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Research Article

Effect of Coefficient of Variation on Variable Sampling Scheme Indexed in AQL and AOQL under Measurement Error

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Abstract
This study investigates the impact of measurement error on variable sampling schemes indexed by Acceptance Quality Limit (AQL) and Average Outgoing Quality Level (AOQL) while considering a known Coefficient of Variation (CV). We present procedures and tables for selecting appropriate variable sampling plans based on specified AQL and AOQL values. In our approach, rejected lots undergo 100% inspection to replace non-conforming items. The operating characteristic (OC) function is analyzed for various CV values, highlighting how measurement error influences the classification of product quality. Our findings emphasize the importance of understanding the relationship between measurement error, CV, AQL, and AOQL in quality control processes, ultimately aiming to enhance product quality and optimize inspection resources.

Keywords: AOQL, AQL, Coefficient of variation, Measurement error, OC function, Variable sampling scheme
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1. Introduction

The primary objective of quality control is to ensure that a product or service meets the required standards and satisfies customer expectations. This involves maintaining consistency in production processes and ensuring product reliability. To achieve this, the acceptance of an application is recognized as part of a process that involves detecting and analyzing product quality, implementing quality control measures, and making necessary improvements, particularly in identifying and managing defective components.Replacement plan is one of the classifications of warranty that requires fewer instances but provides the same protection to manufacturers and consumers [1]. To check the stability of the product. CV is defined as the ratio of the standard deviation to the mean; This is better than the overall effect. It is considered an important metric to identify and compare changes. It is more important to use CV to describe variance than standard deviation. CV allows investors to determine how unpredictable or risky the assumption is compared to the expected return on investment. In recent years, a lot of work has been done on different models for different situations. [2] proposed a two-stage regression model based on the dependent variable. [3] investigated the robustness of one-shot methods measured by AQL and AOQL. [4] and [5] investigated that CV can be used as a negative factor. Obtaining a high level of final product while controlling the production cost is a challenge in the production process. Analytical techniques have been used effectively to solve this problem; For this purpose, the product is analysed. All audits have the potential for errors, such as accepting the wrong product and rejecting the appropriate product.

These errors are called observational errors, are mostly due to chance and can be predicted. The requirement that a product measure be within certain limits is often more important than the requirement that the product mean and variance be at or near a decision. Many authors have proposed acceptance criteria as a measure of error. [6] proposed acceptance through change as a measure of uncertainty. [7] presents a model based on measurement error for variables. [8] proposed a two-stage variable sampling plan to compare its performance with the single sampling plan by minimizing the ASN using the two-point approach on the OC curve. [9] have used three forms of acceptance criteria(σ-method, s-method and R-method) for the selection of single sampling plan for variables. [10] introduced a new variable sampling plan based on the process capability index to deal with product acceptance determination. [11] studied the impact of the coefficient of variation (CV) on single-sampling plans, highlighting its role in improving quality control under normality assumptions. [12] determines plan parameters using the classical two-point condition on the operating characteristic curve to meet both producer and consumer risk requirements. The proposed sampling plan achieves the same protection with a smaller sample size, particularly for high-quality lots. [13] investigates the performance of the coefficient of variation chart in the presence of measurement errors for a finite production horizon. Also, studies a two-sided Shewhart coefficient of variation chart with measurement errors for detecting both increases and decreases in the coefficient of variation for short run processes using an error model with a linear covariate. [14] considered a generalized multiple dependent state (GMDS) sampling plan for accepting a lot based on the coefficient of variation when a quality characteristic comes from a normal distribution. [15] aimed to develop a coefficient of variation (CV) control chart utilizing the generalized multiple dependent state (GMDS) sampling approach for CV monitoring. [16] developed some novel calibration-based coefficient of variation estimators for the study variable under double-stratified random sampling (DSRS) using the robust features of linear (L and TL) moments, which offer appropriate coefficient of variation estimates.

The remaining article is structured as follows: Section 2 discusses the methodology of the sampling plan. Section 3 presents the numerical tables, calculations, and results. Section 4 provides a discussion on the effect of CV on AQL, AOQL, and measurement error. Finally, the conclusion of this study is presented in Section 5.

2. Variable Sampling with Known Coefficient of Variation Under Measurement Error

In connection with the variable sampling plan when σ is known, the density function is given by:

$$\phi(y_e) = \int_{\infty}^{y_e} \frac{1}{\sqrt{2\pi}} e^{\frac{-1}{2}Z^2} dZ$$

where $Z \sim N(0,1)$. The acceptance criterion for the inspection plan with upper specification limit, U_e, is:

accept the lot if $\bar{x} + k_{\sigma_e} \leq U_e$

where k_{σ_e} is the acceptance parameter. Now, the acceptance criterion for the lower specification limit, L_e, is:

accept the lot if $\bar{x} + k_{\sigma_e} \geq L_e$.

The fraction non-conformities in a lot given will be:

$$\phi(-\nu_e) = p_e \tag{2.1}$$

with

$$\nu_e = \frac{U_e - \mu}{\sigma_e}.$$

If the proportion defective in the lot is p_e, then $\nu_e \sigma_e + \mu = U_e$ and its probability of acceptance will be:

$$P_a(p_e) = \phi(w_e) \tag{2.2}$$

where

$$w_e = (\nu_e - k_{\sigma_e})\sqrt{n_{\sigma_e}\rho_e^2 + v_e^2}$$

whenever ρ_e is the measurement error, given by the equation $\left(\frac{\sigma_p}{\sigma_e} = \frac{\rho_e}{\sqrt{1-\rho_e^2}}\right)$ and v_e is the coefficient of variation.

If all the fallacies originated in the rejected lots are reinstated by the conformities in a rectifying inspection plan. The determination of AOQ is approximated by:

$$AOQ = p_e P_a(p_e).$$

If p_{em} is the proportion non-conformity at the maximum value of AOQ, then AOQL is given by:

$$AOQ = p_{em} P_a(p_{em}). \tag{2.3}$$

If AQL(p_{e1}) is specified, then the corresponding value of v_{AQL} or v_{e1} will be fixed and if $P_a(p_{e1})$ is fixed at 95%, then $w_{AQL} = w_1 = 1.645$. Hence, we have:

$$1.645 = (v_{e1} - k_{\sigma_e})\sqrt{n_{\sigma_e}\rho_e^2 + v_e^2}. \tag{2.4}$$

So that for a given AQL, k_{σ_e} is determined by the sample n_{σ_e}. For calculating the optimal value of n_{σ_e} and k_{σ_e}, a trial value is assumed and the probability of acceptance at p_{em} is found from equation (2.3) as:

$$P_a(p_{em}) = \frac{AOQL}{p_{em}}. \tag{2.5}$$

The auxiliary variables v_{em} and w_{em} corresponding to the values of p_{em} and $P_a(p_{em})$ respectively, can be obtained using the equation (2.1) and (2.2). The values of v_{e1} and $w_{e1} = 1.645$ are known for a given value of p_{e1}. By using values of v_{e1}, w_{e1}, v_{em} and w_{em}, we can calculate n_{σ_e} by the following equation given by Wallis (1948):

$$n_{\sigma_e} = \frac{(w_{e1} - w_{em})^2}{(v_{e1} - v_{em})^2}. \tag{2.6}$$

By using the value of n_{σ_e} given in equation (2.6), it is observed whether or not the trial value of p_{em} satisfies the following equation:

$$AOQL - p_{em}^2\sqrt{n_{\sigma_e}\exp\left[-(w_{em}^2 - v_{em}^2)\right]} = 0. \tag{2.7}$$

The equation (2.7) can be obtained by following the formula:

$$\frac{dAOQ}{dp_e} = P_a(p_e) + p_e\frac{dP_a(p_e)}{dp_e} = 0 \tag{2.8}$$

where

$$\frac{dP_a(p_e)}{dp_e} = -\sqrt{n_{\sigma_e}\exp[-(w_{em}^2 - v_{em}^2)]}.$$

If the trial value of p_{em} would not satisfy equation (2.8), then another value will be obtained from the same equation, and the method of successive substitution is often found for the optimal result, and equation (2.8) can be rewritten as:

$$p_{em} = \frac{AOQL}{p_{em}\sqrt{n_{\sigma_e}\exp\left[-(w_{em}^2 - v_{em}^2)\right]}}.$$

This iterative process continues till the convergence of p_{em} is achieved. Furthermore, the value of k_{σ_e} can be calculated using equation (2.4).

3. Numerical Illustration and Result

For illustrating the calculation numerically, we have considered a single sampling plan for variables under measurement error with the effect of the coefficient of variation. For examining the sampling scheme following values are considered: ρ_e=∞(error free),2,4,6, v_e=0,1,4,8,16.

Furthermore, Table 4.1, Table 4.2, Table 4.3, Table 4.4 is used for the selection of σ-method single sampling plan. For example, if we fix the AQL=1% and AOQL=1.25% then Table 4.1 provides $n_{\sigma_e} = 23$ and $k_{\sigma_e} = 1.984$ when $v_e = 0$. Suppose that it is decided to use the σ-method acceptance criterion when $\sigma_e = 2.0$, there is an upper specification limit $U_e = 10$ exists, and a unit for which the quality characteristic $x > U_e$ is considered as non-conforming. In such a case, Table 4.5, Table 4.6,

Table 4.7, Table 4.8 shows the performance characteristics of the plan with $n_{\sigma_e} = 23$ and $k_{\sigma_e} = 2$ under a rectifying inspection scheme. If the true process average quality is operating at AQL(μ=3.82) then 95% of the submitted lots will be accepted and 5% of the rejected lots will be rectified by replacing non-conforming units with conforming units. In that case, the AOQ will be only 0.95%. If the submitted lot quality deteriorates to 0.19%, only about 67% of the lots will be accepted by the sampling plan, and one out of every three lots will be rejected and rectified. The AOQ in such a case does not exceed the AOQL=1.25%, which means, irrespective of the product quality submitted by the producer, the consumer will receive an average quality not worse than 1.25% under the rectification scheme.

The user of Table 4.1, Table 4.2, Table 4.3, Table 4.4 given here should understand the limitations of plans indexed by AOQL. Sampling with rectification of rejected lots on the one hand reduces the average percentage of nonconforming items in the lots, but on the other hand, introduces non-homogeneity in the series of lots finally accepted. That is, any lot will have a quality of p_e% or 0% nonconforming, depending on whether the lot is accepted or rectified. Thus, the assumption underlying the AOQL principle is that the homogeneity in the qualities of individual lots is unimportant and only the average quality matters. For plans listed in Table 4.1 if the individual lot quality happens to be the product quality p_{em} at which AOQL occurs, then the associated probability of acceptance will be poor. For example, at an AQL=0.25% and an AOQL=1.25% Table 4.9 gives $p_a(p_{em}) = 0.32$, then, from equation (2.5), $p_{em} = 3.90\%$, then on an average of every three lots passed on to the customer, two will be free from non-conforming items, the third lot will contain 3.90% non-conforming items, which is 16 times the AQL specified for $v_e = 0$. In a similar way, we can interpret the results for other values of v_e. Furthermore, if we consider the plan given in Table 4.2, the AQL is set at 0.15%, which means, a lot must produce no more than 0.15% defective items during the production process to be acceptable. AOQL of 0.5% means the average proportion of defective products after inspection shall not rise above 0.5%. The acceptance probability is comparatively low $p_a(p_{em}) = 0.414$ i.e. 41.4% given in Table 4.10, this low likelihood indicates that the lot will probably be rejected more than half the time, then equation (2.5) gives lot quality $p_{em} = 1.208\%$, a substantial increase over the AQL of 0.15%. This indicates that the lot's defect rate is significantly higher (almost 8 times) than what is adequate. In addition to, The sample plan given in Table 4.3 may be sufficiently tolerant to accept lots with defect rates higher than the acceptable threshold, as indicated by the high likelihood of acceptance 80.3% given in Table 4.11, due to the lot quality of 0.0996%, obtained by using equation (2.5), being greater than the permissible limit of both AQL= 0.065% and AOQL=0.08%. This implies that even if the lot frequently passes inspection, there are still more defects than is ideal. The high CV of 8 indicates a high degree of process variability, which raises the risk of variable product quality and adds to greater failure rates. Table 4.12 provides values of the probability of acceptance for different values of v_e when $\rho_e = \infty$.

To avoid such inconvenience, the producer should maintain the process quality more or less at the AQL. The high rate of rejection of lots at $p_e = p_{em}$ will also indirectly put pressure on the producer to improve the submitted quality.

4. Discussion

In addition to, CV plays a significant role in variable sampling scheme indexing in terms of AQL and AOQL, especially in the presence of measurement error. Here's how it affects these parameters:

1. AQL:

- In variable sampling schemes, AQL represents the maximum acceptable level of non-conforming items in a batch or lot.
- The impact of CV on AQL is primarily through its influence on measurement error. A higher CV can lead to increased measurement variability, which may affect the determination of whether a batch meets the AQL criteria.
- When there's measurement error, a higher CV can result in wider variability in measured values, potentially leading to misclassification of batches as conforming or non-conforming.

2. AOQL:

- AOQL represents the average quality level of outgoing lots over time when the process is operating at its AQL.
- Measurement error, influenced by the CV, can affect the AOQL by introducing variability in the measurement process.
- A higher CV can lead to increased uncertainty in measuring the quality of outgoing lots, potentially impacting the AOQL calculations.
- In variable sampling schemes, where measurement error is considered, adjustments may need to be made to the AOQL calculations to account for the variability introduced by the CV.

CV		AQL%											
	AOQL%	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	44,3.105											
	0.08	16,2.935	43,2.965										
	0.125	9,2.800	15,2.794	38,2.823									
	0.2	6,2.666	8,2.644	13,2.638	29,2.660								
	0.32	4,2.533	5,2.502	7,2.482	11,2.475	29,2.504							
v_e=0	0.5	3,2.404	4,2.367	5,2.339	6,2.319	11,2.311	29,2.346						
	0.8	2,2.260	3,2.219	3,2.186	4,2.159	6,2.134	10,2.129	27,2.169					
	1.25		2,2.070	2,2.033	3,2.002	4,1.968	5,1.947	9,1.945	23,1.984				
	2			2,1.967	2,1.825	3,1.786	3,1.756	5,1.735	8,1.733	17,1.766			
	3.2					2,1.587	2,1.552	3,1.522	4,1.504	6,1.502	16,1.548		
	5							2,1.301	2,1.276	3,1.261	6,1.263	14,1.319	
	8								2,1.004	2,0.983	3,0.968	5,0.975	12,1.045
	0.05	45,3.107											
	0.08	17,2.948	44,2.968										
	0.125	10,2.829	16,2.808	39,2.827									
	0.2	7,2.719	9,2.676	14,2.655	30,2.666								
	0.32	5,2.619	6,2.561	8,2.519	12,2.495	30,2.509							
v_e=1	0.5	4,2.529	5,2.460	6,2.406	7,2.364	12,2.333	30,2.351						
	0.8	3,2.439	4,2.361	4,2.296	5,2.241	7,2.184	11,2.154	28,2.175					
	1.25		3,2.271	3,2.198	4,2.133	5,2.059	6,2.004	10,1.971	12,1.867				
	2			3,2.099	3,2.025	4,1.937	4,1.864	6,1.802	24,1.991	18,1.778			
	3.2					3,1.822	3,1.734	4,1.651	9,1.769	7,1.551	17,1.561		
	5							3,1.519	5,1.590	4,1.373	7,1.318	16,1.333	
	8								3,1.438	3,1.203	4,1.108	5,1.049	13,1.064
	0.05	59,3.139											
	0.08	31,3.055	59,3.001										
	0.125	24,3.015	30,2.917	53,2.865									
	0.2	21,2.990	23,2.874	28,2.780	44,2.720								
	0.32	19,2.975	20,2.849	22,2.740	26,2.645	45,2.684							
v_e=4	0.5	18,2.965	19,2.835	20,2.719	21,2.611	26,2.645	44,2.528						
	0.8	17,2.958	18,2.825	18,2.705	19,2.590	21,2.627	25,2.487	43,2.358					
	1.25		17,2.819	17,2.697	18,2.579	19,2.617	20,2.469	24,2.316	38,2.193				
	2			17,2.691	17,2.571	18,2.611	18,2.460	20,2.298	22,2.153	31,1.877			
	3.2					17,2.607	17,2.454	18,2.289	19,2.137	21,1.809	24,1.719		
	5							17,2.285	17,2.129	18,1.784	19,1.677	29,1.447	
	8								17,1.924	17,1.771	17,1.658	19,1.370	27,1.197
	0.05	103,3.190											
	0.08	74,3.162	101,3.052										
	0.125	69,3.154	74,3.025	96,2.922									
	0.2	66,3.151	68,3.017	72,2.896	87,2.791								
	0.32	65,3.149	66,3.014	67,2.889	70,2.771	87,2.631							
v_e=8	0.5	65,3.148	65,3.012	66,2.887	67,2.766	70,2.610	87,2.475						
	0.8	65,3.148	65,3.011	65,2.886	65,2.764	66,2.605	69,2.454	85,2.305					
	1.25		65,3.011	65,2.886	65,2.763	65,2.603	66,2.450	69,2.285					
	2			64,2.885	64,2.763	65,2.602	65,2.448	66,2.281	67,2.126	74,1.979			
	3.2					64,2.602	65,2.447	65,2.279	65,2.123	66,1.968	74,1.768		
	5							64,2.381	64,2.121	65,1.966	66,1.757	72,1.557	
	8								64,2.121	64,1.965	65,1.755	66,1.547	70,1.317
	0.05	275,3.25											
	0.08	259,3.25	273,3.12										
	0.125	257,3.25	259,3.11	270,2.990									
	0.2	257,3.25	257,3.11	258,2.988	264,2.866								
	0.32	256,3.25	256,3.11	257,2.988	257,2.865	264,2.706							
v_e=16	0.5	256,3.25	256,3.11	256,2.987	257,2.865	257,2.704	263,2.551						
	0.8	256,3.25	256,3.11	256,2.987	256,2.865	256,2.704	257,2.549	262,2.382					
	1.25		256,3.11	256,2.987	256,2.865	256,2.704	256,2.549	257,2.381	260,2.224				
	2			256,2.987	256,2.865	256,2.704	256,2.549	256,2.381	256,2.224	258,2.068			
	3.2					256,2.704	256,2.549	256,2.381	256,2.224	256,2.067	257,1.857		
	5							256,2.381	256,2.224	256,2.067	256,1.857	257,1.648	
	8								256,2.224	256,2.067	256,1.857	256,1.648	256,1.411

Table 4.1. Values of n_{σ_e} and k_{σ_e} for different values of v_e when $\rho_e = 4$

CV		AOQL%											
	AOQL(%)	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	45,3.108											
	0.08	16,2.942	43,2.966										
	0.125	9,2.810	16,2.802	39,2.827									
	0.2	6,2.678	9,2.654	14,2.646	30,2.666								
	0.32	4,2.547	5,2.514	8,2.492	12,2.483	30,2.509							
v_e=0	0.5	3,2.420	4,2.381	5,2.351	7,2.330	11,2.320	30,2.351						
	0.8	2,2.278	3,2.236	3,2.201	4,2.172	6,2.145	10,2.138	28,2.174					
	1.25		2,2.089	3,2.051	3,2.018	4,1.982	6,1.959	10,1.954	24,1.990				
	2			2,1.990	2,1.844	3,1.803	3,1.771	5,1.747	8,1.743	17,1.773			
	3.2					2,1.607	2,1.570	3,1.538	4,1.518	6,1.513	17,1.555		
	5							2,1.321	3,1.294	3,1.276	6,1.274	15,1.326	
	8								2,1.026	2,1.003	3,0.984	5,0.988	13,1.053
	0.05	46,3.111											
	0.08	17,2.954	46,2.972										
	0.125	10,2.837	17,2.814	40,2.831									
	0.2	7,2.728	10,2.684	15,2.661	31,2.671								
	0.32	5,2.628	6,2.569	9,2.527	13,2.502	31,2.514							
v_e=1	0.5	4,2.539	5,2.470	6,2.415	8,2.372	12,2.340	31,2.356						
	0.8	3,2.449	4,2.371	4,2.306	5,2.250	7,2.193	11,2.161	29,2.180					
	1.25		3,2.281	3,2.208	4,2.143	5,2.068	7,2.013	11,1.979					
	2			3,2.109	3,2.035	4,1.947	4,1.873	6,1.811	25,1.997	18,1.784			
	3.2					3,1.832	3,1.744	4,1.661	9,1.777	7,1.560	18,1.567		
	5							3,1.529	5,1.599	4,1.383	7,1.326	16,1.339	
	8								4,1.448	3,1.213	4,1.118	6,1.058	14,1.070
	0.05	61,3.142											
	0.08	31,3.057	60,3.004										
	0.125	24,3.017	31,2.919	55,2.867									
	0.2	21,2.991	23,2.875	29,2.782	45,2.722								
	0.32	19,2.975	20,2.851	22,2.742	26,2.647	46,2.685							
v_e=4	0.5	18,2.966	19,2.836	20,2.720	21,2.612	26,2.646	45,2.529						
	0.8	17,2.958	18,2.826	18,2.706	19,2.591	21,2.627	25,2.487	43,2.359					
	1.25		17,2.820	18,2.697	18,2.579	19,2.617	20,2.470	24,2.317	39,2.194				
	2			17,2.691	17,2.571	18,2.611	18,2.460	20,2.299	23,2.153	32,1.879			
	3.2					17,2.608	17,2.455	18,2.290	19,2.137	21,1.811	24,1.721		
	5							17,2.285	18,2.130	18,1.785	19,1.678	30,1.449	
	8								17,1.925	17,1.772	17,1.659	19,1.376	27,1.199
	0.05	103,3.191											
	0.08	75,3.162	102,3.053										
	0.125	69,3.155	74,3.025	97,2.923									
	0.2	66,3.151	68,3.017	72,2.897	87,2.792								
	0.32	65,3.149	66,3.014	67,2.890	70,2.772	88,2.632							
v_e=8	0.5	65,3.149	65,3.012	66,2.888	67,2.766	70,2.611	87,2.476						
	0.8	65,3.148	65,3.012	65,2.886	65,2.764	67,2.605	69,2.454	85,2.306					
	1.25		65,3.011	65,2.886	65,2.763	65,2.603	66,2.450	69,2.285					
	2			64,2.885	64,2.763	65,2.602	65,2.448	66,2.281	67,2.126	75,1.980			
	3.2					64,2.602	64,2.447	65,2.279	65,2.123	66,1.968	74,1.768		
	5							64,2.381	64,2.122	65,1.966	66,1.757	72,1.557	
	8								64,2.121	64,1.965	65,1.755	65,1.547	70,1.317
	0.05	275,3.254											
	0.08	260,3.251	274,3.117										
	0.125	257,3.250	259,3.114	270,2.990									
	0.2	257,3.250	257,3.113	259,2.988	264,2.867								
	0.32	256,3.250	256,3.113	257,2.988	258,2.865	264,2.706							
v_e=16	0.5	256,3.250	256,3.113	256,2.987	257,2.865	257,2.704	263,2.551						
	0.8	256,3.250	256,3.113	256,2.987	256,2.865	256,2.704	257,2.549	262,2.382					
	1.25		256,3.113	256,2.987	256,2.865	256,2.704	256,2.549	257,2.381	260,2.224				
	2			256,2.987	256,2.865	256,2.704	256,2.549	256,2.381	256,2.224	258,2.068			
	3.2					256,2.704	256,2.549	256,2.381	256,2.224	256,2.067	257,1.857		
	5							256,2.381	256,2.224	256,2.067	256,1.857	257,1.648	
	8								256,2.224	256,2.067	256,1.857	256,1.648	256,1.411

Table 4.2. Values of n_{σ_e} and k_{σ_e} for different values of v_e when $\rho_e = 6$

CV		AQL %											
	AOQL(%)	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	37,3.082											
	0.08	13,2.898	36,2.943										
	0.125	7,2.751	13,2.757	32,2.799									
	0.2	5,2.606	7,2.593	11,2.598	24,2.633								
	0.32	3,2.461	4,2.438	6,2.427	9,2.431	25,2.477							
v_e=0	0.5	3,2.320	3,2.292	4,2.272	5,2.261	9,2.267	24,2.319						
	0.8	2,2.164	2,2.131	3,2.106	3,2.087	5,2.074	8,2.082	23,2.141					
	1.25		2,1.969	2,1.941	2,1.917	3,1.894	5,1.885	8,1.897	19,1.953				
	2			2,1.835	2,1.725	2,1.696	3,1.677	4,1.669	6,1.681	14,1.730			
	3.2					2,1.480	2,1.455	2,1.437	3,1.432	5,1.443	13,1.511		
	5							2,1.198	2,1.184	3,1.181	5,1.201	12,1.280	
	8								1,0.889	2,0.879	2,0.880	4,0.907	10,1.003
	0.05	53,3.127											
	0.08	29,3.045	53,2.989										
	0.125	23,3.007	54,2.992	48,2.853									
	0.2	20,2.984	22,2.866	27,2.771	40,2.708								
v_e=4	0.32	19,2.971	20,2.844	21,2.734	25,2.636	41,2.678							
	0.5	18,2.963	18,2.831	19,2.714	21,2.604	25,2.641	40,2.522						
	0.8	17,2.958	17,2.823	18,2.702	19,2.586	20,2.624	23,2.482	39,2.352					
	1.25		17,2.817	17,2.694	18,2.576	18,2.615	20,2.466	23,2.312	36,2.188				
	2			17,2.689	17,2.569	17,2.610	18,2.458	19,2.296	21,2.149	30,1.867			
	3.2					17,2.607	17,2.453	18,2.288	18,2.135	20,1.804	23,1.711		
	5							17,2.284	17,2.128	18,1.781	19,1.673	27,1.437	
	8								17,1.923	17,1.770	17,1.656	19,1.371	26,1.188
	0.05	97,3.186											
	0.08	74,3.161	96,3.048										
	0.125	68,3.153	72,3.023	92,2.918									
	0.2	66,3.150	67,3.015	71,2.895	84,2.788								
	0.32	65,3.149	66,3.013	67,2.889	70,2.770	87,2.630							
v_e=8	0.5	65,3.148	65,3.012	66,2.887	66,2.766	69,2.609	85,2.473						
	0.8	64,3.148	65,3.011	65,2.886	65,2.764	66,2.605	69,2.453	82,2.302					
	1.25		65,3.011	65,2.885	65,2.763	65,2.603	66,2.449	68,2.284	78,2.140				
	2			64,2.885	64,2.763	65,2.602	65,2.448	65,2.280	67,2.125	73,1.977			
	3.2					64,2.602	64,2.447	64,2.278	65,2.122	66,1.967	72,1.766		
	5							64,2.381	64,2.121	65,1.966	66,1.757	71,1.555	
	8								64,2.121	64,1.965	64,1.755	65,1.547	69,1.316
	0.05	272,3.253											
	0.08	259,3.251	271,3.116										
	0.125	257,3.250	259,3.114	268,2.990									
	0.2	257,3.250	257,3.113	258,2.988	263,2.866								
v_e=16	0.32	256,3.250	256,3.113	257,2.988	257,2.865	263,2.706							
	0.5	256,3.250	256,3.113	256,2.987	256,2.865	257,2.704	262,2.550						
	0.8	256,3.250	256,3.113	256,2.987	256,2.865	256,2.704	257,2.549	261,2.382					
	1.25		256,3.113	256,2.987	256,2.865	256,2.704	256,2.549	257,2.381	259,2.224				
	2			256,2.987	256,2.865	256,2.704	256,2.549	256,2.381	256,2.224	258,2.068			
	3.2					256,2.704	256,2.549	256,2.381	256,2.224	256,2.067	257,1.857		
	5							256,2.381	256,2.224	256,2.067	257,1.857	257,1.648	
	8								256,2.224	256,2.067	256,1.857	256,1.648	256,1.411

Table 4.3. Values of n_{σ_e} and k_{σ_e} for different values of v_e when $\rho_e = 2$

CV		AQL%											
	AOQL%	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	47,3.112											
	0.08	17,2.900	46,2.972										
	0.125	9,2.754	16,2.807	40,2.831									
	0.2	6,2.608	9,2.661	14,2.652	30,2.670								
	0.32	4,2.464	6,2.523	8,2.500	12,2.489	31,2.513							
v_e=0	0.5	3,2.324	4,2.392	5,2.361	7,2.338	12,2.327	31,2.355						
	0.8	2,2.168	3,2.249	4,2.213	4,2.183	6,2.154	11,2.145	29,2.178					
	1.25		2,2.104	3,2.065	3,2.031	4,1.994	6,1.968	10,1.961	25,1.994				
	2			2,2.006	2,1.860	3,1.817	4,1.783	5,1.748	8,1.741	18,1.788			
	3.2					2,1.623	2,1.585	3,1.551	4,1.529	6,1.522	17,1.561		
	5							2,1.337	3,1.308	3,1.288	6,1.284	15,1.332	
	8								2,1.044	2,1.019	3,1.998	5,0.999	13,1.060
	0.05	45,3.142											
	0.08	16,3.061	45,3.006										
	0.125	8,3.019	15,2.922	39,2.869									
	0.2	5,2.994	8,2.877	13,2.785	30,2.726								
	0.32	3,2.978	4,2.852	6,2.743	11,2.649	30,2.686							
v_e=4	0.5	2,2.969	3,2.838	4,2.721	6,2.614	11,2.647	30,2.531						
	0.8	2,2.962	2,2.829	3,2.710	3,2.592	5,2.628	9,2.488	30,2.358					
	1.25		2,2.823	2,2.703	2,2.614	3,2.618	5,2.470	9,2.313	24,2.197				
	2			1,1.697	2,2.612	2,2.614	3,2.463	4,2.294	7,2.154	17,1.882			
	3.2					2,2.612	2,2.458	2,2.286	3,2.138	5,1.813	9,1.723		
	5							2,2.283	2,2.131	3,1.790	4,1.683	14,1.452	
	8								1,1.931	2,1.778	2,1.669	3,1.378	12,1.203
	0.05	109,3.195											
	0.08	78,3.166	105,3.055										
	0.125	71,3.157	77,3.029	34,2.924									
	0.2	68,3.154	71,3.021	9,2.897	24,2.792								
	0.32	67,3.152	68,3.017	5,2.891	6,2.771	25,2.632							
v_e=8	0.5	66,3.151	67,3.015	3,2.889	4,2.768	6,2.611	24,2.476						
	0.8	66,3.150	66,3.014	2,2.888	2,2.765	3,2.606	7,2.457	22,2.306					
	1.25		66,3.013	2,2.887	2,2.765	2,2.605	4,2.452	7,2.288	19,2.145				
	2			1,2.887	1,2.764	2,2.604	3,2.451	4,2.284	5,2.128	11,1.980			
	3.2					2,2.604	2,2.449	2,2.282	3,2.125	4,1.970	12,1.772		
	5							2,2.382	2,2.123	2,1.968	4,1.760	8,1.557	
	8								1,2.123	1,1.966	2,1.758	3,1.550	6,1.318
	0.05	43,3.232											
	0.08	12,3.221	39,3.094										
	0.125	7,3.219	21,3.097	27,2.964									
	0.2	4,3.218	5,3.081	8,2.957	19,2.839								
	0.32	3,3.217	4,3.081	4,2.955	6,2.883	19,2.678							
v_e=12	0.5	2,3.217	3,3.080	3,2.954	3,2.832	6,2.673	19,2.523						
	0.8	2,3.216	2,3.080	2.2.954	2,2.832	3,2.671	5,2.517	17,2.413					
	1.25		2,3.080	2,2.954	2,2.831	2,2.671	4,2.517	7,2.411	12,2.199				
	2			1,2.954	1,2.831	2,2.671	2,2.517	4,2.411	1,2.190	6,2.036			
	3.2					1,2.671	2,2.516	3,2.342	1,2.258	1,2.034	2,1.918		
	5							2,2.342	1,2.258	1,2.034	2,1.918	4,1.616	
	8								1,2.190	1,2.033	1,2.917	3,1.615	4,1.379
	0.05	28,3.255											
	0.08	6,3.251	22,3.117										
	0.125	5,3.251	7,3.115	22,2.991									
	0.2	3,3.251	5,3.114	8,2.989	18,2.868								
	0.32	2,3.250	4,3.114	4,2.988	5,2.866	9,2.706							
v_e=16	0.5	2,3.250	3,3.114	2,2.988	3,2.866	5,2.705	9,2.551						
	0.8	2,3.250	2,3.114	2,2.988	2,2.865	3,2.705	3,2.550	7,2.382					
	1.25		2,3.113	1,2.988	1,2.865	2,2.705	3,2.550	6,2.382	4,2.224				
	2			1,2.988	1,2.865	2,2.705	2,2.550	4,2.382	4,2.224	2,2.068			
	3.2					1,2.705	2,2.550	2,2.381	2,2.224	1,2.067	7,1.858		
	5							2,2.381	2,2.224	1,2.067	1,1.857	2,1.648	
	8								1,2.224	1.2.067	1,1.857	2,1.648	3,1.412

Table 4.4. Values of n_{σ_e} and k_{σ_e} for different values of v_e when $\rho_e = \infty$

CV	μ	ν_e	p(%)	w	Pa	AOQ
	3.82	3.09	0.1	1.6381	0.9493	0.095
	4.2	2.9	0.19	0.4364	0.6687	0.1248
	4.5	2.75	0.3	-0.5123	0.3042	0.0907
ν_e=0	5	2.5	0.62	-2.0934	0.0182	0.0113
	5.3	2.35	0.94	-3.0421	0.0012	0.0011
	5.6	2.2	1.39	-3.9908	0	0
	3.82	3.09	0.1	1.639	0.9494	0.095
	4.2	2.9	0.19	0.2299	0.5909	0.1103
	4.5	2.75	0.3	-0.8825	0.1887	0.0562
ν_e=4	5	2.5	0.62	-2.7366	0.0031	0.0019
	5.3	2.35	0.94	-3.849	0.0001	0.0001
	5.6	2.2	1.39	-4.9614	0	0
	3.82	3.09	0.1	1.6433	0.9498	0.0951
	4.2	2.9	0.19	-0.2376	0.4061	0.0758
	4.5	2.75	0.3	-1.7225	0.0425	0.0127
ν_e=8	5	2.5	0.62	-4.1974	0	0
	5.3	2.35	0.94	-5.6823	0	0
	5.6	2.2	1.39	-7.1672	0	0
	3.82	3.09	0.1	1.6477	0.9503	0.0951
	4.2	2.9	0.19	-0.8369	0.2013	0.0376
	4.5	2.75	0.3	-2.7984	0.0026	0.0008
ν_e=12	5	2.5	0.62	-6.0676	0	0
	5.3	2.35	0.94	-8.0291	0	0
	5.6	2.2	1.39	-9.9906	0	0
	3.82	3.09	0.1	1.6387	0.9494	0.095
	4.2	2.9	0.19	-1.5063	0.066	0.0123
	4.5	2.75	0.3	-3.9893	0	0
ν_e=16	5	2.5	0.62	-8.1275	0	0
	5.3	2.35	0.94	-10.6104	0	0
	5.6	2.2	1.39	-13.0934	0	0

Table 4.5. Performance characteristic for variable plan under known CV under measurement error when $\rho_e = 4$

CV	μ	ν_e	p(%)	w	Pa	AOQ
	3.82	3.09	0.1	1.6381	0.9493	0.095
	4.2	2.9	0.19	0.4364	0.6687	0.1248
	4.5	2.75	0.3	-0.5123	0.3042	0.0907
ν_e=0	5	2.5	0.62	-2.0934	0.0182	0.0113
	5.3	2.35	0.94	-3.0421	0.0012	0.0011
	5.6	2.2	1.39	-3.9908	0	0
	3.82	3.09	0.1	1.639	0.9494	0.095
	4.2	2.9	0.19	0.2299	0.5909	0.1103
	4.5	2.75	0.3	-0.8825	0.1887	0.0562
ν_e=4	5	2.5	0.62	-2.7366	0.0031	0.0019
	5.3	2.35	0.94	-3.849	0.0001	0.0001
	5.6	2.2	1.39	-4.9614	0	0
	3.82	3.09	0.1	1.6433	0.9498	0.0951
	4.2	2.9	0.19	-0.2376	0.4061	0.0758
	4.5	2.75	0.3	-1.7225	0.0425	0.0127
ν_e=8	5	2.5	0.62	-4.1974	0	0
	5.3	2.35	0.94	-5.6823	0	0
	5.6	2.2	1.39	-7.1672	0	0
	3.82	3.09	0.1	1.6477	0.9503	0.0951
	4.2	2.9	0.19	-0.8369	0.2013	0.0376
	4.5	2.75	0.3	-2.7984	0.0026	0.0008
ν_e=12	5	2.5	0.62	-6.0676	0	0
	5.3	2.35	0.94	-8.0291	0	0
	5.6	2.2	1.39	-9.9906	0	0
	3.82	3.09	0.1	1.6387	0.9494	0.095
	4.2	2.9	0.19	-1.5063	0.066	0.0123
	4.5	2.75	0.3	-3.9893	0	0
ν_e=16	5	2.5	0.62	-8.1275	0	0
	5.3	2.35	0.94	-10.6104	0	0
	5.6	2.2	1.39	-13.0934	0	0

Table 4.6. Performance characteristic for variable plan under known CV under measurement error when $\rho_e = 6$

CV	μ	v_e	p(%)	w	Pa	AOQ
	3.8196	3.0902	0.1	1.4711	0.9294	0.0929
	4.2	2.9	0.19	0.5102	0.6951	0.1297
	4.5	2.75	0.3	-0.2475	0.4022	0.1199
v_e=0	5	2.5	0.62	-1.5105	0.0655	0.0406
	5.3	2.35	0.94	-2.2682	0.0117	0.0109
	5.6	2.2	1.39	-3.026	0.0012	0.0017
	3.8196	3.0902	0.1	1.4977	0.9329	0.0933
	4.2	2.9	0.19	0.5024	0.6923	0.1292
	4.5	2.75	0.3	-0.2826	0.3887	0.1158
v_e=1	5	2.5	0.62	-1.5908	0.0558	0.0347
	5.3	2.35	0.94	-2.3758	0.0088	0.0082
	5.6	2.2	1.39	-3.1607	0.0008	0.0011
	3.82	3.09	0.1	1.7484	0.9598	0.0961
	4.2	2.9	0.19	0.3467	0.6356	0.1186
	4.5	2.75	0.3	-0.7599	0.2237	0.0666
v_e=4	5	2.5	0.62	-2.6042	0.0046	0.0029
	5.3	2.35	0.94	-3.7108	0.0001	0.0001
	5.6	2.2	1.39	-4.8174	0	0
	3.82	3.09	0.1	2.0151	0.9781	0.0979
	4.2	2.9	0.19	-0.2109	0.4165	0.0777
	4.5	2.75	0.3	-1.9683	0.0245	0.0073
v_e=8	5	2.5	0.62	-4.8973	0	0
	5.3	2.35	0.94	-6.6547	0	0
	5.6	2.2	1.39	-8.4121	0	0
	3.82	3.09	0.1	2.1682	0.9849	0.0986
	4.2	2.9	0.19	-1.9514	0.0255	0.0048
	4.5	2.75	0.3	-5.2036	0	0
v_e=16	5	2.5	0.62	-10.624	0	0
	5.3	2.35	0.94	-13.8763	0	0
	5.6	2.2	1.39	-17.1285	0	0

Table 4.7. Performance Characteristic for Variable plan under Known CV under Measurement Error when ρ_e = 2

CV	μ	v_e	p(%)	w	Pa	AOQ
	3.82	3.09	0.1	1.6381	0.9493	0.095
	4.2	2.9	0.19	0.4364	0.6687	0.1248
	4.5	2.75	0.3	-0.5123	0.3042	0.0907
v_e=0	5	2.5	0.62	-2.0934	0.0182	0.0113
	5.3	2.35	0.94	-3.0421	0.0012	0.0011
	5.6	2.2	1.39	-3.9908	0	0
	3.82	3.09	0.1	1.639	0.9494	0.095
	4.2	2.9	0.19	0.2299	0.5909	0.1103
	4.5	2.75	0.3	-0.8825	0.1887	0.0562
v_e=4	5	2.5	0.62	-2.7366	0.0031	0.0019
	5.3	2.35	0.94	-3.849	0.0001	0.0001
	5.6	2.2	1.39	-4.9614	0	0
	3.82	3.09	0.1	1.6433	0.9498	0.0951
	4.2	2.9	0.19	-0.2376	0.4061	0.0758
	4.5	2.75	0.3	-1.7225	0.0425	0.0127
v_e=8	5	2.5	0.62	-4.1974	0	0
	5.3	2.35	0.94	-5.6823	0	0
	5.6	2.2	1.39	-7.1672	0	0
	3.82	3.09	0.1	1.6477	0.9503	0.0951
	4.2	2.9	0.19	-0.8369	0.2013	0.0376
	4.5	2.75	0.3	-2.7984	0.0026	0.0008
v_e=12	5	2.5	0.62	-6.0676	0	0
	5.3	2.35	0.94	-8.0291	0	0
	5.6	2.2	1.39	-9.9906	0	0
	3.82	3.09	0.1	1.6387	0.9494	0.095
	4.2	2.9	0.19	-1.5063	0.066	0.0123
	4.5	2.75	0.3	-3.9893	0	0
v_e=16	5	2.5	0.62	-8.1275	0	0
	5.3	2.35	0.94	-10.6104	0	0
	5.6	2.2	1.39	-13.0934	0	0

Table 4.8. Performance characteristic for variable plan under known CV under measurement error when $\rho_e = \infty$

CV		AQL%											
	AOQL(%)	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	0.68462											
	0.08	0.48678	0.6899										
	0.125	0.37398	0.5014	0.67466									
	0.2	0.29645	0.38101	0.49125	0.65077								
	0.32	0.24546	0.30439	0.37744	0.47488	0.67303							
v_e=0	0.5	0.21404	0.25693	0.30818	0.37456	0.49724	0.68675						
	0.8	0.19258	0.22477	0.26136	0.30783	0.38869	0.50119	0.69534					
	1.25		0.20694	0.23425	0.26838	0.32534	0.40026	0.5173	0.68964				
	2			0.1003	0.24467	0.28546	0.33675	0.41206	0.51112	0.68165			
	3.2					0.26547	0.30185	0.35283	0.4161	0.50142	0.68164		
	5							0.32483	0.36793	0.42307	0.52727	0.69684	
	8								0.34829	0.38443	0.4484	0.53969	0.70863
	0.05	0.68											
	0.08	0.50133	0.71161										
	0.125	0.39951	0.51594	0.68322									
	0.2	0.33297	0.40798	0.50786	0.65699								
	0.32	0.29212	0.34321	0.40728	0.4945	0.67753							
v_e=1	0.5	0.26937	0.30617	0.35042	0.40758	0.5165	0.69107						
	0.8	0.25792	0.28473	0.31583	0.3544	0.42336	0.52198	0.70293					
	1.25		0.27702	0.29985	0.32729	0.37423	0.43717	0.53889					
	2			0.29692	0.31654	0.34888	0.39009	0.45203	0.69616	0.66956			
	3.2					0.3435	0.3713	0.41098	0.53672	0.53237	0.69074		
	5							0.39997	0.46154	0.4746	0.55902	0.7065	
	8								0.43228	0.45784	0.50469	0.57584	0.71918
	0.05	0.73071											
	0.08	0.62803	0.74037										
	0.125	0.59635	0.64404	0.73587									
	0.2	0.58582	0.60883	0.6465	0.71357								
	0.32	0.58969	0.60239	0.62031	0.64894	0.73526							
v_e=4	0.5	0.5999	0.60744	0.61737	0.6328	0.66659	0.7485						
	0.8	0.61693	0.62091	0.62626	0.63389	0.65032	0.68018	0.7613					
	1.25		0.63889	0.64175	0.64601	0.65744	0.6676	0.69247	0.76246				
	2			0.65998	0.66431	0.66561	0.67561	0.68326	0.70747	0.75713			
	3.2					0.69041	0.69312	0.69519	0.70777	0.72198	0.74111		
	5							0.72061	0.72411	0.72712	0.73639	0.7896	
	8								0.75019	0.75309	0.75577	0.80709	0.80716
	0.05	0.79835											
	0.08	0.7729	0.80981										
	0.125	0.77208	0.78092	0.81269									
	0.2	0.7783	0.78313	0.78856	0.80966								
	0.32	0.7794	0.79105	0.80421	0.79575	0.82136							
v_e=8	0.5	0.79929	0.78443	0.80158	0.79802	0.80837	0.82893						
	0.8	0.80177	0.80842	0.79893	0.81456	0.81615	0.81486	0.83862					
	1.25		0.80621	0.82423	0.82141	0.8249	0.8198	0.82848					
	2			0.83556	0.83815	0.83407	0.83822	0.83843	0.84074	0.84955			
	3.2					0.84571	0.84147	0.84725	0.85269	0.85205	0.86114		
	5							0.86579	0.86572	0.8208	0.86607	0.87407	
	8								0.88105	0.87949	0.87999	0.86502	0.88712
	0.05	0.88906											
	0.08	0.88521	0.89379										
	0.125	0.88223	0.89252	0.89739									
	0.2	0.89558	0.88861	0.89561	0.90112								
	0.32	0.89634	0.89851	0.90249	0.91397	0.90623							
v_e=16	0.5	0.90596	0.90412	0.90585	0.90882	0.90806	0.91121						
	0.8	0.90802	0.91078	0.91484	0.90974	0.91091	0.90926	0.91585					
	1.25		0.91638	0.9184	0.91651	0.9187	0.91936	0.91965	0.91745				
	2			0.92472	0.92605	0.92469	0.92549	0.92502	0.92538	0.92698			
	3.2					0.93171	0.93337	0.93299	0.93216	0.93082	0.93224		
	5							0.93835	0.93635	0.93904	0.93642	0.93732	
	8								0.94472	0.94488	0.94531	0.94667	0.94633

Table 4.9. Values of probability of acceptance for different values of v_e when $\rho_e = 4$

		AQL%											
CV	AOQL%	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	0.657											
	0.08	0.4946	0.6368										
	0.125	0.382	0.5091	0.6608									
	0.2	0.304	0.389	0.4989	0.6549								
	0.32	0.2524	0.312	0.3853	0.4826	0.6618							
v_e=0	0.5	0.2199	0.2637	0.3159	0.3823	0.5047	0.6788						
	0.8	0.1982	0.2309	0.2686	0.315	0.3963	0.5078	0.7007					
	1.25		0.2124	0.2409	0.2749	0.3324	0.4077	0.5244	0.6938				
	2			0.1038	0.2507	0.2919	0.3436	0.4193	0.5146	0.6637			
	3.2					0.2712	0.308	0.3595	0.423	0.5085	0.6868		
	5							0.3307	0.3742	0.4296	0.534	0.7022	
	8								0.353	0.3903	0.4546	0.5459	0.713
	0.05	0.6911											
	0.08	0.5084	0.6929										
	0.125	0.4065	0.5229	0.6895									
	0.2	0.3394	0.4149	0.5147	0.662								
	0.32	0.2978	0.3495	0.414	0.5011	0.6809							
v_e=1	0.5	0.2744	0.3117	0.3564	0.414	0.5231	0.6918						
	0.8	0.2623	0.2895	0.3211	0.3601	0.4296	0.5285	0.7017					
	1.25		0.2812	0.3044	0.3323	0.3798	0.4432	0.5449					
	2			0.3008	0.3208	0.3536	0.3953	0.4577	0.7016	0.6744			
	3.2					0.3474	0.3757	0.4158	0.5426	0.5379	0.6965		
	5							0.404	0.4668	0.4796	0.5643	0.7118	
	8								0.4367	0.4616	0.5091	0.5806	0.7241
	0.05	0.7345											
	0.08	0.633	0.7293										
	0.125	0.5985	0.6461	0.7395									
	0.2	0.588	0.6106	0.6491	0.723								
	0.32	0.5909	0.6037	0.6223	0.6495	0.7414							
v_e=4	0.5	0.601	0.6084	0.6187	0.6331	0.6688	0.7534						
	0.8	0.6174	0.6216	0.6272	0.6347	0.6513	0.6814	0.7637					
	1.25		0.6394	0.6424	0.6466	0.6548	0.6688	0.6975	0.7655				
	2			0.6628	0.6658	0.6701	0.6766	0.6883	0.71	0.7582			
	3.2					0.6922	0.695	0.7004	0.7087	0.7238	0.7438		
	5							0.7214	0.7248	0.7317	0.7366	0.7927	
	8								0.7516	0.7537	0.7557	0.7693	0.8087
	0.05	0.8042											
	0.08	0.7722	0.8103										
	0.125	0.7729	0.7832	0.8075									
	0.2	0.7767	0.7854	0.7791	0.8113								
	0.32	0.7869	0.7901	0.7903	0.7977	0.822							
v_e=8	0.5	0.7989	0.7856	0.7934	0.8031	0.8083	0.8305						
	0.8	0.8024	0.8093	0.811	0.8064	0.8085	0.8173	0.8397					
	1.25		0.8069	0.7935	0.8227	0.8179	0.8261	0.828	0.8454				
	2			0.8323	0.8344	0.8354	0.832	0.8386	0.8409	0.8505			
	3.2					0.8467	0.849	0.8493	0.8516	0.852	0.8624		
	5							0.8655	0.866	0.8662	0.867	0.8741	
	8								0.8772	0.8813	0.8815	0.8816	0.8872
	0.05	0.8893											
	0.08	0.8749	0.8923										
	0.125	0.8844	0.8934	0.8974									
	0.2	0.8967	0.8907	0.888	0.9011								
	0.32	0.897	0.8995	0.9043	0.8988	0.9063							
v_e=16	0.5	0.9064	0.9047	0.9068	0.9029	0.909	0.9112						
	0.8	0.9083	0.9111	0.9153	0.9105	0.9123	0.9126	0.915					
	1.25		0.9166	0.9187	0.9169	0.9193	0.9205	0.9177	0.9179				
	2			0.9249	0.9263	0.9267	0.9268	0.9269	0.9271	0.9273			
	3.2					0.9318	0.9299	0.9333	0.9327	0.9319	0.9328		
	5							0.9384	0.9365	0.9393	0.937	0.9377	
	8								0.9444	0.9449	0.9453	0.9441	0.9459

Table 4.10. Values of probability of acceptance for different values of v_e when $\rho_e = 6$

		AQL%											
CV	AOQL%	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	0.6533											
	0.08	0.4465	0.6618										
	0.125	0.3298	0.4618	0.6543									
	0.2	0.259	0.341	0.4518	0.6174								
	0.32	0.2119	0.2674	0.3382	0.4356	0.6416							
v_e=0	0.5	0.1837	0.2236	0.2723	0.3361	0.4588	0.6574						
	0.8	0.1659	0.195	0.2295	0.2727	0.3508	0.4634	0.6672					
	1.25		0.1803	0.2058	0.2369	0.2906	0.3632	0.4805	0.6589				
	2			0.0795	0.2168	0.2545	0.3031	0.3761	0.4751	0.6285			
	3.2					0.2382	0.2721	0.3204	0.3816	0.4666	0.6525		
	5							0.2963	0.3371	0.3904	0.4941	0.6694	
	8								0.3218	0.356	0.4178	0.5083	0.6821
	0.05	0.7167											
	0.08	0.6167	0.7154										
	0.125	0.5876	0.6289	0.7236									
	0.2	0.5802	0.5983	0.629	0.6912								
	0.32	0.5753	0.5963	0.6116	0.6404	0.7157							
v_e=4	0.5	0.5748	0.6033	0.6119	0.6254	0.6578	0.7378						
	0.8	0.5605	0.6174	0.6219	0.6299	0.644	0.6717	0.7458					
	1.25		0.6375	0.6388	0.6435	0.6504	0.6624	0.6978	0.7227				
	2			0.6657	0.6556	0.6665	0.6723	0.6895	0.7117	0.7388			
	3.2					0.6885	0.6918	0.651	0.7044	0.7142	0.7373		
	5							0.5324	0.72	0.7274	0.7319	0.7831	
	8								0.7493	0.751	0.7542	0.7646	0.8015
	0.05	0.7976											
	0.08	0.7453	0.803										
	0.125	0.7737	0.7803	0.8075									
	0.2	0.7709	0.7725	0.7791	0.8021								
	0.32	0.7666	0.7884	0.7903	0.7889	0.7815							
v_e=8	0.5	0.7921	0.7792	0.7934	0.7972	0.8047	0.811						
	0.8	0.7988	0.8044	0.811	0.8066	0.8015	0.8113	0.833					
	1.25		0.7688	0.7935	0.8159	0.8161	0.8259	0.8236	0.8414				
	2			0.8323	0.834	0.8344	0.8373	0.8359	0.8398	0.8469			
	3.2					0.8263	0.8356	0.9076	0.844	0.8524	0.8604		
	5							0.8394	0.8553	0.8615	0.8658	0.8724	
	8								0.8755	0.844	0.8762	0.8766	0.8852
	0.05	0.8887											
	0.08	0.8835	0.8915										
	0.125	0.8771	0.88	0.8969									
	0.2	0.8906	0.8913	0.8988	0.8977								
	0.32	0.9026	0.8939	0.8945	0.8971	0.906							
v_e=16	0.5	0.9041	0.9098	0.9099	0.9099	0.9027	0.911						
	0.8	0.9068	0.9092	0.9126	0.9124	0.9108	0.9125	0.9155					
	1.25		0.9203	0.9209	0.9197	0.9159	0.9192	0.9162	0.9197				
	2			0.924	0.9251	0.9233	0.9234	0.9211	0.9248	0.9231			
	3.2					0.9311	0.9325	0.9316	0.9298	0.9333	0.9316		
	5							0.9379	0.9391	0.938	0.9371	0.9374	
	8								0.9447	0.9448	0.9452	0.9463	0.9461

Table 4.11. Values of probability of acceptance for different values of v_e when $\rho_e = 2$

		AQL(%)											
CV	AOQL(%)	0.04	0.065	0.1	0.15	0.25	0.4	0.65	1	1.5	2.5	4	6.5
	0.05	0.7											
	0.08	0.501	0.727										
	0.125	0.389	0.515	0.7									
	0.2	0.311	0.395	0.505	0.663								
	0.32	0.258	0.318	0.392	0.489	0.696							
v_e=0	0.5	0.226	0.27	0.322	0.389	0.51	0.714						
	0.8	0.203	0.236	0.274	0.321	0.402	0.514	0.719					
	1.25		0.227	0.246	0.281	0.338	0.413	0.53	0.702				
	2			0.104	0.255	0.297	0.349	0.425	0.524	0.672			
	3.2					0.276	0.313	0.365	0.428	0.514	0.696		
	5							0.336	0.379	0.435	0.54	0.714	
	8								0.358	0.395	0.46	0.553	0.72
	0.05	0.618											
	0.08	0.613	0.739										
	0.125	0.59	0.633	0.743									
	0.2	0.571	0.61	0.644	0.66								
	0.32	0.565	0.597	0.623	0.645	0.741							
v_e=4	0.5	0.556	0.556	0.616	0.63	0.666	0.744						
	0.8	0.533	0.485	0.571	0.635	0.65	0.684	0.746					
	1.25		0.446	0.521	0.568	0.635	0.667	0.698	0.715				
	2			0.509	0.513	0.559	0.581	0.689	0.71	0.748			
	3.2					0.439	0.559	0.651	0.709	0.718	0.738		
	5							0.532	0.679	0.665	0.698	0.786	
	8								0.606	0.639	0.576	0.767	0.801
	0.05	0.76											
	0.08	0.704	0.802										
	0.125	0.689	0.716	0.814									
	0.2	0.656	0.626	0.784	0.811								
	0.32	0.617	0.601	0.747	0.806	0.821							
v_e=8	0.5	0.566	0.589	0.732	0.764	0.808	0.831						
	0.8	0.552	0.521	0.672	0.756	0.799	0.779	0.84					
	1.25		0.478	0.629	0.713	0.755	0.717	0.779	0.835				
	2			0.548	0.651	0.661	0.606	0.694	0.798	0.847			
	3.2					0.532	0.574	0.666	0.739	0.79	0.837		
	5							0.579	0.702	0.751	0.793	0.874	
	8								0.625	0.72	0.718	0.798	0.887
	0.05	0.782											
	0.08	0.754	0.813										
	0.125	0.693	0.785	0.851									
	0.2	0.662	0.745	0.795	0.848								
	0.32	0.62	0.675	0.759	0.82	0.861							
v_e=12	0.5	0.575	0.613	0.74	0.784	0.819	0.861						
	0.8	0.567	0.548	0.689	0.764	0.807	0.824	0.879					
	1.25		0.493	0.645	0.719	0.757	0.743	0.78	0.883				
	2			0.551	0.661	0.678	0.675	0.696	0.901	0.894			
	3.2					0.571	0.584	0.605	0.899	0.886	0.894		
	5							0.498	0.877	0.84	0.832	0.909	
	8								0.813	0.815	0.814	0.818	0.909
	0.05	0.865											
	0.08	0.849	0.883										
	0.125	0.784	0.84	0.873									
	0.2	0.748	0.756	0.806	0.855								
	0.32	0.683	0.68	0.773	0.828	0.904							
v_e=16	0.5	0.638	0.65	0.753	0.791	0.832	0.904						
	0.8	0.612	0.584	0.708	0.776	0.812	0.865	0.912					
	1.25		0.531	0.661	0.726	0.762	0.779	0.808	0.921				
	2			0.573	0.674	0.686	0.678	0.715	0.821	0.924			
	3.2					0.583	0.607	0.632	0.769	0.907	0.974		
	5							0.55	0.625	0.883	0.882	0.923	
	8								0.518	0.868	0.865	0.866	0.913

Table 4.12. Values of probability of acceptance for different values of v_e when $\rho_e = \infty$

5. Conclusion

The difference between parameters significantly impacts the variation in measurement parameters, specifically in Acceptance Quality Limit (AQL) and Average Outgoing Quality Level (AOQL), by influencing the measurement error and subsequently the measurement process. Measurement errors introduce biases that can lead to overestimation or underestimation of the Coefficient of Variation (CV), which can severely affect the reliability of AQL and AOQL determinations, leading to erroneous acceptance or rejection decisions in quality control. CV plays an essential role in variable sampling schemes indexed by AQL and AOQL, as higher CV values introduce greater variability, leading to batch misclassification and significantly impacting AOQL assessments. Addressing and mitigating the effects of high CV values are crucial to ensure consistent quality control outcomes, and modifications to quality control methods can improve the accuracy of AQL and AOQL assessments while optimizing inspection resources. Reducing variability not only enhances product quality but also ensures the robustness and reliability of the entire quality control process. This paper explores how CV affects variable sampling plans under AQL and AOQL, examining how measurement errors influence the performance of these plans, and provides valuable insights into designing sampling plans that maintain specific quality levels despite inherent measurement errors, which is critical for balancing quality assurance with operational efficiency in production.

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References

[1] D. C. Montgomery, *Introduction to Statistical Quality Control*, John Wiley & Sons, 8 edition, Aug. 2019.

[2] Y. Ching-Ho, A. Muhammad, C. Chia-Hao, S. R. A. Khan, A. Liaquat, J. Chi-Hyuck, *A variable sampling plan based on the coefficient of variation for lots resubmission*, Sci. Rep., **13** (2023), 1-18, Article ID 22986. http://dx.doi.org/10.1038/s41598-023-50498-2

[3] R. Sankle, J. Singh, *Single sampling plans for variables indexed by aql and aoql with measurement error*, J. Mod. Appl. Stat. Methods, **11**(2) (2012), 396-406. http://dx.doi.org/10.22237/jmasm/1351743060

[4] Y. Tong, Q. Chen, *Sampling inspection by variables for coefficient of variation*, Theor. Appl. Probab., **3** (1991), 315-327.

[5] J. Wang, H. Xiao, *A sampling test with varied coefficients as the quality indices*, The Journal of Quantitative and Technical Economics, **2001**(3) (2001), 117-119.

[6] H. Melgaard, P. Thyregod, *Acceptance sampling by variables under measurement uncertainty*, Physica-Verlag HD, **6** (2001), 47-57. http://dx.doi.org/10.1007/978-3-642-57590-7_4

[7] P. Wilrich, *Variables Sampling Under Measurement Error*, Wiley, Sept. 2014. http://dx.doi.org/10.1002/9781118445112.stat04214

[8] Y. Aijun, L. Sanyang, D. Xiaojuan, *Variables two stage sampling plans based on the coefficient of variation*, J. Adv. Mech. Des. Syst. Manuf., **10**(1) (2016), 1-12. http://dx.doi.org/10.1299/JAMDSM.2016JAMDSM0002

[9] K. Govindaraju, V. Soundararajan, *Selection of single sampling plans for variables matching the mil-std-105 scheme*, J. Qual. Technol., **18**(4) (1986), 234-238. http://dx.doi.org/10.1080/00224065.1986.11979017

[10] C.W. Wu, W. Pearn, *A variables sampling plan based on cpmk for product acceptance determination*, Eur. J. Oper. Res., **184**(2) (2008), 549-560. http://dx.doi.org/10.1016/j.ejor.2006.11.032

[11] J. R. Singh, A. Sanvalia, *Single sampling plan for variable indexed by aql and aoql with known coefficient of variation*, Int. J. Comput. Sci. Eng., **5**(10) (2017), 20-25. http://dx.doi.org/10.26438/ijcse/v5i10.2025

[12] S. W. Liu, S. W. Lin, C.W. Wu, *A resubmitted sampling scheme by variables inspection for controlling lot fraction nonconforming*, Int. J. Prod. Res., **52**(12) (2014), 3744-3754. http://dx.doi.org/10.1080/00207543.2014.886028

[13] M. H. Lee, M. B. C. Khoo, X. Chew, P. H. H. Then, *Effect of measurement errors on the performance of coefficient of variation chart with short production runs*, IEEE Access, **8** (2020), 72216-72228. http://dx.doi.org/10.1109/ACCESS.2020.2985410

[14] G. Srinivasa Rao, M. Aslam, R. A. K. Sherwani, M. A. Shehzad, C.H. Jun, *Generalized multiple dependent state sampling plans for coefficient of variation*, Commun. Stat. Theor. M., **51**(20) (2022), 6990-7005. http://dx.doi.org/10.1080/03610926.2020.1869989

[15] G. S. Rao, M. Aslam, F. S. Alamri, C.H. Jun, *Comparing the efficacy of coefficient of variation control charts using generalized multiple dependent state sampling with various run-rule control charts*, Sci. Rep., **14** (2024), 1-17, Article ID 2726. http://dx.doi.org/10.1038/s41598-024-53296-6

[16] U. Shahzad, I. Ahmad, A. V. García-Luengo, T. Zaman, N. H. Al-Noor, A. Kumar, *Estimation of coefficient of variation using calibrated estimators in double stratified random sampling*, Mathematics, **11**(1) (2023), Article ID 252, 17 pages. http://dx.doi.org/10.3390/math11010252