

Motivation

Historically, U.K. teenage fertility rates were higher than many European countries (Darroch et al., 2001). Teenage fertility fell slowly between 1998 and 2008 – under-18 fertility rate from 27 to 19 births per 1000. In the subsequent seven years, rates halved to 10 births per 1000 in 2015, mirroring U.S' declines (Kearney & Levine, 2015; Lindberg et al., 2016). Explanations for such teenage fertility trends include the ten-year UK Government's Teenage Pregnancy Strategy (TPS), ending in 2010 (Hadley et al., 2016; Wellings et al., 2016). The TPS provided young people with knowledge (e.g. Sex and Relationships Education) and sexual health services to reduce teenage pregnancy (Hadley et al., 2016).

This paper considers declines within wider 1998-2016 U.K. societal changes: rising post-compulsory educational aspirations; altering teenage ethnic composition; housing affordability decline which may relate to the postponement of permanently leaving the parental home; and increased deprivation associated with economic recession and Government austerity post-2008. This paper is able to consider these contextual changes whilst controlling for TPS funding per head.

To understand the decline in teenage fertility, this paper examines teenage conceptions rates which have altered throughout the last two decades, but have done so differently throughout England. As noted by Wellings et al. (2016), vast geographical differences exist amongst teenage fertility rates and their declines. Insufficient attention has been placed on explaining this variation. This paper's contribution is the use of an ecological approach to examine, for the 326 Local Authority Districts of England, factors associated with under-18 conception rate decline.

Data and Methods

Our dependent variable is the annual under-18 conception rates for England's 326 LADs 1998 to 2016. We attach time-varying contextual information about each LAD.

Deprivation is measured in three ways. Economic deprivation in terms of unemployment is measured by the Jobseekers' Allowance claimant rate per 1000 adults, and the economic deprivation within teenagers is measured by the percentage of secondary school pupils in state-funded schools eligible for Free School Meals (FSM). Educational deprivation is measured by the educational attainment in a LAD by the percentage of 16-year-olds attaining at least five GCSE 'passes'. The UK has a growing second generation of Black and Asian teenagers, found to experience different fertility. Ethnic composition is identified by individual percentages of Black, and South Asian pupils within state-funded secondary schools. To view accessibility to 'affordable housing' and characteristics of an area, we measure the house price to workplace earnings ratio for unaffordability, and the provision of social housing per capita (adults). TPS funding has been divided by the 13-17 female population in each LAD. Finally, we separate LADs by urban/rural, where the most urban category is separated to include London-specific categories for Inner London, and Outer London.

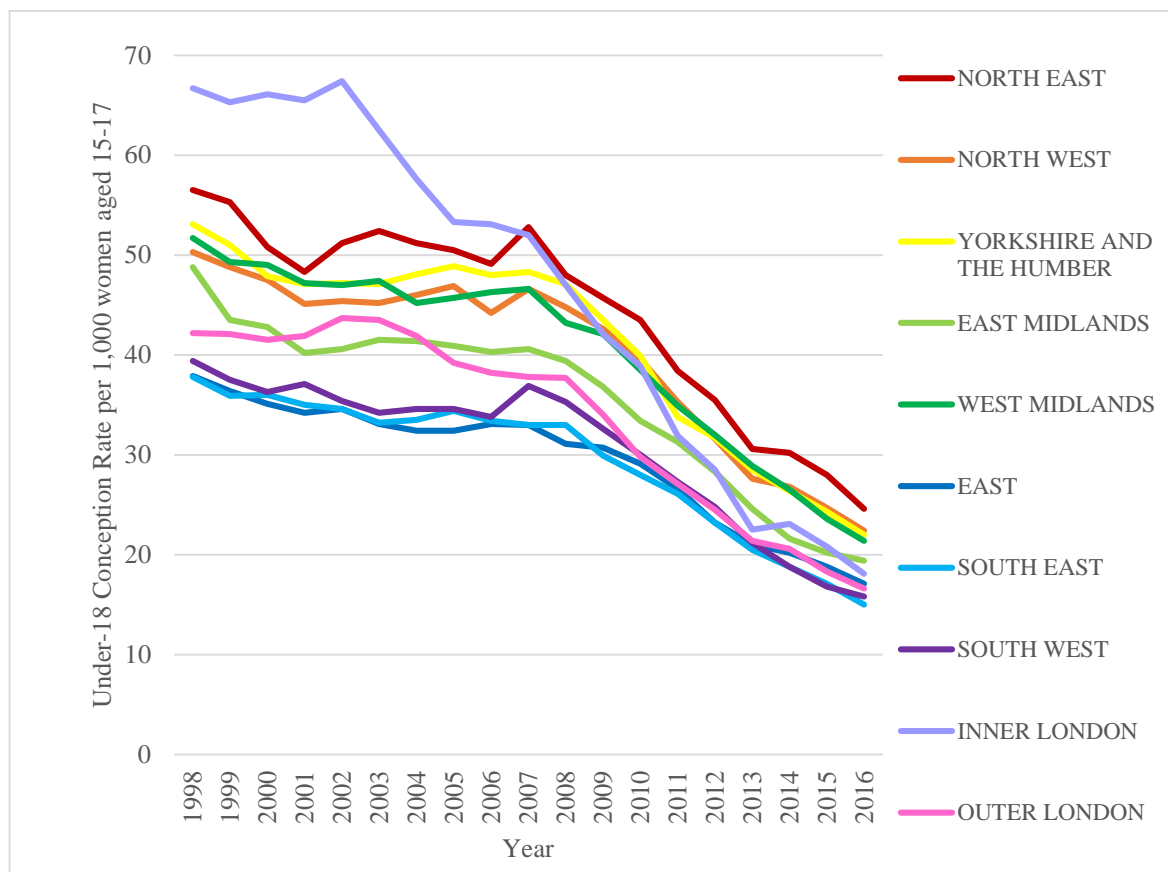
To investigate associations between LAD-level characteristics and teenage conception trends we employ panel regression, with annual rates clustered within LADs. Random intercept linear regressions are used to identify teenage conception variability within and between LADs. Repeated measures capture time-constant (e.g. region) and time-varying (e.g. ethnic composition) characteristics' effects on teenage conception trends 1998-2016. Interactions between characteristics and time period test whether effects alter throughout the period. Fixed effect models are used to examine the associations between the changes in teenage conception rates with the changes in the characteristics as they focus on the within-LAD variation.

Results

As viewed in Figure 1, all regional average teenage conception rates have declined. Regions in England which are located in the North have higher under-18 conception rates than the Southern regions

(excluding Inner London). The ranks of the regional average teenage conception rates have largely been consistent throughout 1998-2016; regions with lower conception rates continue to have relatively lower rates even though all regions have declined. Inner London has had a distinctive decline in teenage conception rates as they are the highest until 2007, and have declined rapidly to one of the lowest regional rates in 2016.

Figure 1 - The Regional Under-18 Conception Rates in England, 1998-2016



Model 1 (Table 1) contains only the interaction between the urban/rural categories and time period. Model 2 includes all of the LAD characteristic measures with Jobseekers' Allowance Claimant rates as the measure of economic deprivation. Model 3 includes the same covariates as Model 2 but with the Free School Meal prevalence measure as the measure of economic deprivation. Both measures of, overall (Jobseekers' Rate) and teenage-specific (FSM), LAD economic deprivation have significant associations with LADs under-18 conception rates. LADs with greater economic deprivation have higher under-18 conception rates, and these effects do not *weaken* according to time period. However, the coefficient for each percentage of Jobseeker's Allowance claimants in the population is higher in the 1999-2005 compared to the most recent period. Unemployment better explains the between-LAD variation in teenage conception rates than the teenage economic deprivation measure as σ_u is 3.90 and 4.86 respectively.

LADs which are classified as rural (Significant Rural, Rural-50%, and Rural-80%) have lower teenage conception rates than the most urban non-London LADs. The differences between the rural and the most urban LADs are only partly explained by the inclusion of LAD characteristics. The uniquely higher teenage conception rates of Inner London LADs in late 1990s and early 2000s which are illustrated in Figure 1, are explained by accounting for Inner London's distinctive characteristics in Models 2 and 3 of Table 1. Conversely, the much lower teenage conception rates in Outer London LADs compared to the most urban non-London LADs is not explained by Outer London's characteristics.

Table 1 – Random Intercept Regression Models of Under-18 Conception Rates for Local Authority Districts, England, 1998-2016

VARIABLES	1 Time and Rural/Urban	2 Unemployment measure ¹	3 FSM ¹
Rate of 16-64-year-old Jobseekers per 1000	...	1.47***	...
1999-2005 * Jobseekers Allowance	...	1.30***	...
2006-2010 * Jobseekers Allowance	...	-0.04	...
2011-2016 * Jobseekers Allowance	...	0.17	...
% Pupils Eligible for Free School Meals in Secondary School	...	...	0.20**
1999-2005 * FSM	...	...	0.14*
2006-2010 * FSM	...	...	0.16*
2011-2016 * FSM	...	...	0.08
Urban/ Rural Measure (Ref. = Major Urban)	REF.	REF.	REF.
Large Urban	-1.26	1.95	2.15
Other Urban	0.90	3.06**	2.98**
Significant Rural	-8.45***	-3.94***	-3.77**
Rural-50%	-10.90***	-5.34***	-5.16***
Rural-80%	-14.86***	-9.86***	-9.95***
Inner London	15.89***	0.44	1.52
Outer London	-6.86**	-6.16***	-5.68**
Time Period (Ref. = 1998)	REF.	REF.	REF.
1999-2005	-4.21***	-1.18	-1.02
2006-2010	-8.20***	23.89***	14.70***
2011-2016	-23.15***	-26.11***	-36.94***
Urban/Rural Interactions with Time Period	REF.	REF.	REF.
Large Urban * 1999-2005	-0.60	-1.05	-1.24
Large Urban * 2006-2010	0.55	-2.27	-2.16
Large Urban * 2011-2016	0.39	-1.94	-2.40*
Other Urban * 1999-2005	-1.64	-0.93	-0.85
Other Urban * 2006-2010	-1.88	-2.83**	-2.49*
Other Urban * 2011-2016	-5.25***	-3.60**	-2.79*
Significant Rural * 1999-2005	1.07	0.81	0.91
Significant Rural * 2006-2010	2.81**	-0.04	0.41
Significant Rural * 2011-2016	5.30***	0.81	0.56
Rural-50% * 1999-2005	-0.45	-1.31	-1.35
Rural-50% * 2006-2010	2.56*	-1.03	-0.76
Rural-50% * 2011-2016	7.05***	1.63	1.38
Rural-80% * 1999-2005	0.05	0.13	0.03
Rural-80% * 2006-2010	3.22**	0.26	0.52
Rural-80% * 2011-2016	9.49***	4.42***	4.12***
Inner London * 1999-2005	-0.04	-4.43	-6.52*
Inner London * 2006-2010	-11.15***	3.08	-2.54
Inner London * 2011-2016	-18.25***	-0.97	-5.80
Outer London * 1999-2005	3.84**	2.40	2.24
Outer London * 2006-2010	1.57	5.67***	4.28**
Outer London * 2011-2016	2.66	4.54**	2.99
Constant	48.71***	42.78***	45.06***
sigma_u	8.61	3.90	4.86
sigma_e	5.71	4.91	4.94
rho	0.69	0.39	0.49
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$			
¹ These models also control for the % Black, % South Asian, educational attainment, social housing, housing unaffordability, TPS funding, and their interactions with time period (excluded from this abstract table).			

Table 2 contains the fixed effect models of the within LAD variation in teenage conception rates. Model 1 (Table 2) includes only time period. Model 2 includes all time varying LAD measures with the economic deprivation measure as Jobseekers Allowance Claimant rates. Model 3 includes the same measures as Model 2 but with Free School Meal prevalence as the measure of economic deprivation.

Increases in the level of LAD deprivation is associated with greater under-18 conception rates in all three of measures (economic and educational). The decline in under-18 conception rates is greater in 2006-2010 and 2011-2016 compared to 1998-2005, although after controlling for LAD characteristics the difference in the decline between 2006-2010 and 1998-2005 became significantly only at the 10% level. In Model 2, the variation in the LAD characteristics (which included overall adult economic deprivation) explained around half of the greater decline in 2011-2016 compared to 1998-2005. However, including the alterations in the LAD characteristics in the fixed effect models explained little of the average within-LAD variation, only reducing the variation (σ_e) from 6.32 to 5.68/5.76.

Table 2 – Repeated Measures Fixed Effect Linear Regression Model of Under-18 Conception Rates for Local Authority Districts, England, 1998-2016

VARIABLES	Model 1 Time Period Only	Model 2 Unemployment measure	Model 3 FSM
<i>Time Period (Ref. = 1998-2005)</i>	<i>REF.</i>	<i>REF.</i>	<i>REF.</i>
2006-2010	-3.73***	-0.46*	-0.32
2011-2016	-16.71***	-8.14***	-10.03***
<i>% Pupils in Secondary Schools which were Black</i>	...	-0.36***	-0.42***
<i>% Pupils in Secondary Schools which were South Asian</i>	...	-0.36***	-0.38***
<i>TPS Funding per each Female aged 13-17</i>	...	0.27***	0.26***
<i>% of Pupils Attaining at least 5 GCSEs A-C</i>	...	-0.16***	-0.01
<i>Total Number of Social Housing Units for each LAD per 100 people (18 and over)</i>	...	0.47***	0.52***
<i>Median House Price to Workplace Earnings Ratio</i>	...	-0.17**	-0.44***
<i>Rate of 16-64-year-old Jobseekers per 1000</i>	...	2.27***	...
<i>% Pupils Eligible for Free School Meals in Secondary School</i>	...	...	0.58***
<i>Constant</i>	39.73***	40.42***	31.98***
<u>Random Effects</u>	<u>---</u>	<u>---</u>	<u>---</u>
sigma_u	10.79	8.57	8.24
sigma_e	6.32	5.68	5.76
rho	0.74	0.69	0.67

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Conclusions and Next Steps

The characteristics of England's areas are better at explaining the levels of, rather than the changes in, under-18 conception rates within the last two decades. Some of the geographical variation in under-18 conception rates has been explained, but parts of the decline may be due to unmeasured or immeasurable characteristics. For example, Rural and Outer London LADs have different under-18 conception rates to the most urban non-London LADs beyond these characteristics. We have also explored England's variation in the proportion of teenage conceptions leading to abortion in a separate paper.