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Distorted Cost Allocation: An Encouragement or Discouragement?*

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ABSTRACT

Firms allocate divisions overhead costs, to provide information for management decisions (information perspective) and create incentives

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to control costs (motivation perspective). They occasionally distort (over- or under-allocate) cost, so that the allocated cost is deviated from the optimal level for which divisions are expected to be accountable (hereafter, cost distortion). We study the impact of cost distortion on divisional performance and firm performance. We find that both over- and under-allocation discourage divisional managers from improving their subsequent performance and that cost distortion negatively affects the overall firm performance. Our findings suggest that for motivation and decision-facilitating purpose, it is desirable that overhead costs are allocated at an anticipated level.

Keywords: Cost allocation, cost distortion, divisional incentives, accurate cost drivers

1. INTRODUCTION

Most top management teams allocate corporate cost (or common cost) to divisions to purvey information for management decisions and motivate divisional managers to be well-aligned with the organization goals (Fremgen and Liao 1981; Merchant and Shields 1993; Rajan 1992; Wagenhofer 1996). According to IFRS Discussion report on December 9, 2014, corporate costs can be divided into two categories: costs to provide identifiable services to the entity's cash-generating units, (e.g., centralized functions such as information technology that the entity's cash-generating units utilize to operate) and stewardship costs (e.g, board of directors' costs, public company costs, senior officer salaries, etc.). From an information perspective, firms need to deliver cost information that induces divisions to make better management decisions such as pricing of products or services. The allocation also serves as a communication device to inform managers of how their actions affect costs across the organization (McWatters and Zimmerman 2015). For example, if a firm allocates its overhead cost related to human resource department in headquarter to divisions based on the number of divisional employees, headquarter can deliver divisions a signal and affect their decisions in hiring and firing employees. From a motivation perspective, a cost allocation serves as a monitoring tool (McWatters and Zimmerman 2015). With appropriate allocations, headquarters can effectively monitor divisional actions and divisions can focus on their own operations expecting that they are charged

only what they are accountable for.

Common costs are supposed to be allocated based on the drivers that trigger them. In other words, divisions anticipate that they would share costs which they are responsible for. However, firms frequently allocate common costs deviating from the anticipated level that can be explained by the economic factors. Such cost distortion can occur due to either the usage of irrelevant cost allocation bases (i.e., imprecise cost allocation) or subjective ex post adjustments (i.e., discretionary cost allocation). Depending on the reasons behind cost distortion, its consequence could be positive or negative. In this study, we study how the cost distortion influences divisional performance and overall firm's performance.

The literature suggests two implications on cost distortion in the opposite ways. On one hand, intentional cost distortion could induce optimal actions of divisions (Hiromoto 1988; Merchant and Shields 1993; Wagenhofer 1996). From an information perspective, cost distortion could deliver information that leads to a desirable behavior which a firm anticipates from its divisions. Further, different weighting of bases or new allocation bases can be imposed on divisions to reflect the relevant changes in business environment and such discretionary adjustments can induce adaptive behaviors (Bol 2008). From a motivation perspective, if the cost distortion takes place as the cost spreads evenly across divisions, it could generate harmony among workforces, because equitable treatment can smooth out divisional compensation and increase morale and coordination among workers (Lazear 1989). Moreover, if the discretionary adjustment in cost allocations mitigate prior misallocation based on incomplete financial cost drivers, (Bol 2008, Baker, Gibbons, and Murphy 1994) which often reflect uncontrollable events and cannot capture every dimension of a divisional performance, divisional managers would perceive the allocation mechanism based on the subjectivity as fair and justifiable (Holmström and Milgrom 1991). Further, the discretionary adjustment in cost allocation could prevent divisions from "gaming" the allocation system. Employees often have a good understanding of actions that could decrease the allocated costs. Volitional cost distortion can be used to rule out such divisional manipulation.

On the other hand, the cost distortion might disincentivize managers. From an information perspective, an imprecise cost allocation might lead to suboptimal decisions. For instance,

if volume-based drivers are used as allocation bases, then segments would have incentives to reduce the volume level, even if maintaining the level economically benefits the firm. Second, cost distortion characterized either by flexibility or subjectivity would give divisions a perception that the allocation system is opportunistic, arbitrary, and unreliable, which can decrease the information value of the system. From a motivation perspective, if cost allocation is arbitrary, the manager's performance measures will be affected, and the individuals will feel upset (McWatters and Zimmerman 2015) and deem the system as unfair, which can lead to a discouragement at the segment level and a decline in corporate performance. Moreover, in a zero-sum game setting, if a firm over (under) allocates cost to divisions, freeriders may benefit from cost allocation schemes without paying the fair amount. Swaray (2012) suggests that such freeriding behavior tends to dispirit coworkers in a way that overall team performance gets worse. Specifically, overallocated teams would be discontented with bearing greater negative externality than expected, would deem the allocation system as unfair and would not strengthen activities that the firm desires to reinforce.

Our sample consists of 19,654 segment-year observations between 2009 and 2017 employing compustat firm and segment database. First, we study the determinants of segment cost. Our analysis indicates that individual segment costs are commensurate with segment revenue and size. At the firm level, total segment costs are associated with the firm size, the corporate-level costs, the number of segments, and the existence of "corporation/other" segment. We also find the evidence that segment costs are sticky: i.e., segment costs increase more in response to increasing divisional sales activity than they decrease in response to decreasing sales activity.

Next, we predict individual annual segment cost based on its determinants and use the difference between the actual and predicted value of segment cost (i.e., residual) as a proxy for the degree of cost distortion. We find that the cost distortion decreases divisional manager's efforts, in terms of lower ROA, profit margin, and asset turnover, suggesting that distortion indeed discourages managers to exert efforts in the subsequent period. Interestingly, both over- and under-allocation demotivate managers, with over-allocation causing greater deterioration in performances. Further, the cost distortion adversely affects firm's subsequent performances, implying that distortion effect is suboptimal and non-trivial from the

whole organization perspective.

This paper contributes to the literature in two ways. First, our paper contributes to literature on cost behavior (Banker and Byzalov 2014; Banker et al. 2014; Weiss 2010). Previous studies primarily focus on firm-level cost behavior. In this article, we aim to empirically study the determinants of segment-level cost and attempt to estimate the abnormal component in the allocated cost, which is unobservable and has been underexplored in the literature.

Second, our study sheds light on the important role of cost allocation as an incentive mechanism. Theories exist on the incentive mechanisms of cost allocation system (Schmeidler and Tauman 1994; Wagenhofer 1996; Wei 2004; Rogerson 1992), but the literature lacks empirical evidence. Building on this stream of literature, we find that cost distortion discourages divisional and firm performance, suggesting that allocation is desirable at the anticipated level.

The remainder of this paper is organized as follows. In section 2, we discuss the related literature and develop our hypotheses. In section 3, we describe the sample, variables and models used to test the hypotheses. In section 4, we report and discuss the findings. In section 5, we summarize and provide implications of our study.

2. RESEARCH BACKGROUND AND HYPOTHESES

In this section, we construct our hypotheses building on the literature's findings on cost allocation. First, we present what factors the firm consider in properly allocating common costs to its division. Next, we discuss why managers often distort cost allocation intentionally. Prior studies suggest that firms may need to divert from usual cost allocation rules in order to promote fairness or supplement incomplete cost drivers. In other words, because of tensions between accuracy, fairness in cost allocation, and the uncontrollability by environmental uncertainty, firms turn to subjective allocation which naturally results in cost distortion. To understand the implication of such intentional cost distortion, this study develops a set of hypotheses of whether such intentional cost distortion is indeed optimal and improves firm performance.

2.1. The Determinants of Cost Allocation

We identify factors for divisional cost allocation related to volume-related segment characteristics and the firm's organizational structure. Prior studies suggest that overhead costs are driven by volume-related cost drivers of division such as value of total assets, and sales revenue (Foster and Gupta 1990; Banker and Johnston 1993; Anderson, Banker, and Janakiraman 2003). First, an increase in divisional sales revenue can be explained by advertisements, marketing campaigns, and administrative staff's efforts at headquarters. Segments should take the cost burden that they have generated by raising their own revenue. Second, we conjecture that overhead costs are driven by the previous sales revenue. Cress and Pettijohn (1985)'s survey documents that 50 percent of manufacturers use an expected actual standard, 42 percent an average previous performance, and 8 percent an ideal standard. The previous sales revenue could be used as an allocation base or as a proxy for sales target, which is a common cost allocation base in business practices. Third, an increase in assets could lead to an increase in an allocation amount. For example, if a firm acquires new machines, expenses such as utility expense, building rent, depreciation on office equipment, or property taxes could be incurred. Thus, it is rational for divisions to pay for the negative externality they create by increasing the volume of assets.

Also, the determinants of cost allocation may be related to organizational structure of the firm. Ramadan (1989) argues that the decision to allocate service costs is related to organizational variables (i.e., degree of interdependence and decentralization, costs of monitoring divisional manager's performance and the number of divisions). Lamont (1997), Shin and Stulz (1998) and Rajan, Servaes, and Zingales (2000) document that a resource allocation in diversified firms appears different from that in focused firms. Moreover, the number of segments can either increase or decrease the likelihood of cost allocation. On one hand, divisions will bear less cost burden with an increase in the number of segments because common resources would be shared across a greater number of segments from a principal-agent perspective. On the other hand, divisions could be charged greater common costs because the larger number of segments makes the headquarters increase its

administrative jobs. For example, if there are a large number of segments in a firm, the headquarters should monitor divisional managers' action in detail because each division has greater chance to hide their actions in forms of pursuing their private interests or free-riding on the other divisions' outcomes. Additionally, we posit that divisional interdependence and cost allocation practices are positively correlated. Zimmerman (2010) mentions that cost allocations are in reality transfer pricing. In decentralized setting, firms will flexibly allocate resources by using transfer pricing as well as cost allocation. Ramadan (1989) documents that cost allocations are more likely to exist in companies with a high degree of interdependence between divisions. We also assume that an increase in firm's overhead cost leads to increase in segment's overhead costs. Most firms allocate their common costs to divisions for information facilitating and control purposes (Fremgen and Liao 1981; Rajan 1992; Merchant and Shields 1993; Wagenhofer 1996). For example, Joye and Blayney's survey (1990) find that 80% of firms allocated costs to divisions. In addition, a survey by Fremgen and Liao (1981) show that 84 % of firms allocated at least part of their indirect costs to their profit centers. Therefore, the size of the common cost is one of the most crucial determinants of cost allocation. Moreover, we incorporate firm leverage and firm asset, because of the suggestion that activity-based costing (ABC) firms sustain a significantly higher leverage profile and larger net-total assets than non-ABC firms (Kennedy and Affleck-Graves 2001). Finally, we assume that firms that use "corporate/other" segments are inclined to allocate costs more to such segments, while they allocate less to other core segments. Lail, Thomas, and Winterbotham (2014) find that managements using "corporate/other" segments tend to mask the true performance of operating (or core) segments by allocating firm-wide expenses to such segments instead of allocating to core segments.

2.2. The Reasons to Distort Costs

The cost distortion exists when the allocated cost is deviated from the optimal level. Divisions would expect that the common costs are allocated based on the variables that trigger such costs. Cost can be distorted with or without manager intentions. On one hand, a firm might unintentionally diverge from "true" allocation drivers

as a result of cognitive limitations (Bailey, Hecht, and Towry 2011; Bol 2008). This might be due to a management's fixation on the traditional costing approach. Al-Omiri and Drury (2007) report that 35 percent of UK organizations still adopt the traditional costing method while only 29 percent adopt activity-based costing (ABC) system. Second, firms might find it challenging to identify suitable cost drivers that represent both high accuracy and sensitivity. There might be a time lag between the actual cost incurrence and the firm's awareness of it.

On the other hand, firms might intentionally distort cost. Discretionary allocation can be classified into ex ante (or predetermined) and ex post allocation. First, firms might distort cost ex ante. Firms may spread costs based on a simple cost driver such as sales revenue of divisions (also known as peanut butter costing). Firms would expect that such system is perceived as fair by workers, because costs are evenly distributed to divisions according to the ability to bear the cost. Some firms would implement such system because the measurement and information gathering cost of ABC system is too high (Banker and Potter 1993). In this case, the key objective of allocation system is fairness, simplicity, and consistency (McWatters and Zimmerman 2015). Secondly, managements might use subjectivity ex post to mitigate the incompleteness of explicit cost allocation bases. Cost distortion as a result of ex post flexible adjustment can induce adaptive divisional actions (Bol 2008). In a volatile management environment and based on firm's new preferences, different weighting of bases or new allocation bases can be imposed on divisions in order to reflect changes in business environment. Moreover, firms might distort costs in order to limit the divisional misuse of allocation system. If divisions are aware that a certain action would decrease the level of allocated amount, they can use the information to "game" the system (Courty and Marschke 2004, Gibbs et al. 2004). In this case, the cost distortion based on subjectivity can play a role in restraining divisions from making perverse decisions. In this sense, the cost distortion could be perceived as a proper allocation scheme based on the combination of objective cost drivers and subjectivity. Third, the management responsible for the cost allocation might favor (disfavor) certain divisional managers. Such favoritism (animosity) will lead to cost under- (over-) allocation.

2.3. The Impact of Cost Distortion on Divisional and Firm Performance

We study the effect of cost distortion on segment and firm performance from two different standpoints. From an information perspective, one of the main issues of cost allocation has been to determine the optimal level of accuracy. Accuracy encompasses two measurement characteristics: precision and freedom from bias (Merchant and Shields 1993). Prior studies measure accuracy in terms of the number of allocation bases incorporated in the costing system. Hence, ABC (traditional costing system) has been regarded as more (less) accurate allocation system.

The advocates of ABC claim that it can better control and manage overhead costs and criticized traditional costing system for causing firms to fail in a competitive market (Stapleton et al. 2004). The underlying causes for the inadequacy of conventional cost systems include the dramatic evolution of cost structure, the declining importance of direct labor as a dominant cost driver, and the complexity of firms' product lines (Terzioglu 2016). However, an ABC system also has its limitations. Accuracy requires high information gathering costs and additional allocation bases can be subject to high measurement errors (Demskwe and Feltham 1976; Banker and Potter 1993). As an alternative, several firms use fewer cost allocation bases at the expense of allocation accuracy. They use an aggregated, simplistic method to assign overhead costs. For instance, in terms of product cost allocation, Merchant and Shields (1993) argue that firms deliberately use less accurate system to overstate costs to prevent price shaving by sales personnel, while some other firms understate costs to encourage improvement in production methods or to stimulate consumptions.

Our research differs from prior literature in that we define inaccuracy in a broader scope. It not only implies an incompleteness due to fixation on an aggregated costing method but also a bias triggered by subjectivity. The subjectivity here includes, but without limitations, the usage of subjective measures, emotional bias on divisional managers, flexible ex post adjustments of the weighting and ex post adoption of new allocation bases.

From this perspective, the cost distortion could induce either optimal or suboptimal decisions of divisional managers. On one hand, it could deliver timely and relevant information, and

could facilitate managers to make better economic decisions. An imprecise cost allocation could induce a desirable divisional behavior. For example, Hiromoto (1988) reports that a Japanese electronics company employs labor costs as an allocation base instead of using more accurate bases. Such allocation decision is to encourage investment in modern production technologies. Second, a discretionary cost allocation can allow divisions to readily adapt to a volatile management environment. In such an environment, firms can set new priorities and can impose different weighting of allocation bases or employ new allocation bases.

On the other hand, the cost distortion could lead to suboptimal behaviors. An imprecise cost allocation would deliver inaccurate information and mislead the management decisions (Bol 2008). For example, if a cost allocation is based on volume-based drivers such as sales or production, divisions would make myopic decisions to merely focus on the volume reduction by sacrificing the firm value and would misperceive that their decisions are optimal. Second, a discretionary cost allocation would give divisions a perception that their allocation system is highly opportunistic and arbitrary. The management's favoritism (animosity) on a certain divisional manager might induce cost under (over) allocation of the division. Such bias could reduce the effectiveness of cost allocation system and could lower the productivity of employees (Baker, Jensen and Murphy 1988).

From a motivation point of view, the cost distortion could motivate or demotivate divisions. On one hand, an imprecise cost allocation can increase morale and harmony among workers. If costs are allocated based on a peanut butter costing, bonus would be smoothed out across divisions and the unfairness perception among employees would diminish. Lazear (1989) mentions that firms desire to treat workers in a similar manner to preserve worker unity, to maintain good spirit and to create a cooperative and harmonic work environment. Second, a discretionary cost allocation can mitigate the imperfect allocation based on objective cost drivers. If divisions are aware that objective cost drivers often reflect uncontrollable events and cannot capture every dimension of divisional performance, they would perceive the allocation mechanism based on the subjectivity as fair and justifiable (Holmström and Milgrom 1991). Third, a discretionary cost distortion could prevent divisions from "gaming" the system (Bol 2008). Employees often have a good understanding

of which actions could decrease their allocated portion. Providing workers with less accurate information would prevent them from manipulating the system. It can deter divisions from taking distorted actions based on their knowledge of the system.

On the other hand, imprecise allocation can demotivate divisions. First, based on the agency model, a cost allocation is one method of paying for the externality that each division has created (Zimmerman 2010). For example, when branch managers hire an additional salesperson, they are imposing a negative externality on the firm (i.e., more human resources and legal services). However, if managers bear greater negative externality than expected, they would be discouraged to hire a new person even if the overall economic benefits exceed the costs of hiring. Second, a behavioral approach-based research argues that when divisional performances are conditioned in the responsibility accounting through allocation procedures, over time, divisions "learn" that performance measures that drive costs influence financial environments. Divisions would strengthen activities that a firm reinforces. However, if a firm allocates costs arbitrarily and provides a distorted signal, divisions will not strengthen desired activities that would positively affect firm's financial performances. Moreover, Bromwich and Walker (1998) state that divisional managers should act as an owner by bearing a certain level of uncontrollable costs. However, if managers lose controllability because of the bias in costing system, they would be disincentivized to make responsible decisions to effectively control and reduce costs. Third, from a fairness perspective, cost allocation is not merely an incentive mechanism that influences individual divisional behaviors, but it is an unbiased observer which takes into account interdivisional comparisons of utility (Choudhury 1990). In a firm where managerial incentives are dependent upon divisional profits, the cost allocation serves as an income redistributor among divisions. In this regard, managers expect "fair" cost allocation in order to receive equitable managerial compensation. However, if the cost is allocated against a fairness perspective, overallocated divisions, in particular, would suspect that they are unjustifiably bearing heavy burden. Moreover, the cost allocation system would lose its reliability of being a fair income distributor among segments.

H1a: Cost distortion does not have impact on managerial efforts of divisions.

H1b: Cost distortion does not have impact on firms' subsequent performance.

For the segments that are overallocated, the discouragement effect would be greater. First, from an information perspective, the inaccuracy of firm's cost allocation behaviors will give a wrong signal to divisions. In making economic decisions, the cost allocation would be one of the least criteria to consider, since managers would not be able to expect the accurate level of cost that would be allocated to their divisions. Second, from a motivation perspective, if an allocation becomes unpredictable and uncontrollable, it is less likely to be used as a powerful incentive tool for divisions. Also, if divisional compensation is based on the income after cost allocation, divisions that are overallocated might feel 'unfair'. Several papers (Fleurbaey 1994; Chevaleyre, Endriss, and Maudet 2017) discuss the problem of fair resource allocation and claim that resources must be allocated in a compensatory way. However, if costs are allocated in a way that undermines the reliability of compensation system, then segments will have less motivation to work efficiently, since they cannot obtain the anticipated payoff from a certain performance.

For segments that are under-allocated, the motivation effect would be greater. From an information perspective, under-allocated divisions would make better economic decisions. For example, if a division is under-allocated, it could more flexibly shave the price of its products and increase sales. From a motivation perspective, segments might deem an under-allocation as a "fair" treatment, because their allocation might have been based upon subjective evaluations as well as objective measurements. Several paper have documented that subjectivity can complement the incompleteness of objective allocation bases (Murphy and Oyer 2003; Gibbs et al. Bushman, Indjejikian and Smith 1996). Thus, the fairness of the system would motivate divisions to enhance the value of a firm.

H2: If segments are over (under) allocated, they are discouraged (encouraged) to improve their performance.

3. RESEARCH DESIGN

3.1. Sample

We start our sample selection by using Compustat-segment between 2009 and 2017. Segments are comprised of business, geographic, operating, and state segments and each firm chooses different types of classification. In our sample, most firms classify their segments based on either business or geographic area. We eliminate observations that are related to non-operating activities. For example, we eliminate all the divisions that are classified as 'eliminations', and 'corporate'. There are segments with negative sales revenue. Negative revenue may be due to intersegment elimination, which are revenues generated from sales to other business or geographic segments within a firm. These revenues are eliminated from firm's consolidated sales, since segments that are named as 'Eliminations' or 'Corporate' usually take the corresponding negative value of sales revenue. However, certain segments that have negative sales are named differently. Hence, we additionally delete segments that have negative divisional revenue. We obtain financial statement data from Compustat and restrict our sample to non-financial firms (excluding SIC code from 6000 to 6999). All continuous variables are winsorized at the top and bottom 1 percentiles. Our final sample consists of 19,654 segment-year observations. Table 1 panel A shows a sample selection process. Panel B displays a breakdown of firms and segments by year and panel C demonstrates a breakdown of firms and segments by one-digit firm industry. Manufacturing industry accounts for approximately 50 percent of overall industries.

Table 2 panel A (B) provides descriptive statistics (Pearson correlation) for the main variables used in the regression analyses. We provide statistics for the key segment and firm level financial variables in raw and logarithm form.

3.2. Model

We first examine the determinants of cost allocation. First, following Anderson, Banker, and Janakiraman (2003), we include changes in the sales revenue, and the value of assets as imperfect,

Table 1. Sample Composition

Panel A: Sample Selection Process

		Firm-segment-year	Firm-year
Compustat firm-year, and Compustat-segment segment-year observations (2009–2017)		217,611	58,100
(Less) Single-segment or Inter-segment or elimination segment	(26,231)	191,380	38,857
(Less) Missing financial variables in segment-year	(98,539)	92,841	32,582
(Less) Segment-year observations with segment revenue identical to firm revenue.	(23,261)	69,580	19,550
(Less) Financial industries	(9,266)	60,314	16,951
(Less) Missing variables in the regression	(40,660)	19,654	7,480

Panel B: Sample Composition by year

Year	Firm-segment-year	Firm-year
2009	402	189
2010	896	360
2011	2,414	922
2012	2,659	1,010
2013	2,680	1,014
2014	2,688	1,033
2015	2,715	1,042
2016	2,576	959
2017	2,624	951
Total	19,654	7,480

Panel C: Sample Composition by industry

1-digit SIC	Description	Firm-segment-year	Firm-year
0	Agriculture, forestry, and fisheries	104	51
1	Mineral and construction	1,977	730
2	Manufacturing	3,881	1,428
3	Manufacturing	5,911	2,218
4	Transportation, communications, utilities	3,535	1,259
5	Whole trade and retail trade	1,777	762
7	Service industries	1,558	656
8	Service industries	730	327
9	Public administration	181	49
Total		19,654	7,480

Table 2. Descriptive Statistics

Panel A: Descriptive Statistics

Variable	N	Mean	Std. Dev.	p25	Median	p75
ΔSegment cost	19,654	0.072	0.429	-0.046	0.038	0.135
Log(Segment cost)	19,654	6.039	2.055	4.747	6.153	7.449
Segment cost (M$)	19,654	2236.004	5199.273	115.200	470.296	1719.000
ΔSegment revenue	19,654	0.073	0.376	-0.047	0.039	0.137
Log(Segment revenue)	19,654	6.131	2.132	4.858	6.282	7.603
Segment revenue (M$)	19,654	2540.356	5824.115	128.714	534.876	2005.00
ΔSegment asset	19,654	0.055	0.338	-0.052	0.024	0.118
Log(Segment asset)	19,654	6.301	2.151	4.959	6.413	7.790
Segment asset (M$)	19,654	3338.262	7832.966	142.513	609.54	2416.318
ΔFirm cost	19,654	0.043	0.184	-0.033	0.038	0.115
Log(Firm cost)	19,654	7.575	1.926	6.446	7.665	8.895
Firm cost (M$)	19,654	8947.410	19650.860	629.909	2132.918	7297.049
ΔFirm asset	19,654	0.049	0.180	-0.031	0.034	0.101
Log(Firm asset)	19,654	7.932	2.057	6.695	7.995	9.308
Firm asset (M$)	19,654	15248.010	34620.540	808.449	2967.200	11024.000
Firm leverage	19,654	0.284	0.203	0.142	0.268	0.393
Segment subsidy	19,654	0.007	0.039	0.000	0.000	0.000
# of segments	19,654	6.915	3.417	5.000	6.000	8.000
Corporation/Other segment	19,654	0.023	0.148	0.000	0.000	0.000
Firm Herfindahl	19,654	0.202	0.256	0.041	0.077	0.258
Segment Herfindahl	19,654	0.104	0.173	0.014	0.033	0.110
Firm R&D	19,654	0.014	0.029	0.000	0.000	0.015
Segment R&D	19,654	0.002	0.012	0.000	0.000	0.000
Segment ROA	19,654	0.109	0.224	0.034	0.095	0.180
Segment profit margin	19,654	-0.033	1.311	0.035	0.100	0.181
Segment asset turnover	19,654	1.334	1.219	0.529	1.021	1.741
Cost distortion	19,654	0.112	0.176	0.022	0.057	0.126
Over-allocation	19,654	0.052	0.119	0.000	0.000	0.055
Under-allocation	19,654	-0.058	0.131	-0.059	0.000	0.000
Over-allocation_ alternative	19,654	0.044	0.111	0.000	0.000	0.040

Table 2. (continued)

Variable	N	Mean	Std. Dev.	p25	Median	p75
Under-allocation_ alternative	19,654	-0.049	0.104	-0.054	-0.005	0.000
Over-allocation_raw	19,654	0.093	0.250	0.000	0.001	0.075
Under-allocation_raw	19,654	-0.065	0.153	-0.064	0.000	0.000
Firm ROA	7,480	0.025	0.098	0.005	0.038	0.074
Firm profit margin	7,480	0.012	0.213	0.005	0.044	0.088
Firm asset turnover	7,480	1.020	0.692	0.528	0.857	1.328
Firm distortion1	7,480	0.007	0.019	0.000	0.001	0.004
Firm distortion2	7,480	0.018	0.050	0.000	0.002	0.010

Panel B: Pearson Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Δ*Segment cost*	1.00								
(2) Δ*Segment revenue*	0.76*	1.00							
(3) Δ*Segment asset*	0.38*	0.41*	1.00						
(4) Δ*Firm cost*	0.38*	0.39*	0.23*	1.00					
(5) Δ*Firm asset*	0.20*	0.24*	0.42*	0.47*	1.00				
(6) *Firm leverage*	-0.01	-0.01	-0.02*	-0.02*	-0.02*	1.00			
(7) *# of segments*	-0.02*	-0.03*	-0.02*	-0.04*	-0.03*	-0.05*	1.00		
(8) *Segment subsidy*	0.01	0.00	-0.01*	0.00	-0.01	0.01	-0.09*	1.00	
(9) *Corportion/Other segment*	0.00	0.02*	-0.00	0.00	-0.00	0.02*	-0.01	0.01	1.00

* shows significance at the .05 level

yet observable cost drivers (*ΔSegment revenue, ΔSegment asset)*. Further, we include the interaction variable between change in segment revenue and a dummy variable, which equals one if segment revenue decreases, to capture asymmetric cost behavior (*ΔSegment revenue*DEC*). Moreover, we include organizational factors that are related to cost allocation. We include the change in firm's cost (*ΔFirm cost*), in order to examine whether headquarters have a propensity to allocate common costs to divisions rather than bear all costs by themselves (Horngren, Datar, and Rajan 2011). We also include firm leverage and firm asset (*ΔFirm asset, ΔFirm leverage*), based on the inference that ABC firms are more inclined

to have greater financial leverage and asset (Kennedy and Affleck-Graves 2001). We include the measure of diversification, based on the suggestion that resource allocation in diversified firms is different from that of focused firms (# *of segments*). (Lamont 1997; Shin and Stulz 1998; Rajan, Servaes, and Zingales 2000). Also diversification is suggested to be one of the leading factors for the ABC adoption (Anderson 1995; Innes and Mitchell 1995). We also include the measure of subsidy through internal transfers (*Segment subsidy*), which are interchangeably used with cost allocation in decentralized firms (Zimmerman 2010). Thus, following Billett and Mauer (2003), we compute the measure of subsidy as maximum value of capital expenditure minus after-tax cash flows and zero. If the segment's after-tax cash flow is less than the capital expenditures, this difference indicates the component of segment capital expenditures subsidized by the firm's internal capital market. Finally, we include the indicator variable that equals one if a segment is named "Corporation" or "Other(s)" (*Corporation/Other segment*). We use the following OLS regression model.

$$\begin{aligned} \Delta\text{Segment Cost} = {} & \beta_0 + \beta_{1*}\Delta\text{Segment revenue} \\ & + \beta_{2*}\Delta\text{Segment revenue*DEC} + \beta_{3*}\Delta\text{Segment asset} \\ & + \beta_{4*}\Delta\text{Firm cost} + \beta_{5*}\Delta\text{Firm asset} + \beta_6\text{*Firm leverage} \\ & + \beta_7\text{*\# of segments} + \beta_8\text{*Segment subsidy} \\ & + \beta_9\text{*Corporation/Other segment} \\ & + \text{Fixed Effects} + \eta_{i,j,t} \end{aligned} \tag{1}$$

Inferred from Jone's framework (1991) on discretionary earnings, we predict that the fitted value derived from the determinant model represents the optimum divisional cost change after considering determinants that drive change in cost allocation and residual represents the proxy for cost distortion, the bias deviated from the optimal amount.

For hypothesis 1a and 2, we take the residuals and test the association between divisional performance and cost distortion (over and under-allocation) using the following specifications:

$$\begin{aligned} \text{Segment performance}_{i,j,t+1} = {} & \beta_0 + \beta_{1*}\text{Cost distortion} + \text{Controls} \\ & + \text{Fixed Effects} + \eta_{i,j,t+1} \end{aligned} \tag{2}$$

$$\begin{aligned} \text{Segment performance}_{i,j,t+1} = {} & \beta_0 + \beta_1\text{*Over-allocation} \\ & + \beta_2\text{*Under-allocation} + \text{Controls} \end{aligned}$$

$$+ \textit{Fixed Effects} + \eta_{i,j,t+1}, \quad (3)$$

where *Segment performance* is a placeholder for segment ROA, profit margin (ROS) and asset turnover (SOA). Cost distortion is the absolute value of previously calculated residuals, and over (under) allocation is the positive (negative) value of residuals. We note that over (under) allocation is expressed in a raw value, instead of using an absolute form.

For hypothesis 1b, we use the following regression model.

$$\textit{Firm performance}_{i,t+1} = \beta_0 + \beta_1 * \textit{Firm Distortion1 (or 2)} + \textit{Controls} + \textit{Fixed Effects} + \eta_{i,t+1}, \quad (4)$$

where *Firm performance* is a placeholder for firm ROA, profit margin (ROS) and asset turnover (SOA). Firm distortion1 (2) is calculated as the squared sum of cost distortion (the sum of squared cost distortion) scaled by the number of segments within firm-year observations. This measure proxies for the extent to which a firm misallocates costs to divisions from the optimal amount.

Following Russo and Fouts (1997) and Capon, Farley, and Hoenig (1990), we include several firm-level and segment-level controls. We include firm (segment) asset, which is a logarithm of firm (segment) identifiable total assets, firm (segment) R&D intensity, which is firm (segment) R&D expenses scaled by firm (segment) prior sales revenue, and firm (segment) Herfindahl index based on a SIC two-digit firm (segment) main industry.

4. RESULTS

Table 3 provides the result for the determinant model. The result shows that segment cost increases with segment revenue, asset, and the number of segments. Cost is also sticky at the segment level, evidenced by the negative coefficient on *ΔSegment revenue*DEC*. Cost decreases with the firm size and the existence of corporate/ other segments. The adjusted R-square of 60 percent implies high explanatory power of variables over the divisional cost incurrence.

Table 4 panel A provides the result for the effect of cost distortion on segment performance. The coefficients on ROA, ROS, SOA contribution remain significant and negative, supporting the discouragement effect explanation. Panel B provides the results

Table 3: Determinants of Divisional Cost

Dependent variable =	Δ *Segment Cost*$_t$
Δ *Segment revenue*$_t$	0.842*** (0.000)
Δ *Segment revenue*$_t$ * *DEC*$_t$	-0.218*** (0.000)
Δ *Segment asset*	0.125*** (0.000)
Δ *Firm cost*$_t$	0.284*** (0.000)
Δ *Firm asset*$_t$	-0.137*** (0.000)
Firm leverage$_t$	-0.013 (0.139)
# of segments$_t$	0.001** (0.041)
Segment subsidy$_t$	0.03f8 (0.653)
Corporation/Other segment$_t$	-0.047** (0.034)
Fixed Effects	Industry, Year
No. of observations	19,654
adjusted R^2	0.602

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively, using two-tailed tests.

for the impact of cost over (under) allocation, which examine whether both lower- and higher-than-predicted cost allocation are associated with poorer ROA, profit margin, and asset turnover in the subsequent year. The coefficients on over-allocation for each performance indicator are negative, while the coefficients on under-allocation are positive, suggesting that discouragement effect is explained by both over and under-allocation. There can be potential mechanical relationship between over(under) allocation and performance variables. To alleviate the concern, we use one-year-ahead performance as our dependent variable. Moreover, the positive relationship between *Under-allocation* and performances are counter to the expectation that there can be a

Table 4. The Impact of Cost Distortion on Segment Performance
Panel A: The Impact of Cost Distortion on Segment Performance

	(1)	(2)	(3)
Dependent variable =	*Segment ROA*$_{t+1}$	*Segment profit margin*$_{t+1}$	*Segment asset turnover*$_{t+1}$
Cost distortion$_t$	-0.171*** (0.000)	-1.281*** (0.000)	-0.891*** (0.000)
# of segments$_t$	-0.017 (0.344)	-0.406*** (0.009)	0.060 (0.563)
Firm asset$_t$	0.001 (0.328)	0.010*** (0.005)	-0.014* (0.081)
Segment asset$_t$	0.009** (0.051)	-0.058*** (0.000)	0.226*** (0.000)
Firm Herfindahl$_t$	-0.001 (0.814)	0.067*** (0.000)	-0.346*** (0.000)
Segment Herfindahl$_t$	0.032 (0.142)	0.571*** (0.001)	0.083 (0.499)
Firm R&D$_t$	-0.709*** (0.001)	-2.216*** (0.007)	0.082 (0.905)
Segment R&D$_t$	-0.557 (0.119)	0.855 (0.550)	-1.695* (0.083)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	19,654	19,654	19,654
adjusted R^2	0.064	0.048	0.278

mechanical correlation. Moving forward, we find an asymmetric effect on divisional performance between over-allocation and under-allocation. As shown in columns (1) and (2) in panel B, the absolute value of coefficients for over-allocation is significantly higher than under-allocation, suggesting that discouragement effect induced by over-allocation outweighs the effect induced by under-allocation.

Does cost distortion also affect firm-wide performance? If a cost distortion merely discourages segments and its effect is trivial for the firm, the corporate executives may have low incentives to pay attention to distorted allocation system. However, the results in table 5 indicate that the impact of cost distortion on firm level performance is non-trivial. *Firm distortion1* in column (1) presents the squared sum of cost distortion scaled by the number of

Table 4. (continued)
Panel B: The Impact of Cost Over(Under) Allocation on Segment Performance

	(1)	(2)	(3)
Dependent variable =	*Segment ROA*$_{t+1}$	*Segment profit margin*$_{t+1}$	*Segment asset turnover*$_{t+1}$
Over-allocation$_t$	-0.227*** (0.000)	-1.587*** (0.000)	-1.057*** (0.000)
Under-allocation$_t$	0.157*** (0.000)	1.134*** (0.000)	0.981*** (0.000)
# of segments$_t$	-0.017 (0.341)	-0.406*** (0.009)	0.059 (0.573)
Firm asset$_t$	0.001 (0.335)	0.010*** (0.005)	-0.014* (0.077)
Segment asset$_t$	0.009** (0.053)	-0.060*** (0.000)	0.226*** (0.000)
Firm Herfindahl$_t$	-0.001 (0.817)	0.068*** (0.000)	-0.347*** (0.000)
Segment Herfindahl$_t$	0.031 (0.146)	0.571*** (0.001)	0.084 (0.496)
Firm R&D$_t$	-0.711*** (0.001)	-2.240*** (0.007)	0.092 (0.894)
Segment R&D$_t$	-0.544 (0.125)	0.951 (0.503)	-1.677* (0.084)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	19,654	19,654	19,654
adjusted R^2	0.065	0.046	0.278
F-statistics (p-value)			
|*Over-allocation*| = |*Under-allocation*|	4.71 (0.030)	3.30 (0.069)	0.58 (0.446)

***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

segments within firm year. Consistent with table 4, panel A in table 5 show that the coefficients on the degree of distortion are negative and statistically significant. Using an alternative firm distortion measure *Firm distortion2* which captures the sum of squared cost distortion scaled by the number of segments within firm year, we

Table 5. The Impact of Cost Distortion on Firm Performance

Panel A: The Impact of Cost Distortion on Firm Performance

	(1)	(2)	(3)
Dependent variable =	*Firm* ROA_{t+1}	*Firm profit* $margin_{t+1}$	*Firm asset* $turnover_{t+1}$
Firm distortion1$_t$	-0.322*** (0.000)	-0.580*** (0.000)	-1.307*** (0.000)
# of segments$_t$	0.022*** (0.000)	0.036*** (0.000)	0.100*** (0.000)
Firm asset$_t$	0.015*** (0.000)	0.026*** (0.000)	-0.073*** (0.000)
Firm Herfindahl$_t$	-0.361*** (0.000)	-0.749*** (0.000)	-0.777*** (0.000)
Firm R&D$_t$	-0.077*** (0.000)	-0.109*** (0.000)	-0.250*** (0.000)
Firm leverage$_t$	-0.000 (0.476)	0.001 (0.127)	0.003 (0.158)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	7,480	7,480	7,480
adjusted R^2	0.161	0.149	0.444

Panel B: The Impact of Cost Over(Under) Allocation on Firm Performance

	(1)	(2)	(3)
Dependent variable =	*Firm* ROA_{t+1}	*Firm profit* $margin_{t+1}$	*Firm asset* $turnover_{t+1}$
Firm distortion2$_t$	-0.120*** (0.000)	-0.234*** (0.000)	-0.516*** (0.000)
# of segments$_t$	0.022*** (0.000)	0.036*** (0.000)	0.099*** (0.000)
Firm asset$_t$	0.015*** (0.000)	0.026*** (0.000)	-0.073*** (0.000)
Firm Herfindahl$_t$	-0.362*** (0.000)	-0.750*** (0.000)	-0.779*** (0.000)
Firm R&D$_t$	-0.077*** (0.000)	-0.109*** (0.000)	-0.250*** (0.000)
Firm leverage$_t$	-0.000 (0.686)	0.002* (0.076)	0.004* (0.103)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	7,480	7,480	7,480
adjusted R^2	0.161	0.149	0.444

***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 6. Alternative Specification
Panel A: Determinants of Divisional Cost

Dependent variable =	Δ*Segment Cost* – Δ*Firm Cost*
Δ*Segment revenue* – Δ*Firm revenue*$_t$	0.706*** (0.000)
Δ*Segment asset* – Δ*Firm asset*$_t$	-0.098*** (0.000)
# of segments$_t$	-0.006 (0.440)
Segment subsidy$_t$	-0.000 (0.820)
Corporation/Other segment$_t$	0.082 (0.148)
Firm leverage$_t$	-0.028 (0.128)
Fixed Effects	Industry, Year
No. of observations	19,654
adjusted R^2	0.595

find similar results in panel B. Since the distortion leads to segment discouragement, it will adversely affect firm's overall performance.

As robustness tests, we use two alternative distortion measures. First, distortion measure is based on residuals from alternative cost determinant model, as shown in table 6 panel A. All the independent, dependent segment-level change variables are subtracted by firm-level change variables. Panel B displays the results using the alternative measure and we find the results that are consistent with our main results. Second, instead of relying on the determinant model, we use raw distortion measure. We use positive (negative) value of the difference between Δ*Segment cost* and Δ*Firm cost* to indicate over (under) allocation. Panel C reports the results. While the signs of coefficients are consistent with our main findings, the magnitude of coefficients is greater for *Negative (ΔSegment cost– ΔFirm cost)* than *Positive (ΔSegment cost– ΔFirm cost)*. This may be driven by the fact that raw measure of costs includes not only allocated amount but also costs driven by segment financial and operating activities. Costs other than allocated portion may be causing such asymmetry in the magnitude of coefficients.

Table 6. (continued)
Panel B: The Impact of Cost Over (Under) Allocation on Segment's Performance using Alternative Specification

	(1)	(2)	(3)
Dependent variable =	*Segment ROA*$_{t+1}$	*Segment profit margin*$_{t+1}$	*Segment asset turnover*$_{t+1}$
Over-allocation_alternative	-0.242*** (0.000)	-1.860*** (0.000)	-1.353*** (0.000)
Under-allocation_alternative	0.210*** (0.000)	1.622*** (0.000)	1.465*** (0.000)
# of segments$_t$	-0.018 (0.315)	-0.415*** (0.008)	0.052 (0.611)
Firm asset$_t$	0.001 (0.301)	0.011*** (0.003)	-0.014* (0.078)
Segment asset$_t$	0.010** (0.029)	-0.050*** (0.001)	0.235*** (0.000)
Firm Herfindahl$_t$	-0.002 (0.646)	0.058*** (0.000)	-0.356*** (0.000)
Segment Herfindahl$_t$	0.034 (0.118)	0.587*** (0.001)	0.095 (0.433)
Firm R&D$_t$	-0.719*** (0.001)	-2.287*** (0.006)	0.066 (0.922)
Segment R&D$_t$	-0.573 (0.108)	0.721 (0.612)	-1.860** (0.053)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	19,654	19,654	19,654
adjusted R^2	0.065	0.051	0.284

5. CONCLUSION

We study the impact of cost distortion on divisional performance and firm performance and find both over- and under-allocations discourage divisional managers to improve their subsequent performance and that cost distortion negatively affects the overall firm performance. Our paper studies the determinants of divisional costs following previous theories and introduces a new measure of

Table 6. (continued)
Panel C: The Impact of Cost Over (Under) Allocation on Segment's Performance using Raw Change in Segment Cost minus the Change in Firm Cost

	(1)	(2)	(3)
Dependent variable =	*Segment ROA*$_{t+1}$	*Segment profit margin*$_{t+1}$	*Segment asset turnover*$_{t+1}$
Positive (ΔSegment cost – ΔFirm cost)	-0.081*** (0.000)	-0.376*** (0.000)	-0.506*** (0.000)
Negative (ΔSegment cost– ΔFirm cost)	0.114*** (0.000)	0.513*** (0.000)	0.953*** (0.000)
# of segments$_t$	-0.019 (0.273)	-0.416*** (0.008)	0.038 (0.713)
Firm asset$_t$	0.001 (0.254)	0.012*** (0.002)	-0.013* (0.097)
Segment asset$_t$	0.010** (0.021)	-0.056*** (0.000)	0.244*** (0.000)
Firm Herfindahl$_t$	-0.002 (0.581)	0.069*** (0.000)	-0.365*** (0.000)
Segment Herfindahl$_t$	0.038* (0.077)	0.612*** (0.000)	0.127 (0.295)
Firm R&D$_t$	-0.749*** (0.001)	-2.488*** (0.004)	-0.120 (0.862)
Segment R&D$_t$	-0.540 (0.138)	1.012 (0.496)	-1.663* (0.095)
Fixed Effects	Industry, Year	Industry, Year	Industry, Year
No. of observations	19,654	19,654	19,654
adjusted R^2	0.059	0.028	0.282

cost distortion. We include relevant cost drivers and organizational factors that can affect cost allocation decisions and focus on the less-studied area in cost accounting, which is the performance effects of cost distortion. While prior theoretical papers deem cost allocation as an incentive mechanism, few empirical papers have touched upon the impact. We find that cost distortion, particularly over-allocation, leads to a segment discouragement. Moreover, cost distortion negatively affects the firm performance. Our findings suggest that for motivation and segment decision facilitating

purpose, it is desirable that overhead costs are allocated at an anticipated level. Future research can explore how to capture the ex post and ex ante cost distortion and whether there is a mechanism to resolve the cost distortion in subsequent periods (e.g., incentive scheme free from possibly unequitable cost allocation).

Our study has several limitations. First, we cannot differentiate firms that allocate common costs from those that do not. Fremgen and Liao (1981), however, report that around 80 percent of firms allocate costs. Moreover, Merchant and Manzoni (1989) report that SG&A is allocated to segments for seven out of twelve firms. Additionally, the segment cost variable we employ includes both operating cost and the allocated amount and we cannot include unobservable or other relevant cost drivers, such as machine hours or level of production, due to the lack of data availability and heterogeneity in firms' allocation base selections. But we try to alleviate this concern by incorporating possible factors that trigger higher operating cost and allocated portion as well as industry-year fixed effects in the cost determinant model.

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APPENDIX
DEFINITION OF VARIABLES

Variables	Definition
Δ*Segment cost*	Logarithm of change in segment cost, where segment cost is the segment revenue minus the operating income after depreciation.
Δ*Segment revenue*	Logarithm of change in segment revenue.
Δ*Segment asset*	Logarithm of change in segment asset.
Δ*Firm asset*	Logarithm of change in firm asset.
Δ*Firm cost*	Logarithm of change in firm cost, where firm cost is the firm revenue minus the operating income after depreciation.
# of segments	Number of segments.
Corporation/Other segment	Dummy variable that equals 1 if a segment is named "Corporation" or "Other(s)."
Segment subsidy	Larger value between capital expenditure and after-tax cash flow following Billett and Mauer (2003), scaled by the segment asset.
Cost distortion	Absolute value of residual obtained from model 1 regression
Over-allocation	Positive value of residual obtained from model 1 regression
Under-allocation	Negative value of residual obtained from model 1 regression
Firm asset	The logarithm of firm asset.
Segment asset	The logarithm of segment asset.
Firm Herfindahl	Herfindahl index formed based on 2-digit firm industry.
Segment Herfindahl	Herfindahl index formed based on 2-digit segment industry.
Firm R&D	Firm Research and development expense, scaled by the firm asset.
Segment R&D	Divisional Research and development expense, scaled by the segment asset.
Firm leverage	The sum of debt in current liabilities and long-term debt, scaled by the total assets.

Variables	Definition
Segment ROA	Operating income after depreciation at the end of the following period, scaled by the segment asset at the beginning of the following period.
Segment profit margin	Operating income after depreciation at the end of the following period, scaled by the segment revenue at the end of the following period.
Segment asset turnover	Segment revenue at the end of the following period, scaled by the segment asset at the beginning of the following period.
Firm distortion1	The squared sum of cost distortion scaled by the number of segments within firm year.
Firm distortion2	The sum of squared cost distortion scaled by the number of segments within firm year.
Firm ROA	Income before extraordinary items at the end of the following period, scaled by the firm asset at the beginning of the following period.
Firm profit margin	Income before extraordinary items at the end of the following period, scaled by the firm revenue at the end of the following period.
Firm asset turnover	Firm revenue at the end of the following period, scaled by the firm asset at the beginning of the following period.