Firm size and cost system sophistication: The role of firm age

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Abstract

The costing literature has failed to conclusively explain why some companies implement sophisticated costing systems while others do not. Although some contingency variables were proposed, inconclusive results were reported which raised concerns about their underlying theory. Focusing on firm size, as the most examined and confusing variable in this contingency literature, we develop and test more complex relations than in prior studies to provide more insights into its role. More specifically, we test potential indirect positive relations between firm size and cost system sophistication (through product diversity and cost structure) and bring to light the role of firm age largely neglected in the cost accounting literature. Using two different statistical analyses (i.e. SEM and PLS) and data from manufacturing firms, our findings suggest, in contrast to the majority of prior studies, that not all larger firms should be expected to have sophisticated costing systems. The impact of firm size on cost system sophistication depends on firm age and is mediated by product diversity but not cost structure. We conclude by emphasizing the need for more complex models to further advance the theory on costing systems. Such models should go beyond explaining the potential impact of each contextual variable in isolation.

Keywords: Firm size; Firm age; Cost system sophistication; Contextual variables SEM analysis

1. Introduction

Why some companies require and implement sophisticated costing systems (SCSs) and others do not has been a puzzling question for years (e.g. Gosselin, 1997; Al-Omiri and Drury, 2007; Banker et al., 2008; Kallunki and Silvola, 2008; Schoute, 2011; Fisher and Krumwiede, 2015; Al-Sayed and Dugdale, 2016; Wouters and Stecher, 2017). To answer this question, prior research, adopting a contingency perspective, has proposed a number of contextual variables which were expected to determine the need for and implementation of more SCSs. Factors such as competition (e.g. Bjørnenak, 1997; Al-Omiri and Drury, 2007; Brierley, 2008a), product diversity (e.g. Malmi, 1999; Schoute, 2011), cost structure (e.g. Brown et al., 2004; Al-Sayed and Dugdale, 2016) and firm size (e.g. Bjørnenak, 1997; Malmi, 1999; Al-Sayed and Dugdale, 2016) have all been examined in the cost accounting literature. However, the empirical results have been largely confusing and inconclusive in relation to each of the proposed variables (Brown et al., 2004; Al-Sayed and Dugdale, 2016).

This logically drives us to either question the underlying proposed theory for why each contextual variable influences the need for more SCSs, assume that the measures and modeling techniques used in prior studies could not appropriately test the theory (Drury and Tayles, 2005; Schoute, 2011) or a combination of both. In any case, more research is needed in order to elucidate the reasons behind the inability of each of the proposed contextual variables to explain variations in cost system sophistication (CSS) in practice (Brown et al., 2004; Al-Sayed and Dugdale, 2016). Without such research, our knowledge and understanding of the importance and need for SCSs and how they relate to their context will remain undermined.

In this direction, we aim to scrutinize the impact of firm size on CSS and suggest some explanations for its confusing results in the costing literature. Firm size has been the most examined contextual variable in the management/cost accounting literature (Brown et al., 2004; Lamminmaki, 2008) and yet most bewildering (Askarany et al., 2010) with studies reporting a positive (e.g. Hoque, 2000; Al-Omiri and Drury, 2007), negative (e.g. Malmi, 1999) and no relationship (e.g. Bjørnenak, 1997; Schoute, 2011) with CSS. The confusion regarding its impact has led some researchers to treat it as a control variable and hence avoid the need to theorize on the direction of its expected influence (e.g. Hoque, 2000; Kallunki and Silvola, 2008; Schoute, 2011) leading Krumwiede (1998, p.252) to state “the reasons for the size impact are not clear”. Accordingly, we seek to more closely examine the role of firm size by addressing two important limitations we have observed in prior studies.

First, we contend that the theoretical arguments for a positive impact of firm size on CSS have not fully been tested in previous studies. A number of scholars have expected firm size to influence CSS because larger firms are believed to have more resources to invest in SCSs along with a wider variety of products and higher levels of overheads (Van Nguyen and Brooks, 1997; Brown et al., 2004; Drury and Tayles, 2005; Kallunki and Silvola, 2008). Therefore, it has been expected that larger firms should implement more SCSs in order to more fairly distribute the higher levels of overheads over their various products and to avoid the potential cost distortion from less SCSs along with the associated negative impact on decision making. However, while the above argument points to a potentially positive indirect effect of firm size on CSS, through product diversity and cost structure, previous studies have only modeled and tested a direct positive one and reported mixed results as mentioned before (Lamminmaki, 2008; Brierley, 2011). As such, a better understanding of the impact of firm size on CSS requires a closer examination of its underlying theoretical arguments by explicitly testing not only its direct positive impact but also its indirect positive one through product diversity and cost structure. These have been overlooked so far.

Second, the cost accounting literature has largely neglected the role of firm age despite the potential insights this variable could bring with respect to both the direct and the yet untested indirect positive impact of firm size on CSS through product diversity and cost structure. Firm age has received significant attention in different streams of literature such as the innovation literature (e.g. Huergo and Jaumandreu, 2004; Xie and O'Neill, 2014), operations management literature (e.g. Shah and Ward, 2003; Hadid and Mansouri, 2014; Hadid et al., 2016) and employee wages literature (e.g. Davis and Haltiwanger, 1991; Brown and Medoff, 2003; Heyman, 2007), and helped to clarify some mystifying relationships. However, it has rarely been used in the cost accounting literature[1]. We believe that firm age can contribute to our understanding of the impact of firm size on CSS in three different ways.

Firstly, firm age has been reported to have a negative influence on the level of product innovation (Balasubramanian and Lee, 2008; Kotha et al., 2011; Coad et al., 2016). That is, aging firms have been found to focus more on process innovation and to adopt an exploitative innovation strategy through which they develop new products that are not substantially different from the existing ones (Huergo and Jaumandreu, 2004; Xie and O'Neill, 2014). This raises the question of whether the assumption that larger firms have a wider variety of distinct products, due to which they need more SCSs, holds regardless of firm age. Due to the expected complexity of introducing and managing an increasing portfolio of different products (Balasubramanian and Lee, 2008; Kotha et al., 2011; Schoute, 2011; Xie and O'Neill, 2014) and the complex organizational structure of larger firms (Clarke et al., 1999; Lamminmaki, 2008; Pavlatos and Paggios, 2009), firm age may limit larger firms' desire to continuously diversify their products portfolio and encourage them to focus more on process innovation instead. This argument begs for empirical testing to the potential negative moderating role of firm age in the direct firm size-product diversity association.

Secondly, the literature on employee wages has provided evidence indicating that older firms pay their employees higher wages and additional fringe benefits which also increase over time (Davis and Haltiwanger, 1991; Brown and Medoff, 2003; Heyman, 2007). Such evidence may have a significant bearing on the potential indirect positive impact of firm size on CSS through cost structure and deserves to be explored. To the extent that the higher growth in wages in aging firms increases the proportion of direct labor costs compared to overheads, this may restore again the importance and relevance of direct labor costs as a means for overheads allocation and reduce the need for more SCSs. Because larger firms are logically expected, on average, to have a higher number of production employees than smaller firms (Gosselin, 1997; Hoque, 2000; Brown et al., 2004; Askarany et al., 2010; Schoute, 2011), the potential increase in direct labor costs, due to firm age,

[1] While Jänkälä and Silvola (2012) included firm age in their study of activity-based costing system, it was mainly considered as a control variable and no theorization or justification for its inclusion was provided.

could be more substantial in these firms. As such, even if it is true that larger firms have a higher level of overheads compared to smaller ones, this may not necessarily and automatically lead to the implementation of more SCSs. A firm decision to implement a more SCS could depend on the composition of its cost structure and specifically the extent to which its overheads exceed its direct labor costs which could be influenced by firm age as pointed out above. This underlines the importance of taking into account, when examining the potential indirect impact of firm size on CSS through cost structure, (1) the level of direct labor costs compared to overheads and (2) how firm age may affect these cost elements directly and through its potential interaction with firm size.

Finally, firm age may also influence the firm size-CSS relationship through organizational inertia. To survive and maintain reliable performance, aging firms are more likely to have institutionalized processes and standardized routines which have been produced and reproduced over time (Hannan and Freeman,1984). However, such institutionalized processes and standardized routines are likely to lead to organizational inertial and may affect firms' ability to introduce changes to their internal systems including the costing system even if resources are available for implementing these changes (Burns and Scapens, 2000; Hadid and Mansouri, 2014). Proposed changes may face resistance which could either halt these changes or at least slow them down and make them more costly to implement (Shah and Ward, 2003; Fisher and Krumwiede, 2015). As such, it is worth exploring whether firm age negatively influences the ability and desires of larger firms to implement more SCSs.

In response to the above, we will attempt to address the following questions:

(1) *Does firm size have a direct positive as well as an indirect positive impact on cost system sophistication through product diversity and cost structure?*
(2) *Do larger firms have sophisticated costing systems regardless of their age?*

We will seek to answer the research questions by integrating knowledge from four different streams of literature; the cost accounting literature, innovation literature, organizational inertia literature and the literature on employees' wages. We develop a more complex model than in prior studies in which we hypothesize a negative moderating effect of firm age on the direct positive firm size-CSS relationship. Furthermore, we test the potential indirect positive impact of firm size on CSS through product diversity and cost structure. However, as explained earlier, we also expect firm age to negatively (positively) moderate the direct positive impact of firm size on product diversity (cost structure).

Using two different statistical analyses (i.e. SEM and PLS) and data from 108 manufacturing firms, our findings suggest, in contrast to the majority of prior studies, that not all larger firms should be expected to have SCSs. We find firm age to negatively moderate the direct positive impact of firm size on SCSs. Further, we find evidence for a positive indirect effect of firm size on CSS through product diversity but not the level of direct labor costs compared to overheads. Finally, our analyses document a negative interaction effect between firm size and age on product diversity and a positive one on the level of direct labor costs compared to overheads. These results imply that older firms which are larger in size do not necessarily develop completely dissimilar products to the existing ones and report a higher level of direct labor cost compared to overheads. As such, these firms may not necessarily require a more SCS than other firms.

Our study contributes to the management/cost accounting system literature adopting the contingency perspective in two ways. Firstly, the current study will improve our theoretical understanding of the influential role of firm size on CSS which has been puzzling for years. More specifically, we will challenge and formally test some of the assumptions made to propose a relationship between firm size and CSS. This is important to explain the inconclusive results (on firm size) reported by prior studies and offer a reconciliation which will be a step forward towards a more coherent theory in this area of research. Secondly, but relatedly, we will bring into the equation a new variable (i.e. firm age) rarely mentioned in the cost accounting literature and highlight its significance and relevance to this literature.

Section 2 of this paper summarizes the relevant literature and presents the main hypotheses. Section 3 explains the data collection method and variables measurement. In section 4, the statistical analyses are carried out and the results are reported while section 5 offers a discussion of the main findings along with their implications. Section 6 presents the research limitations and concludes the paper.

2. Literature review and hypotheses development

2.1 Firm size and CSS

The role of firm size in influencing the decision to implement more SCSs has been tested extensively in prior research (Lamminmaki, 2008). In this line of literature, a number of scholars have considered firm size as one of the main independent variables in their models with a formal hypothesis being reported (e.g. Bjørnenak, 1997; Drury and Tayles, 2005; Askarany and Smith, 2008; Brierley, 2011). Others, however, have acknowledged its potential impact and included it only as a control variable (e.g. Hoque, 2000; Kallunki and Silvola, 2008; Schoute, 2011). Regardless of whether a formal hypothesis has been reported or not, the dominant theoretical expectation has been that larger firms are more likely to require a SCS in comparison with smaller firms for a number of reasons.

Firstly, SCSs are expensive to implement and more importantly to maintain (Van Nguyen and Brooks, 1997; Askarany et al., 2010; Balakrishnan et al., 2012). Larger firms, however, are argued to have the necessary resources enabling them to experiment and invest in such systems (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004; Kallunki and Silvola, 2008; Lamminmaki, 2008; Askarany et al., 2010; Brierley, 2011). Secondly, some scholars have also expected that as firms get larger in size they will have a wider variety of products and markets (Khandwalla, 1972; Clarke et al., 1999; Brown et al., 2004; Drury and Tayles, 2005; Kallunki and Silvola, 2008). As such, they need more SCSs to capture the resources consumed by different products and markets for more informed decisions (e.g. Clarke et al., 1999; Brown et al., 2004; Drury and Tayles, 2005; Kallunki and Silvola, 2008; Pavlatos and Paggios, 2009; Balakrishnan et al., 2012). This also implies that larger firms could spread the cost of implementing and maintaining their SCS over more products (or product lines) (Brown et al., 2004; Brierley, 2008a), which may decrease the likelihood of questioning the need for such a system in rational companies performing a cost-benefit analysis for their costing systems (Fisher and Krumwiede, 2015). Finally, as firms grow in size, they are claimed to have an increasing proportion of overheads and decreasing direct labor costs and therefore are more likely to invest in or require a SCS to avoid the information distortion which could occur because of using unsophisticated costing systems (Van Nguyen and Brooks, 1997; Brown et al., 2004). Based on the aforementioned arguments, a positive relationship between firm size and CSS has been proposed in prior studies (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004; Kallunki and Silvola, 2008; Lamminmaki, 2008; Askarany et al., 2010; Brierley, 2011; Al-Sayed and Dugdale, 2016).

However, despite the dominant expectation of a positive relationship, empirical evidence has not fully confirmed it. As table 1 shows, while some researchers found support for a positive impact of firm size on CSS (e.g. Van Nguyen and Brooks, 1997; Brierley, 2011), others found no relationship (e.g. Gosselin, 1997; Lamminmaki, 2008) while Malmi (1999) reported a negative relationship suggesting that smaller firms were implementing more SCSs.

It is worth to note that the studies in table 1: (1) tested only the potential direct positive impact of firm size on CSS and hence assumed that firm size could explain variations in the level of CSS independently of other contextual variables and (2) their mixed results are, to some extent, robust against measurement issues in relation to both firm size and CSS. More specifically, researchers who measured firm size using firm revenues found mixed results (e.g. Gosselin, 1997; Brierley, 2008a) and those who measured it using the number of employees also reported inconclusive results (e.g. Hoque, 2000; Askarany et al., 2010; Schoute, 2011). In a similar vein, studies which focused on ABC as a more SCS returned divergent results (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004) as well as those which operationalized sophistication through other measures such as cost pools, cost drivers and their diversity level (e.g. Brierley, 2011; Drury and Tayles, 2005; Lamminmaki, 2008).

Table 1: A non-exhaustive summary of the empirical findings on firm size-CSS relationship

Study	Firm size	Dependent variable	Empirical results
Van Nguyen and Brooks (1997)	Employees	ABC	+
Gosselin (1997)	Revenue	ABC	0

Gosselin (1997)	Employees	ABC	0
Bjørnenak (1997)	Employees	ABC	0
Krumwiede (1998)	Revenue	ABC	+
Malmi (1999)	Employees	ABC	-
Malmi (1999)	Revenue	ABC	-
Clarke et al. (1999)	Revenue	ABC	+
Hoque (2000)	Employees	ABC	+
Brown et al. (2004)	Employees	ABC	0
Drury and Tayles (2005)	Revenue	CSS	+
Al-Omiri and Drury (2007)	Revenue	CSS	+
Kallunki and Silvola (2008)	Employees	ABC	+
Kallunki and Silvola (2008)	Revenue	ABC	0
Lamminmaki (2008)	Revenue	CSS	0
Brierley (2008)	Employees	ABC	+
Brierley (2008)	Revenue	ABC	+
Pavlatos and Paggios (2009)	Revenue	CSS	0
Askarany et al. (2010)	Employees	ABC	0
Brierley (2011)	Combined (Revenue and employees)	CSS	+
Schoute (2011)	Employees	ABC	0

Collectively, the inability of researchers to offer sufficient empirical confirmation for the assumed direct positive relationship between firm size and CSS and the difficulty to fully attribute that to measurement issues raise some concerns about the validity of the suggested theory used to develop hypotheses relating firm size to CSS.

Thus, we will argue in the following subsections that previous studies on firm size-CSS relationship have two main limitations. First, their theorization on the role of firm size also points to a potential indirect positive effect- through product diversity and overheads- while they only tested the direct positive one. Therefore, a better understanding of the role of firm size requires testing more complex relations than in prior studies. Second, prior studies have neglected the role of other potential influential variables such as firm age which could influence the theorization on both the direct as well as the indirect positive impact of firm size on CSS as shown in the following subsections.

2.2 Firm size, age, product diversity and CSS

Some scholars (Clarke et al., 1999; Brown et al., 2004; Drury and Tayles, 2005; Brierley, 2008a) expected a positive firm size-CSS relationship because they assumed that as firms grow in size they will increase the diversity of their products. This argument suggests, however, that the impact of firm size on CSS could be indirect through product diversity which in turn may affect CSS. A common argument in the cost accounting literature is that diversified products may influence the need for more SCSs if these products consume resources differently (Drury and Tayles, 2005; Brierley, 2008a; Balakrishnan et al., 2012). When product diversity is high, the use of less sophisticated costing systems (with fewer cost centers and volume-based drivers) may overestimate the costs of standardized, high volume, relatively simple products while underestimating the costs of more customized, low volume, relatively complex ones leading to cost information distortion (Al-Omiri and Drury, 2007; Schoute, 2011). In this direction, a number of empirical studies have tested and found evidence in favor of the positive impact of product diversity on CSS (e.g. Malmi, 1999; Drury and Tayles, 2005; Schoute, 2011). However, this indirect path (size-diversity-CSS) has not been tested in prior studies and was rather taken for granted. As a result, we will formally test the following:

H1: Firm size has an indirect positive effect on cost system sophistication through product diversity.

Developing and testing H1 is also important for another reason suggested by the innovation literature, namely the role of firm age. We will argue, using insights from the innovation literature, that firm age may influence product diversity and that the expected firm size-product diversity association (implied in H1) does not necessarily hold for all larger firms but may depend on the interaction with firm age.

In examining the impact of firm age on innovation, Huergo and Jaumandreu (2004) observed a different innovation orientation between old and young firms. While both were investing in innovation, older firms focused their attention more on process innovation to reduce operating costs while young firms invested more in product innovation. Huergo and Jaumandreu concluded that young firms are more innovative in terms of new product development but as they get older they reduce the level of product innovation and focus more on process innovation. However, even if some older firms continue to invest in the development of new products, such products may not substantially differ from their existing ones as empirically demonstrated by Balasubramanian and Lee (2008) and, more recently, Xie and O'Neill (2014). Both studies attributed their findings to the impact of past organizational experience.

Unlike young firms, old firms are more influenced by their past experience and accumulated knowledge which constrain their engagement in substantially unfamiliar innovative activities (Xie and O'Neill, 2014). Old firms have most likely learnt over time how to produce, market and sell their existing products in a more efficient way than younger firms can do (Anderson and Eshima, 2013; Xie and O'Neill, 2014). Furthermore, given their survival demonstrated by obtaining sufficient profits to cover their overall costs, they may have fewer incentives to gain new experiences with fundamentally new products which require new learning and major changes in relation to production, marketing and sales functions (Hannan and Freeman, 1984; Anderson and Eshima, 2013). The benefits of such radical innovation may not outweigh the cost of overcoming their organizational inertia (Balasubramanian and Lee, 2008).

Kotha et al. (2011) provide additional evidence in favor of this conclusion. Reporting on 128 biotechnology firms over 20 years, Kotha et al found that although older firms generated more innovative output than younger firms, the impact of the innovative output of younger firms was significantly higher. In March's (1991) terminology, this implies that aging firms focus more on exploitative innovation which usually results in incremental changes to current products (or output) as opposed to major changes usually generated from an exploratory innovation approach which seems to be adopted by younger firms. A similar conclusion was reached more recently by Coad et al. (2016). Coad et al. (2016) theoretically proposed and empirically confirmed that younger firms would invest in riskier innovation than older firms. They then concluded that young firms are more likely to engage in exploratory innovation leading to products substantially new to the market. In contrast, aging firms are found to adopt an exploitative innovation approach which leads to adaptation of the existing products.

The aforementioned argument and findings suggest that firm age has a direct negative impact on the level of product diversity. In addition, given the expected complexity of introducing substantially different products (e.g. Balasubramanian and Lee, 2008; Xie and O'Neill, 2014), complexity of managing an increasing portfolio of different products (e.g. Kotha et al., 2011; Schoute, 2011) and the complex organizational structure of larger firms (e.g. Clarke et al., 1999; Lamminmaki, 2008;

Pavlatos and Paggios, 2009), we could expect firm age to negatively influence the ability or desire of larger firms to increase the diversity of their products portfolio. In larger firms seeking to introduce more diverse products and which need to deal with the complexities presented above, we believe that the effect of past experience and organizational inertia driven by firm age as suggested by Balasubramanian and Lee (2008) and Xie and O'Neill (2014) will be more influential. This will significantly add to these firms' problems and may constrain their ability to keep diversifying their products portfolio. Thus, we hypothesize:

H2: Firm age has a direct negative impact on product diversity.
H3: Firm age negatively moderates the direct positive impact of firm size on product diversity.

2.3 Firm size, age, overheads level and CSS

Another indirect relationship between firm size and CSS could be through cost structure. As mentioned before, some scholars justified a positive firm size-CSS relationship because firms getting larger in size were expected to have a higher percentage of overheads in comparison to direct labor costs (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004). We should recall that an important reason for criticizing traditional costing systems was their reliance on direct labor cost drivers in an environment where direct labor costs were decreasing and overheads were increasing (e.g. Johnson and Kaplan, 1987; Balakrishnan et al., 2012). Based on that, companies with higher levels of overheads were expected to implement more SCSs in order to allocate them more fairly to cost objects for better decision making (Clarke et al., 1999; Al-Omiri and Drury, 2007; Brierley, 2008a). Otherwise, the cost information distortion which could result from the reliance on unsophisticated costing systems, which rely heavily on labor-related cost drivers to allocate overheads, could be substantial (e.g. Abernethy et al., 2001; Brown et al., 2004; Drury and Tayles, 2005; Fisher and Krumwiede, 2015). Therefore, because firms, as assumed in the costing literature, are expected to have higher levels of overheads as they grow in size, scholars found it logical to expect them to implement more SCSs to allocate their overheads more fairly (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004). However, we see two problems in prior studies adopting this assumption.

First, scholars in the costing literature did not test the validity of this argument but rather took it for granted and limited their analyses to the direct firm size-CSS association even if both variables (i.e. firm size and cost structure) were included in the same study (e.g. Clarke et al., 1999; Van Nguyen and Brooks, 1997; Brown et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2008a). Second, while prior studies did not test the indirect effect of firm size on CSS through cost structure, they did test the influence of cost structure on CSS separately. However, most prior studies have not captured this influence (e.g. Clarke et al., 1999; Malmi, 1999; Brown et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2008a; Al-Sayed and Dugdale, 2016). As such, how could firm size be expected to influence CSS through cost structure when the latter was not found to have an influence on CSS?

One problem which, we believe, has contributed to the lack of relationship between overheads and CSS in previous studies was their focus on the percentage of overheads when measuring cost structure without considering the level of direct labor costs in the same analysis. By not taking the level of direct labor costs explicitly into account, prior studies did not fully test the common argument that more SCSs were needed because overheads were increasing and direct labor costs were decreasing (Johnson and Kaplan, 1987; Cooper and Kaplan, 1992; Balakrishnan et al., 2012). Including direct labor costs is important since a company may decide to shift to a more SCS if its overheads exceed its direct labor costs to an extent where the latter are perceived as an invalid means for allocating overheads fairly. Including only the percentage of overheads does not necessarily capture the above logic. It may not be the percentage of overheads alone which influences the decision for more SCSs but rather how it is compared to direct labor costs, which then determines whether the latter can still be considered as an appropriate allocation rate or not. Therefore, we will formally test the validity of the above argument through the following hypothesis:

H4: Firm size has an indirect positive effect on cost system sophistication through the level of direct labor costs compared to overheads.

As firm age has been argued to influence the firm size-product diversity relationship, it may also influence the firm size-cost structure association but through a different mechanism (i.e. employee wages). Prior studies argued that the changes in the business environment observed in the 70s and 80s led to increases in overheads and decreases in direct labor costs (Johnson and Kaplan, 1987; Wouters and Stecher, 2017). However, the question is ‘should we expect the cost structure of companies to remain the same over time?’ That is, if overheads in a company have become higher than direct labor costs for some reasons, will that situation never change? The answer could be ‘no’ according to the literature linking firm age and employee wages.

Davis and Haltiwanger (1991) reported empirical evidence suggesting that older firms offer their production employees higher wages even after controlling for other variables including industry and size. Similar results were reported by Troske (1998) who found that young firms (<5 years) pay about 20% lower wages to their workers compared with older firms (>15 years) even after controlling for firm size and location. Using data from 1067 employees and controlling for the effect of firm size and unionization, Brown and Medoff (2003) provided additional evidence of the positive association between firm age and employee wages indicating that as firms get older, they pay higher wages to their employees. Such a positive relationship could be attributed to different reasons.

For instance, unlike young firms, old firms are more expected to have longer-tenure employees and employees with greater years of service resulting in valuable firm-related experience which may justify the higher wages received by these employees and which is expected to increase over time (Brown and Medoff, 2003; Heyman, 2007). In addition, it is not unusual for some companies to employ workers with the promise to receive, after a certain period, more benefits in the form of bonus, pension and healthcare insurance depending on their performance. Older firms may use these forms of fringe benefits to attract and retain high quality employees especially that such benefits could lead to lower taxes on employee wages (Brown and Medoff, 2003; Heyman, 2007). Therefore, labor costs are expected to increase either due to a continuous increase in the direct wages workers receive, the other benefits offered by older firms or a combination of both. Moreover, older firms (more than young firms) are expected to have a more stable performance and sufficient level of profitability which has helped them survive over the years (Hannan and Freeman, 1984; Hadid and Mansouri, 2014). As a result, such firms cannot claim the inability to pay fair wages to their workers as doing so may increase employee resentment and hinder these firms' ability to attract good workers (Brown and Medoff, 2003). Heyman (2007) also confirmed the positive association between firm age and employee wages although it was only pronounced in the manufacturing industry but not the service one.

The literature presented so far suggests a direct positive influence of firm age on labor costs. However, this literature does not differentiate between direct labor costs and indirect labor costs which is important for the costing literature. Therefore, the expected positive impact of firm age on labor costs could mean an increase in either direct labor costs, indirect labor costs or both. Despite that, we believe it is worth to test exploratory hypotheses about the potential role of firm age in changing the cost structure of firms and whether its impact, as explained above, increases direct labor costs and their weight in the cost structure of firms. As a result, we test the following exploratory hypothesis:

H5: Firm age has a direct positive impact on the proportion of direct labor costs compared to overheads.

In addition, we could also explore the possibility of a positive moderating effect of firm age on the influence of firm size on the labor cost/overheads proportion. That is, to the extent that firm age continuously increases direct labor costs, as argued before, this effect could be more pronounced in larger firms for one reason. Because larger firms are logically expected, on average, to have a higher number of production employees than smaller firms (Gosselin, 1997; Hoque, 2000; Brown et al., 2004; Askarany et al., 2010; Schoute, 2011), the total increase in direct labor costs could be more substantial in larger firms than smaller ones. Therefore, another exploratory hypothesis is reported.

H6: Firm age positively moderates the direct impact of firm size on the level of direct labor costs compared to overheads.

2.4 Firm size, age and CSS

In addition to the indirect impact of firm size on CSS through product diversity and cost structure discussed earlier, some researchers may still support a direct positive one due to the higher resources available in larger firms (Van Nguyen and Brooks, 1997; Brown et al., 2004; Kallunki and Silvola, 2008; Lamminmaki, 2008; Askarany et al., 2010; Brierley, 2011). These resources have been argued to enable larger firms to invest in implementing and maintaining more SCSs. However, even if that is case, firm age may influence this potential direct positive impact as suggested by the organizational inertia literature. Hannan and Freeman (1984) pointed out that firms survive because of their ability to produce and reproduce reliable structure and performance. To be able to do so, process institutionalization and standardized routines are developed and reproduced over time. However, while this approach helps firms to produce and reproduce reliable performance over time and increase the likelihood of survival, it also unintentionally produces organizational inertia making it difficult and more costly to promptly adapt to environmental changes (Hannan and Freeman, 1984; Burns and Scapens, 2000).

Attempts to change will be faced with resistance and even if that resistance does not completely stop changes from happening, it will at least delay them and make them more costly to implement (Shah and Ward, 2003). Given that institutionalization and establishing standardized routines take time to occur (Burns and Scapens, 2000), it follows that older firms are more likely to face higher levels of organizational inertia than newly created firms (Hadid and Mansouri, 2014). If large firms, as pointed out in the literature (Chenhall and Langfield-Smith, 1998; Kallunki and Silvola, 2008), are more formalized and structured, then they may have already developed their routines and standardized processes (Ling et al., 2007). And as they are aging, the rules, routines and standardized processes produced and reproduced over time will be difficult to challenge and update (Shah and Ward, 2003; Hadid and Mansouri, 2014).

As a result, it seems reasonable to expect that major changes to their internal systems including the costing system will be more difficult to introduce even if sufficient resources are available. This suggests that the ability of large firms to introduce more SCSs could be constrained by the level of organizational inertia driven by their age. If this reasoning is correct, then we may expect the level of CSS to depend on firms' ability to overcome age-associated problems including the resistance to change (Fisher and Krumwiede, 2015). This perhaps another reason why a number of studies could not confirm the direct positive relationship they anticipated between firm size and the shift to more SCSs (see table 1) and deserves empirical testing.

As firm age has largely been neglected in the cost accounting literature, it is difficult to offer more robust argument than the one presented above. However, some scholars did indicate that some firms had tried to introduce more sophistication to their costing systems but failed to do so eventually. For instance, in Krumwiede's (1998) study, about 22 firms either considered and then rejected the use of a more SCS or implemented it and then abandoned it. While this study did not elaborate on the reasons behind the failure to keep such SCS, it is interesting to note that these firms were not significantly different in their size (and most of the other studied variables) to other firms which were able to upgrade their costing system and maintain it. Similar results were reported by Gosselin (1997) where 18 firms abandoned a more SCS after its implementation. We believe that the role of firm age might have contributed to the inability of such firms to make changes to their costing system given their size was not significantly different to other firms which successfully upgraded to a more SCS. As such, this potential role of firm age deserves empirical testing through the following hypothesis:

H7: Firm age negatively moderates the direct positive impact of firm size on cost system sophistication.

3. Methodology

3.1 Variables measurement

Cost system sophistication was mainly operationalized in prior studies in two different ways. A number of scholars assumed that ABC systems represented more SCSs than traditional costing systems (e.g. Van Nguyen and Brooks, 1997; Schoute, 2011; Al-Sayed and Dugdale, 2016). Therefore, by asking respondents on the adoption/non-adoption of ABC, they classified companies into those with SCSs and those with simpler costing systems. However, this approach has been criticized on the ground that even the sophistication of ABC systems differs from one company to another in terms of the detailed list of activities used as cost pools and the number of different cost drivers associated with these cost pools. Following this logic, some researchers suggested measuring sophistication by focusing on the actual content of costing systems represented by the number and nature of cost centers and drivers (Abernethy et al., 2001; Drury and Tayles; 2005; Al-Omiri and Drury, 2007; Schoute, 2009)[2]. In this study, we followed these prior studies and measured CSS by focusing on the actual content of the costing system represented by the number of cost pools and different cost drivers.

Company size was operationalized by collecting information on the number of employees (e.g. Bjørnenak, 1997; Askarany et al., 2010). Using the number of employees instead of revenues to measure firm size was deemed appropriate for two reasons. First, as explained before, table 1 suggests that the mixed results on the impact of firm size on CSS is not due to measurement issues in relation to firm size and CSS. Hence, we believe that using the number of employees to measure firm size should not significantly affect our findings. Second, given our arguments regarding the role of labor costs and the potential impact of firm size and age on this cost element (H4-H6), we believe that using the number of employees will help to better capture the scale of labor costs. *Company age* was measured by requesting information on the number of years since the firm inception (Ittner et al., 2002).

The level of overheads and direct labor costs were measured as in previous studies (e.g. Drury and Tayles; 2000, 2005; Al-Sayed and Dugdale, 2016) by asking respondents to break down (as a percentage) their total costs into direct costs and overheads. *Product diversity* was measured by four items based on Drury and Tayles (2005) and Krumwiede (1998).

[2] Although Schoute and Budding (2017) have recently adopted Brierley's (2008b) three definitions of sophistication, we are unable to build on this relatively new research for an important reason. Neither Brierley (2008b) nor Schoute and Budding (2017) tested hypotheses on the impact of firm size on CSS. Therefore, we believe that, given the aim and focus of our study, using similar measures to those used by prior studies (see table 1) will help to isolate the role and impact of firm age from any potential noise a change in the measures of sophistication may introduce.

To control for the potential effect of *competition*[3], the three-item measure developed by Khandwalla (1977) and tested in subsequent studies by Chong and Chong, (1997) and Drury and Tayles (2000) was used. Measures used in this study are presented in the Appendix.

3.2 Sample selection and data collection

Empirical data were obtained from Syrian medium and large private manufacturing companies through a questionnaire instrument. The questionnaire aimed to collect information on the implementation of a number of management accounting practices including costing practices along with several contextual variables. However, only a portion of this information is used for the purpose of this study. The sampling frame, determined by the Syrian Ministry of Industry, consisted of 1202 companies located across the country. Because a reliable post service was not available as well as the email address of the companies, companies (480) in only three different major cities were telephoned to seek their acceptance to participate and to arrange for administering the questionnaire in person.

Of the 480 potential participants, only 336 accepted to take part in this research, 196 of which agreed to meet one of the researchers in order to fill in the questionnaire while the rest (138) kindly offered to receive the questionnaire by email. Companies which rejected to participate (480-336 = 144) provided reasons such as company's policy not to participate (48), busy (59) and the scope of the study did not apply to their systems (37).

Before distributing the questionnaire, it was pre-tested by 5 chartered accountants with significant practical experience to ensure clarity, readability and avoid potentially confusing items. The questionnaire was developed in English and then translated to Arabic and back to English to ensure the Arabic version conveyed the same

3 We also wanted to control for the potential influence of modern operational systems such as total quality management and Just in Time. However, there was no sufficient variation in these variables to differentiate between companies.

meaning. The data collection process began in January 2011. Depending on the company, the questionnaire was distributed to and filled by participants holding positions such as a financial manager or their deputy (97), production manager (3), accountant (1) and senior manager (7). The experience of respondents in their company varied from less than 5 years (17%), 6-10 years (30%), 11-15 years (32%), 16-20 years (15%) to over 20 years (6%).

While the data used in this study could be deemed relatively old (i.e. collected in 2011), we believe that this does not pose a serious threat to our model and findings. For instance, companies sampled at any point in time (e.g. 2021) may have similar characteristics to those of our sample firms in relation to the variables (i.e. size, age, product diversity, cost structure, etc.) included in our model. As such, we believe that our model, analyses and associated findings can still be useful for both theory development and practice.

To improve the response rate, non-respondents received reminders either by telephone and/or by email when that was an option. 118 questionnaires were received, of which 10 were unusable due to missing data and therefore they were removed leaving a response rate of 32% (108/336). Table 2 breaks down the sample firms per industry. Following the literature (e.g. Hoque, 2000; Al-Omiri and Drury, 2007; Maiga et al., 2014), we tested non-response bias by comparing early and late respondents based on their size (number of employees) and the items measuring cost system sophistication which are both of main interest to our study. In all cases the respective t-tests indicated no significant differences which suggested that response bias was not a threat in this study. Given that all questions in the questionnaire were answered by the same informant, common method bias can be an issue. To test for the extent of this problem, we followed prior studies and used Harman’s single factor test (Podsakoff et al., 2003; Fullerton et al., 2013). All variables were subjected to an exploratory factor analysis and since the first factor did not explain substantial variance, this provided some assurance that this type of bias does not invalidate our results (Podsakoff et al., 2003; Fullerton et al., 2013).

Table 2: Sample distribution per industry

Industry	Number of companies
Textile	14
Food and Beverage	18
Electrical products (appliances)	10
Rubber and Plastic	16
Pharmaceutical	11
Furniture & Fixtures	9
Footwear	6
Construction	24
Total	108

4. Data analysis

4.1 Measurement model

A confirmatory factor analysis (CFA) and the maximum likelihood estimation method were applied to evaluate our measurement model. As suggested by Hair et al. (2010), assessing the model fit in a CFA requires, in addition to the Chi square measure, at least one incremental index and one absolute index. Following these recommendations, we relied on the Chi square, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), the ratio of Chi square to the degrees of freedom, Goodness of Fit Index (GFI) and Akaike Information Criterion (AIC) (Hair et al., 2010; Fullerton et al., 2013; Akaike, 1987). Given the relatively small sample size and the data normality issues associated with it, we carried out all analyses using the bootstrapping method with 1000 samples with replacement. This method should improve our confidence in the results and its significance in this respect has been established in the accounting literature (e.g. Bisbe and Malagueno, 2012; Hall, 2011; Hadid, 2019; Hadid and Al-Sayed; 2021).

The results are presented in table 3. Panel A in table 3 points to relatively poor fit on three indicators. The Chi square was significant (χ^2 = 67.928, p = 0.007, 42 df), GFI (.90) and RMSEA (.08). Among the constructs included, competition did not have an average variance extracted (AVE) of > .5 and hence it was removed from the analysis[4]. When competition was removed, the model fit improved as evidenced in Panel B (table 3). The Chi square became insignificant (χ^2 = 21.706, p = 0.357, 20 df), the χ^2 /df ratio (1.09) was less than 2 indicating an acceptable fit (Fullerton et al., 2013). CFI (.99) and GFI (.96) were greater than the .90 standard value and RMSEA (.03) was well below the boundary value of .08 (Hair et al., 2010). Finally, AIC for our model (71.706) was also below the AIC for the saturated model (90) providing additional positive evidence of the good fit of our model (Fullerton et al., 2013).

The convergent validity was evident by having all items significantly loading (> .5, p <.001) on their intended constructs (table 3). In addition, the AVE of each construct was > .5. Discriminant validity, as shown in table 4, was also supported as the square root of AVE of any construct exceeded the correlation of that construct with other constructs in the analysis. Reliability of multi-item constructs was tested through Cronbach Alpha which was .883 and .877 for product diversity and cost system sophistication constructs, respectively.

Table 3: Confirmatory factor analysis

Panel A (with competition included)

	Standardized coefficients (loadings)	p-value	AVE
Cost system sophistication			0.95
Sophist1	0.96	<0.01	
Sophist2	0.99	<0.01	
Product diversity			0.67
Divers1	0.88	<0.01	
Divers2	0.74	<0.01	
Divers3	0.80	<0.01	
Divers4	0.85	<0.01	
Competition			0.42
Comp 1	0.74	<0.01	
Comp 2	0.52	<0.01	
Comp 3	0.67	<0.01	

Model fit indices: Chi-square, 67.928; degrees of freedom, 42; p value, 0.007; Chi-square ratio, 1.62; CFI, 0.97; GFI, 0.90; RMSEA, 0.08; AIC, 139.93 (saturated model, 156).

Panel B (with competition excluded)

	Standardized coefficients (loadings)	p-value	AVE
Cost system sophistication			0.95
Sophist1	0.96	<0.001	
Sophist2	0.99	<0.001	
Product diversity			0.67
Divers1	0.88	<0.001	
Divers2	0.74	<0.001	

[4] Although prior researchers argued for an effect of competition on the level of CSS, this effect was not supported empirically by a number studies (e.g. Bjørnenak, 1997; Drury and Tayles, 2005; Brierley, 2008a). Even in our study when we included competition in the structural model for curiosity, its impact was not significant (untabulated results).

Divers3	0.80	<0.001
Divers4	0.85	<0.001

Model fit indices: Chi-square, 21.706; degrees of freedom, 20; p value, 0.357; Chi-square ratio, 1.09; CFI, 0.99; GFI, 0.96; RMSEA, 0.03; AIC, 71.706 (saturated model, 90).

Table 4: Correlation matrix

	Construct	1	2	3	4	5	6	7
1	Cost system sophistication	0.98						
2	Product diversity	0.76***	0.82					
3	Firm size	0.78***	0.71***	1				
4	Firm age	-0.09	0.08	0.04	1			
5	Direct labor costs	-0.06	-0.18*	-0.03	0.07	1		
6	Overheads	0.25**	0.47***	0.22*	0.12	-0.50**	1	
7	Direct Labor-overheads	-0.19	-0.39***	-0.15	-0.04	0.84**	-0.89**	1

* p<.05, ** p<.01, *** p<.001
Values in the diagonal represent the square root of AVE

4.2 Structural model and hypotheses testing (SEM)

Structural equation model (SEM)[5] was conducted to test the research hypotheses which is commonly used in the management accounting literature to test complex relations while accounting for measurement errors (Hair et al., 2010; Fullerton et al., 2013). In the structural model, two latent constructs were included, namely product diversity and cost system sophistication. Four observed variables were also included, namely firm size[6], age, the interaction term[7] between age and size and the percentage of overheads compared to direct labor costs. The latter variable was calculated by deducting the percentage of overheads from the percentage of direct labor costs reported by respondents. Although the benefits of SEM can be maximized when used for relations between latent constructs, observed variables were also justified for inclusion by a number of scholars (e.g. Singh, 1986; Das et al., 2000; Fullerton et al., 2013). Before evaluating the structural paths, we assessed the structural model fit. Table 5 summarizes the results and figure 1 presents the structural model.

[5] AMOS v24 was used in this study to carry out the SEM analysis.
[6] Following a number of researchers (e.g. Bjørnenak, 1997; Van Nguyen and Brooks, 1997; Krumwiede, 1998; Askarany et al., 2010; Brierley, 2011), we did not transform firm size. Researchers who transformed firm size logarithmically either (1) did not explain the reasons for doing so (e.g. Pavlatos and Paggios, 2009), (2) did so for 'potential' non-linearity but again with no explanation or theory to support their decision (e.g. Drury and Tayles, 2005; Al-Omiri and Drury, 2007), or (3) simply for statistical reasons and mainly normality issues (e.g. Brown et al., 2004; Schoute, 2011). In this research we used bootstrapping to mitigate normality issues as explained later.
[7] Firm size and firm age were standardized and a product term to represent their interaction was then calculated and used in the analysis.

As shown in table 5, although the Chi Square was significant ($\chi2 = 43.285$, $p = 0.013$, 25 df), other indicators were within the acceptable levels. The $\chi2$ /df ratio (1.73) was less than 2 indicating an acceptable fit (Fullerton et al., 2013). CFI (.98) and GFI (.93) were greater than the .90 standard value and RMSEA (.08) did not exceed the boundary value of .08 (Hair et al., 2010). Finally, AIC for our model (103.285) was below the AIC for the saturated model (110) providing additional positive evidence of the good fit of our model (Fullerton et al., 2013). Therefore, the model was judged acceptable and next the structural paths were evaluated.

The results of our analysis suggest a direct positive relationship between firm size and CSS ($\beta = 0.48$, $p < .05$). In addition, firm size is found to have a direct positive relationship with product diversity ($\beta = 0.78$, $p < .05$) which in turn positively influences CSS ($\beta = 0.34$, $p < .05$). As such, this implies that product diversity partially mediates the firm size-CSS association (H1 is supported). In contrast to expectation, firm age does not have a direct negative influence on product diversity ($\beta = 0.02$, $p > .05$), but as proposed its interaction with firm size negatively affects the level of product diversity ($\beta = -0.12$, $p < .05$). These results support H3 but not H2.

Table 5: Structural model and results

Relations			Direct effect		Indirect effect		Total effect	
			Standardized coefficients	p-value*	Standardized coefficients	p-value*	Standardized coefficients	p-value*
Product diversity	<---	Age	0.023	0.353				
Product diversity	<---	Size	0.778	0.001				
Product diversity	<---	Age * Size	-0.123	0.040				
Labor-overheads	<---	Age	-0.009	0.448				
Labor-overheads	<---	Size	-0.11	0.169				
Labor-overheads	<---	Age * Size	0.149	0.056				
Cost system sophistication	<---	Age	-0.167	0.027	0.008	0.317	-0.159	0.021
Cost system sophistication	<---	Size	0.476	0.001	0.268	0.008	0.744	0.001
Cost system sophistication	<---	Age * Size	-0.126	0.051	-0.041	0.026	-0.167	0.004
Cost system sophistication	<---	Product diversity	0.344	0.009				
Cost system sophistication	<---	Labor-overheads	0.009	0.480				

Model fit indices: Chi-square, 43.285; degrees of freedom, 25; p-value, 0.013; Chi-square ratio, 1.73; CFI, 0.98; GFI, 0.93; RMSEA, 0.08; AIC, 103.285 (saturated model, 110).
* Bias corrected one tailed p-values based on 1000 bootstraps with replacement

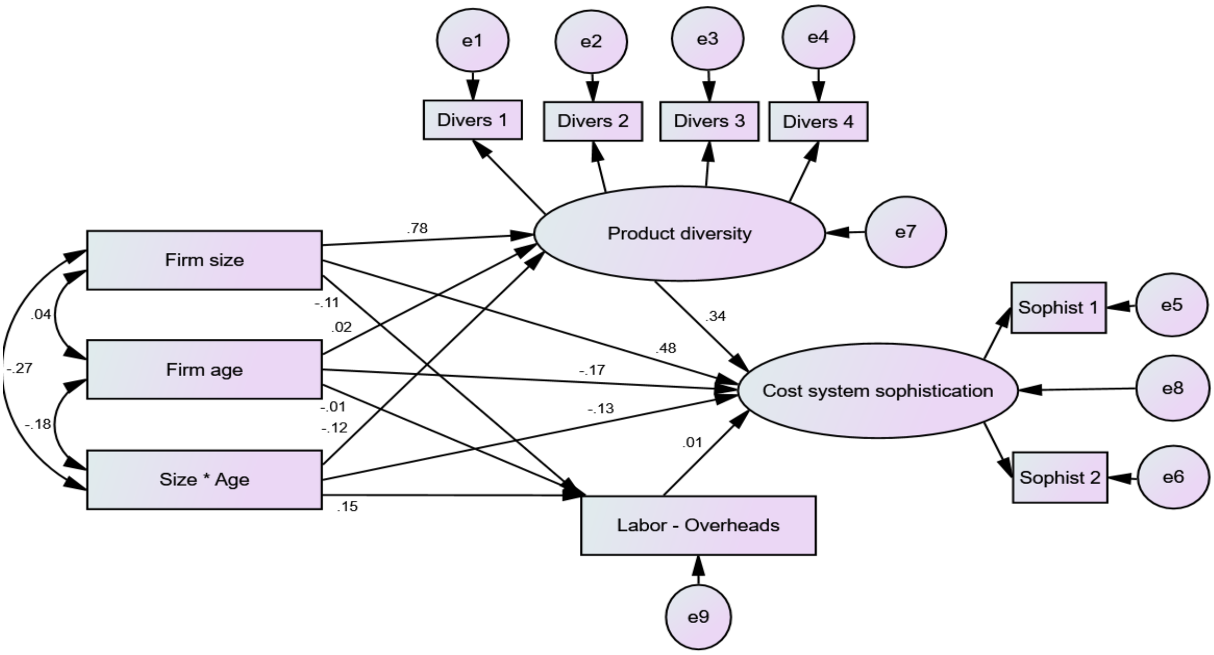

Figure 1: The structural model

H4 points to the potential indirect positive impact of firm size on CSS through cost structure (i.e. direct labor compared to overheads). However, our analysis does not offer support to this hypothesis. Firms getting larger in size do not necessarily have higher overheads than direct labor costs ($\beta = -0.11$, $p > .05$) and even the second path of this indirect relation is not significant ($\beta = 0.01$, $p > .05$). Therefore, H4 is rejected. Similarly, firm age is not directly associated with a higher proportion of direct labor costs compared to overheads ($\beta = -0.01$, $p > .05$) and hence H5 is rejected. However, its interaction with firm size ($\beta = 0.15$, $p = .056$) is marginally associated with higher direct labor costs compared to overheads which supports H6. Finally, our analysis also provides some support for H7 given the negative and significant coefficient ($\beta = -0.13$, $p = .051$) of the interaction term between firm size and age on CSS. Table 6 provides a summary of the hypotheses testing results.

Table 6: A summary of the results of hypotheses testing

No.	Hypothesis	Results
H1	Firm size has an indirect positive effect on cost system sophistication through product diversity.	Supported
H2	Firm age has a direct negative impact on product diversity.	Not supported

H3	Firm age negatively moderates the direct positive impact of firm size on product diversity.	Supported
H4	Firm size has an indirect positive effect on cost system sophistication through the level of direct labor costs compared to overheads	Not supported
H5	Firm age has a direct positive impact on the proportion of direct labor costs compared to overheads.	Not supported
H6	Firm age positively moderates the direct impact of firm size on the level of direct labor costs compared to overheads.	Supported
H7	Firm age negatively moderates the direct positive impact of firm size on cost system sophistication.	Supported

4.2 Robustness and additional tests

In developing H4 we have argued for including not only the level of overheads as in prior studies but also the level of direct labor costs and hence the variable included in the main analysis was constructed by deducting the percentage of overheads from the percentage of direct labor costs. However, we have also replicated the same analysis using both the percentage of overheads, as in prior studies, and the percentage of direct labor costs separately. In either case, the measurement and structural model presented a good fit using the same criteria as in the main analysis. In addition, the structural relations between other variables remained qualitatively the same and therefore table 7 reports the results in relation to the two variables only.

As table 7 shows, when the level of overheads is used as a proxy for the cost structure as in prior studies, the results suggest a marginal positive association with firm size ($p < .10$). However, firm size negatively interacts with firm age ($p < .10$) in influencing the level of overheads. Interestingly, the level of overheads is not associated with CSS and therefore the assumption that firm size is positively related to CSS through its influence on the level of overheads leading in turn to the need for more SCSs is not supported in this study.

When the percentage of direct labor costs is used, the results suggest no influence of either firm size or age. However, the interaction of firm size and age has a marginal positive association ($p < .10$) with direct labor costs suggesting that firms getting larger in size and older in age have higher direct labor costs than other firms. Like the percentage of overheads, the percentage of direct labor costs is not associated with CSS. Further analyses were carried out using the logarithm of firm age to account for potential nonlinearity effects. However, doing so did not qualitatively change the results.

Table 7: Structural paths for overheads and direct labor costs

Relations			Direct effect	
			Standardized coefficients	p-value*
Overheads	<---	Age	0.091	0.159
Overheads	<---	Size	0.174	0.063
Overheads	<---	Age * size	-0.136	0.068
Cost system sophistication	<---	Overheads	-0.023	0.371
Direct labor	<---	Age	0.093	0.143
Direct labor	<---	Size	0.002	0.478
Direct labor	<---	Age * size	0.122	0.087
Cost system sophistication	<---	Direct labor	0.024	0.341

* Bias corrected, one tailed p-values based on 1000 bootstraps with replacement.

4.2.1 PLS analysis

To provide more assurance about the quality of the SEM results and test the sensitivity of these results to the estimation and factor score calculation methods used in SEM, we conducted an additional check using Partial Least Square structural equation model (PLS) through SmartPls 3 (Hadid, 2019; Hadid and Al-Sayed; 2021). The analysis was carried out with 1000 bootstraps with replacement as in the previous SEM analysis. The results are presented in tables 8 and 9. Except for labor-overheads, all R^2 values were relatively high being .60 and .65 for product diversity and CSS respectively. The cross-validated redundancy values were mostly greater than zero suggesting a satisfactory predictive ability of the model (Hair et al., 2012, 2011; Hadid, 2019). In addition, as can be seen from tables 8 and 9, the structural results and path coefficients are largely consistent with the SEM findings in relation to both the direct and indirect effects.

Table 8: PLS results - Direct effects

	Endogenous variables									
Exogenous variables	Product diversity	95% CI		Labor-overheads	95% CI		Cost system sophistication	95% CI		VIF
		Lower	Upper		Lower	Upper		Lower	Upper	
Age	0.035	-0.262	0.136	-0.009	-0.131	0.338	-0.173	-0.417	-0.056	1.038
Size	0.742	0.654	0.843	-0.110	-0.421	0.081	0.548	0.399	0.831	2.633
Age*Size	-0.112	-0.335	-0.011	0.149	0.001	0.486	-0.146	-0.282	-0.043	1.158
Product diversity							0.245	0.091	0.686	3.001
Labor-overheads							0.001	-0.211	0.116	1.212
Adjusted R2	0.603			0.016			0.645			
Cross-validated	0.437			-0.003			0.618			

redundancy

Table 9: PLS results - Indirect effects

Panel (A)

Indirect paths	Standardized coefficient	Sample mean	95% CI	
			Lower	Upper
Age -> Diversity -> Sophistication	0.009	0.005	-0.086	0.038
Age -> Labor-overheads -> Sophistication	0.000	0.000	-0.041	0.01
Size -> Diversity -> Sophistication	0.182	0.192	0.069	0.475
Size -> Labor-overheads -> Sophistication	0.000	0.000	-0.064	0.016
Size*Age -> Diversity -> Sophistication	-0.028	-0.031	-0.148	-0.001
Size*Age -> Labor-overheads -> Sophistication	0.000	0.001	-0.047	0.021

Panel (B)

	Total indirect effects				Total effect			
	Standardized coefficient	Sample mean	95% CI		Standardized coefficient	Sample mean	95% CI	
			Lower	Upper			Lower	Upper
Age -> Sophistication	0.009	0.005	-0.091	0.039	-0.165	-0.160	-0.387	-0.056
Size -> Sophistication	0.182	0.192	0.065	0.449	0.730	0.730	0.664	0.849
Size*Age -> Sophistication	-0.027	-0.030	-0.121	0.003	-0.173	-0.172	-0.285	-0.100

5. Discussion and implications

5.1 Discussion

Our results indicate that not all large firms are expected to implement more SCSs as theorized by the majority of prior studies (e.g. Van Nguyen and Brooks, 1997; Brown et al., 2004; Drury and Tayles, 2005; Brierley, 2008a; Lamminmaki, 2008; Askarany et al., 2010; Brierley, 2011) for three reasons.

First, our analysis shows that the direct positive relationship between firm size and CSS is negatively moderated by firm age. This suggests that as larger firms age, they are less likely to shift to more SCSs. According to the organizational inertia theory (Hannan and Freeman,1984), as firms get older they lose the flexibility enjoyed by younger firms. Older firms are more expected to have developed rules, routines and standardized processes which, over time, constrain their ability to change or at least make attempts to change more costly (Hannan and Freeman, 1984; Balasubramanian and Lee, 2008). In consequence, even if these companies recognize the need for more SCSs, it will not be an easy task to implement the necessary changes (Fisher and Krumwiede, 2015). This implies that having more resources may not be a sufficient reason to observe SCSs in contrast to what prior research has expected (e.g. Chenhall and Langfield-Smith, 1998; Al-Omiri and Drury, 2007; Kallunki and Silvola, 2008; Askarany et al., 2010).

This may explain the findings by Krumwiede (1998) and Gosselin (1997) who both found that in a group of larger firms, some managed to implement SCSs whilst others did not. The negative interaction between firm size and age on CSS indicates that depending on the level of organizational inertia, the benefits from moving to a more SCS may not outweigh the cost of overcoming organizational inertia (Fisher and Krumwiede, 2015). As such, not taking into account the role of firm age may explain why some studies did not find support for the direct influence of firm size on CSS (e.g. Gosselin, 1997; Brown et al., 2004; Lamminmaki, 2008; Askarany et al., 2010, Schoute, 2011).

Second, our results provide some support for the previously implied indirect positive impact of firm size on CSS through product diversity (Clarke et al., 1999; Drury and Tayles, 2005; Brierley, 2008a; Schoute, 2011). However, we find that this does not hold regardless of firm age. Our analyses reveal that the direct positive association between firm size and product diversity is negatively moderated by firm age. As the innovation literature pointed out, firm age may influence the innovation orientation of firms by possibly shifting attention from product innovation to process innovation and thus negatively affecting the level of product diversity (Huergo and Jaumandreu, 2004; Kotha et al., 2011; Coad et al., 2016). In addition, even older firms which still focus on product innovation, they are more likely to adopt an exploitative innovation approach which usually results in new products that are not substantially different from the existing ones (Balasubramanian and Lee, 2008; Xie and O'Neill, 2014). While our analysis does not capture a direct negative influence of firm age on product diversity, its negative interaction with firm size indicates that firms getting larger in size and older in age would follow this route.

Such firms may not need to update their costing systems to understand how new products are consuming resources given their similarity to the existing ones. By largely neglecting this point in prior studies, larger firms have been perceived as a homogeneous group of companies in terms of their innovation orientation and that this orientation does not change (e.g. Bjørnenak, 1997; Brown et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Schoute, 2011). In conclusion, while the premise that firm size has an indirect positive impact on CSS through product diversity has some merits (Clarke et al., 1999; Drury and Tayles, 2005; Brierley, 2008a; Schoute, 2011), our findings helps in increasing our theoretical understanding of how such an impact is influenced by firm age. This, in turn, assists in clarifying the findings of prior studies which failed to capture any significant impact of firm size on CSS (Bjørnenak, 1997; Brown et al., 2004; Kallunki and Silvola, 2008; Askarany et al., 2010).

Third, we find no support for the potential indirect impact of firm size on CSS through cost structure. Previous studies on costing systems have adopted Johnson and Kaplan's (1987) argument in relation to the level of overheads assuming that overheads will always increase at the expense of direct labor costs (e.g. Bjørnenak, 1997; Clarke et al., 1999; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2008a). However, this overlooks the potential increase in direct labor costs that accrues over time in association with firm age (Davis and Haltiwanger, 1991; Heyman, 2007). Such an increase may restore again the importance and relevance of direct labor costs as a means for overheads allocation and reduce the need for more SCSs requiring more non-volume based allocation rates. Our findings in tables 5 and 7 offer interesting insights in this respect.

Table 5 documents a positive interaction effect between firm size and age on the level of direct labor costs compared to overheads. This suggests that our argument regarding the increase in direct labor costs due to firm age is particularly applicable to larger firms as they are expected to have, on average, a higher number of employees than smaller firms. As these firms age, the wages of their employees increase (Brown and Medoff, 2003; Heyman, 2007), which in turn increases the importance of this cost element to total costs, which may encourage some large firms not to invest in more SCSs.

Furthermore, table 7 interestingly documents a direct positive association between firm size and the level of overheads. While this confirms the assumption that larger firms are expected to have higher overheads (Van Nguyen and Brooks, 1997; Brown et al., 2004), it still does not necessarily mean that these larger firms will seek more SCSs as the same table shows (i.e. the overheads-CSS relationship is not significant). The significant negative (positive) interaction between firm size and age on the level of overheads (direct labor costs) points to the need to explicitly consider the level of direct labor costs and not merely focus on the level of overheads. These results collectively suggest that even if larger firms have higher overheads compared to smaller firms, this does not necessarily mean they will implement more SCSs. Such larger firms may have similar or even higher levels of direct labor costs, depending on their age, making the latter an appropriate means for allocating overhead costs and reducing the need for more SCSs. As such, neglecting this role of firm age could also be an additional reason for the inability of prior studies to detect any significant relationship between firm size and CSS (see table 1 for a summary).

Before highlighting the implications of our findings and concluding the paper, it is important to address one potential concern in relation to our findings. Because our hypotheses and arguments were mostly based on literature from developed countries, some may argue that our findings based on data collected from a developing country (Syria) could be country-driven due to different national economic, institutional and cultural aspects[8]. However, the existing business-related literature on Syria, while scarce, does not indicate that this is likely to be the case.

More specifically, over twenty years before the data for this study was collected, the Syrian government made significant steps to liberalize the economy, and in 1991 the government issued Law No. 10 which aimed to attract foreign investments and increase the role of private companies in the economy (Gallhofer et al., 2009). This was followed by joining the Arab Free Trade Area in 1997 which reduced trade barriers between Arab countries and hence increased the competition facing Syrian private companies (Gallhofer et al., 2011; Kamla et al., 2012; Haffar et al., 2013). As such, Syrian private companies (which provided the data in this study) face, at least to some extent, similar market forces to those operating in developed countries. By

[8] We thank the Associate Editor for bringing this point to our attention.

2010, the private sector employed 75% of the total labor force and its contribution to GDP reached 65% (Seifan 2010; Kamla, 2014)[9].

Furthermore, the education system in relation to accounting has largely been influenced by the Western model (Kamla et al., 2012). For instance, around 2005, Syrian universities incorporated the international accounting standards in their curriculum in order to keep the knowledge of accounting graduates up to date (Gallhofer et al., 2011). In the case of management accounting, the influence of Western developments is also clear since most textbooks taught at Syrian universities are simply translated versions of textbooks written by scholars in developed countries (Dik, 2011). When we were studying towards our first degree in accounting in Syria around twenty years ago, the textbooks, back then, included detailed information on traditional costing practices, ABC and balanced scorecard which are still taught to accounting graduates in the UK and other developed countries to this date.

While it is true that Syria differs from other developed (Western) countries in relation to the level of poverty, corruption and religion, it is not clear whether and how such differences could influence the relationships examined in our current study. For instance, Kamla (2012) focused on Syrian women accountants' attitude and the influence of wearing hijab on their career progression and indeed found a negative influence. However, there is nothing to suggest that even female accountants with hijab would behave differently in relation to decisions about costing practices which we examine in this article.

Based on the above, while we cannot completely rule out the potential influence of the national context of Syria, there are no clear reasons in the existing literature to believe that our findings are likely to be country-driven. This could perhaps explain why scholars who also collected data from Syrian private companies did not emphasize the role of national context when testing their models built on knowledge from literature on developed countries (e.g. Al-Taweel, 2014; Katrib and Abdul Rahman; 2014; Elkotayni, 2016).

[9] A more detailed, socio-historical information on Syria can be found in Gallhofer et al. (2009).

5.2 Implications

Our findings have both theoretical and practical relevance. First, we have tested some previously implied assumptions (i.e. higher diversity and overheads) regarding the mechanism through which firm size influences the need for SCSs. Second, we have theorized and empirically demonstrated that the impact of firm size (in contrast to prior research) on CSS depends on the level of firm age. By doing so, we have addressed another piece of the puzzle by explaining and offering a reconciliation to the confusing firm size-CSS relationship presented in the literature (e.g. Bjørnenak, 1997; Malmi, 1999; Brown et al., 2004; Al-Omiri and Drury, 2007; Brierley, 2011; Al-Sayed and Dugdale, 2016). Third, but relatedly, we have identified and explained the relevance of another variable (firm age) which has largely been neglected in the costing literature despite its increasing importance in other streams of literature such as the innovation and operations management literature (e.g. Shah and Ward, 2003; Huergo and Jaumandreu, 2004; Balasubramanian and Lee, 2008; Hadid and Mansouri, 2014; Xie and O'Neill, 2014; Hadid et al., 2016).

If the quality of our argument has been satisfactory so far, our findings imply that the mixed results in prior studies do not question the power of the contingency theory. Rather, it is our incomplete understanding of all the players in the context in which companies operate which is likely to have played a role in developing simpler models than needed to capture the complexity of business life and the interrelationships among contextual variables. However, a better understanding of the context is not an easy task and necessitates the integration of knowledge from different streams of literature even outside the accounting domain.

For managers, our findings indicate that it is not a rule that because a firm is getting larger in size it should automatically implement a SCS as prior research has suggested (e.g. Al-Omiri and Drury, 2007; Brierley, 2011; Al-Sayed and Dugdale, 2016). Traditional and simpler costing systems were criticized and argued to be invalid for certain reasons (e.g. product diversity, increasing overheads, decreasing direct labor costs, etc.) (Johnson and Kaplan, 1987, Cooper and Kaplan, 1988, 1992), but if these reasons do not apply to a company even if it is large in size, then traditional, volume-based costing system may not seriously distort its cost information. The argument used to develop our hypotheses and empirical results provide support to this conclusion. Consequently, it is very important for managers to be aware of why they have implemented a system and keep monitoring these reasons in order to promptly react when the reasons change. However, based on the organizational inertia literature, it is worth to bear in mind that managers' ability to promptly react to environmental changes decreases as their firms get older.

6. Conclusion and limitations

This study set out to provide more theoretical and empirical insights into the puzzling relationship between firm size and CSS. By integrating knowledge from the cost accounting literature, innovation literature, organizational inertia literature and employee wages literature, we developed a more complex model which brought to light the likely indirect relationship between firm size and CSS and the role of firm age in that relationship. The model was tested using data from manufacturing firms and through two different statistical analyses (i.e. SEM and PLS) and was largely supported.

Our findings suggest, in contrast to the majority of prior studies, that not all larger firms should be expected to have SCSs. We find firm age to negatively moderate the direct positive impact of firm size on SCSs. Further, we find evidence for a positive indirect effect of firm size on CSS through product diversity but not the level of direct labor costs compared to overheads. Finally, our analyses document a negative interaction effect between firm size and age on product diversity and a positive one on the level of direct labor costs compared to overheads. These results imply that older firms which are larger in size do not necessarily develop completely dissimilar products to the existing ones and report a higher level of direct labor cost compared to overheads. As such, these firms may not necessarily require a more SCS than other firms.

Like other survey studies, our study has limitations. First, the sample size is relatively small and future research could replicate our analysis using larger samples to validate its assumption and underlying theory. Second, we collected information from one respondent per company. While our test of the respective potential bias indicated no significant threat to our findings, collecting information from more informants per company could improve the quality of data and findings. However, the practical difficulty associated with this recommended approach makes it rare in the literature (Fullerton et al., 2013). Third, given the nature of our survey data, our model tests and confirms correlations between variables and no inferences on causality could be made. However, cross-sectional survey data is very common in the literature given the practical difficulty associated with collecting data over different periods of time from the same respondents/companies (e.g. Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2008a; Fullerton et al., 2013; Al-Sayed and Dugdale, 2016). Finally, given the potential concern, discussed earlier, that our findings could be country-driven, future research may replicate our study using data from developed countries. Such research could be very useful in either confirming our findings or in opening doors for alternative interpretations which further the knowledge in this area.

Despite the above limitations, our study still offers new insights to the management/cost accounting literature by improving our theoretical understanding of how firm size impacts CSS and explaining its inconclusive results in the literature. We hope that our study encourages future research to develop more complex relations to explain other mystifying associations in connection with CSS and to resist the full attribution of such confusing relationships to the use of different measures and statistical techniques. Fully blaming measures and statistical analyses for all mixed results may hinder attempts to uncover more theoretical insights into how variables are related.

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Appendix

"Cost system sophistication: respondents were asked to indicate the number of cost pools and the number of different cost allocation bases/cost drivers used in their firms as follows:

Cost pool:	1	2-3	4-5	6-10	11-20	21-30	31-50	over 50
	☐	☐	☐	☐	☐	☐	☐	☐
Cost driver:	1	2	3	4	5	6	7	over 7
	☐	☐	☐	☐	☐	☐	☐	☐

Level of overheads: respondents were asked to report the percentage of their direct material, labor and overheads to total costs.

<u>Cost item</u> <u>Percentage</u>

(1) Material that can be directly traced to cost objects.
(2) Labor that can be directly traced to cost objects.
(3) Overhead costs that cannot be directly traced to cost objects, e.g., manufacturing energy to operate machines & machines' depreciation.

Product diversity

Respondents were asked to indicate, on a five-point scale, the level to which:

(1) Product lines are quite diverse. (1- very low to 5- very high)
(2) Most products require different processes to design, manufacture and distribute. (1- very low to 5- very high)
(3) There is variation in the products consumption of support department overheads. (1- very low to 5- very high)
(4) Products are customized/standardized. (1- highly Standardized, 5- highly customized)

Competition: respondents were asked to indicate the level of competition in the following three areas on a five-point scale.

(1) Bidding for purchases of inputs (1- very low to 5- very high)
(2) Price competition (1- very low to 5- very high)
(3) Competition for manpower (1- very low to 5- very high)

Firm size: respondents were asked to indicate the number of employees in their firm on the eight-point scale below.

(1) 1-50, **(2)** 51-150, **(3)** 151-250, **(4)** 251-350,
(5) 351-500, **(6)** 501-700, **(7)** 701-1000, **(8)** More than 1000

Company age: respondents were asked to report the year in which their firm was founded/established."