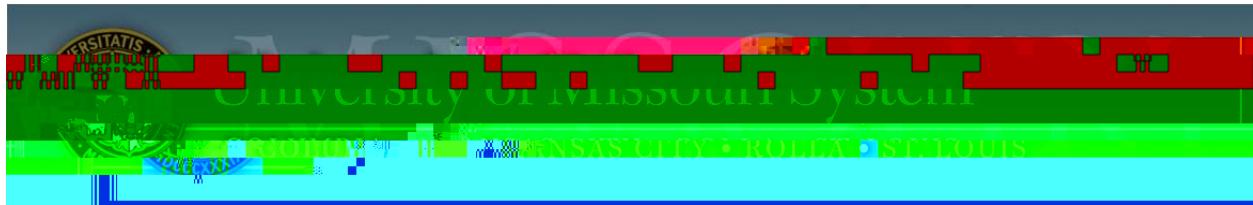# Communicating Uncertainty – An example using the SOC Approach to Reporting IPEDS HR Survey Data

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ABSTRACT

Beginning in fiscal year 2013, NCES mandated the use of SOC codes for submitting IPEDS HR Survey data. Consequently, institutions that previously submitted using other than SOC codes might need to apply, retroactively, the mandated FY 2013 SOC approach to pre FY 2013 HR data in order to generate associated historical trends. This presentation discusses some ways in which the uncertainty introduced by this retroactive application might best be communicated to the university officers who routinely utilize these historical trends.

OUTLINE

Motivating example using a specific metric (Ratio of Managers to Faculty)

SOC's at UM

Implications of ignoring uncertainty when reporting this metric

Incorporating uncertainty using a Bayes like approach when reporting this metric

Suggested improvements

Summary

Motivating Example

<mark>*** Refer to SOC handout NOW! ***</mark>

Fig 1.   UM IPEDS HR Survey employees.

FY	Total	No. Missing SOC	% Missing SOC
2010	28,108	1,126	4.01
2011	28,612	773	2.70
2012	28,852	208	0.72
2013	28,355	0	0.00

Fig 2.   Jobs (business_unit + jobcode) of UM IPEDS HR Survey employees.

FY	Total	No. Missing SOC	% Missing SOC
2010	3,435	415	12.08
2011	3,440	296	8.60
2012	3,446	159	4.61
2013	3,354	0	0.00
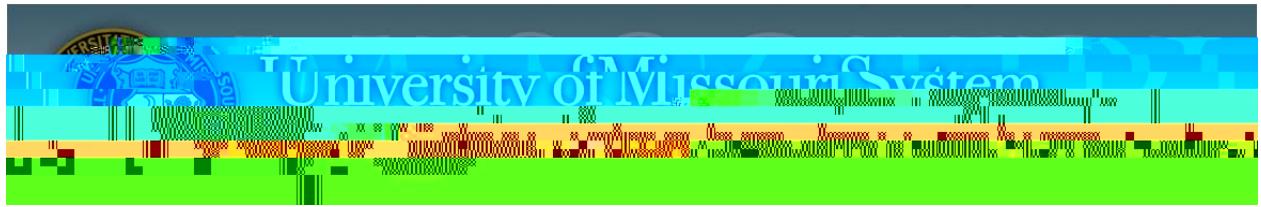
Beta Distribution:

$$f\left(p\mid\alpha,\beta\right)=\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}\,p^{\alpha-1}\left(1-p\right)^{\beta-1}I_{0,1}\left(p\right),\text{ where}$$

$$\alpha>0,\ \beta>0,\text{ and }\Gamma\left(t\right)=\int_{0}^{\infty}u^{t-1}e^{-u}du.$$

Wikipedia

$$\mu_{p\mid\alpha,\beta}=Exp\left(p\mid\alpha,\beta\right)=\frac{\alpha}{\alpha+\beta},\text{ and }Mode\left(p\mid\alpha,\beta\right)=\frac{\alpha-1}{\alpha+\beta-2},\text{ and}$$

$$\sigma^{2}_{p\mid\alpha,\beta}=Var\left(p\mid\alpha,\beta\right)=\frac{\alpha\beta}{\left(\alpha+\beta\right)^{2}\left(\alpha+\beta+1\right)}.$$

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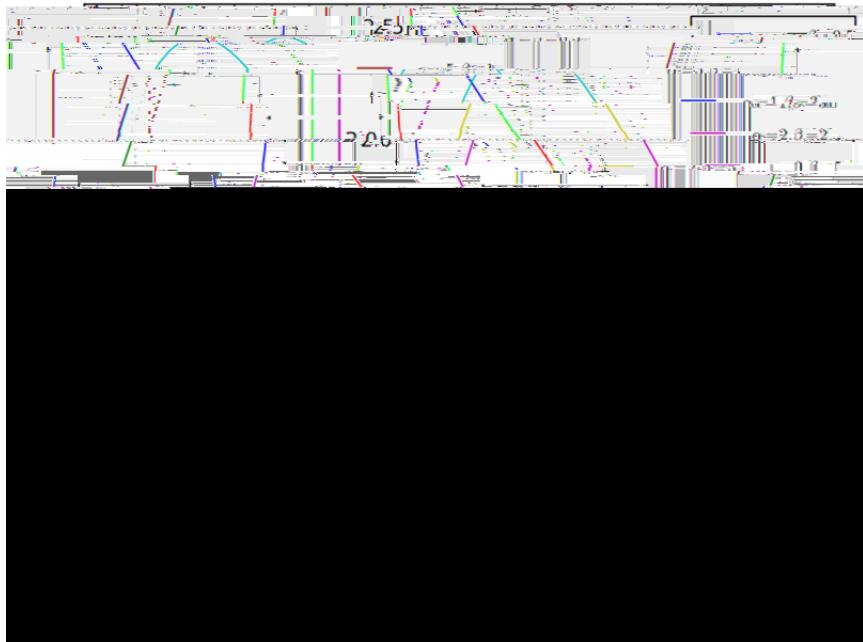
Example:

Suppose you "believe" (for whatever reason) that, for a given FY:

Each of these employees who have a missing SOC, either has a management occupation, or is a postsecondary teacher.

Each is three times more likely to be a teacher than a manager.

Then, for each FY you want parameters alpha and beta to satisfy:

alpha	beta	Exp(p)	StdDev(p)	Var(p)
0.5	1.5	0.25	0.2500	0.0625
1.0	3.0	0.25	0.1936	0.0375
2.0	6.0	0.25	0.1443	0.0208
4.0	12.0	0.25	0.1050	0.0110
8.0	24.0	0.25	0.0754	0.0057
16.0	48.0	0.25	0.0537	0.0029

y

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0.00   0.25   0.

p
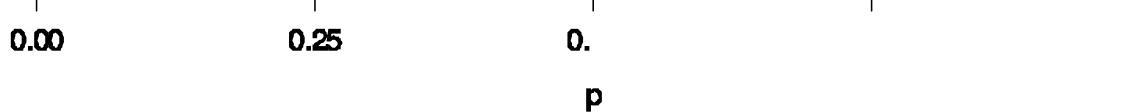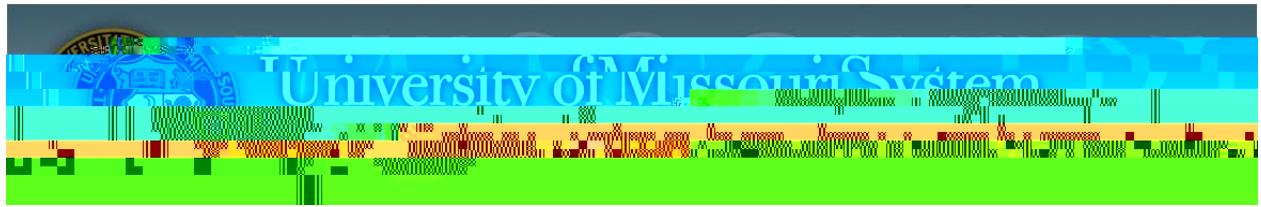
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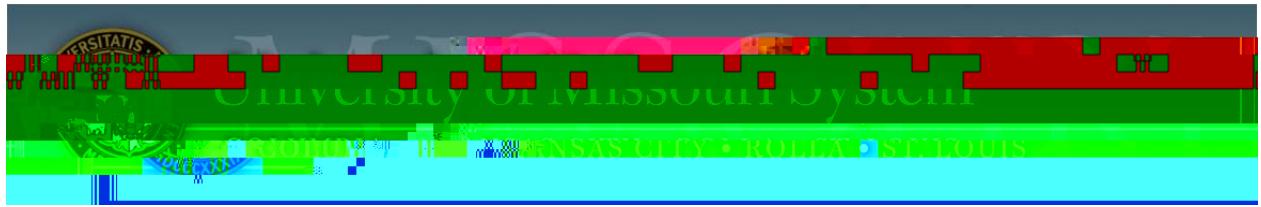
Appendix (Handouts)

2010 Standard Occupational Classification

Maj(Min(Broad Group   Detailed Occupation

BUSINESS_UNIT	VCVP	VCVP_DESCR	CSD	CSD_DESCR	DEPT	DEPT_DESCR	DEPTID	DEPTID_DESCR	iAcademic_Depts

KCITY   KACAF   Vc Academic Affairs   KA&S   College

STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SCHEMIST	Chemistry	SCHEMIST	Chemistry	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SCRIM&CJ	Criminology & Criminal Justice	SCRIM&CJ	Criminology & Criminal Justice	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SDEANA&S	Dean of Arts & Sciences	SDEANA&S	Dean of Arts & Sciences	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SECONOMI	Economics	SECONOMI	Economics	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SENGLISH	English	SENGLISH	English	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SFORLANG	Foreign Languages & Literature	SFORLANG	Foreign Languages & Literature	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SGERONTO	Gerontology	SGERONTO	Gerontology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SHISTORY	History	SHISTORY	History	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SIWGSTU	Institute for Women & Gender S	SIWGSTU	Institute for Women & Gender S	0
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SMATH&CS	Mathematics & Computer Science	SMATH&CS	Mathematics & Computer Science	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPHILOSO	Philosophy	SPHILOSO	Philosophy	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPHYASTR	Physics and Astronomy	SPHYASTR	Physics and Astronomy	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPOLISCI	Political Science	SPOLISCI	Political Science	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPSYCHOL	Psychology	SPSYCHOL	Psychology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPSYCTR	Center for Trauma Recovery	SPSYCTR	Center for Trauma Recovery	0
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SSOCIOLO	Sociology	SSOCIOLO	Sociology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SSOCWORK	Social Work	SSOCWORK	Social Work	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SA&SACAD				

	A	B	C	D	E	F	G	H	I	J	K
1											
2				Alpha =		8.000000		MISSING =	25.000	16.000	1.000
3				Beta =		24.000000		MGMNT =	38.000	35.000	37.000
4								TTTPSTCH =	1068.000	1049.000	1077.000
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