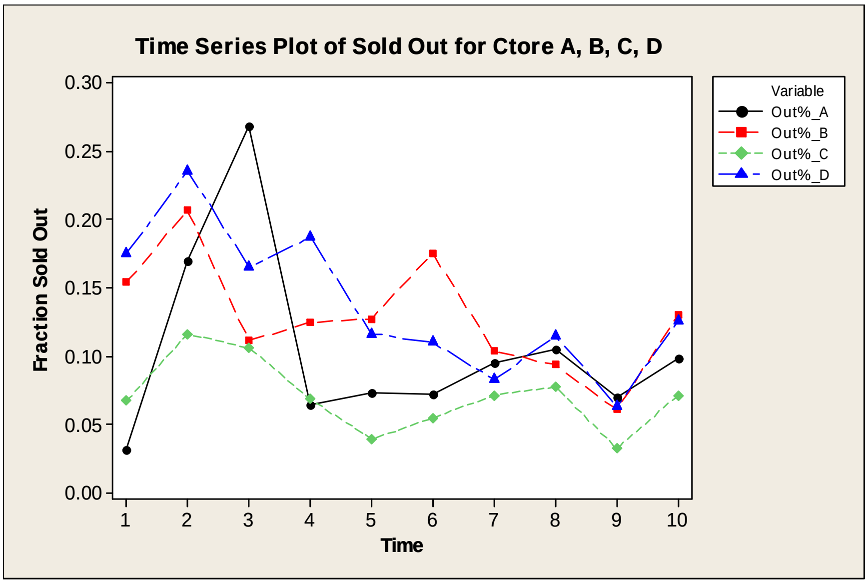
Sold Out - Solution

The fractions Sold Out are computed at the 10 instants for each of the 4 stores. The corresponding time series plot turned out as follows, where time 7 to 10 corresponds to the period after the installation of the new system at store A and B,



We see that both the variability and the level of % Sold Out were higher before the installation of the new system, and this is so, not only for store A and B, but also for C and D.

Some reflections (may be questioned): A possible explanation for the somewhat surprising result is the attention given to the sold out issue and that all store managers try to do better. A crucial point here is whether this added awareness was absent in the pre-period or not. If absent, the store managers in store C and D have shown that they could do as well without the system. However, we cannot be sure that the reduced level and variation of sold out will be maintained in the future. Maybe the system may help those managers that otherwise would have trouble to keep up the inventory. This experiment is therefore inconclusive, and should be followed up before large investments are made. However, as store scanner technology has developed, most stores may have this as opportunity or routine anyway. Note also that some changes in the working environment may require a learning period and there is a trend towards improvement. This does not seem to be the case here, but is hard to judge based on only 4 observed instants after the change.

Several possibilities exist for formal testing of improvement, both with respect to the level and variation. We restrict ourselves here to focus on the level and choose to aggregate separately the numbers prior to and after the installation of the system. We may do this separately for each store and test for each or aggregate further over the stores of each type (A, B) and (C,D).

The aggregation gave the following:

	A	B	C	D	(A,B)	(C,D)
Before No. Lines	640	332	701	622	972	1323
No. Sold out	73	50	52	103	123	155
Fraction Sold out	0.114	0,151	0.074	0.166	0.127	0.117
After No. Lines	456	257	505	444	713	949
No. Lines	42	25	32	43	67	75
Fraction Sold out	0.092	0.097	0.064	0.097	0.094	0.079

For the combined (A,B) we have 12.7% items sold out before and 9.4% after, a reduction by 3.3%. For (C,D) the numbers were 11.7% before and 7.9% after a reduction by 3.8%.

A natural formal test is the two-sample test based binomial assumptions (which may be questioned to some extent). For the combined (A,B) we have the output below, (based on some assumptions to be questioned)

Test and CI for Two Proportions

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Sample     X    N  Sample p
1        123  972  0.126543
2         67  713  0.093969


Difference = p (1) - p (2)
Estimate for difference:  0.0325741
95% CI for difference:  (0.00264859; 0.0624995)
Test for difference = 0 (vs not = 0):  Z = 2.13  P-Value = 0.033
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We see that the hypothesis of no difference in the sold out probabilities before and after the installation is rejected, using a 5% significance level (since P<0.05). If we can argue that the installation of the system cannot lead to increased sold out risk, we may cut the P-value in half, getting P=0.0155. This is still not sufficient to claim significance at 1% level since (P > 0.01).

Performing the same analysis on (C,D) gives significance at 1% level even without the one-sided assumption. Doing the test on each store separately the two-sided P-values are respectively for A, B, C and D: 0.235, 0.048, 0.461, 0.001, thus showing a statistically significant (“not due to chance”) improvement for store B and D.

Note: The binomial tests are done without pooling the probability estimates. Doing so may make slight difference in P-values (for B the two-sided P becomes 0.054).