.

<table>
<thead>
<tr>
<th>Exp. sign</th>
<th>Estimate</th>
<th>( t )-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.006***</td>
<td>14.45</td>
</tr>
<tr>
<td>Interactions with ( \Delta \ln S_{n,i,t} ) (( \beta_1 )):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( JUDEFF_n )</td>
<td>-0.050***</td>
<td>-2.88</td>
</tr>
<tr>
<td>( SHPROT_n )</td>
<td>0.070***</td>
<td>3.78</td>
</tr>
<tr>
<td>( COMMONLAW_n )</td>
<td>-0.063***</td>
<td>-8.43</td>
</tr>
<tr>
<td>( INC_{n,i,t-1} )</td>
<td>0.949***</td>
<td>147.89</td>
</tr>
<tr>
<td>( DEC_{n,i,t-1} )</td>
<td>0.745***</td>
<td>88.23</td>
</tr>
<tr>
<td>( GDP_{n,t} )</td>
<td>0.010***</td>
<td>9.50</td>
</tr>
<tr>
<td>( ASINT_{n,i,t} )</td>
<td>-0.045***</td>
<td>-14.41</td>
</tr>
<tr>
<td>( AVOIDLOSS_{n,i,t} )</td>
<td>0.021</td>
<td>1.58</td>
</tr>
<tr>
<td>( AVOIDDECC_{n,i,t} )</td>
<td>0.076***</td>
<td>12.12</td>
</tr>
<tr>
<td>( FCF_{n,i,t-1} )</td>
<td>0.393***</td>
<td>31.31</td>
</tr>
<tr>
<td>Interactions with ( DEC_{n,i,t} ) ( \Delta \ln S_{n,i,t} ) (( \beta_2 )):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( JUDEFF_n (\beta_2^1) )</td>
<td>(-0.132***)</td>
<td>(-4.69)</td>
</tr>
<tr>
<td>( SHPROT_n (\beta_2^{SP}) )</td>
<td>(0.109***)</td>
<td>(3.09)</td>
</tr>
<tr>
<td>( COMMONLAW_n )</td>
<td>(-0.041***)</td>
<td>(-2.83)</td>
</tr>
<tr>
<td>( INC_{n,i,t-1} )</td>
<td>(-0.193***)</td>
<td>(-14.42)</td>
</tr>
<tr>
<td>( DEC_{n,i,t-1} )</td>
<td>0.159***</td>
<td>11.08</td>
</tr>
<tr>
<td>( GDP_{n,t} )</td>
<td>(-0.006***)</td>
<td>(-3.15)</td>
</tr>
<tr>
<td>( ASINT_{n,i,t} )</td>
<td>(-0.129***)</td>
<td>(-22.86)</td>
</tr>
<tr>
<td>( AVOIDLOSS_{n,i,t} )</td>
<td>0.050**</td>
<td>2.23</td>
</tr>
<tr>
<td>( AVOIDDECC_{n,i,t} )</td>
<td>0.132***</td>
<td>4.64</td>
</tr>
<tr>
<td>( FCF_{n,i,t-1} )</td>
<td>(-0.214***)</td>
<td>(-8.14)</td>
</tr>
</tbody>
</table>

Adjusted \( R^2 \) | 0.7185 |
N | 202,404 |

*, **, *** indicate significance at 10%, 5% and 1%, respectively. The \( t \)-statistics are clustered by firm. Because we lack legal environment indexes for China, observations for Chinese firms were excluded from the sample.
Table 5. Estimates of the relationship between development and cost stickiness

The estimation equation is Model B

$$\Delta \ln C_{n,i,t} = \beta_0 + (\beta_1^{\text{HDI}} \text{HDI}_n + \beta_1^X X_{n,i,t}) \Delta \ln S_{n,i,t} + (\beta_2^{\text{HDI}} \text{HDI}_n + \beta_2^X X_{n,i,t}) \text{DEC}_{n,i,t} \Delta \ln S_{n,i,t} + \varepsilon_{n,i,t}$$

where $\Delta \ln C_{n,i,t}$ is the log-change in deflated operating costs, $\Delta \ln S_{n,i,t}$ is the log-change in deflated sales, $\text{DEC}_{n,i,t}$ is the sales decrease dummy, $\text{HDI}_n$ is the human development index, and $X_{n,i,t}$ are the control variables. The variable definitions are provided in Table 1.

<table>
<thead>
<tr>
<th>Exp. sign</th>
<th>Estimate</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.006***</td>
<td>15.02</td>
</tr>
</tbody>
</table>
| Interactions with $\Delta \ln S_{n,i,t}$ ($\beta_1$):
  - $\text{HDI}_n$ | -0.226*** | -10.53      |
  - $\text{INC}_{n,i,t}$ | 0.899*** | 326.67      |
  - $\text{DEC}_{n,i,t}$ | 0.697*** | 109.49      |
  - $\text{GDP}_{n,t}$ | 0.005*** | 4.29        |
  - $\text{ASINT}_{n,i,t}$ | -0.044*** | -14.12      |
  - $\text{AVOIDLOSS}_{n,i,t}$ | 0.015 | 1.14        |
  - $\text{AVOIDDEC}_{n,i,t}$ | 0.077*** | 12.89       |
  - $\text{FCF}_{n,i,t}$ | 0.397*** | 31.74       |
| Interactions with $\text{DEC}_{n,i,t} \Delta \ln S_{n,i,t}$ ($\beta_2$):
  - $\text{HDI}_n$ ($\beta_2^{\text{HDI}}$) | -0.317*** | -7.53       |
  - $\text{INC}_{n,i,t}$ | -0.222*** | -32.01      |
  - $\text{DEC}_{n,i,t}$ | 0.120*** | 14.07       |
  - $\text{GDP}_{n,t}$ | -0.008*** | -4.59       |
  - $\text{ASINT}_{n,i,t}$ | -0.136*** | -24.61      |
  - $\text{AVOIDLOSS}_{n,i,t}$ | 0.091*** | 4.31        |
  - $\text{AVOIDDEC}_{n,i,t}$ | 0.142*** | 5.33        |
  - $\text{FCF}_{n,i,t}$ | -0.218*** | -8.29       |

Adjusted R$^2$ 0.7156

N 207,432

*, **, *** indicate significance at 10%, 5% and 1%, respectively. The t-statistics are clustered by firm. Because we lack the development index for Taiwan, observations for Taiwanese firms were excluded from the sample.