Spontaneous Pregnancy Loss in Denmark following Economic Downturns

Abbreviations Used:

ARIMA: Autoregressive, Integrated, Moving Average

CI: Confidence Interval

NPR: National Patient Register

SUMMARY

An estimated 11 to 20 percent of clinically recognized pregnancies result in spontaneous abortion. The literature finds elevated risk of spontaneous abortion among women that self-report adverse financial life events. This work suggests that, at the population level, national economic decline — an ambient and plausibly unexpected stressor — will precede an increase in spontaneous abortion. We test this hypothesis using high-quality pregnancy and spontaneous loss information for all women in Denmark. We applied time-series methods to monthly counts of clinically-detected spontaneous abortions (n=157,449) and the unemployment rate from Denmark beginning January 1995 and ending December 2009. Methods controlled for temporal patterns in spontaneous abortions (e.g., seasonality, trend) as well as changes in the population of pregnancies at risk of loss. Unexpected increases in the unemployment rate precede by one month a rise in spontaneous abortions (coefficient = 33.19, 95% confidence interval: 8.71, 57.67). An attendant analysis that uses household durable goods consumption as an indicator of financial insecurity supports inference from our main test. Changes over time in elective abortions and in the cohort composition of high-risk pregnancies do not account for results. In Denmark, ambient stressors as common as increasing unemployment precede a population-level increase in spontaneous abortions.

MeSH headings: spontaneous abortion, fetal mortality, psychological stress, economic recession

An estimated 11 to 20 percent of clinically recognized pregnancies result in spontaneous pregnancy loss (1). In addition to their somatic cost, spontaneous pregnancy losses at less than 20 weeks precede an increased risk of long-term depression and anxiety among the parents (2-4). Research that uses stillbirths (i.e., > 28 weeks) to approximate overall loss indicates that the incidence of spontaneous loss has remained relatively stable as compared with secular reductions in maternal morbidity from childbirth and neonatal mortality (5). International agencies, therefore, have issued calls to redouble efforts to identify preventable causes (6).

Whereas research identifies maternal age (7), common behavioral factors (e.g., smoking [7]) and chromosomal abnormalities (8) as antecedents of spontaneous pregnancy loss, these and other known risk factors cannot explain the majority of events. Increasingly, individual-level research implicates psychosocial stress as a risk factor. Hogue and colleagues (9) find that self-reported recall of stressful life events— severe financial events in particular—in the 12 months prior to delivery varies positively with losses at 20 weeks or later. The literature, although not without null findings on pregnancy loss less than 22 weeks of age (10), further reports a positive relation between self-reported severe life events in months before conception and chromosomally normal spontaneous losses at earlier stages of pregnancy (≥ 11 weeks) (11). This work, in conjunction with evidence of elevated maternal cortisol levels among early pregnancy losses, supports the plausibility of pregnancy disruption by life stressors (12).

Researchers, however, disagree on whether psychosocial stressors *per se* play a causal role in spontaneous loss. The most serious inferential problem involves endogeneity, which epidemiologists also refer to as confounding by a common cause. Discovered associations may arise from "social selection" into exposure in which unmeasured aspects of the mother precede an increased likelihood of self-reporting severe life events (e.g., financial hardship, arguments with spouse), decisions to conceive, and a subsequent adverse pregnancy outcome. Such common causes could include innate or acquired characteristics, as well as the socio-economic environment of the mother. Much research documents that these circumstances predict stressful life events (13), fertility decisions (14) and adverse health (15), which makes it challenging to attribute a distinct causal role to stressful life events.

Given the issue of confounding by a common cause, researchers have turned to ambient and relatively common sources of population stress that may approximate a natural experiment (16). To the extent that the timing of an ambient stressor is exogenous, or independent of mothers' characteristics, this study design would reduce bias due to unmeasured confounding.

Ambient economic downturns reflect a plausible source of population variation in psychosocial stress. The literature finds that ambient economic downturns precede an increased incidence of stressful financial events such as loss of wages and income and inability to pay bills (17, 18). Research also reports that the experience of undesirable job and financial events increases the likelihood of subsequently experiencing other stressors such as changing

residence, trouble with spouse or partner, and problems with children (19, 20). The literature further finds increased perinatal morbidity immediately following regional economic downturns (21).

The growing literature on the economy and birth outcomes (21) includes a report in the U.S. of increased male more than female fetal loss (>20th week) following economic downturns (16). We build on this sex-specific finding in late-pregnancy and examine whether economic downturns precede an increase in overall spontaneous pregnancy losses, including those that occur before the 20th week. We test this hypothesis using aggregate monthly data on the unemployment rate and high-quality clinical data in Denmark that registers spontaneous pregnancy losses as early as the first trimester. Our time-series analysis contributes to the literature by minimizing confounding due to a common cause, capturing losses as early as the 1st trimester using detailed clinical registry data, accounting for temporal variation in elective abortions, and limiting selection bias by examining all clinically detected pregnancies in Denmark.

MATERIALS AND METHODS

Data and Variables

We retrieved information on spontaneous abortions and other pregnancy outcomes from several national registers in Denmark including the National Patient Register and the Medical Birth Register. Previous reports describe in detail the quality and provenance of these Registers (22, 23). Researchers consider Denmark's National Patient Register (NPR) as comprehensive with

respect to including information on in- and out-patient visits for somatic and psychiatric visits and the ability to link individual data to other health and non-health registries (22). The NPR includes a unique personal identification number linked to visits, procedures, or diagnoses relating to pregnancy including positive pregnancy tests, receipt of prenatal care, screening for anomalies, and surgeries and deliveries. Beginning in 1995, the NPR contains all outpatient activities and emergency room contacts. This year serves as the start date of our analysis, and our dataset continues until 2009, the last year of data available to us at the time of our test.

From the NPR, we constructed a cohort of ongoing pregnancies based on pregnancy-related diagnoses and the corresponding gestational ages recorded with the diagnoses. We excluded ectopic (ICD-10 code: O00) and molar pregnancies (ICD-10 code: O01) and other abnormal products of pregnancies (ICD-10 code: O02). For each remaining detected pregnancy, we coded one of four possible outcomes: spontaneous loss (ICD-10 codes: O03, P95), elective non-clinically indicated abortion (ICD-10 code: O04), elective clinically-indicated abortion (ICD-10 codes: O05, O06), or live birth. In a small number of cases with conflicting information (i.e. an apparent induced abortion occurring just before a live birth), we used a set of decision rules based on distance between events and hierarchy of outcomes to decide which outcomes to assign. We used the exact date of visit associated with these procedure and diagnostic codes to assign the month and year of the event. Given the high quality, completeness, and coverage of live births and elective abortions in Denmark's Population Registers (24, 25),

we view our NPR-based count of spontaneous abortions as a reliable estimate of the population of clinically-detected pregnancies that end in spontaneous loss.

We used the monthly unemployment rate as our independent variable because much theory as well as empirical research reports that populations experience more job, financial, and other stressors, as well as psychological distress, when the unemployment rate increases. The unemployment rate measures the percentage of the labor force not working but seeking employment. Previous literature on birth outcomes also uses the unemployment rate to gauge economic contraction (16, 21). We retrieved Denmark's monthly unemployment rate from the EUROSTAT Labour Force Survey, described in detail elsewhere (26).

Analysis

Tests of association turn on whether the assumed dependent variable moves away from its statistically expected value in "exposed" cases. Our hypothesis implies, for example, that spontaneous abortions will rise above their expected value in pregnancies exposed to unexpectedly high levels of unemployment. Spontaneous abortions, however, exhibit well-documented temporal patterns including seasonality, trend, and the tendency for high or low values to be "remembered" into subsequent months. These patterns, referred to collectively as autocorrelation, confound tests of association because the expected value of a patterned series is not its mean.

To address the autocorrelation problem, researchers have devised data-driven routines that identify and remove patterns in the dependent variable. We

use the routines of Box and Jenkins to implement this approach (27). These routines express autocorrelation as a product of “autoregressive” (AR), “integrated” (I) and “moving average” (MA) parameters, collectively referred to as ARIMA models. The residuals of these ARIMA models meet the assumptions of correlational tests in that they have an expected value of 0 and exhibit no serial dependence.

Testing our hypothesis required that we estimate the population at risk of spontaneous abortion in any month. We cannot directly observe the size of the cohort at risk. As a surrogate, we approximated this population with the number of live births six months later. We empirically arrived at six months by determining the strongest positive correlation of spontaneous abortions from later live births (analyses available upon request). The six month span also coheres with the literature reporting that spontaneous losses from a conception cohort peak late in the first trimester (1) and that the majority of live births occur in the ninth month of gestation (i.e., six months after the peak in spontaneous losses).

We implemented the above time-series approach with the following steps. First, we used Box and Jenkins transfer function modeling to express as a control variable the monthly count of spontaneous abortions in month t as a function of live births in month $t+6$. Second, we added ARIMA parameters to the transfer function to express autocorrelation identified in its residual values (i.e., error term). Third, we removed secular trends and seasonal cycles, as confirmed with the augmented Dickey-Fuller test (28), from the unemployment rate over the test period. We removed trends by taking the first differences of the series (i.e.,

values at month t-1 subtracted from values at month t) and removed seasonal cycles by taking the 12^{th} differences (i.e., values at month t-1 or t-12 subtracted from values at month t). Fourth, we estimated the test model formed by adding the de-trended and de-seasonalized unemployment rate into the model resulting from step 2. Consistent with our hypothesis, we specified a synchronous (i.e., spontaneous abortions and unemployment in the same month) as well as 1 month lagged (i.e., spontaneous losses follow unemployment by 1 month) relation. Fifth, we applied outlier detection and correction routines to correct the confidence intervals of estimated coefficients (29). Sixth, we inspected the residuals of the equation to ensure that they exhibited no autocorrelation.

RESULTS

Table 1 provides descriptive statistics of clinically detected pregnancies in the Danish registry (1995 to 2009). Spontaneous pregnancy losses account for 11.6 percent of detected pregnancies, with a mean monthly count of 874.7. About 71 percent of pregnancies result in a live birth. Overall, the number of pregnancies declines about 11 percent from 1995 (96,871) to 2009 (86,354).

Figure 1 plots the count of spontaneous abortions over the 180 months. The series exhibits considerable variation over the test period (range: 748 to 1110; standard deviation [SD] = 61.8). Spontaneous losses show seasonality with peaks in Januaries. The unemployment rate also shows strong trend and seasonality (top panel of Figure 2), which required differencing the series at lag 1 and 12 months to render the series stationary in its mean. These differencing operators did not fully remove autocorrelation at lags 1 and 12 months. We

therefore specified an autoregressive parameter at lag 1 month and a moving average parameter at 12 months (see Supplemental Material i-ii). The bottom panel of Figure 2 shows the resulting unemployment series after removal of trend and seasonality. This series serves as the independent variable for our test.

Outliers in the spontaneous pregnancy loss series (Figure 1) may reduce the efficiency of our estimates by inflating confidence intervals. Outlier detection routines discovered three outliers: Feb. 2000, Apr. 2000, and Dec. 2001. We performed conventional outlier correction routines before examining our key independent variable (29).

Results (Table 2) from the final equation support the hypothesis in that unexpected increases in the unemployment rate precede by one month a rise in monthly spontaneous abortions (coefficient = 33.19, 95% confidence interval [CI]: 8.71, 57.67). We, however, cannot reject the null for a synchronous association. The count of live births at t+6 months also varies positively with spontaneous losses at time t. Spontaneous losses also show substantial autocorrelation best captured by autoregressive parameters at lags 4 and 12 months and a moving average parameter at 3 months (Table 2). After removal of autocorrelation none of the lags of the residual values of the spontaneous abortion series exceeded twice their standard error (Supplemental Material iii.).

To give the reader a sense of the magnitude of the discovered relation at lag 1 month, we estimated (from Table 2) the number of spontaneous abortions statistically attributable to increases in the unemployment rate. In the 82 months for which spontaneous pregnancy losses rose above their expected value, the

average “excess” was 34 losses. The average residual unemployment rate (net of autocorrelation) for the 90 months in which it increased is 0.16. Multiplying the discovered unemployment rate coefficient at lag 1 month by this average increase in unemployment (i.e., 33.19 x 0.16) implies that about 15% (i.e., 5.31 / 34) of the unexpected rise in spontaneous abortions is statistically attributable to increases in the unemployment rate.

Sensitivity Analyses

Over the test period, elective abortions account for 16.6% of clinically detected conceptions. To the extent that economic downturns precede an acute rise in elective abortions, this circumstance could lower the denominator of live births several months later and induce a positive relation between economic downturns and spontaneous loss. We therefore assessed this possibility by applying time-series methods to the elective abortion series and proceeded with the six steps described in the Methods. As with the spontaneous abortion test, we included lags of the de-trended and de-seasonalized unemployment rate at 0 and 1 month. Results from the final equation for elective abortions do not reject the null (Supplemental Material iv.). The unemployment rate coefficient at 0 month tends toward a negative association such that increases in the unemployment rate coincide with a *reduction* in elective abortions. This slightly negative relation implies a *larger* denominator of pregnancies at risk for spontaneous abortion than what we estimated. This larger denominator would suppress variation in our incidence measure, following economic downturns.

Such suppression would bias our test toward a type II error. Given that the spontaneous abortion test rejected the null, results indicate that elective abortions do not bias inference of our main test.

We then examined the extent to which pregnant women in Denmark show inherently higher risk of spontaneous pregnancy loss immediately after economic downturns—but not because of downturns—due the changing composition of the cohort at risk. High-risk mothers, as indicated by older maternal age or nulliparity, may anticipate acute monthly downturns and become pregnant months in advance of the downturn. Although we know of no research that finds such an acute relation, we acquired aggregate data on maternal age and parity and tested whether economic downturns predict a high risk cohort of live births six months later. Discovery of an association at the six month lag would cohere with the notion that mothers at risk of spontaneous loss late in the first trimester (and at heightened risk of loss following economic downturns) would deliver live births approximately six months after the peak risk of spontaneous loss. Results for maternal age and parity groups (Supplemental Material v.) show no increase in a high-risk pool of pregnancies following economic downturns.

To assess robustness of our findings to use of a separate independent variable, we examined the relation between another indicator of the status of financial adversity in Denmark—quarterly household consumption of durable goods—and spontaneous pregnancy loss. Literature in economics finds that household consumption of durable goods (e.g., furniture, major household appliances) reacts sensitively to financial shocks in household resources (30,

31). We therefore reasoned that an aggregate decline in household durable goods consumption gauges the population's incidence of stressful financial events and may precede an increase in spontaneous pregnancy loss. Statistics Denmark uses multiple sources of information, including value added tax records and mandatory vendor surveys, to estimate household durable goods consumption (32). Although we could not acquire data at the month resolution, we retrieved quarterly data on household durable goods consumption in Denmark and converted the monthly pregnancy loss information into a quarterly time series (i.e., 60 quarters from 1995 to 2009). We then proceeded with the same analytic steps as outlined in the Methods but with quarterly data.

The durable goods series correlates inversely with the quarterly unemployment rate at -0.59 (95% CI: -.34, -.84). This statistic suggests that household durable goods consumption serves as a distinct indicator of economic adversity while still showing an expected inverse correlation (i.e., high unemployment corresponds with low durable goods consumption). Results support that spontaneous pregnancy losses rise above expected values in quarters when household durable goods consumption falls (coef. = -0.015, 95% CI: -.026, -.004; see Table 3). This relation does not persist into the subsequent quarter.

DISCUSSION

We tested whether increases in the unemployment rate precede increases of spontaneous abortions in Denmark. Consistent with the hypothesis, we find that spontaneous abortions rise above their expected value one month after the

unemployment rate unexpectedly rises. A secondary analysis, using quarterly household durable goods consumption to gauge ambient financial uncertainty, provides similar inference. These findings, using what we believe to be the most comprehensive population-level dataset on pregnancy, support that economic stressors may act as antecedents of spontaneous pregnancy loss.

Strengths of our approach include detection in the Danish registries of over 11 percent of pregnancies as ending in spontaneous abortion. This coverage better approximates cohort-based "gold-standard" estimates of these losses than do national registries in other high-income countries (e.g., USA) (33). The population-based nature of the register also minimizes selection bias and permits generalizability of results to the entire country. We also include the population of live births as a proxy for the denominator of pregnancies at risk. This control strategy, as well as the short induction period we examined (i.e., 0 and 1 month), precludes the possibility that changes in fertility drive the discovered associations. Additional analyses of elective abortions and compositional changes in the pregnancy cohort at risk further indicate that these factors do not account for the positive relation between the unemployment rate and spontaneous pregnancy loss.

Our time-series methods rule out rival explanations of seasonality, trend, and other patterning in spontaneous abortions because we removed these patterns before examining the association between the unemployment rate and the dependent variable. In addition, we used a well-understood and well-measured ambient stressor—unexpected increases in the rate of unemployment.

For these reasons, we believe that our analyses provide a more accurate estimate of the relationship between a policy-regulated ambient stressor and spontaneous abortion than do individual-level, interview-based studies that cannot control for “endogenous” characteristics of the mother (10, 11).

Limitations of our work include that we do not know how many pregnancies spontaneously end before clinical recognition and registration. Spontaneous abortions in the first month of gestation, for example, reportedly account for a large fraction of overall losses (34). We, however, know of no literature suggesting that ambient stressors affect unregistered differently from registered gestations. If registered and unregistered gestations respond similarly to ambient stressors, then results may underestimate the magnitude of spontaneous abortions induced by unexpectedly high unemployment rates. We also could not acquire sex of the abortus, which did not allow direct examination, suggested in previous literature (16), of male-specific sensitivity *in utero* to ambient economic decline.

We could not identify which subgroups of pregnant women or conceptions appear most at risk of spontaneous abortion following unexpectedly high rates of unemployment. The aggregate nature of the time-series test also precluded subgroup analysis by socioeconomic status. We intend to acquire and analyze such microdata in future work. The monthly data did not allow us to rigorously estimate a mother’s competing risk of elective or spontaneous abortion. Only individual-level data, in a time-to-event competing risks framework, could identify the temporal nature of these joint risks. We further caution against using our

estimates to infer individual-level responses to job loss. Scholars, rather, should view our test as like those gauging a population-level response to an ambient an stressor such as air pollution or a heat wave.

Our analysis cannot inform which mechanisms may connect unemployment rates to spontaneous abortion. Extensive survey and clinic-based studies, however, identify plausible inflammatory, endocrinal (e.g., corticotrophin-releasing hormone) and behavioral (e.g., alcohol consumption, smoking) candidates (35, 36). Economic decline or stressful economic events reportedly activate many of these mechanisms (37, 38) and predict adverse pregnancy outcomes (15). We encourage further elucidation and measurement of pathways that may connect stressful financial and non-financial events to spontaneous pregnancy loss.

Speculation that stress induces pregnancy loss dates back at least to biblical times (39). We contribute to the literature by reporting that, in a well-defined population of clinically-detected pregnancies, spontaneous abortions rise one month after a rise in the unemployment rate. Our work extends reports of elevated pregnancy loss following rare ambient stressors (e.g., China's cultural revolution, life-threatening rocket attacks) (40, 41) in that we examine a more common stressor over which society arguably exerts collective control. The fact that Denmark provides a generous social safety net and employment protection programs raises the possibility that our results may not generalize elsewhere. We expect that greater availability of such data in the future will facilitate replication of our tests in societies with less social protection and safety net programs.

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Table 1. Characteristics of Clinically Detected Pregnancies in Denmark Over 180 Months Spanning January 1995 to December 2009.

	n	%	Monthly Mean (SD)	Monthly Range
Live Births	967,046	71.1	5,372 (340)	4,664—6,185
Terminations				
Spontaneous	157,449	11.6	874 (62)	748—1,110
Elective, clinically-indicated	9,174	0.7	51 (10)	29—79
Elective, non-clinically indicated	225,287	16.6	1,252 (134)	975—1,624

Figure 1. Monthly Count of Spontaneous Abortions In Denmark Over 180 Months, January 1995 To December 2009.

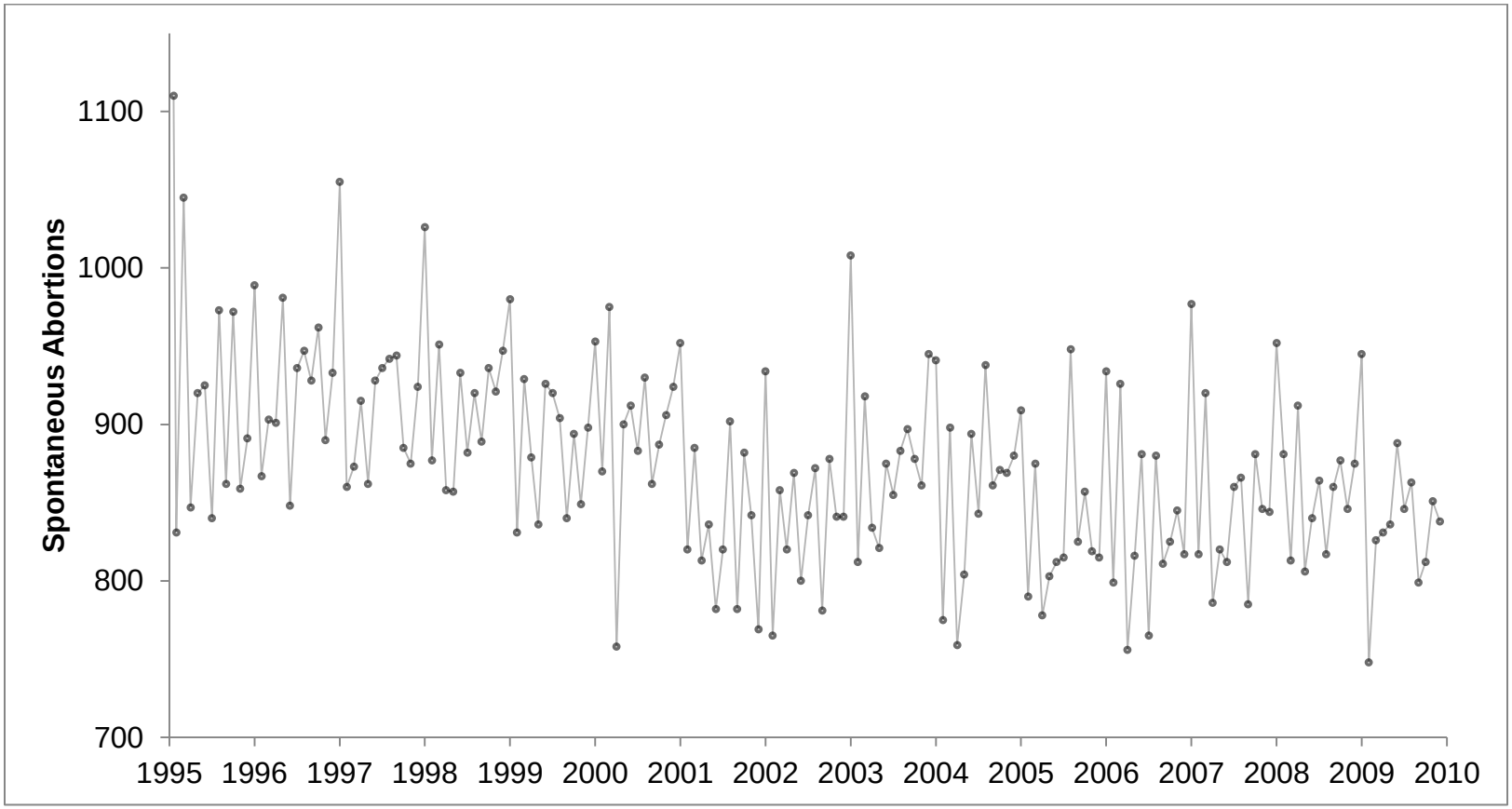

Figure 2. Unemployment Rate in Denmark Over 180 Months, January 1995 to December 2009. The Top Panel Plots the Raw Unemployment Rate; the Bottom Panel Plots the Residual Unemployment Rate after Removal of Trend and Seasonality (First 14 Months Lost to Time-Series Modeling).

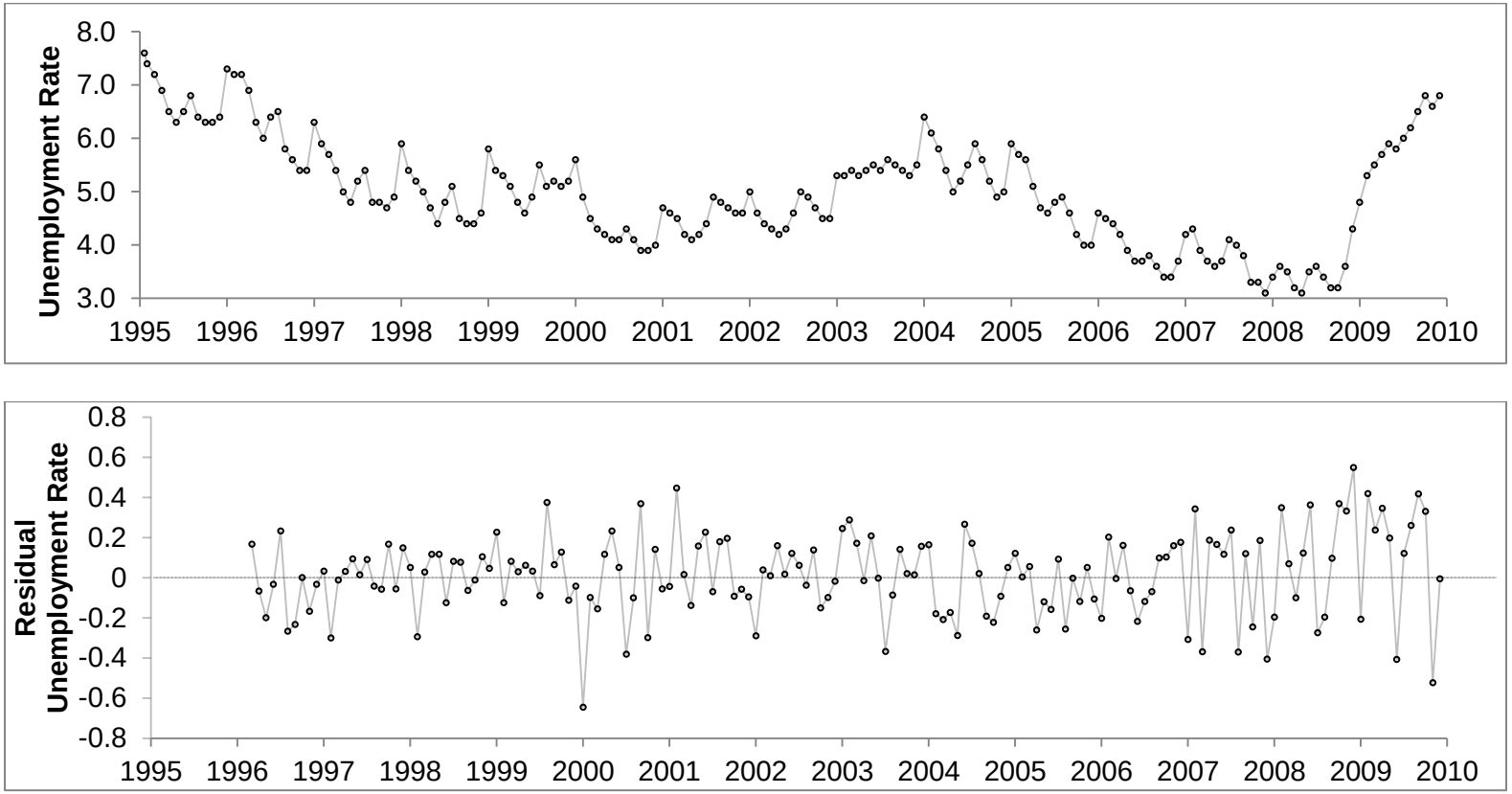

Table 2. Time Series Results† Predicting Spontaneous Abortions in Denmark From January 1995 to December 2009 as a Function of Live Births, Autocorrelation, and The Unemployment Rate.

Parameter	**Lag (months)**	**Coefficient**	**(95% CI)**
Constant	—	572.08	(395.50, 748.66)
Live Births	[+6]	.05	(.02, .09)
Autoregressive Parameter	4	-.23	(-.39, -.07)
	12	.65	(.53, .77)
Moving Average Parameter	3	-.21	(-.39, -.03)
Residual Unemployment Rate	0	-18.06	(-41.09, 4.97)
	1	33.19	(8.71, 57.67)

† Adjusted for three outliers.

Table 3. Time Series Results† Predicting Spontaneous Abortions in Denmark Over 60 Quarters, 1995 to 2009, as a Function of Live Births, Autocorrelation, and Household Durable Goods Consumption.

Parameter	**Lag (quarters)**	**Coefficient**	**(95% CI)**
Constant	—	1546.64	(1169.18, 1924.10)
Live Births	[+2]	.06	(.04, .09)
Autoregressive Parameter	3	.47	(.25, .69)
	4	.31	(.09, .53)
Moving Average Parameter	none	--	--
Residual Household Durable Goods Consumption	0	-.015	(-.026, -.004)

† Adjusted for one outlier.

Supplemental Material

Table i. Time Series Results Removing Trend and Seasonality From the Crude Unemployment Rate.

Parameter	**Lag (months)**	**Coefficient (95% CI)**
Differencing operator	1	n/a
Differencing operator	12	n/a
Autoregressive Parameter	1	.33 (.19, .47)
Moving Average Parameter	12	.53 (.37, .69)

Table ii. Coefficients (Standard Errors in Parentheses) for the Lagged Values of the Autocorrelation (ACF) And Partial Autocorrelation (PACF) Functions of the Residualized Value of the Unemployment Rate—the Independent Variable for our Tests.

Lag at Month:	ACF (SE)	Ljung-Box Q Statistic†	PACF (SE)
1	.00 (.08)	.0	.00 (.08)
2	-.02 (.08)	.1	-.02 (.08)
3	-.06 (.08)	.7	-.06 (.08)
4	-.05 (.08)	1.1	-.05 (.08)
5	.09 (.08)	2.7	.09 (.08)
6	.02 (.08)	2.8	.01 (.08)
7	.12 (.08)	5.1	.11 (.08)
8	-.04 (.08)	5.4	-.03 (.08)
9	.18 (.08)	11.0	.20 (.08)
10	.03 (.08)	11.1	.03 (.08)
11	-.10 (.08)	13.0	-.09 (.08)
12	-.01 (.08)	13.0	-.01 (.08)

† This Statistic assesses whether a group of overall autocorrelations differs statistically from 0. None of the Q-statistics rejects the null of no difference (based on the chi-square distribution with Lag-1 degrees of freedom).

Table iii. Coefficients (Standard Errors in Parentheses) for the Lagged Values of the Autocorrelation (ACF) and Partial Autocorrelation (PACF) Functions of the Final Equation for Spontaneous Abortions in Denmark.

Lag at Month:	ACF (SE)	Ljung-Box Q Statistic†	PACF (SE)
1	-.05 (.08)	.4	-.05 (.08)
2	.12 (.08)	2.5	.12 (.08)
3	.00 (.08)	2.5	.01 (.08)
4	.01 (.08)	2.5	-.01 (.08)
5	.06 (.08)	3.0	.06 (.08)
6	.02 (.08)	3.1	.03 (.08)
7	.14 (.08)	6.2	.13 (.08)
8	-.02 (.09)	6.3	-.02 (.08)
9	.11 (.09)	8.1	.08 (.08)
10	.00 (.09)	8.1	.01 (.08)
11	.05 (.09)	8.5	.03 (.08)
12	-.18 (.09)	13.8	-.20 (.08)

† This Statistic assesses whether a group of overall autocorrelations differs statistically from 0. None of the Q-statistics rejects the null of no difference (based on the chi-square distribution with Lag-1 degrees of freedom).

Table iv. Time Series Results† Predicting Elective Abortions in Denmark From January 1995 to December 2009 as a Function of Live Births, Autocorrelation, and The Unemployment Rate.

Parameter	**Lag (months)**	**Coefficient**	**(95% CI)**
Constant	—	878.39	(553.71, 1203.07)
Live Births	[+6]	.06	(.00, .12)
Autoregressive Parameter	1	-.26	(-.43, -.10)
	12	.69	(.58, .80)
Moving Average Parameter	5	-.27	(-.44, -.11)
Residual Unemployment Rate	0	-49.59	(-105.04, 5.86)
	1	4.87	(-50.67, 60.42)

† Time-series routines detected no outliers in elective abortions.

Table v. Time Series Results Predicting Monthly Live Births to Specific Age and Parity Subgroups in Denmark From January 1995 to December 2009 as a Function of Autocorrelation and The Unemployment Rate. Each Row Represents a Separate Regression for that Maternal Subgroup.

Maternal Subgroup	**Differencing Operator(s)**	**ARIMA parameter(s)**	**Unemployment Coefficient (95% CI)**
<20 years	1	AR(1), MA(6)	-4.44 (-9.02, 0.14)
20-24 years	1	AR(12), MA(1,12)	-9.83 (-26.96, 7.30)
25-34 years	1 and 12	MA(1,12)	-47.19 (-124.34, 29.96)
35-44 years	1 and 12	AR(12), MA(1)	-15.34 (-33.38, 2.71)
Nulliparous	12	AR(1), MA(12)	-5.69 (-51.87, 40.49)
Primiparous†	none	AR (1,12), MA(12)	-14.48 (-70.93, 41.97)
Parity > 1†	12	AR(1), MA(12)	-18.06 (-35.24, 1.96)

† includes a constant