Research on Using Synthetic Microdata to Protect Economic Data: Utility and Privacy Protection

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Workshop on Challenges and New Approaches for Protecting Privacy in Federal Statistical Programs

June 7, 2019 (SPEED Session)

United States Census Bureau

U.S. Department of Commerce
Economics and Statistics Administration
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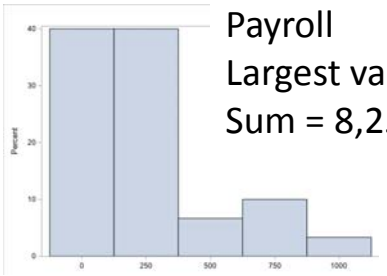
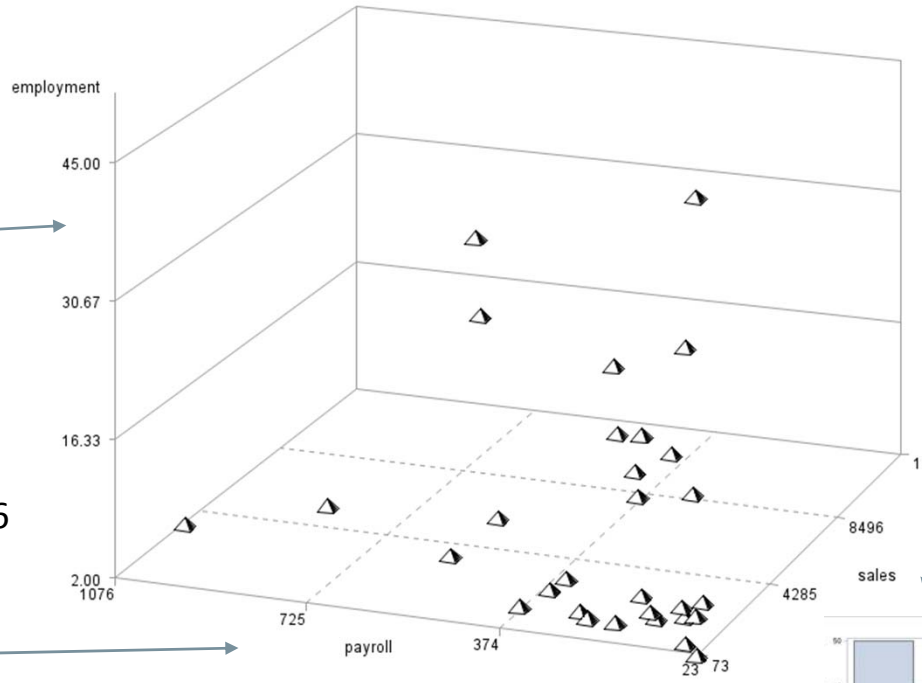
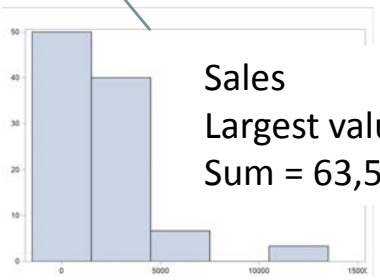
Original Data from One Fictional Industry

Employment
Largest value = 45
Sum = 325



Payroll
Largest value = 1,076
Sum = 8,257





Sales
Largest value = 12,708
Sum = 63,504

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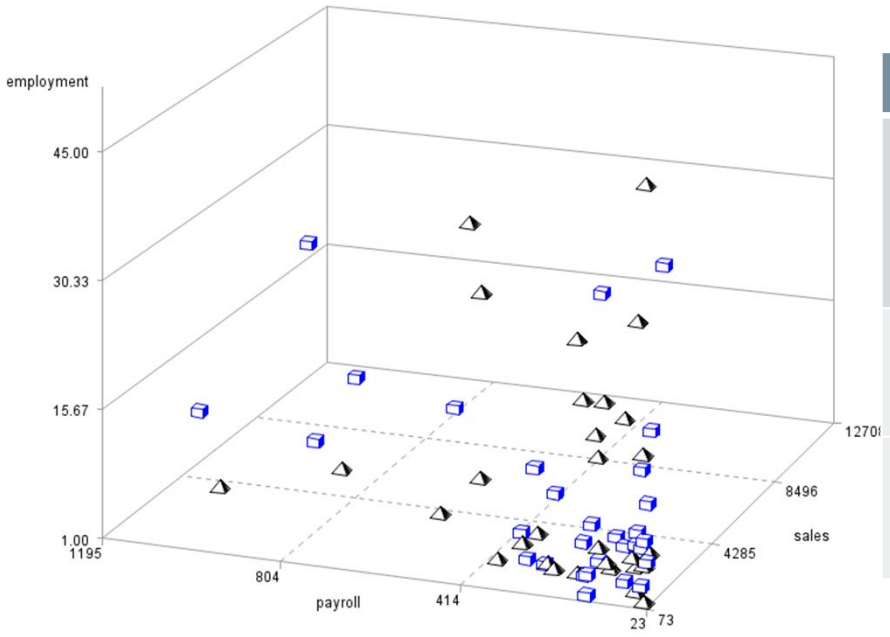
Synthetic Data from One Fictional Industry

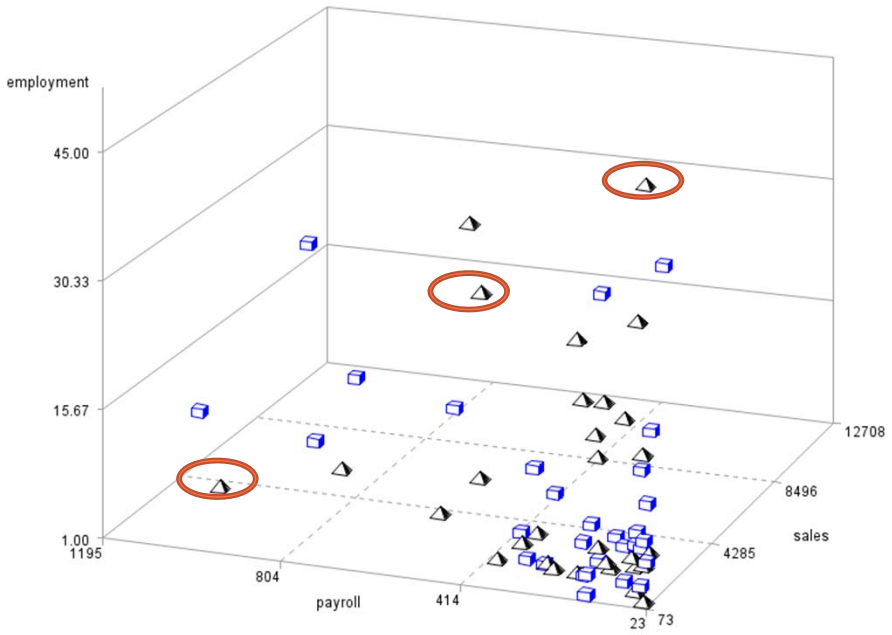


Utility

Metric		Original	Synthetic
Totals	Payroll	8,257	8,278
	Sales	63,504	57,803
	Employment	325	275
Industry Average	Payroll/Employment	25.41	30.10
	Sales/Payroll	7.69	6.98
Multiple Regression	log(Sales) = $\beta_0 + \beta_1$log(Payroll) + $\beta_2$log(Employment)	$\beta_0 = 2.10$ $\beta_1 = 0.78$ $\beta_2 = 0.53$	$\beta_0 = 2.11$ $\beta_1 = 0.79$ $\beta_2 = 0.51$

Note: Illustration! More than one synthetic data set produced via proposed method

Synthetic Data from One Fictional Industry



Disclosure Risk

Intruder Scenario	Maximum Value	Original	Synthetic	
			Metric 1	Metric 2
Intruder only has access to synthetic data *	Payroll	1,076	1,195	n/a
	Sales	12,708	8,903	
	Employment	45	33	
Intruder has access to true value of 2nd largest establishment in industry (by item)**	Payroll	1,076	1,195	97,436
	Sales	12,708	1,195	50,773
	Employment	45	33	245

* Most "revealing" scenario with synthetic data

1. Developed univariate (marginal distribution) risk metrics
2. Multivariate distribution risk metric under development
3. Need to decide on "global" measure

** Metric 1 = maximum(largest synthetic value, true 2nd largest value)
Metric 2 = Synthetic data total – true 2nd largest value (from p-percent rule)

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