Refining Measures to Improve Performance Measurement of the Accounts Receivable Collection Function

Philip Leitch*
Dawne Lamminmaki**

Abstract

Accounts receivable management is an important facet of financial management. The average collection period and aging schedule are two widely used gauges of accounts receivable collection performance. These performance measures are deficient, however, especially when used for internal evaluation, as a change in the average collection period or the composition of an aged schedule does not necessarily relate to a change in collection efficiency. This study proposes refinements to these metrics. In the case of the ageing schedule, it is proposed that accounts receivable values should be related to their original credit sales. To calculate the average collection period, it is proposed that the balance of accounts receivable should be divided into age categories and these categories should be matched to the credit sales that generated them. The manner in which these revised measures constitute more accurate internal indicators of accounts receivable performance is outlined and empirically examined.

Keywords

Accounts Receivable Management
Credit Management
Creditors
Average Collection Period
Ageing Schedule

*In Vitro Technologies Pty Ltd, Australia
**Griffith University

Introduction

Offering sales on credit is common practice for most organisations (Pike, Cheng, Cravens, and Lamminmaki, 2005) and accounts receivable can be one of the most significant assets on an organisation's balance sheet (Jackling, Raar, Wigg, Williams, and Wines, 2004). As a percentage of total assets, accounts receivable has been estimated to constitute 20% for large organisations and 30% in small / medium sized organisations (Jackling, Raar, Wigg, Williams, and Wines, 2004) and up to 80% of business transactions between corporations are conducted on credit (Asselbergh, 1999). Given the size of the accounts receivable balance for many organisations and the significant degree of sales that are made on credit, it is important that this asset is appropriately managed and that suitable financial analysis tools are used for internal control purposes. The imperative of ensuring this asset is efficiently and effectively managed is heightened during economically depressed periods.

A common goal of accounts receivable management is to ensure debts are collected within specified credit terms (Pike and Cheng, 2001). Another common goal is the identification of delinquent accounts to reduce the total trade credit which is written off as a bad debt (Peacock, Martin, Burrow, Petty, Keown and Martin, 2003; Jackling, Raar, Wigg, Williams, and Wines, 2004, p. 384). These two goals normally go hand-in-hand, as early identification of delinquent customers reduces the size and age of accounts receivable and also reduces the probability of accounts defaulting (Peacock, et.al., 2003).

Accounts receivable collection efficiency measures indicate the performance of the accounts receivable processes and the success of collection policies applied (Carpenter and Miller, 1979). The two commonly used accounts receivable collection efficiency

indicators are the *Aging Schedule* and *Average Collection Period* (ACP).[1] Both of these measures suffer from deficiencies however, and can be highly misleading when using internal information to monitor the efficiency of the accounts receivable collection function. Use of the measures can result in an inaccurate reflection of accounts receivable managers' performance. The objective of this study is to outline the manner in which these measures are deficient and to advance refinements that correct for the noted deficiencies. The paper's focus is restricted to the Aging Schedule and the ACP measure.

Motivation for the study comes from problems identified within the organisation where one of the authors works. It was observed that changing credit sales levels were resulting in distorted Aging Schedule values, and that this in turn was providing misleading signals with respect to collection efficiency. As a consequence, performance of the accounts receivable function was being appraised erroneously. Further motivation derives from the prior literature's failure to offer a satisfactory resolution to this accounts receivable performance measurement deficiency.

The remainder of the paper is organised as follows. Next, a description and literature review pertaining to the traditional accounts receivable Aging Schedule and ACP is provided. This is followed by an examination of deficiencies inherent to the two approaches and then a description of how corrections can be made to overcome these deficiencies. In the subsequent section, empirical data is drawn upon to explicate the way that the revised approaches proposed constitute preferred indicators of accounts receivable collection efficiency. The paper's concluding section outlines implications arising for practice, describes the study's contributions and limitations, and suggests some avenues for further research that build on the revised measures advanced herein.

---

[1] Average Collection Period is known by a variety of names, and is frequently referred to as Days Sales Outstanding (DSO), Debtor Days, or Days Outstanding.

Description of the Collection Efficiency Measures

The Traditional Aging Schedule

The Aging Schedule is a popular accounts receivable tool (Pike and Cheng, 2001) and is widely referred to in the normative accounting and finance literature (Peacock, et.at., 2003; Arnold, 2005). It comprises a classification of outstanding balances according to the period of time they have been outstanding (Equation 1).

These age categories can be calibrated according to months, weeks, or days, depending on an organisation's requirements, and are frequently expressed as a percentage relative to the total accounts receivable balance (Lewellen and Johnson, 1972; Lewellen and Edmister, 1973; Zeune, 1991).   If debts are collected on time, most debts should be younger, and few should be older. It is assumed that increased collection efficiency would reduce the percentage of debt in the older categories.

Equation 1: Traditional Aging Schedule

$$P_t = \frac{r_t}{\sum r}$$

or stated in 30 day categories:

$$\text{Current} = \frac{r_1}{\sum r} \qquad \text{30 Days} = \frac{r_2}{\sum r}$$

$$\text{60 Days} = \frac{r_3}{\sum r} \qquad \text{90 Days} = \frac{r_4}{\sum r}$$

$$\text{120+ Days} = \frac{\sum_{t=5}^{\infty} r_t}{\sum r}$$

Where:
P_t = the proportion of accounts receivable "t" financial periods in the past.

r_t = the total accounts receivable sourced from credit sales issued t financial periods in the past.

(Peacock, Martin, Burrow, Petty, Keown, JR, and Martin, 2003; Arnold, 2005)

The Average Collection Period (ACP)

The ACP (Equation 2) is a measure of the average time taken to collect accounts receivables. ACP is a ratio that draws on credit sales and accounts receivable, and it appears to be widely taken for granted that ACP only reflects collection efficiency (Benishay, 1965; Lewellen and Johnson, 1972; Freitas, 1973; Lewellen and Edmister, 1973; Stone, 1976; Zeune, 1991). That is, if credit sales increase, a proportional increase will arise in the accounts receivable balance, and the ACP ratio will remain the same. If collection efficiency was to increase, then the balance of accounts receivable relative to credit sales would decrease, and the lower ratio would reveal greater efficiency.

ACP has been cited as the most commonly used accounts receivable collection measure (Pike and Cheng, 2001). A shortcoming is apparent in the accounting and finance textbook literature that widely promotes use of ACP (Hilton, 1994; Peacock, et.al., 2003; Bazley, Hancock, Berry, and Jarvis, 2004; Jackling, et.al., 2004; Arnold, 2005; Birt, Chalmers, Beal, Brooks, Byrne, and Oliver, 2005; Horngren, Harrison and Bamer, 2005; Lasher, 2005; Doupnik and Perera, 2007), as this normative literature systematically fails to highlight the deficiencies that are endemic to the measure.

Equation 2: Traditional Average Collection Period

$$ACP = \frac{r}{s} \cdot 365$$

Where:
ACP = Average Collection Period, in days.
s = credit sales -- the total credit sales for the previous 12 months (referred to hereafter as "Yearly" calculation), or credit sales for the previous month multiplied by 12 (known hereafter as "Monthly" calculation).
r = balance of accounts receivable -- the total balance of outstanding credit sales.

(Hilton, 1994; Peacock, et.al., 2003; Bazley, et.al., 2004; Jackling, et.al., 2004; Birt, et.al., 2005)

It is evident from Equations 1 and 2 that both the ACP and the Aging Schedule use accounts receivable balances to provide indicators of collection efficiency. However, an organisation's accounts receivable balance is the result of both credit sales and collections and thus the accounts receivable balance changes when either credit sales or collections are made. Because both credit sales and collections affect the accounts receivable balance, difficulty arises in identifying whether a change in an accounts receivable balance has been caused by a change in collection activity, a change in credit sale activity, or both.

Deficiencies in Collection Efficiency Measures

Deficiencies of the Traditional Aging Schedule

The Aging Schedule is usually expressed in percentages, with the total of all categories equalling 100 percent. This calculation signifies that all categories must change when any accounts receivable category is altered. As Zeune (1991) notes: "[Aging Schedule] Percentages are interdependent. They must always sum to 100%." (p. 15). This interdependence creates a challenge when attempting to interpret a change in a particular category (Benishay, 1965; Lewellen and Johnson, 1972; Lewellen and Edmister, 1973; Zeune, 1991).

This problem of interdependency in an Ageing Schedule is most apparent when changes in credit sales occur. Rising credit sales will result in a schedule exhibiting increasing values in the younger categories, and a misleading suggestion of increased collection efficiency for the older categories (Lewellen and Johnson, 1972; Lewellen and Edmister, 1973; Zeune, 1991). Lewellen and Edminster (1973) argue that it is only in periods of evenly occurring credit sales that an Aging Schedule can be seen to represent a tool that accurately depicts collection efficiency. Zeune (1991) and Lewellen and Johnson (1972) conclude that the Aging Schedule produces an incorrect analysis and false warning patterns can be raised by normal sales fluctuations.

One can conclude that the sum of credit sales achieved in the most recent 30 day period is

positively correlated to the current category in a traditional Aging Schedule.

Deficiencies of the Traditional Average Collection Period

The workings of the ACP signify that when credit sales are high and an accounts receivable balance is low, collection efficiency is deduced to be high. In other words, the ACP implies that, given unchanging collection efficiency, the balance of accounts receivable will stay in proportion to credit sales. This assumption does not appear to hold true, however, as an increase in credit sales will not result in a proportionally equal increase in the entire accounts receivable balance. Therefore, we can conclude that the ACP can provide misleading indications of collection efficiency when credit sales are not constant (Lewellen and Johnson, 1972; Stone, 1976).

There is a direct relationship between ACP and credit sales. An increase in credit sales will trigger an increase in the ACP, falsely implying a decrease in accounts receivable collection efficiency. Similarly, a decrease in credit sales will lead to a false suggestion of an improvement in accounts receivable collection efficiency (Benishay, 1965; Lewellen and Johnson, 1972; Cotter, 1973; Freitas, 1973; Lewellen and Edmister, 1973; Stone, 1976; Zeune, 1991; Ridley, 1993). During periods of credit sale volatility, the ACP becomes similarly volatile, providing a misleading suggestion of changing levels of collection efficiency (Lewellen and Johnson, 1972). Zeune (1991) showed that when credit sales are uneven over time, the ACP will relate more strongly to changes in credit sales activity than changes in accounts receivable collection efficiency. Due to the potentially misleading nature of the ACP, Ridley (1993), Zeune (1991), Stone (1976), Cotter (1973), Freitas (1973), Lewellen and Edminster (1973) and Lewellen and Johnson (1972) have all concluded that there is little reason to use ACP. Despite the long-standing nature of some of these commentaries, as already noted, ACP continues to be promoted in an uncritical manner in the normative literature. The effect of changing credit sales levels on ACP is demonstrated in Appendix A.

From Appendix A it is evident that changes in credit sales result in changes in the value of the ACP, independent of any change in collection efficiency. This is due to an indirect relationship between credit sales and accounts receivables. When using total credit sales for the previous 12 months, every month contributes equally to the ACP measure even though only the most recent month's sales are likely to be represented in the current accounts receivable balance. All credit sales occurring in the last 12 months affect the ACP regardless of the fact that no receivables from the older sales may remain uncollected.

The indirect relationship between ACP and credit sales is not resolved by utilising a smaller history of credit sales, such as 3 months. This is because few of the older credit sales within the 3 month period are likely to remain as accounts receivable, yet they have the same degree of influence on the ACP as sales made in the current month. Utilising only the last month's credit sales is also unsuccessful as a large proportion, perhaps half or more, of accounts receivable are generated from prior months and therefore bear no relationship to the current month's sales. Without a direct relationship between accounts receivables balance and the credit sales that generated them, the ACP fails to constitute a reliable indication of collection efficiency.

Correcting the Measures

Due to the shortcomings identified, some commentators have attempted to advance alternative collection efficiency measures (Lewellen and Edmister, 1973; Gallinger and Ifflander, 1986; Zeune, 1991). Despite the documented deficiencies of the ACP and the Aging Schedule, the alternatives offered have not been widely acknowledged or applied (Pike and Cheng, 2001) and we continue to see the ACP and Aging Schedule widely promoted in accounting texts (Hilton, 1994; Peacock, et.al., 2003; Bazley, et.al., 2004; Jackling, et. al., 2004; Arnold, 2005; Birt, et.al., 2005; Horngren, et.al., 2005; Lasher, 2005; Doupnik and Perera, 2007). The paucity of attention directed to these deficiencies in prior research is a concern, and is particularly surprising as the shortcomings of the ACP and the Aging Schedule were first commented on as early as the mid 1960's (Benishay, 1965).

The enduring popularity of the ACP and Aging Schedule is most likely attributable to their

4

simplicity of calculation and interpretation. It would therefore appear to be a useful step forward if the measures could be modified in a way that frees them from the distorting effects of credit sales changes whilst maintaining their ease of computation and interpretation. It is believed that such a step can be achieved by directly relating accounts receivable to the credit sales that generated them. The following sections expound on this modification.

Correcting the Aging Schedule

As already noted, the traditional Aging Schedule is frequently expressed as a percentage schedule, where each age category displays the percentage of total accounts receivable contained within that category. Therefore, a corrected Aging Schedule should also categorise accounts receivable in this manner. The Aging Schedule can be corrected by the inclusion of credit sale information in the calculation of the percentages (see Equation 3).

The traditional Aging Schedule (Equation 1) relates accounts receivables balances to credit sales over a longer period, while the corrected Aging Schedule (Equation 3) relates accounts receivable categories to their original credit sales. This corrects for the shortcoming noted in the Aging Schedule, as it removes period interdependencies from the measure.

Categories are no longer related to each other as they are no longer required to sum to 100%. Detailed comparisons between the traditional and corrected Aging Schedules are provided in Tables 1 and 2. Note that Table 2 reflects the fact that the corrected Aging Schedule is not required to sum to 100% (in this case it sums to 99.91%). The correction also ensures that changes in categories can only be attributed to changes in collection efficiency. Thus, changes in credit sales should have no effect on younger balances.

The approach presented herein extends the work of Lewellen and Edminster (1973). A distinguishing facet of the corrected Aging Schedule advanced concerns its re-structuring and re-categorisation of the calculations. Further, appearing below is an exposition of how the corrected Aging Schedule can be used as the basis for preparing a corrected ACP.

Prior examinations of Aging Schedules include Stone (1976), Gentry and De La Garza (1985) and Zeune (1991). Stone (1976) discussed payment patterns (i.e. cash flows) and "balance fractions" (% of credit sales outstanding over time), however did not consolidate these into a schedule. Gentry and De La Garza (1985) outlined a complex system concerned with identifying collection variations relative to targets. Although representing an accurate approach, it was based on specific sale collections, which detracted from its intuitive appeal due to interpretation and monitoring difficulties that would likely arise. Zeune (1991) used worked examples to largely replicate what had been established in prior studies. It is believed the approach outlined herein is superior to what has been documented in this prior literature.

Equation 3: Corrected Aging Schedule

$$P = \left(\frac{r_1}{s_1} \quad \frac{r_2}{s_2} \quad . \quad . \quad \frac{r_t}{s_t} \right)$$

Or more concisely:

$$P_t = \frac{r_t}{s_t}$$

Where:
P_t = Aging Schedule percentage category for financial period t.

The corrected Aging Schedule utilises the total credit sales within each period. The total credit sales "s" generated in period "t" are represented as "s_t":

$$s = \left(s_1 \quad s_2 \quad . \quad . \quad s_t \right)$$

Accounts receivable are divided into age categories matching the periods used for the credit sale. The total accounts receivables "r" generated by credit sales from period "t" is represented as "r_t":

$$r = \left(r_1 \quad r_2 \quad . \quad . \quad r_t \right)$$

The accounts receivable categories, "r_t", are transformed into percentages of their original sales, "s_t", creating a percentage Aging Schedule, "P_t".

Table 1: Formulae Applied in Traditional and Corrected Aging Schedules

	Current (0 - 29 Days)	30 Days (30 – 59 Days)	60 Days (60 – 89 Days)	90 Days (90 – 119 Days)	120+ Days (120+ Days)	Total
Credit Sales	s_1	s_2	s_3	s_4		$\sum s$
Accounts Receivable	r_1	r_2	r_3	r_4		$\sum r$
Traditional Aging Schedule	$\dfrac{r_1}{\sum r}$	$\dfrac{r_2}{\sum r}$	$\dfrac{r_3}{\sum r}$	$\dfrac{r_4}{\sum r}$	$\dfrac{\displaystyle\sum_{t=5}^{\infty} r_t}{\sum r}$	$\dfrac{\sum r}{\sum r}$
Corrected Aging Schedule	$\dfrac{r_1}{s_1}$	$\dfrac{r_2}{s_2}$	$\dfrac{r_3}{s_3}$	$\dfrac{r_4}{s_4}$	$\displaystyle\sum_{t=5}^{\infty} \dfrac{r_t}{s_t}$	$\dfrac{\sum r}{\sum s}$

Table 2: Computational Example of Traditional and Corrected Aging Schedules

	Current (0 - 29 Days)	30 Days (30 – 59 Days)	60 Days (60 – 89 Days)	90 Days (90 – 119 Days)	Total
Credit Sales	$61,677.56	$56,454.85	$53,547.59	$51,757.76	$223,437.75
Accounts Receivable	$45,368.57	$11,397.89	$1,645.87	$573.96	$58,986.31
Traditional Aging Schedule	76.91%	19.32%	2.79%	0.97%	100.00%
Corrected Aging Schedule	73.56%	20.19%	5.06%	1.11%	99.91%

Correcting the Average Collection Period

When developing a corrected ACP, the objective is to develop a measure that correctly reflects the average time that credit sales remain in accounts receivable. The primary flaw of the traditional ACP concerns an assumption that the accounts receivables balance maintains a specific ratio to credit sales, which was noted above to be incorrect. Instead, changes in credit sales affect the accounts receivable in a "deferred" manner, as demonstrated in Figures A1 and A2 of Appendix A.

This flaw may be corrected by calculating the ACP ratio in a different way. Instead of using the total balance of accounts receivable in ratio to total credit sales, the balance of accounts receivable can be divided into age categories and those categories are then matched to the credit sales that generated them. When the

ratios of the individual categories are added together, they provide a corrected version of the ACP. The aligning of accounts receivable to the credit sales that generated them creates a direct relationship, which in turn creates a more meaningful ratio.

This correction will ensure that within each age category, accounts receivables will remain in proportion to credit sales (assuming constant collection efficiency), even if credit sales are changing. The smaller the time category used for the ratio, the more direct the relationship and therefore the more accurate the measure of collection efficiency[2].

[2] If the duration of the age categories is taken to be a year, then the corrected ACP literally equals the traditional ACP, and thus no benefit will be gained. Therefore, a minimum category size of approximately one calendar month is suggested, while durations of a week or a day are more desirable.

It should be noted that a ratio of age categorised accounts receivables to credit sales has already been created, as this is the definition of the corrected Aging Schedule. Consequently, the calculation of a corrected ACP can be achieved by adding together all of the categories of the Aging Schedule (see Equation 4). The value computed represents the average time accounts receivable are outstanding in proportion to the duration of the category selected.[3] For example, given a 30 day categorisation of the aging schedule, a sum of all Aging Schedule categories of 1.5 would equate to 45 days (1.5 x 30 days).

The calculation of the corrected ACP can be seen to build from the work of Bineshay (1965). Two key points of departure are evident. In the Bineshay (1965) work, static credit sales were assumed and receivables as a percentage of credit sales were not identified. The static credit sales assumption carries significant calculation implications and detracts from real world applicability. The approach advanced herein represents not only a particularly novel way to calculate the ACP measure, it also lends itself to real world application.

The traditional ACP calculation uses the accounts receivable balance divided by the total credit sales for the year. The corrected ACP uses age-categorised accounts receivable balances divided by their source credit sales. Thus, both methods utilise all outstanding balances in accounts receivable, provide a ratio of accounts receivable to credit sales and provide an aggregate turnover based measure. These are two variants of the same measure, and given unchanging sales they will produce the same value. As noted in Appendix A, a shortcoming of the traditional ACP arises when there are changes in credit sales. Applying the corrected ACP measure to the four scenarios described in Appendix A reveals that the measure advanced is free of distortion (see Appendix B), as it remains unaffected by any of the changes to credit sales.

---

[3] This is similar to the traditional ACP, where the age category of credit sales is one year, or equivalent to one year, and therefore the traditional ratio calculated in the ACP is multiplied by 365 to determine duration in Days.

Equation 4: Corrected Average Collection Period

$$ACP = \sum_{t} P_t \cdot L$$

Where:
ACP = Average Collection Period in Days
  t = Category or financial period, such as calendar month.
  P_t = Aging Schedule percentage category for financial period t.
  L = Length of schedule categories in days (i.e. length of t).

Appendices A and B present four scenarios of changing credit sales with collection efficiency held constant. Appendix C introduces the effect of changing collection efficiency on the ACP measure. As can be seen in Figure C1 in Appendix C, if credit sales remain constant, both the traditional and corrected ACP represent mechanisms that will accurately detect changes in collection efficiency. If credit sales are variable across periods, however, detecting a change in collection efficiency becomes problematic with the traditional ACP, but not with the corrected ACP (see Appendix C, Figure C2).

In addition to the greater accuracy of the corrected Aging Schedule and ACP, for these measures to be useful, they need to be easy to apply. A report of total sales by period and a report of a non-percentage based ageing schedule would be enough to calculate the measure. This is data that one would expect would be relatively easy to retrieve from most financial systems. Thus, the advantages of the proposed approaches include ease of preparation as well as interpretation

Empirical Data Collection

Issues associated with the suggested modifications to the Aging Schedule and ACP have been examined using empirical data collected in *In Vitro Technologies New Zealand*, a medium-sized company that is a subsidiary of a large Australian entity. The company provides medical supplies and equipment, the majority of its sales are on credit, and accounts receivable represents 30% of it total assets. It has a customer base

between three and four hundred customers, and an average annual sales turnover of $4.5 million NZD. Access has been secured to the company's weekly sales and accounts receivable data over a four year period.[4] For every week in this four year period, a measurement was made of the total credit sales for the previous 12 months, the total credit sales for the previous 30 days, and the balance of outstanding accounts receivable. These values were used to generate the collection efficiency measures in a manner consistent with Equations 1-4.

A summary of the sales and accounts receivable balances for the company is provided in Figure D1 in Appendix D. This data is characterised by large variations in credit sales and accounts receivable balances.

Testing for flaws in the Traditional Aging Schedule

It was noted in the earlier discussion that the traditional Aging Schedule can be expected to suffer from interdependencies between the schedule's categories. The veracity of this claim has been examined by creating a correlation matrix of categories, as shown in Table 3. The significant correlation between the Current and the 30, 60 and 90 Days categories (all $p \leq 0.01$) demonstrates that as the Current category increases, the 30, 60 and 90 Days categories decrease. This supports the assertions of previous commentators and the interdependency concerns outlined above.

In outlining the impact of credit sales on the traditional Aging Schedule we asserted that the sum of credit sales achieved in the most recent 30 day period can be expected to be positively correlated to the current category in a traditional Aging Schedule. This relationship has been examined by correlating credit sales for the previous 30 days with the current category of the traditional Aging Schedule (Table 4). This analysis provides supporting evidence that credit sales are significantly positively correlated with the current category of the traditional Aging Schedule ($p = 0.01$). This finding, along with the correlations identified for the Current category, demonstrate that credit sales have a significant distorting effect on the Aging Schedule.

---

[4] Data analysed spans the years 2004 to 2007.

Testing for flaws in the Traditional Average Collection Period

As shown in Equation 2, the traditional ACP is generally calculated in one of two ways: a yearly version, which uses credit sales from the previous year; or a monthly version, which uses credit sales from the previous 30 days. Both versions of the calculation are analysed here.

A flaw in the traditional ACP approach that was noted above concerns an anticipated positive relationship between credit sales and ACP. However, this relationship only exists if the change to credit sales persists. As shown in Appendix A, Figure A2, a one-off increase in credit sales causes an initial increase that quickly dissipates. Figure A2 further demonstrates that higher sales in one period result in a sustained decrease in the ACP for the next 12 periods. As credit sales for this company are known to fluctuate, it was expected that either a positive or negative relationship could arise.

The presence of a credit sales distorting effect on the traditional ACP has been examined by determining whether credit sales are correlated to the traditional ACP, as shown in Table 5. The traditional monthly and yearly ACP were found to be significantly negatively related to credit sales from the last 30 days and 360 days respectively ($p < 0.01$).

Appraising the Corrected Aging Schedule

Consistent with the approach taken for the traditional Aging Schedule in Table 3, an examination of the interdependency of the categories of the corrected Aging Schedule has been undertaken by formulating a correlation matrix of the categories, as shown in Table 6. Unlike Table 3, no negative correlations were noted, signifying that the problem identified for the traditional Aging Schedule appears to be absent for the corrected Aging Schedule.

Table 6 reveals six significant and positive correlations between the Current and 30 Days ($p < 0.05$), Current and 90 Days ($p < 0.01$), Current and 120+ Days ($p < 0.05$), 30 Days and 60 Days ($p < 0.01$), 30 Days and 90 Days ($p < 0.01$) and 60 Days and 90 Days ($p = 0.01$). It is notable that only positive correlations

Table 3: Traditional Aging Schedule Correlation Matrix of Categories

Spearman's Roe N = 209		Current	30 Days	60 Days	90 Days	120+ Days
Current	Correlation Coefficient	1.000	-.943(**)	-.280(**)	-.161(*)	-.013
	Sig. (1-tailed)	.	.000	.000	.010	.423
30 Days	Correlation Coefficient	-.943(**)	1.000	.085	.087	-.042
	Sig. (1-tailed)	.000	.	.112	.105	.272
60 Days	Correlation Coefficient	-.280(**)	.085	1.000	.131(*)	-.016
	Sig. (1-tailed)	.000	.112	.	.029	.407
90 Days	Correlation Coefficient	-.161(*)	.087	.131(*)	1.000	.107
	Sig. (1-tailed)	.010	.105	.029	.	.062
120+ Days	Correlation Coefficient	-.013	-.042	-.016	.107	1.000
	Sig. (1-tailed)	.423	.272	.407	.062	.

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 4: Traditional Aging Schedule Correlation to Credit Sales

Spearman's Rho N = 209		Current
Credit Sales for Previous 30 Days	Correlation Coefficient	.209(**)
	Sig. (1-tailed)	.001

** Correlation is significant at the 0.01 level (1-tailed).

Table 5: Traditional Average Collection Period Correlation to Credit Sales

Pearson Correlation N = 209		Monthly	Yearly
Credit Sales for Previous 30 Days	Correlation Coefficient	-.296(**)	.050
	Sig. (2-tailed)	.000	.475
Credit Sales for Previous 360 Days	Correlation Coefficient	.068	-.507(**)
	Sig. (2-tailed)	.330	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 6: Corrected Aging Schedule Correlation Matrix of Categories

Spearman's Rho		Current	30 Days	60 Days	90 Days	120+ Days
Current	Correlation Coefficient	1.000	.135(*)	.080	.181(**)	.160(*)
	Sig. (1-tailed)	.	.025	.125	.004	.015
	N	209	209	209	209	183
30 Days	Correlation Coefficient	.135(*)	1.000	.215(**)	.239(**)	.028
	Sig. (1-tailed)	.025	.	.001	.000	.355
	N	209	209	209	209	183
60 Days	Correlation Coefficient	.080	.215(**)	1.000	.162(**)	.052
	Sig. (1-tailed)	.125	.001	.	.010	.241
	N	209	209	209	209	183
90 Days	Correlation Coefficient	.181(**)	.239(**)	.162(**)	1.000	.083
	Sig. (1-tailed)	.004	.000	.010	.	.133
	N	209	209	209	209	183
120+ Days	Correlation Coefficient	.160(*)	.028	.052	.083	1.000
	Sig. (1-tailed)	.015	.355	.241	.133	.
	N	183	183	183	183	183

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

were observed in Table 6, whereas Table 3 revealed negative correlations. This indicates that the corrected measure is capable of showing improvement in multiple categories simultaneously as collection efficiency improves, which was not possible using the traditional Aging Schedule.

The impact of changes in credit sales on the corrected Aging Schedule was examined by determining whether credit sales for the previous 30 days were correlated to the Current category of the traditional Aging Schedule. This analysis is shown in Table 7. Unlike the case for the traditional Aging Schedule, it has been found that credit sales are not significantly positively correlated to the Current category of the corrected Aging Schedule.

Table 7: Corrected Aging Schedule Correlation to Credit Sales

Spearman's Rho N = 209		Current
Sales for Month	Correlation Coefficient	-.027
	Sig. (1-tailed)	.701

Appraising the Corrected Average Collection Period

The distorting effect of credit sales on the corrected ACP was investigated by testing for a relationship between credit sales and the corrected ACP. An examination of this relationship has been made by correlating credit sales for the previous 30 and 360 days (see Table 8). Unlike the case for the traditional ACP, no association between ACP and credit sales for the previous 30 or 360 days is in evidence. The effect of removing the credit sale distortion is shown in the aggregate statistics of the corrected and traditional ACP, shown in Table 9. The corrected ACP demonstrates less extremes and lower variability than the traditional measures.

Conclusion

Accurate monitoring and proper management of accounts receivable are important dimensions of financial management in organisations that make credit sales. Despite this, flawed collection efficiency measures are widely promoted in the normative literature and extensively used in practice. This is particularly problematic where these measures are used for internal performance measurement, as an inaccurate gauging of the efficiency of the accounts receivable collection function will result.

There is a paucity of research directed to this issue and the limited related literature is becoming somewhat dated. As problems and suggested improvements to the Ageing schedule and ACP have been afforded literary attention as far back as the 1960s, it is perplexing that the flawed measures are still uncritically espoused in the normative literature. This paper seeks to remedy this situation by offering new ways of dealing with the shortcomings of the traditional measures in a parsimonious manner.

It has been noted that distortions resulting from changing levels of credit sales do not affect the corrected ACP. The corrected ACP will decrease whenever there is an increase in accounts receivable collections, regardless of credit sale activity. Similarly, the corrected Aging Schedule provides a stronger basis for monitoring changes in collection achievement. The corrected Aging Schedule reveals improvements in the age categories in which collections are made without affecting other age categories, and similarly without being distorted by credit sale activity.

The corrections applied remove the distorting effect of changes in credit sales. This does not mean that changes in credit sales will not affect the measures, as changes in credit sales may alter collection efficiency. While a small volume of credit sales may be easy to manage, large credit sales can result in a proliferation of accounts that may be difficult to manage.

The contributions in this paper are seen as significant as no prior research has identified refinements that eliminate the distortions of these measures in such an easy to apply manner. This is of particular pertinence to managers, as for a measure to be useful, it needs to be constructed in a form that facilitates easy adoption. Testimony with respect to the practicality of the measures advanced is evident from the fact that the subject company of this study's empirical phase has adopted the refined measures to

Table 8: Corrected Average Collection Period Correlation to Credit Sales

Pearson Correlation N = 209		Corrected ACP
Credit Sales for Previous 30 Days	Correlation Coefficient	-.006
	Sig. (2-tailed)	.933
Credit Sales for Previous 360 Days	Correlation Coefficient	.045
	Sig. (2-tailed)	.518

Table 9: Descriptive Statistics for Traditional and Corrected ACP Measures

	Average Collection Period		
	Corrected	Traditional Monthly ACP	Traditional Yearly ACP
Minimum	31.02	30.96	27.45
Maximum	68.33	73.87	104.37
Mean	43.02	43.69	49.12
Standard Deviation	6.41	8.70	12.20

gauge accounts receivable collection efficiency. Unlike previous studies of this issue, this paper clearly demonstrates the implications of the ACP distortions under various sales volatility scenarios and how the corrected ACP measure resolved the distortion in each case. An additional merit of this paper is that it highlights the direction of a distortion resulting from a particular change in sales. This problem is particularly significant for any organisation that experiences high sales volatility or seasonality, or are in a pattern of sales growth or sales decline.

That part of the study that analysed empirical data has provided affirmation that both the traditional Aging Schedule and traditional ACP were affected by changes in credit sales. It has also shown that the traditional Aging Schedule is subject to interdependence, where a change in one category results in changes in the value of other categories. It has also demonstrated that the corrected Aging Schedule and corrected ACP are free from these shortcomings.

As already noted, the parent organisation of the company that served as the case study for this study is now applying the refined measures promoted in this paper and these measures were subsequently used to justify an overhaul of the company's receivables management. Changes made by the parent company included a revised approach to the raising of late payment fees, application of administration fees, and debtor controls being executed from Head Office instead of at the branch level. Differences between high performing and low performing sites have been made more apparent following the elimination of any change in credit sales effects. The impact of seasonal sales volatility on the accounts receivable performance measures has been eliminated for the first time. These changes highlight the extent to which adoption of the refined accounts receivable performance measures can carry profound organisational implications. Considered in combination, the rationale provided in this paper, together with the impact that the refined measures have had in the case study organisation support the view that the refined measures more accurately capture accounts receivable collection efficiency relative to the measures widely espoused in the normative literature.

Several limitations should be born in mind when interpreting this study. Firstly, the study has restricted its focus to a limited number of accounts receivable collection performance measures. Secondly, only the distorting effect of sales changes has been examined. Further, as the empirical data examined was limited to one organisation, caution must be exercised if seeking to generalise the findings to a broader population. Despite this cautionary note, based on the rationale provided, the authors are unaware of any factors that would preclude the observations made in the case study entity from being replicated in a range of other business contexts. Finally, the refinements presented in this study are most applicable to an internal management context, as the data required to make the measurement refinements would not be available to the users of conventional annual financial accounts. It is

notable, however, as noted in connection with the corrected ACP, if the age categories' duration is a year, the corrected ACP is identical to the traditional ACP. This signifies that for the external user drawing on reported annual published accounts, the ratio results would converge with those reported using the corrected measures promoted in this study.

In light of the limited research in this area, it would be revealing to survey organisations to ascertain the extent and manner in which the Aging schedule, ACP and other accounts receivable collection measures are used for internal performance measurement, the degree to which practitioners are aware of the problems with these measures and also the extent to which the distortion effects result in inappropriate management actions. Additional case study research may also provide insight on how these measures are used in practice, what modifications are made, if any, and impediments that would be encountered in adopting the methods outlined in this paper. Anecdotal observations made suggest managers are aware of some of the distorting problems of accounts receivable collection measures, but are unsure how to correct them. It may also be fruitful to investigate the applicability of these corrections to other areas such as inventory turnover and other time based ratios.

References

Arnold, G. (2005), *Corporate Financial Management (3rd ed.)*, Prentice Hall, Bath, United Kingdom.

Asselbergh, G. (1999), "A strategic approach on organizing accounts receivable management: some empirical evidence", *Journal of Management and Governance*, 3(1): pp.1-29.

Bazley, M., Hancock, P., Berry, A., and Jarvis, R. (2004), *Contemporary Accounting (5th ed.)*, Thomson, Victoria.

Benishay, H. (1965), "Managerial controls of accounts receivable: A deterministic approach", *Journal of Accounting Research,* 3(1): pp.114-132.

Birt, J., Chalmers, K., Beal, D., Brooks, A., Byrne, S., and Oliver, J. (2005), *Accounting: Business Reporting for Decision Making*, John Wiley and Sons Australia, Ltd, Singapore.

Carpenter, M. D., and Miller, J. E. (1979), "A reliable framework for monitoring accounts receivable", *Financial Management*, Winter: pp.37-40.

Cotter, R. V. (1973), "Comment: A general model for accounts-receivable analysis and control", *The Journal of Financial and Quantitative Analysis*, 8(2): pp.219-221.

Doupnik, T., and Perera, H. (2007), *International Accounting (1st ed.)*, McGraw-Hill, United States.

Freitas, L. P. (1973), "Monitoring accounts receivable", *Management Accounting,* 55(3): pp.18-21.

Gallinger, G. W., and Ifflander, A. J. (1986), "Monitoring accounts receivable using variance analysis", *Financial Management*, 15(4).

Hilton, R. W. (1994), *Managerial Accounting (2nd ed.)*, McGraw-Hill Inc., USA.

Horngren, C. T., Harrison, W. T. and Bamer, L. S. (2005), *Accounting (6th ed.)*, Pearson Education International.

Jackling, B., Raar, J., Wigg, R., Williams, B., and Wines, G. (2004), *Accounting: A Framework for Decision Making*, McGraw Hill, Australia.

Lasher, W. R. (2005), *Practical Financial Management (4th ed.),* South-Western, USA.

Lewellen, W. G., and Edmister, R. O. (1973), "A general model for accounts-receivable analysis and control", *The Journal of Financial and Quantitative Analysis*, 8(2): pp.195-206.

Lewellen, W. G., and Johnson, R. W. (1972), "Better way to monitor accounts receivable", *Harvard Business Review*, May-June 1972: pp.101-109.

Peacock, R., Martin, P., Burrow, M., Petty, J. W., Keown, A. J., Scott, D. F. Jr., and Martin, J. D. (2003), Financial Management (3rd ed.), Prentice Hall, China.

Pike, R., and Cheng, N. S. (2001), "Credit management: An examination of policy choices, practices and late payment in UK companies", *Journal of Business Finance and Accounting,* 28(7 and 8): pp.1013-1042.

Pike, R., Cheng, N. S., Cravens, K., and Lamminmaki, D. (2005), "Trade credit terms: Asymmetric information and price discrimination evidence from three continents", *Journal of Business Finance and Accounting*, 32(5 and 6): pp.1197-1236.

Ridley, J. (1993), "The best way to report on customer receivables", *Management Accounting,* 71(8): pp.24-27.

Stone, B. K. (1976), "The payments-pattern approach to the forecasting and control of accounts receivable", *Financial Management,* Autumn: pp.65-82.

Zeune, G. D. (1991), "Flawed analysis: How seasonality inaccurately alters traditional ratios", *Business Credit,* 93(8): pp.15-18.

Appendix A: Effect of Changing Credit Sales on Traditional ACP

Assume a company operates in 30 day periods, has a financial year of 360 days and make $1.2M in trade credit sales over the course of a year. Credit sales are evenly earned over the year, such that 1/12, or $100,000 of the credit sales are made each month and 1/360 are made per day. Collections are normally distributed, with an average collection period of 30 days and a standard deviation of 5 days. Four scenarios are considered below. For each scenario, assume credit sales are unchanged for the first five periods, and in the 6th period credit sales change in a particular way. For each of the four scenarios, data over a 24 month period is graphed along with daily ACP calculations.

Scenario 1 (see Figure A1): Credit sales change by 20% and then stay at this level. The effect

of an increase is an immediate increase in the ACP followed by a period where the ACP gradually reduces until it returns to its former level. An entire year is affected.

Scenario 2 (see Figure A2): Credit sales change by 20%, but only for one period (30 days). The effect of a one-off short-term increase in credit sales is an immediate increase in the ACP followed by a reduced ACP period for another 12 periods.

Scenario 3 (see Figure A3): Credit sales change by 20% per year and continue to change at that rate (sustained growth/shrinkage). The effect of increasing credit sales by 20% per year is that the ACP remains at an elevated level.

Scenario 4 (see Figure A4): Credit sales randomly change, where each day's sales may vary from zero to double the daily average. The effect of random credit sales is that ACP moves randomly.

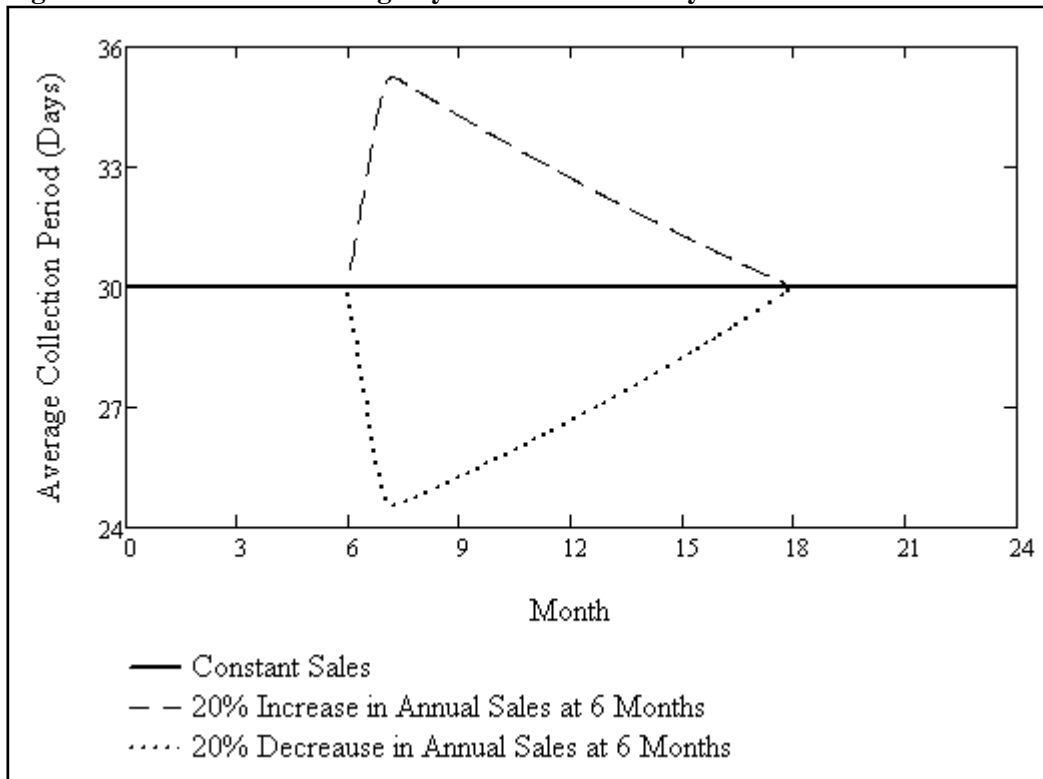**Figure A1: Credit Sales Change By 20% and Then Stay at This Level**

Figure A2: Credit sales change by 20%, but only for one period (30 Days)
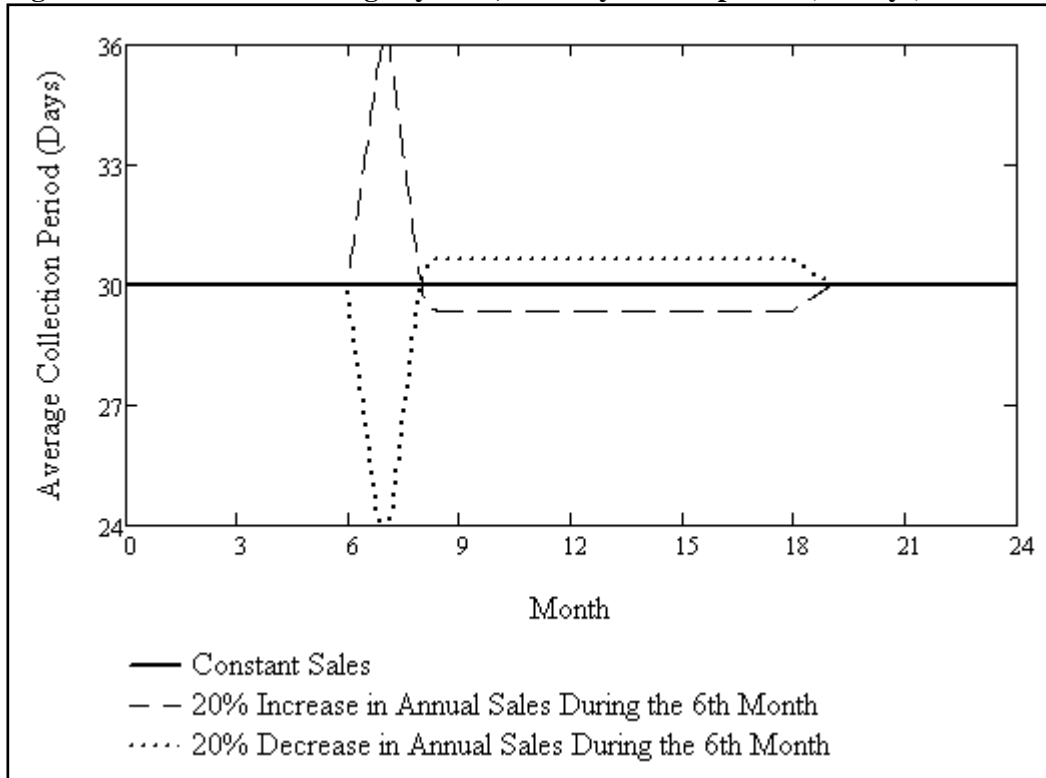

Figure A3: Credit sales change by 20% per year and continue to increase at that rate
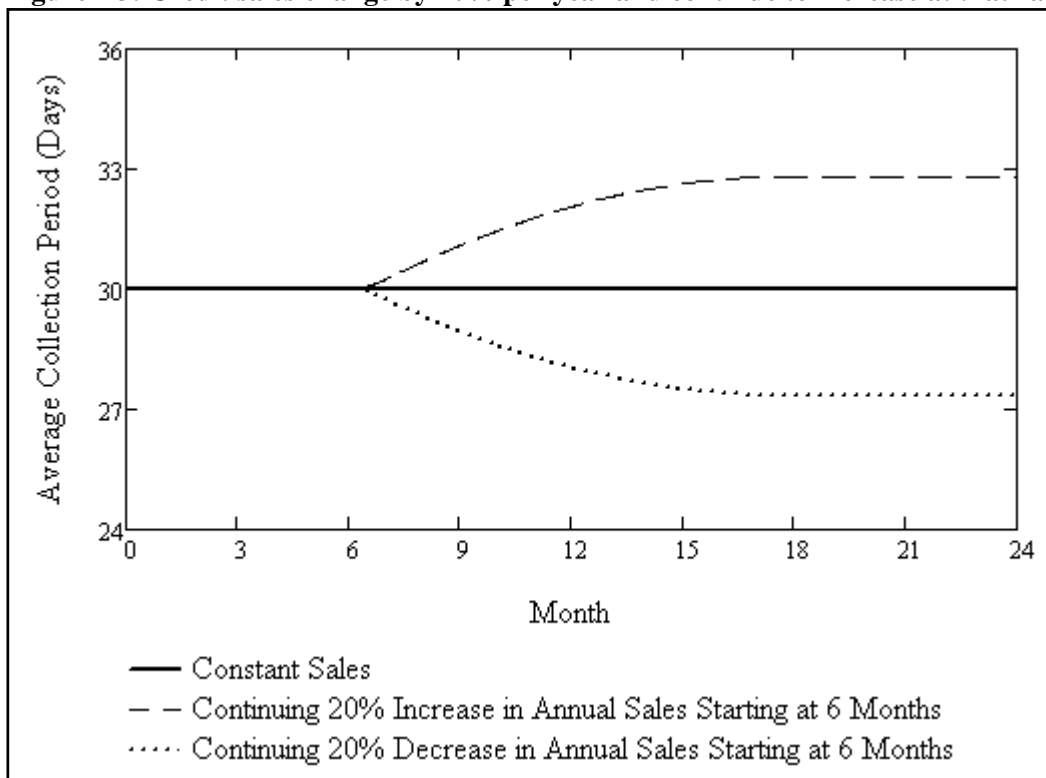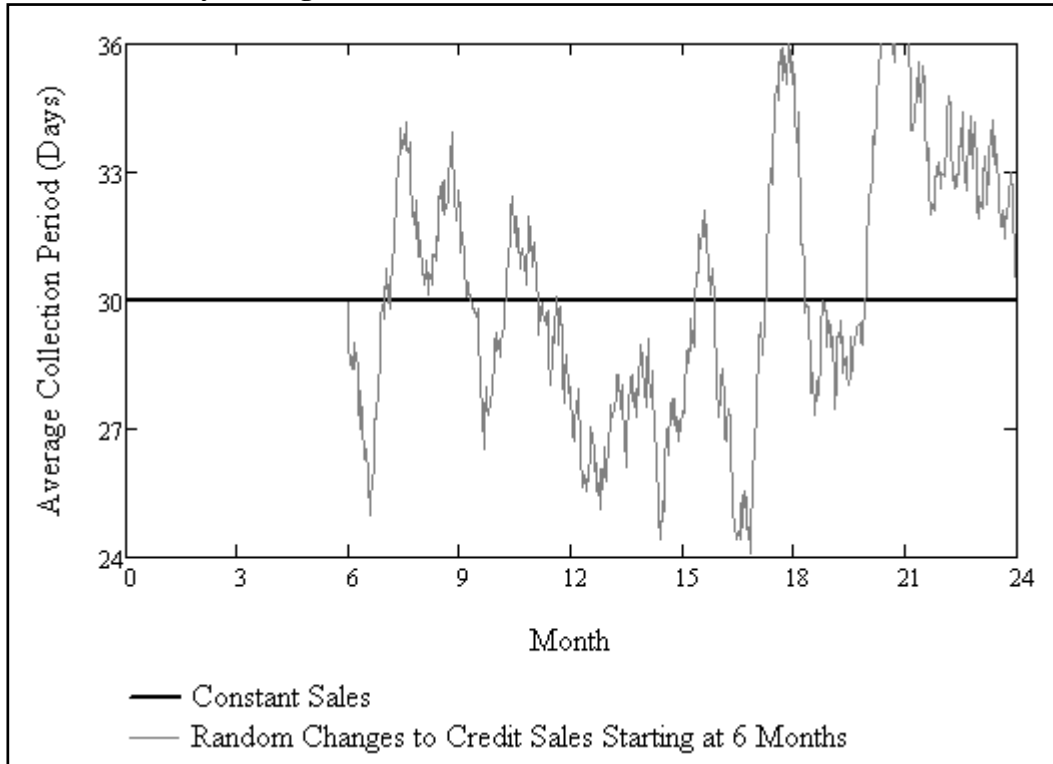
Figure A4: Credit Sales Become Random, Deviating from the Average by Zero to Double the Daily Average.
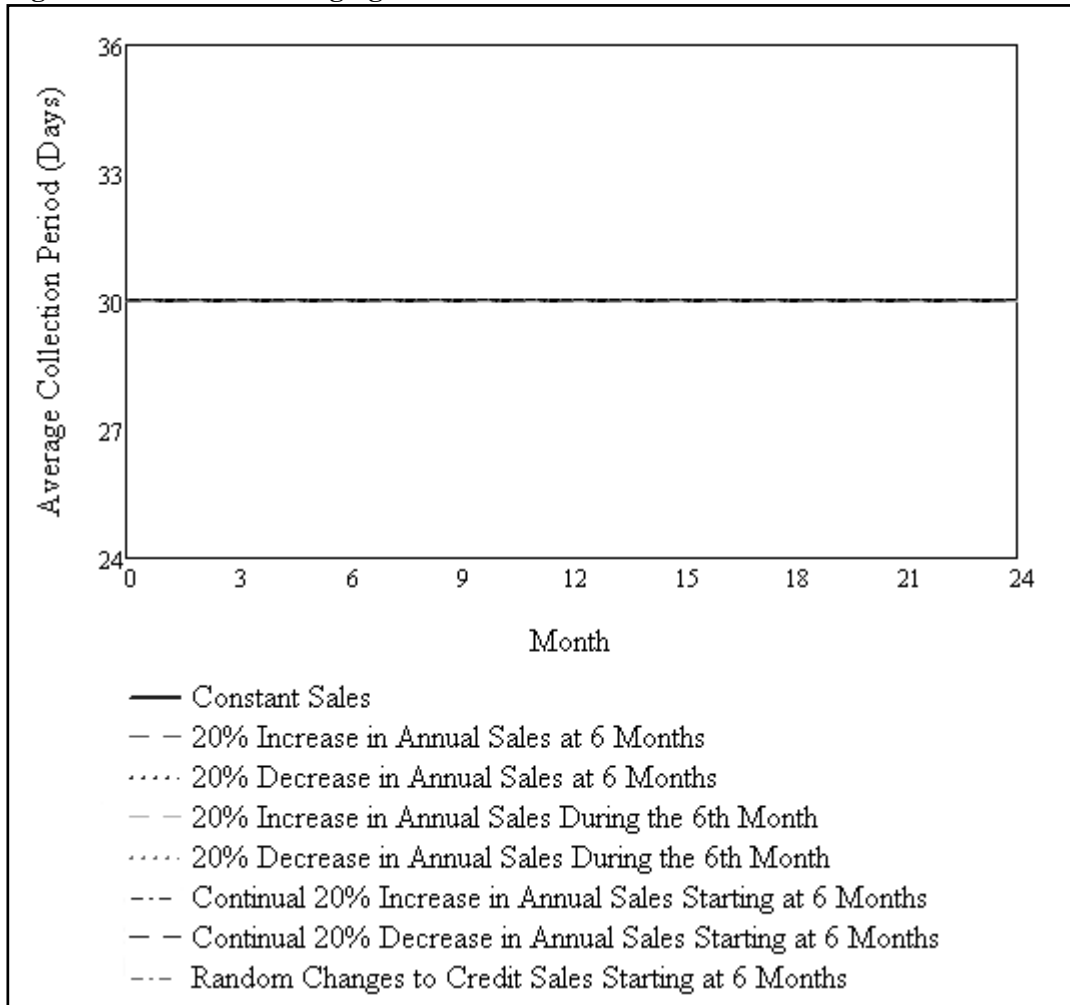
Appendix B: Effect of Changing Credit Sales on Corrected ACP

The correction of ACP is clearly demonstrated when the scenarios of Appendix A are applied to the corrected ACP. In this instance the corrected ACP is calculated using daily categorisation of credit sales and accounts receivables.

The figure below demonstrates that the corrected ACP remained constant, reflecting the unchanging collection efficiency, in spite of various changes to credit sales.

Figure B1: Effect of Changing Credit Sales on Corrected ACP

Appendix C: Effect of Changing Collection Efficiency on Traditional ACP and Corrected ACP

Appendices A and B explored four different scenarios with changing credit sales while collection efficiency is held constant. Appendix C explores two more scenarios incorporating changing collection efficiencies.

Scenario 1 (see Figure C1):Assuming credit sales are the same dollar value from period to period, both the traditional and corrected ACP provide an accurate means of detecting a change in collection efficiency. In the example below, collections were improved at 6 months

(a reduction of 5 days), and both measures accurately reflect the change.

Scenario 2 (see Figure C2):When credit sales vary from period to period, the corrected ACP measure continues to accurately capture the changed collection efficiency. The traditional ACP measure's ability to do this is significantly compromised by spurious changes.

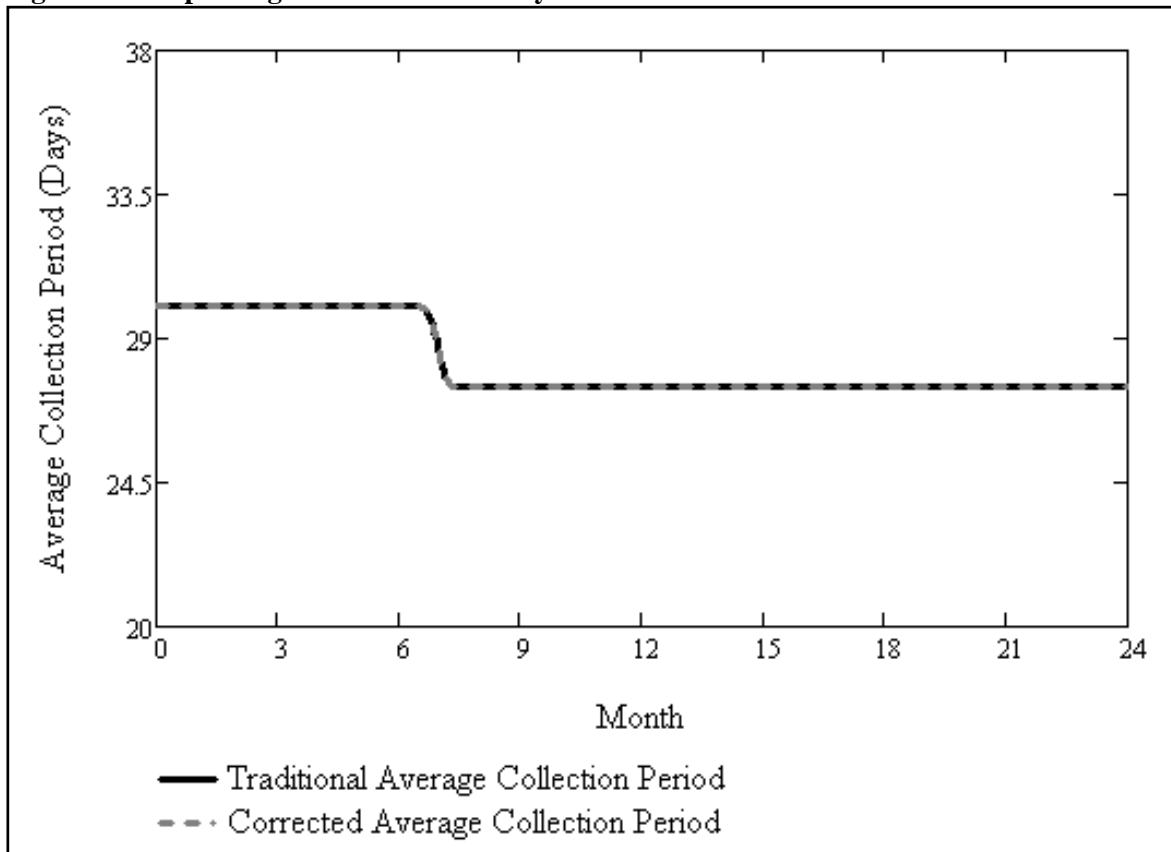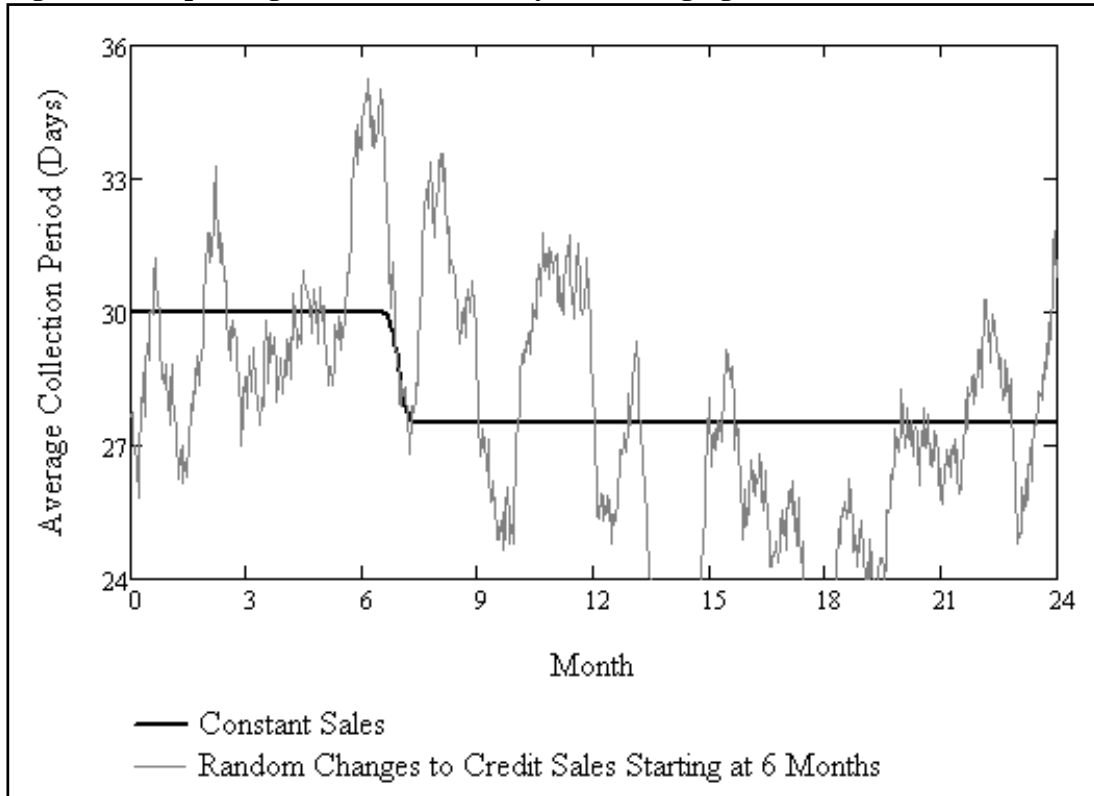**Figure C1: Improving Collection Efficiency and Constant Credit Sales.**

Figure C2: Improving Collection Efficiency and Changing Credits Sales

Appendix D: Summary of Sales and Accounts Receivable of Target Company

Figure D1: Credit Sales and Accounts Receivables of Target Company