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THEORIES, CONCEPTS,
IMPLEMENTATION**

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THEORIES, CONCEPTS,
IMPLEMENTATION**

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COST MANAGEMENT: MODELLING ASYMMETRIC COST BEHAVIOUR

Abstract. The traditional assumption in cost accounting and management is that variable costs move in proportion to the activity volume (sales revenue). However, recent empirical studies provide evidence that the cost response to decreased activity may be less or greater than the cost response to increased activity. Using the ABJ model, we examine the behaviour of the cost of goods sold (COGS), administrative costs, and selling costs in municipal environmental and water utilities from Ukraine for the period 2012-2019. We find strong evidence that the type and degree of cost asymmetry differs across cost items and types of economic activity. The study found that COGS is sticky in environmental enterprises as it grows an average of .818% with a 1% increase in net sales revenue, and only declines .087% with a 1% decrease in net sales revenue. Whereas in water utilities, COGS exhibits anti-sticky behaviour as it increases on average .280% with a 1% increase in net sales revenue, but decreases 1.512% with a 1% decrease in net sales revenue. Administrative costs have shown similar behaviour, but the total selling, administrative costs, and other operating costs demonstrate statistically insignificant sticky behaviour in both types of enterprises. As the main reason for cost stickiness, we support managerial motivation underlying resource adjustments in the face of fluctuations in activity volumes.

Keywords: stickiness costs, cost of goods sold, administrative costs, ABJ model, municipal enterprises.

Introduction

The traditional theoretical assumption in cost accounting and management is that variable costs automatically change symmetrically to changes in the volume of activity. However, recent empirical studies document the asymmetric response of costs to changes in volumes of activity. Numerous studies provide evidence that the cost response to decreased activity may be less or greater than the cost response to increased activity. Anderson et al. (2003) called “sticky” costs that increase more with increase in activity than decrease with an equivalent decrease in activity. In contrast, anti-sticky costs increase less with an increase in activity than decrease with a decrease in activity (Weiss, 2010). Sticky costs arise when, with a drop-in activity (demand), managers do not reduce excess resources in anticipation of an increase in demand. The main reasons for this decision are cited (e.g., Anderson et al., 2003) managerial optimism, the size of the resource adjustment costs, and personal considerations of the manager.

Obviously, the stickiness of costs reduces the predictability of a company’s earnings and hence its attractiveness to investors. Therefore, the issue of cost stickiness has received considerable research attention, but they are focusing on commercial companies. At the same time, in the context of the coronavirus pandemic and global climate change, more attention should be paid to municipal enterprises that directly support the livelihoods of the population. We only found one study (Hosomi & Nagasawa, 2018) on cost behaviour in local public enterprises. The study found that in Japanese municipal companies, the type of asymmetric behaviour of operating costs differs depending on the type of industry. Our study seeks to expand the evidence for asymmetric cost behaviour in

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municipal enterprises, focusing on the cost of goods (services) sold, selling costs, and administrative costs. This study aims to empirically investigate the behaviour of costs in Ukrainian municipal environmental enterprises and water supply enterprises in the aspect of the symmetry of responses to changes in the volume of activities, as well as identifying the reasons for the differences, if any.

Related literature review and hypotheses

Anderson et al. (2003), which was the first to formalize sticky cost behaviour, is considered a foundational study. The authors studied 7,629 US companies over 20 years (64,663 observations) and found that selling, general and administrative (SG&A) costs increased by an average of .55% with sales growth of 1%, but costs decreased by only .35% when sales are reduced by 1%. The researchers labelled this cost behaviour “sticky”, and it was this study that was driving new empirical evidence for cost asymmetry. For instance, He et al. (2010) also found the sticky behaviour of SG&A costs by examining 1802 Japanese firms over 25 years, namely: costs increased by an average of .59% with sales growth of 1%, but decreased by only .45 % with an equivalent decrease in sales.

The research then focuses on other cost categories (cost of goods sold (Abu-Serdaneh, 2014; Hassanein & Younis, 2020; Zonatto et al., 2018), total operating costs (Ozkaya, & Yukcu, 2011; Kama & Weiss, 2013; Zonatto et al., 2018), labor costs (Dalla Via & Perego, 2013; Hassanein & Younis, 2020), selling and administrative costs (Abu-Serdaneh, 2014)) and find empirical evidence from different countries that cost behavior differs between cost items (Dalla Via & Perego, 2013; Abu-Serdaneh, 2014; Zonatto et al., 2018), industries (Ozkaya & Yukcu, 2011; Dalla Via & Perego, 2013; Hosomi & Nagasawa, 2018; Hassanein & Younis, 2020), and corporate governance systems (Sorros & Karagiorgos, 2013).

In the context of the COVID-19 crisis, evidence of a reduction in the cost stickiness during depression and post-crisis periods on average is useful, albeit with differences between cost items (He et al., 2010; Hassanein & Younis, 2020). It is clear that identifying cost behaviour is important because of the negative impact of cost stickiness on expected profit and the difficulty in predicting it. For instance, Weiss (2010) showed that firms with more sticky cost behaviour have less accurate earnings forecasts; Baumgarten (2012) also describes the important implications of cost stickiness for fundamental analysis and analysts' forecasts.

Describing the cause of sticky costs, Anderson et al. (2003) emphasized that “sticky costs occur if committed resources are not reduced to the minimum level necessary to support a reduced activity demand. While the premise of sticky cost behaviour is intuitively striking, no empirical study supports it, and received wisdom in accounting does not reflect it”. Anderson et al. (2003) and subsequent studies attempt to understand and describe the motivation of cost managers when demand and activity change. In general, researchers come to a consensus that cost stickiness is the result of a conscious decision by managers who assess the consequences of their actions, but at the same time, conscious decisions can be distorted by personal considerations.

Thus, the scientific literature on cost stickiness provides compelling evidence for asymmetric cost behaviour across industries and countries. However, as stated above, only Hosomi and Nagasawa (2018) have confirmed the existence of sticky and anti-sticky cost behaviour in municipal companies. Based on the fact that asymmetric behaviour of costs can exist in any business environment, the study hypothesizes that the costs of municipal enterprises can react asymmetrically to changes in the volume of activities. Hence the first hypothesis of our study:

H1: Cost behaviour in municipal enterprises is on average asymmetric.

Also, an analysis of previous studies has shown that most of them focus on SG&A costs, obviously because this type of cost is, firstly, available for all types of enterprises, and secondly, important, since it makes up a significant share in sales revenues, for instance, 26.4% in the sample (Anderson et al., 2003). At the same time, the research interest is the behavior of both the components of SG&A costs and other costs; and there are a priori reasons to consider it different for municipal enterprises, as proved, for example, by Abu-Serdaneh (2014) for industrial enterprises. So, the second hypothesis of the study:

H2: The type and degree of cost asymmetry vary depending on the cost items.

In addition, in our previous study (Yakymova & Kuz, 2019) of municipal enterprises in six European countries, a statistically significant conclusion was obtained that the financial health of a municipal company does not depend on the region (city, community, country), but on economic activity and entrepreneurial goals. This conclusion gives reason to expect a different nature of the behaviour of costs as a factor of financial stability, thereby putting forward a third research hypothesis:

H3: The type and degree of cost asymmetry vary depending on the type of economic activity of municipal enterprises.

Data and methodology

To test hypotheses, we collected data on different cost accounts (cost of goods sold (COGS), selling, administrative costs and other operating costs (SA&O)) and net sales revenue from the financial statements of Ukrainian municipal enterprises for the period 2012-2019. We have formed two initial samples: (i) water utilities of 104 enterprise-years and (ii) environmental enterprises of 57 enterprise-years. The sample of water utilities includes municipal enterprises with the industry NACE code 36.00 – Water collection, treatment and supply; the sample of environmental enterprises includes municipal enterprises with NACE codes 38.11 – Collection of non-hazardous waste, 81.30 – Land improvement, and 81.29 – Other cleaning, and 01.61 – Support activities for crop production. After collecting the data, a screening procedure was performed to obtain the final samples for analysis. Following Anderson et al. (2003), observations with values of any variable at the top or bottom of .5% of its distribution were trimmed from the sample.

To assess the symmetry / asymmetry of cost behaviour, we specify each cost item as a function of net sales according to the model proposed by Anderson et al. (2003) for SG&A costs (also known as the ABJ model), that is, as follows

$$\ln\left(\frac{COGS_{i,t}}{COGS_{i,t-1}}\right) = \beta_0 + \beta_1 \ln\left(\frac{NetRev_{i,t}}{NetRev_{i,t-1}}\right) + \beta_2 DD_{i,t} \ln\left(\frac{NetRev_{i,t}}{NetRev_{i,t-1}}\right) + \varepsilon_{i,t}, \quad (1)$$

$$\ln\left(\frac{SA \& O_{i,t}}{SA \& O_{i,t-1}}\right) = \beta_0 + \beta_1 \ln\left(\frac{NetRev_{i,t}}{NetRev_{i,t-1}}\right) + \beta_2 DD_{i,t} \ln\left(\frac{NetRev_{i,t}}{NetRev_{i,t-1}}\right) + \varepsilon_{i,t}, \quad (2)$$

where $COGS_{i,t}$ is cost of goods sold, $SA \& O_{i,t}$ is selling, administrative costs and other operating costs, $NetRev_{i,t}$ is the net sales revenue for enterprise i at year t , $\varepsilon_{i,t}$ is an error term, $DD_{i,t}$ is a decrease dummy variable that is defined as

$$DD_{i,t} = \begin{cases} 1, & \text{NetRev}_{i,t} < \text{NetRev}_{i,t-1}; \\ 0, & \text{NetRev}_{i,t} \geq \text{NetRev}_{i,t-1}. \end{cases} \quad (3)$$

Note that the cross-sectional sample is characterized by a fairly wide range of economic activities and differences in the size of utilities. Therefore, to improve the compatibility of variables across enterprises and to mitigate potential heteroscedasticity, the relative form of the variables (growth ratios) and the logarithmic specification of the model were chosen.

Similarly, the models are constructed separately for administrative costs and selling costs. However, in Ukraine, environmental municipal enterprises are mainly small businesses with reduced financial reporting. Therefore, for these enterprises, modelling of the behaviour of operating costs by item cannot be carried out.

Based on the specification of the cost model, cost behaviour can be identified as follows. The β_1 coefficient measures the percentage increase in costs when net sales revenue increases by 1%. The sum of the coefficients $\beta_1 + \beta_2$ measures the percentage reduction in costs when net sales revenue decreases by 1%. Hence, based on the definitions of stickiness and anti-stickiness of costs, the empirical hypothesis of asymmetric behaviour of costs is as follows. If the estimates of the coefficients β_1 and β_2 of the cost model are statistically significant, then: the costs are sticky when $\beta_1 + \beta_2 < \beta_1$ or $\beta_1 > 0$ and $\beta_2 < 0$; costs are anti-sticky when $\beta_1 + \beta_2 > \beta_1$ or $\beta_1 > 0$ and $\beta_2 > 0$. If the costs are symmetrical, the estimated β_2 is equal to zero.

Results and Discussions

The ABJ sticky cost models were estimated using ordinary least squares (OLS) sequentially for all cost items. Tables 1 and 2 show regression results for pooled samples of water utilities and environmental enterprises, respectively. Direct comparison of different cost accounts, which shows different results, confirms the second hypothesis “The type and degree of cost asymmetry vary depending on the cost items”.

Table 1: Results of regressing annual changes in costs on annual changes in net sales revenue: water utilities

	Cost of Goods Sold	Selling, Administrative Costs, and Other Operating Costs	Selling Costs	Administrative Costs
β_0	.094**** (6.22)	.027 (.29)	.090** (2.06)	.090*** (2.98)
β_1	.280**** (3.64)	.848* (1.78)	.471** (2.11)	.527**** (3.43)
β_2	1.232** (2.15)	-.220 (-.06)	.589 (.35)	.463 (.40)
R^2	.218	.034	.055	.128
Adjusted R^2	.201	.015	.036	.110
F	13.204	1.748	2.871	7.257
Observations	98	102	102	102
Cost behaviour	anti-sticky**	sticky	anti-sticky	anti-sticky

Notes. The numbers in parentheses are the t-statistics.

*, **, ***, and **** indicate significance at the 10%, 5%, 1% and .1% levels, respectively.

Source. Author's own contribution.

Direct comparison of different types of municipal enterprises, which also shows different results, confirms the third hypothesis “The type and degree of cost asymmetry vary depending on the type of economic activity of municipal enterprises”.

Table 2: Results of regressing annual changes in costs on annual changes in net sales revenue: environmental enterprises

	Cost of Goods Sold	Selling, Administrative Costs, and Other Operating Costs	Administrative Costs
β_0	.048 (1.26)	.115*** (2.79)	.139**** (3.51)
β_1	.818**** (6.18)	.492** (2.56)	.380*** (2.78)
β_2	-.906**** (-4.54)	-.879 (-.31)	-.304 (-1.50)
R^2	.435	.226	.168
Adjusted R^2	.413	.195	.173
F	19.275	7.301	4.658
Observations	53	53	49
Cost behaviour	sticky****	sticky	sticky

Notes. The numbers in parentheses are the t-statistics.

*, **, ***, and **** indicate significance at the 10%, 5%, 1% and .1% levels, respectively.

Source. Author's own contribution.

For all municipal enterprises, all estimates of the coefficient β_1 are statistically significant (with different levels of significance) and positive. Therefore, we can argue that at water utilities, with an increase in the volume of activity (net sales revenue) by 1%, the COGS increases on average by .280%, the total SA&O costs increase by .848%, selling costs increase by .471%, and administrative costs increase by .527%. However, estimates of the β_2 coefficient for SA&O costs, selling and administrative costs are insignificant at the level of 10%, but for the COGS they are positively significant at the level of 5%. The latter means that the COGS decreases by 1.512% ($\beta_1 + \beta_2$) with a fall in sales revenue by 1%. Consequently, the COGS exhibits anti-sticky behaviour, since when income decreases by 1%, it decreases more (1.512%) than increases (.280%) when net sales revenue increases by 1%. For selling costs, these percentage changes are 1.060% and .471%, respectively; and for administrative costs .990% and .527%, respectively. This also indicates their anti-stickiness, although not statistically significant. However, the total SA&O costs are insignificantly sticky, apparently due to the item “Other operating costs”. With a 1% increase in activity, SA&O costs increase by .848%, and with a 1% drop-in activity, they decrease by .628%.

The statistically significant finding for anti-sticky COGS behaviour in water utilities is consistent with previous studies. For instance, Weiss (2010), Dalla Via and Perego (2013), Abu-Serdaneh (2014), Zonatto et al. (2018) also found that COGS behaviour is on average anti-sticky for different industries and countries. In addition, Hosomi and Nagasawa (2018) found anti-stickiness of operating costs in municipal water companies. At the same time, for the sample of municipal environmental enterprises (see Table 2), at a significance level of .1%, sticky behaviour of the cost of goods sold was established. Since the COGS increases on average by .818% with an increase in

the volume of activity by 1%, and decreases by .087% ($\beta_1 + \beta_2$) with a decrease in the volume of activities by 1%.

With regard to total SA&O and administrative costs, estimates of β_1 are positively significant, and β_2 are negative and insignificant at the 10% level. Nevertheless, the stickiness of SA&O and administrative costs can be recognized as they rise .492% and 0.380%, respectively, for a 1% increase in activity, and decline .404% and .076% for a 1% decrease in activity. Thus, our results show sticky behaviour of all considered costs of environmental enterprises, as well as SA&O costs of water utilities, but COGS, administrative costs and selling costs in these enterprises are anti-sticky (significant asymmetry for COGS only). From this it follows that the first hypothesis "Cost behaviour in municipal enterprises is on average asymmetric" can be accepted only for COGS at a significance level of 5%, for other costs there is no reason to accept it at a significance level of no more than 10%.

In previous studies (e.g., Anderson et al., 2003; Kama & Weiss, 2013; Bankeret al., 2016; Hassanein & Younis, 2020), managerial optimism / pessimism about the future has been identified as one of the main reasons for the stickiness / anti-stickiness of costs. In the face of declining sales in previous periods, managers become pessimistic about the future. This pessimism reduces cost stickiness, since "managers are reluctant to add resources when sales increase and are more willing to cut resources when sales decrease" (Bankeret al., 2016, p. 210). On this basis, cost stickiness can be found when managers' expectations for the future are optimistic, and anti-stickiness when future expectations are pessimistic. Applying this argument to the analysed enterprises, we can conclude that the expectations of managers in water utilities are pessimistic, and the expectations of managers in environmental enterprises are optimistic. Managers of environmental enterprises do not cut resources in the face of declining volumes of activity, and this leads to sticky costs.

A study by Hassanein and Younis (2020) is useful to explain this finding. Based on data from the UK chemical industry, the study found that the behaviour of the cost of goods sold changed from sticky before and during the global financial crisis (2008-2009) to anti-stick after the financial crisis. However, there is no difference in SG&A cost behaviour before and after the financial crisis. First, with regard to the reaction of the cost of goods sold to crisis events in our case. The crisis generates pessimism about the future and this is more felt by water utilities, where systemic problems have been accumulating over the years. One of the most important industries that sustains cities and communities is one of the most neglected. As for environmental enterprises, their optimism is based on better financial condition and, accordingly, expectations.

These differences in the analysed industries are documented by Yakymova and Kuz (2019). In a sample of CEE countries, "regardless of the region, water and energy utilities are generally financially unhealthy", while "most environmental enterprises are financially healthy". Secondly, the behaviour of SA&O costs both in water utilities and in environmental enterprises is statistically insignificantly sticky, that is, one that does not respond to crisis phenomena in the financial condition of the enterprise. This result is consistent with the findings of Hassanein and Younis (2020). In addition, it should be noted that net sales revenue fell in 3.85% of the annual enterprise-years in the sample of water utilities, and the COGS fell in 4.81% of the enterprise-years. While, in the sample of environmental enterprises, this relation is reversed, namely: 15.09% and 11.32%, respectively. Administrative costs declined in 10.58% of the enterprise-years in the sample of water utilities, and in 18.87% of the enterprise-years in the sample of environmental enterprises, when revenue fell in 3.85% and 15.09% of the enterprise-years, respectively. These values confirm and clearly demonstrate the anti-stickiness of administrative costs in water utilities and their stickiness in environmental enterprises.

Conclusion

The study contributes to the literature on management accounting and cost management by collecting empirical evidence of asymmetric cost behaviour. The results of the study convincingly confirm that the behaviour of the cost of goods sold (services) is anti-sticky in water utilities and sticky in environmental enterprises. The significant difference in the cost behaviour is explained by the pessimism of managers of financially unstable water supply enterprises with signs of bankruptcy and the optimism of managers of more sustainable environmental enterprises on average. However, the over-optimism of environmental enterprises has negative consequences, because the stickiness of costs makes lower sales affect profits more than increase them. Administrative, selling and other operating (SA&O) costs aggregate show statistically insignificant sticky behaviour in both types of enterprises. This result indicates a neutral attitude of SA&O to the company's financial health and the crisis phenomena and is consistent with previous research. Administrative costs, as well as cost of goods sold, show anti-sticky behaviour in water utilities and sticky behaviour in environmental enterprises, but this finding is not statistically significant.

Thus, the costs of environmental enterprises, in contrast to water utilities, decrease on average more slowly than they increase compared to the change in net revenue. We explain this result in terms of sticky cost theory for two main reasons. First, in anticipation of a future resurgence in demand, managers are conserving resources that are not used when demand declines (managerial optimism). Second, managers estimate resources and demand, but costs are higher when resources are added than savings when resources are reduced. There are other reasons that require empirical confirmation in our subsequent studies. But we support Kama and Weiss (2013) that "any effort to infer sources of sticky costs should be made in light of motivations underlying managers' resource adjustments". In any case, the stickiness of costs is a negative signal for the management of environmental enterprises, as it can mean a loss of management control or the inability of managers to adjust the level of resources in response to changes in demand and volumes of activity. Considering the negative impact of sticky cost behaviour on profit, its predictability and the investment attractiveness of enterprises, managers of environmental enterprises should rethink their cost management policies.

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