

On the Prediction of the Postal Service's Unit Cost Function

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Impetus for Paper

- Predicting costs for USPS is critical in today's changing environment
- USPS uses a complex algorithm referred to as the roll-forward model to predict overall costs
 - Since 2006 visibility into this process curtailed
- Cost drivers and causation embedded in volume variability estimates used to calculate unit attributable cost
- Volume and mail mix fluctuate

Impetus for Paper

- Should be possible to associate volumes to unit cost and hence to operational cost.
- Propose a simple framework for predicting an overall unit cost from a hypothesized configuration of product volumes.
- Facilitate prediction and simulation for planning purposes.
 - No structural assumptions needed as causation already embedded.

Simple Framework

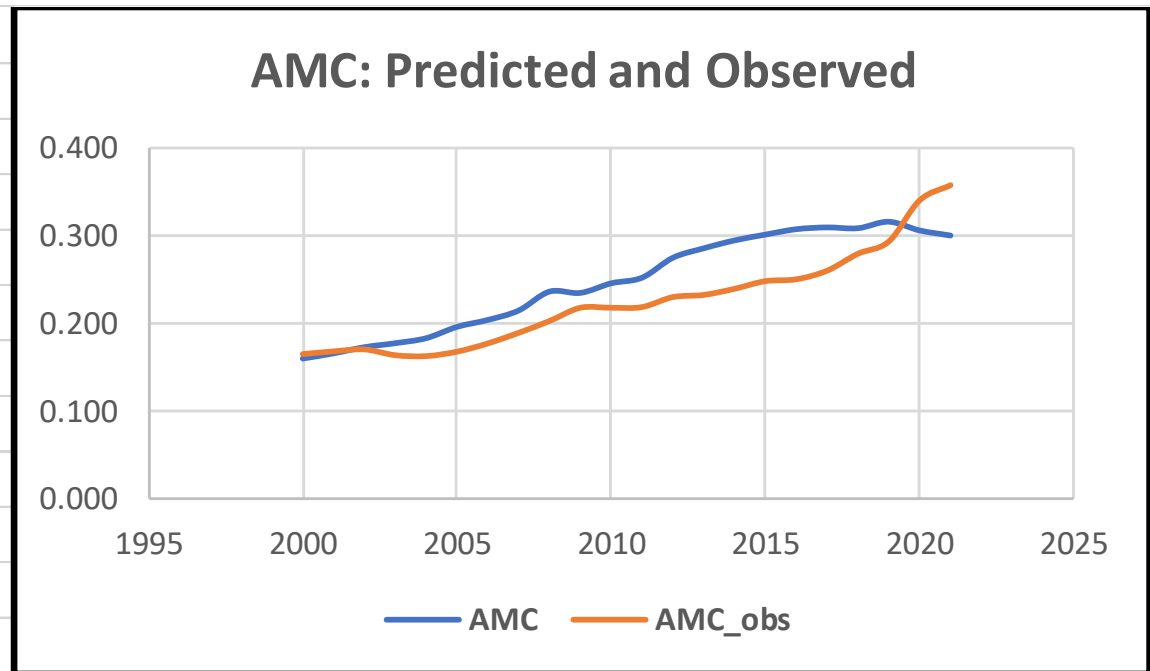
- Link the volume bundle to marginal cost for each product to estimate a product specific marginal cost function
- Calculate the volume weighted average marginal cost (AMC)
- Use AMC to predict the overall unit cost
- Panel data set created by stacking product specific data
 - 15 products x 22 fiscal years = 330 observations

Estimation Procedure

- Step 1
 - Estimate the cost function for each product
 - Calculate average marginal cost by taking the volume-weighted average of the predicted marginal costs for each fiscal year.
- Step 2
 - Estimate equation where AMC is now the predictor

Results: Step 1

FY	AMC	FY	AMC
2000	0.159	2011	0.252
2001	0.165	2012	0.275
2002	0.172	2013	0.286
2003	0.177	2014	0.295
2004	0.183	2015	0.302
2005	0.196	2016	0.308
2006	0.204	2017	0.310
2007	0.215	2018	0.309
2008	0.236	2019	0.316
2009	0.235	2020	0.306
2010	0.246	2021	0.301



Correlation Coefficient 95.6%

Results: Step 2 (OLS no constant)

	Number of obs	=	22			
	F(1, 21)	=	1713.76			
	Prob > F	=	0			
	R-squared	=	0.9907			
	Root MSE	=	0.04389			
Unit Cost	Coef.	Robust Std. Err.	t	P>t	[95% Conf.	Interval]
AMC_pane l	1.7484 83	0.0422364	41.4	0.000	1.66064 8	1.8363 19

Annual total volume variable cost is predicted to be $1/1.748 = 57\%$

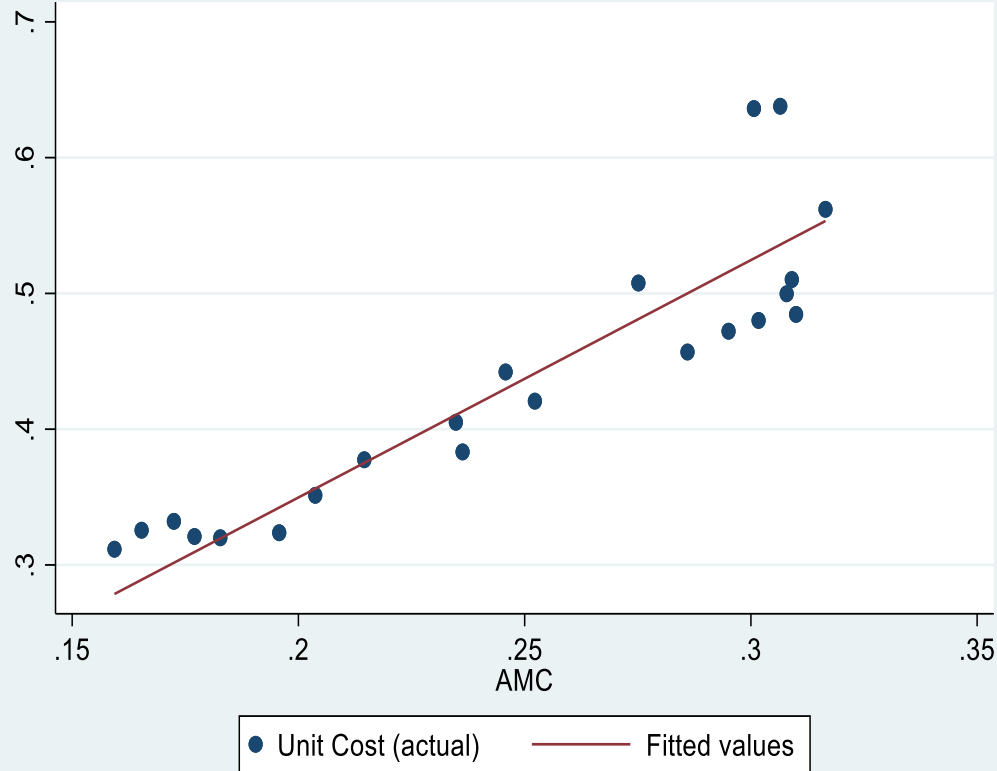
For the period 2000 to 2021 the actual average proportion of attributable to total costs is 58%

Did We Succeed?

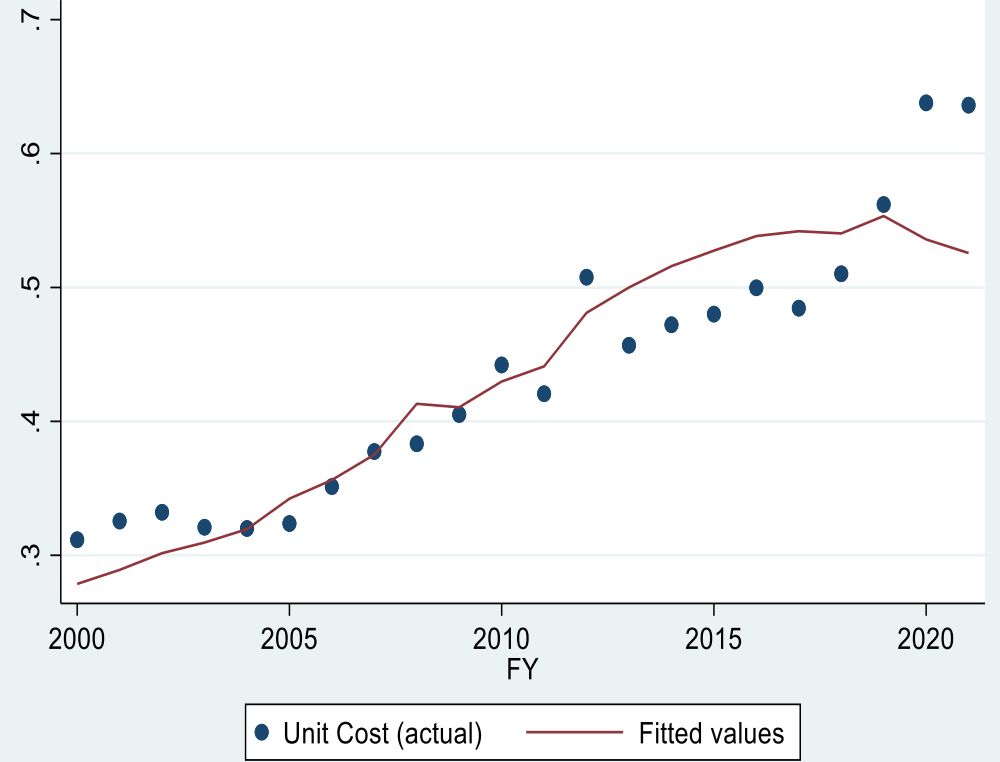
- Found a way to associate volume to operational costs
- Developed a simple framework for predicting overall operating costs
- However, may not be as useful as we had hoped for planning purposes

Step 2 Graphs

Actual and Predicted Unit Cost (plotted against AMC)



Actual and Predicted Unit Cost (against fiscal year)



Data Issues

- The US Postal Service Cost and Revenue Analysis report provides only annual data
 - Costs are attributed each fiscal year based on causal relationships determined through econometric studies
- Too few observations (22).
- Built a panel data set by stacking products (15) and years (22) = 330 observations

Problems and Challenges

- Missing data prior to 2008
 - Estimation technique to fill in missing years may have influenced results
- Data limitations meant
 - Not all products in a class are considered (data limitations)
 - Competitive products are grouped.
- Network variables not significant
 - Why?

Final Remarks

- Framework seems promising
- Data issues need to be resolved/mitigated
- Further exploration of network variables



THANK YOU!