Variations in unemployment and pregnancy intention and resolution: an exploration of the economy and fertility decision-making

The topic of economic determinants of fertility is of fundamental interest to economic demographers. Becker pioneered the idea that couples make fertility decisions to maximize a utility function. He suggested an income effect and quantity-quality tradeoff to childbearing decisions. This theory, when extended to changes in the economy, predicts a negative effect of unemployment on fertility decisions (Becker, 1974). The value of time theory alternatively suggests that as employment opportunities decrease, the opportunity costs of time spent raising children decrease as well. This would imply a positive relationship of fertility and unemployment. Some literature explores the fertility response of a temporary income shock versus a more persistent period of unemployment. The former may lead couples to delay childbearing whereas the latter may ultimately reduce the underlying desire to have children (Kravdal, 2002). The current economic recession in the United States provides opportunity for further study of the mechanisms relating the economy and fertility.

Recent empirical work has indeed shown a short-term decline in births with the recession. A Pew Center report documents that birth rates have declined significantly since the start of the recession in December 2007. Controlling for size of the reproductive-aged population, the fertility rate has dropped from 69.6 births per thousand women in 2007 to 66.7 births per thousand women in 2009. Data for 2010 show evidence of a further drop (Livingston, 2011).

From a neoclassical economic perspective, the pathway from unemployment to fertility is through individuals' rational response to their environment. Couples notice a change in unemployment and successfully reduce their fertility accordingly. The nuances of the mechanisms by which the economy leads to fertility decline are of great interest to the field of

reproductive health. Specifically, we are concerned with the outcome of unintended pregnancy, which remains high in the US, at 49% of all pregnancies (Finer, 2011). Unintended pregnancy is linked to negative health outcomes for mothers and children, and is recognized as a significant public health concern (Mayer, 1997).

Variation in economic conditions may indeed influence contraceptive and sexual behavior prior to pregnancy. Additionally it may change the proportion of pregnancies that are mistimed or unwanted and some of these will end in abortion. Understanding how the economy affects intention of pregnancy and decision-making around termination would bring insight to the discussion of the economy and fertility. I therefore propose two research questions in this paper:

1. Does level of national unemployment predict incidence of unintended, mistimed, or unwanted pregnancy?
2. Does level of national unemployment predict incidence of abortion or miscarriage relative to birth?

Methods

To investigate these questions, I used individual level data from the National Survey of Family Growth (NSFG) and monthly national unemployment data from the National Bureau of Labor Statistics (NBLS). The NSFG is a cross sectional, nationally representative survey that is administered by the National Center for Health Statistics and contains detailed questions about sexual behavior, contraceptive use, relationship status and pregnancy. This analysis uses the pregnancy data file the 2006-2010 survey of women across the US. The pregnancy file contains information on all of the participants' pregnancies, including date of conception, wantedness at the time of conception, and outcome. Therefore pregnancy is the unit of analysis. NSFG

includes inverse probability selection weighting based on of PSU, segment, housing unit, and person within selected household sampling procedures.

The NBLS provides monthly, adjusted unemployment figures for the US. I assigned the monthly unemployment rate to the date of conception from each pregnancy reported in the NSFG between January 1990 and March 2010. I chose this 20-year period because it is long enough to capture significant variation in unemployment rates, but not so long that retrospective recall of pregnancy intention would introduce added bias. I chose to match unemployment to month of conception, based on the theory that the economic conditions may have influenced contraceptive behavior and also decision making regarding whether to have an abortion.

The dependent variables were created from questions asked of each participant for each pregnancy. Pregnancy "wantedness" was assessed using a series of questions that asked the respondent to recall the period prior to each pregnancy and report if she wanted a child at that time or in the future. NSFG coded wantedness according to these responses to classify the pregnancy as: 'later, overdue', 'right time', 'too soon, mistimed', 'didn't care, indifferent', 'unwanted', and 'don't know, unsure'. I collapsed these categories into a dichotomous measure of 'intended' and 'unintended', with unintended encompassing both unwanted and mistimed pregnancies, and intended including those that were overdue, occurred at the right time, or where the woman was indifferent. Those who responded that they didn't know were given missing values. Since the constructs of unwanted and mistimed pregnancies have different meanings, I also categorized the variables into wanted, mistimed, unwanted, and other.

The resolution of each pregnancy is also recorded based on respondent report, and classified as 'live birth', 'abortion', or 'miscarriage'.

I fit five multivariate generalized estimating equation (GEE) models to estimate the effect of unemployment on (1) unintended compared to intended pregnancy, (2) mistimed compared to wanted pregnancy (3) unwanted compared to wanted pregnancy, (4) abortion compared to birth, and (5) miscarriage compared to birth. Given that there were multiple pregnancies per woman in the dataset, GEE provides marginal estimates that account for clustering based on unmeasured factor within each woman. I specified a logit link with binomial family distribution, and an exchangeable correlation matrix. Age at the time of conception, race, and education were adjusted for in all models. Age was modeled as a categorical variable, 15-19, 20-24, and 25-44. Race was classified as non-Hispanic White, non-Hispanic Black, Hispanic, and other. I collapsed education into a dichotomous variable for less than high school education compared to those that completed high school or beyond. While this completed education measure does not capture education level at the time of pregnancy, it could be considered a measure of SES, as it captures education level at the time of survey. Given the frequent occurrence of the primary outcomes of interest, the odds ratios (ORs) should not be interpreted as relative risks (RR), as is done in epidemiologic studies that meet the rare disease assumption.

I used Stata SE 12.0 to complete all analyses. Survey weights were used to report all frequencies and descriptive statistics, and multivariate models accounted for clustering by woman.

Results and Discussion

7,211 women between 15-44 were included in the study sample, collectively contributing 18,901 pregnancies between Jan 1990 and March 2010. The mean unemployment rate across this period was 5.4%, with a minimum of 3.8% in June of 2000 and a maximum of 10.0% in October 2010. The fluctuation in the monthly unemployment rate is displayed in Figure 1. The

figure displays a marked increase in unemployment corresponding with the current economic recession and notable increases in unemployment in the early 1990s. In contrast to unemployment, the proportion of pregnancies that were classified as unintended does not follow a clean shape over the study period.

The classification on unintended pregnancy includes both mistimed and unwanted pregnancies, compared to those that were reported as overdue, at the right time, or indifferent at the time of conception. The weighted responses to each question and associated groups are listed below:

Intended		*Unintended*	
Later, overdue	7.6%	Too soon, mistimed	27.2%
Right time	48.4%	Unwanted	15.8%
Didn't care, indifferent	0.8%		

This measure of 'unintended' pregnancy includes 43% of all pregnancies. The second and third analyses further differentiate these measures to compare mistimed pregnancies to wanted pregnancies, and unwanted pregnancies to wanted pregnancies. The 'later, overdue' and 'indifferent' pregnancies are included in as 'intended' in the first measure, but are not used in generation of the dichotomous variables for mistimed of unwanted.

Descriptive statistics across strata of pregnancy intention are displayed in Table 1. 'Later' and 'indifferent' were grouped into 'other'. The frequencies presented are unweighted, but the percentages account for survey weighting. Mean unemployment rate is slightly higher for pregnancies classified as mistimed (5.47, SE= .03), compared to unwanted (5.37, SE= .03) and wanted (5.38, SE= .02). It is clear from this table, that pregnancy wantedness is not randomly distributed across groups. Women with less than high school education are more likely to classify their pregnancies as mistimed or unwanted as compared to wanted. Black women have higher percentages of pregnancies reported as mistimed or unwanted compared to white women.

Hispanic show the same trend, but to a lesser degree. Over half of women report pregnancies occurring from 15-19 years of age as being mistimed, 32% of 20-24 year old, and only 15% of 25-44 year olds. Classification of unwanted pregnancies does not differ, as dramatically by age, suggesting that the differences in pregnancy intention are largely driven by pregnancies that occur sooner than the woman would have hoped. These observed differences may speak to underlying differences in the incidence of mistimed, unwanted, and wanted pregnancies across racial, SES and age groups. They may also arise from cultural differences and therefore inaccurate measurement of these constructs.

Table 2 presents reported pregnancy outcomes across race, education and age. Again, marked differences in the incidence of reported abortion, miscarriage and birth are visible. Mean unemployment is highest among pregnancies that ended in abortion, (5.47, SE=.03), as compared to miscarriage (5.39, SE .03) and birth (5.37, SE=.01). Reported abortion is highest among black women, which is consistent with national demographics of abortion. The numbers of reported miscarriage are striking because miscarriage is known to occur less frequently than abortion among recognized pregnancies. This inflation may be explained by the underreporting of abortion, and over reporting of miscarriage by participants. This may occur because miscarriage is significantly less stigmatized in the US than abortion and participants may be more comfortable reporting a terminated pregnancy as a miscarriage. There is no reason to believe that this misclassification of miscarriage and abortion would be related to unemployment.

The results of GEE models and associated odds ratios are reported in *Table 3*. There is no indication of a significant association between unemployment rate and odds of unintended pregnancy, after adjusting for education, race and age (OR=1.02, 95% CI [0.99, 1.06]). However, unemployment rates are positively associated with the odds of a pregnancy being

reported as mistimed versus wanted (OR=1.05, [1.01, 1.09]), although the magnitude of the effect is small. There was not significant difference between odds of unwanted versus wanted pregnancy by unemployment. This result supports the hypothesis that changes in the economy, as modeled through the unemployment rate, may have impacts on fertility through changes in desired timing of pregnancy. Higher unemployment at the time of pregnancy meant that women were more likely to classify that pregnancy as mistimed, but not as unwanted.

Although unemployment is the primary exposure of interest, it is worth noting that lower education, being African American, Hispanic, or other race are all associated with higher odds of unintended pregnancy. Interestingly the relationship is reversed for education and mistimed pregnancy, perhaps indicating that lower SES women are more likely to classify unintended pregnancies as unwanted rather than mistimed. Age is a significant predictor of wantedness as well, with odds of unintended, mistimed or unwanted pregnancies significantly reducing with age.

Models 4 and 5 show significant effects of the unemployment rate on odds of abortion versus birth (OR=1.10, [1.05, 1.17]) and miscarriage versus birth (OR=1.10, [1.05, 1.16]). Women with less than a high school education have reduced odds of reporting abortion, as do Hispanic women, and older women. Black women have higher odds of reporting abortion and lower odds of reporting miscarriage. Miscarriage is also significantly associated with age, where 25-44 year olds have higher odds of report compared to teens. Hispanic women have significantly lower odds of miscarriage than white women. These differences may be picking up differential reporting of abortion and miscarriage by race. It may be that abortion is particularly stigmatized certain populations, making them more likely to classify abortions as miscarriages.

The results of these models indicate that women are more likely to terminate a pregnancy in challenging economic times, as measured by national unemployment. The significant effect for miscarriage could indicate a biological mechanism of increases in spontaneous abortion with stressful economic conditions, as has been suggested by previous work. It could also be measuring the same decisional mechanism that is at play for selected termination, and simply increasing as a result of misclassification. To investigate the Trivers-Willard hypothesis, and work by Catalano, I also modeled the economy on odds of male birth, yet did not see a significant effect (model not shown). Since male sex ratios are endemically higher, I would need to look at residual changes in the sex ratio over time to truly see an effect. This is an area of potential further inquiry.

There are several limitations to this current analysis that warrant further investigation and are planned for this paper. As previously discussed, misclassification of abortion and miscarriage is likely an issue with this dataset. I plan to use explore correction factors to correct for this misclassification in future analyses. Additionally, recall bias may affect the results, especially if women who have a live birth are less likely to report that pregnancy as unwanted at the time of conception. Recall problems would likely increase with time from survey. It is unlikely that these biases are differential to unemployment.

Given the lack of geographic data on participants, this model includes only macro variation in unemployment over time. It does not account for the fact that different regions, states, counties, and neighborhoods have different underlying levels of unemployment changes in the local unemployment rate. It may be that states with high unemployment would be most affected by changes in the unemployment rate, because more people are sensitive to shocks in that region. Conversely, it could be hypothesized that those same states would be less affected,

because the relative change in unemployment may be less significant as compared to higher endemic rates. A recent study found that states with the highest income inequality also had the highest rates of unintended pregnancy, but it is unclear how an economic shock may affect these same populations (Kost, 2012). Having data on how individual states changes over time would definitely improve this analysis.

Additionally, exploiting variation in unemployment over time produces a parameter of changes in unemployment rate on pregnancy outcomes, yet does not account for temporal trends in the outcome. It may be that there is some external variable that is driving changes in both unemployment and fertility decision-making that is unmeasured in this analysis. If pregnancy wantedness or outcome exhibits seasonality along with unemployment, then a spurious effect could ne induced. These issues could be resolved by using time-series models, which I plan to complete in future analyses.

Researchers of the economy and fertility have long discussed the problems of endogeneity with fertility decision-making and income. It may be that having more or less children has a direct effect on unemployment and income. This analysis is less impacted by the endogeneity problem, as it uses macro level measures of unemployment at the time of conception. Therefore issues of temporality are not as problematic.

It is possible that the effect of the economy or macro level unemployment on fertility would exhibit a different temporal pattern than explored here. For instance, increases in unemployment several months before pregnancy, may have an impact on contraceptive use and sexual behavior. This analysis, does not model the risk of pregnancy, but instead the relative proportions of pregnancies that are classified as unintended, mistimed, or unwanted in comparison to intended and wanted. Modeling unemployment during the month of conception

therefore captures changes in decision-making prior to conception and also post conception. It is impossible to tease these apart in this analysis by looking simply at the intention and wantedness variables. The inclusion of pregnancy outcome variables gets at decisions women and couples may face once pregnant, and how the economy may influence some people to choose abortion instead of birth.

Additional information on contraceptive use and sexual behavior as well as risk of pregnancy, would be important additions to this framework and could be modeled using the NSFG data.

There are some statistical issues with this analysis, namely the need to account for both survey weighting and clustering of pregnancy within woman. Multilevel models do not allow for inclusion of survey weights without changes to the assumptions about likelihood estimation. I would like to further explore these issues of parameter estimation moving forward with the paper.

Conclusion

The results of this study provide further insight into the relationship between the economy and fertility. I found evidence that increases in unemployment rates are positively associated with the odds of a pregnancy being mistimed as opposed to wanted. Additionally, national unemployment was positively associated with a pregnancy ending abortion or miscarriage as opposed to birth. These results support the quality-quantity hypothesis that economic uncertainty will reduce fertility, although the change in number of births over this time period is unknown. It indicated that this reduction might come as a result of more pregnancies being considered mistimed in light of short-term economic change. The question of whether sustained negative conditions has an effect on reducing the desired number of children, or

increasing unwanted pregnancies remains unanswered with this analysis. These results further explain the reported reduction in fertility observed with as economic decline as partially explained by increases in abortion and miscarriage. This association may be driven by a higher proportion of pregnancies being mistimed or more of those mistimed and unwanted pregnancies resulting in a decision to terminate. There may be some evidence in this analysis of a biologic mechanism for miscarriage being activated by changes in the economy.

Overall this paper contributes to the literature, and emphasizes the importance of looking at pregnancy intention and decision-making behaviors in order to understand the complex pathway through which the economy may impact fertility.

Figure 1: crude rates of unemployment and unintended pregnancy from NSFG and NBLS data.

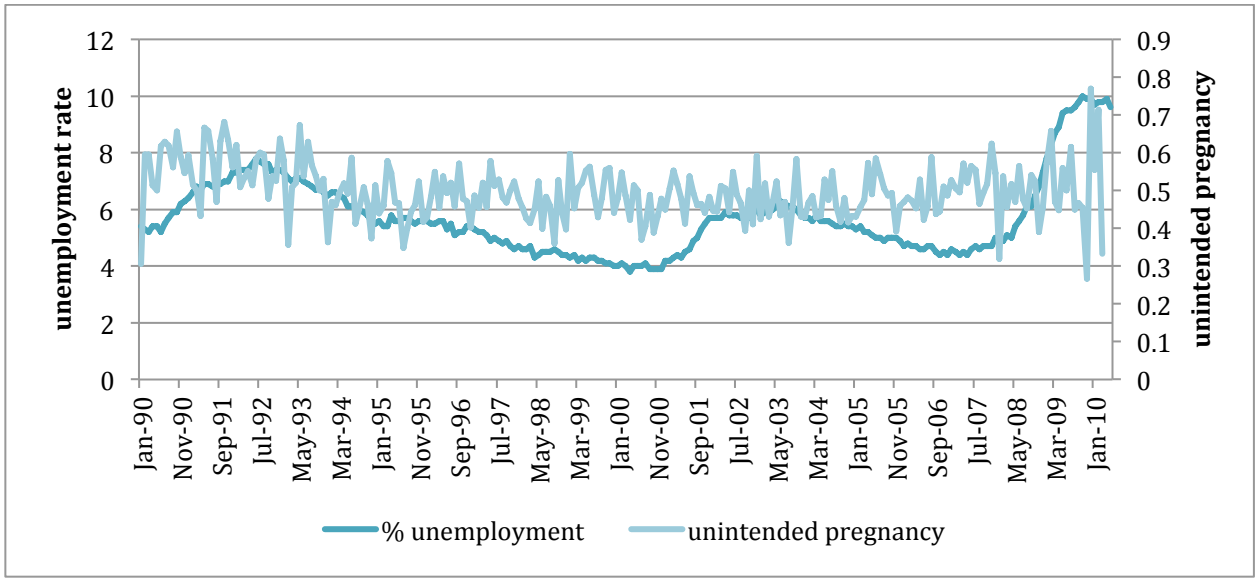

Table 1: Population descriptive statistics for unemployment, education, race and age by pregnancy wantedness measures. Unweighted frequencies and weighted percentages are presented.

	All		Unintended				Intended			
			Mistimed		Unwanted		Wanted		Other	
	%	N	%	N	%	N	%	N	%	N
Mean national unemployment		5.40	5.47		5.37		5.38		5.34	
Education	49.9	8,046	24.3	2,220	12.1	1,218	52.5	3,829	11.1	779
HS and above										
Less than HS	50.1	10,111	30.1	3,185	19.5	2,227	44.0	4,082	6.3	617
Race	54.9	7,698	25.9	2,165	12.8	1,097	51.7	3,677	10.4	759
White										
Hispanic	20.9	4,805	27.4	1,379	17.3	854	47.5	2,223	7.7	349
Black	15.9	4,373	32.4	1,490	25.9	1,235	37.4	1,456	4.3	192
Other	8.3	1,281	26.0	371	17.4	259	48.2	555	8.4	96
Age	18.8	4,209	53.6	2,224	19.7	918	23.7	935	3.1	132
15-19										
20-24	29.5	5,761	32.0	1,854	16.1	1,168	47.1	2,462	4.8	277
25-44	51.7	8,187	15.0	1,327	14.3	1,359	57.8	4,514	13.0	987
Total		18,157	27.2	5,405	15.8	3,445	48.2	7,911	8.7	1396

Table 2: Population descriptive statistics for unemployment, education, race and age by pregnancy outcome measures. Unweighted frequencies and weighted percentages are presented.

			Abortion		Miscarriage		Birth	
	%	N	%	N	%	N	%	N
Mean national unemployment	5.40		5.47		5.39		5.37	
Education	49.9	7,636	10.1	933	16.0	1,239	73.8	5,464
HS and above								
Less than HS	50.1	9.607	8.9	931	15.5	1457	75.6	7,219
Race	54.9	7,307	8.7	697	17.5	1,313	73.8	5,279
White								
Hispanic	20.9	4,566	8.2	379	10.9	551	80.9	3,636
Black	15.9	4,138	14.1	666	15.1	601	70.8	2,871
Other	8.3	1,232	9.4	122	17.2	231	72.8	979
Age	18.8	4,088	14,8	601	16.6	603	68.6	2,884
15-19								
20-24	29.5	5,492	10.9	675	13.8	760	75.3	4,057
25-44	51.7	7,663	6.7	558	16.6	1,333	76.7	5,742
Total		17,243	9.5	1,864	15.8	2,696	74.7	12,683

Table 3: Odds Ratios and associated 95% confidence intervals for the association of national unemployment rates with unintended pregnancy, mistimed pregnancy, unwanted pregnancy, abortion, and miscarriage using GEE models to account for clustering by respondent. All models are adjusted for covariates.

	(1) Unintended Pregnancy		(2) Mistimed Pregnancy		(3) Unwanted Pregnancy		(4) Abortion		(5) Miscarriage	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
National unemployment	1.02	(0.99, 1.06)	1.05	(1.01, 1.09)	0.98	(0.94, 1.02)	1.10	(1.04, 1.17)	1.10	(1.05, 1.16)
Education										
HS and above	1.0		1.0		1.0		1.0		1.0	
Less than HS	1.14	(1.06, 1.23)	0.87	(0.80, 0.95)	1.45	(1.29, 1.62)	0.59	(0.53, 0.68)	1.06	(0.95, 1.17)
Race										
White	1.0		1.0		1.0		1.0		1.0	
Hispanic	0.96	(0.88, 1.06)	0.88	(0.80, 0.99)	1.02	(0.89, 1.16)	0.73	(0.61, 0.86)	0.66	(0.58, 0.75)
Black	1.87	(1.70, 2.05)	1.40	(1.26, 1.56)	2.34	(2.06, 1.67)	1.54	(1.34, 1.78)	0.85	(0.75, 0.96)
Other	1.24	(1.06, 1.45)	1.07	(0.90, 1.26)	1.47	(1.20, 1.81)	0.97	(0.76, 1.25)	1.06	(0.87, 1.27)
Age										
15-19	1.0		1.0		1.0		1.0		1.0	
20-24	0.39	(0.34, 0.43)	0.31	(0.28, 0.34)	0.60	(0.53, 0.68)	0.87	(0.75, 1.0)	0.94	(0.83, 1.06)
25-44	0.21	(0.18, 0.22)	0.12	(0.11, 0.14)	0.55	(0.48, 0.62)	0.57	(0.48, 0.67)	1.16	(1.04, 1.32)

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