

Population change and transport in England & Wales

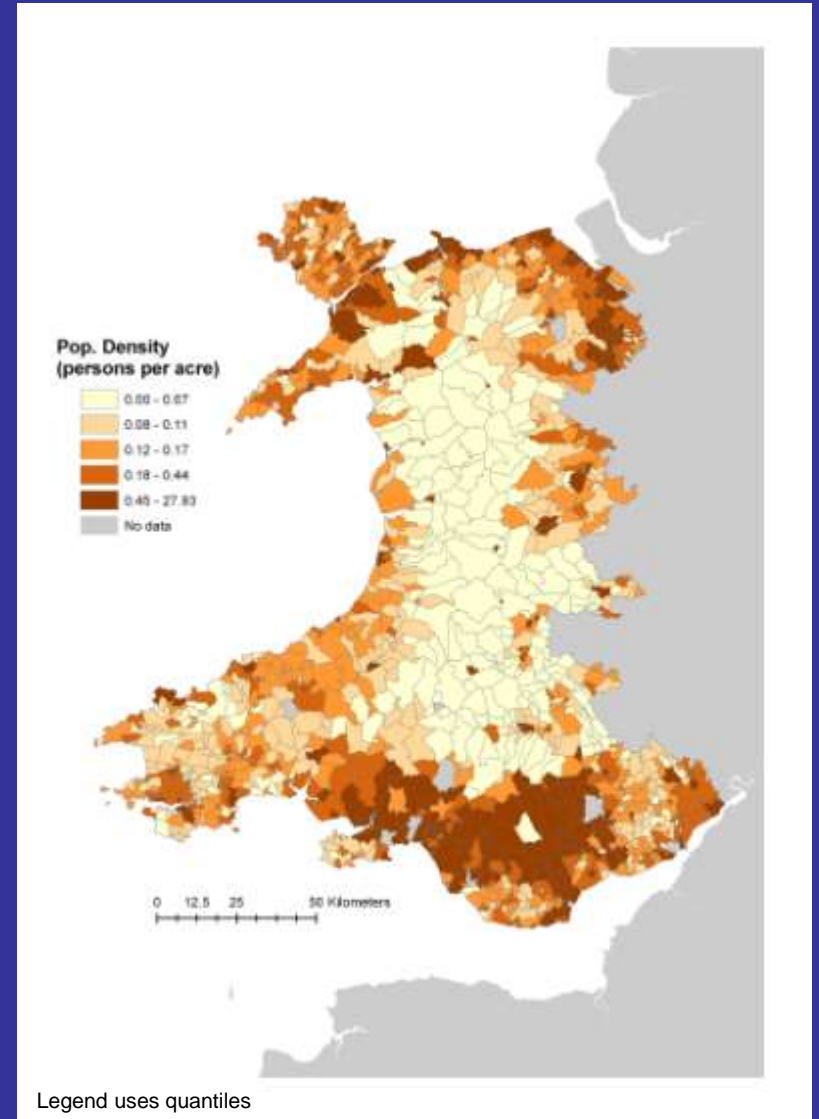
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Administrative Units

- Parishes:
 - 1,290 (14,927 in England & Wales)
 - Represent a village and its hinterland
 - Only data is total pop, males and females
 - Huge number of boundary changes
- Registration districts:
 - 51 (635) – 25 parishes on average
 - Represent a market town and its hinterland
 - Almost all census and vital registration data at this level
 - Age and sex specific population and mortality data allow net migration to be calculated
 - Fewer boundary changes but still difficult to compare decadal change
- Counties:
 - 13 (55)
 - Basic shape and size is Medieval
 - Highly variable sizes (esp. in England)
 - Little new data
 - Relatively few boundary changes

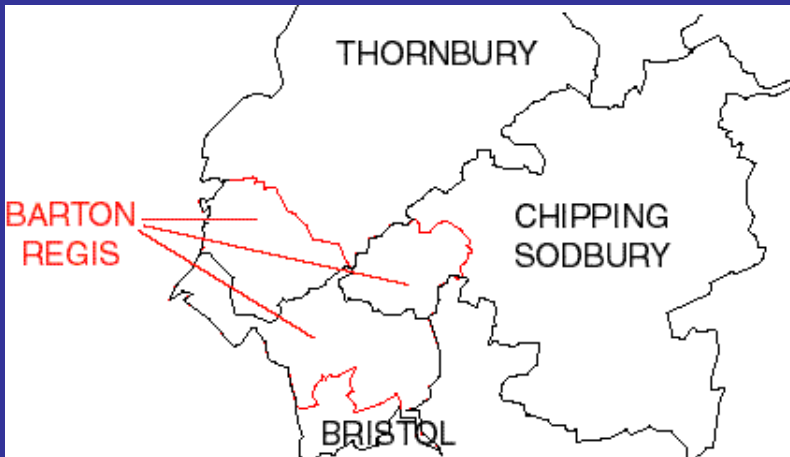
Wales in 1911



Creating a standard geography

- Definition: “the transfer of data from one set (source units) to a second set (target units) of overlapping, non-hierarchical areal units” (Langford *et al*, 1991: p. 56)
- Areal Weighting:
 - Assumption – Variable y is homogeneously distributed across the source zones
 - Using this:

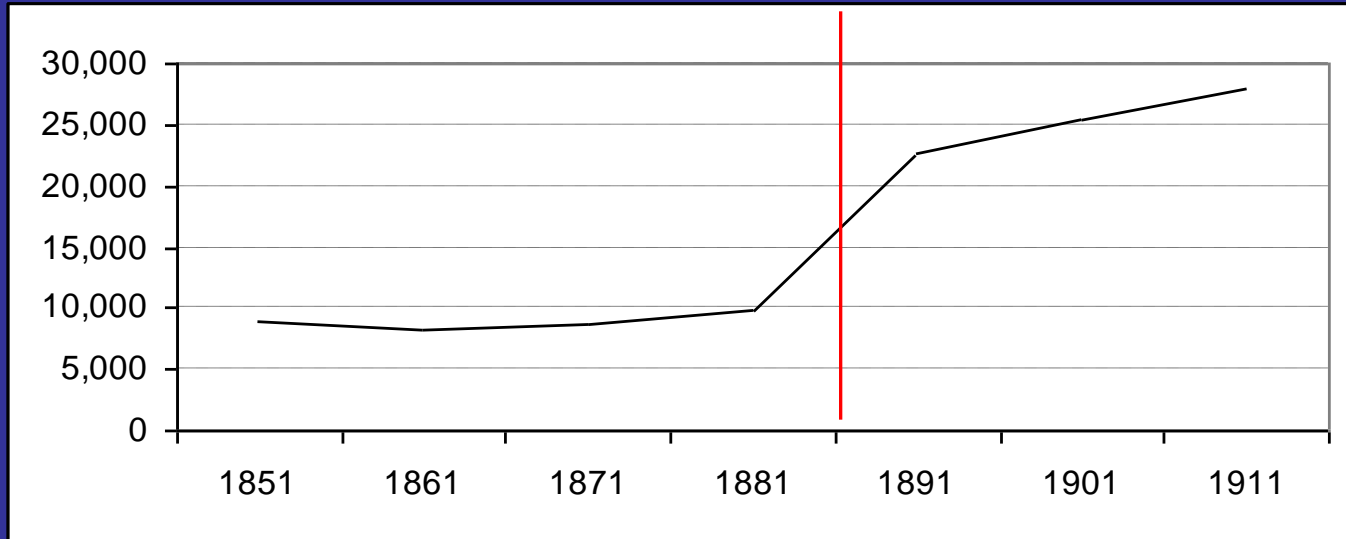
$$\hat{y}_t = \sum_s \left(\frac{A_{st}}{A_s} \times y_s \right)$$



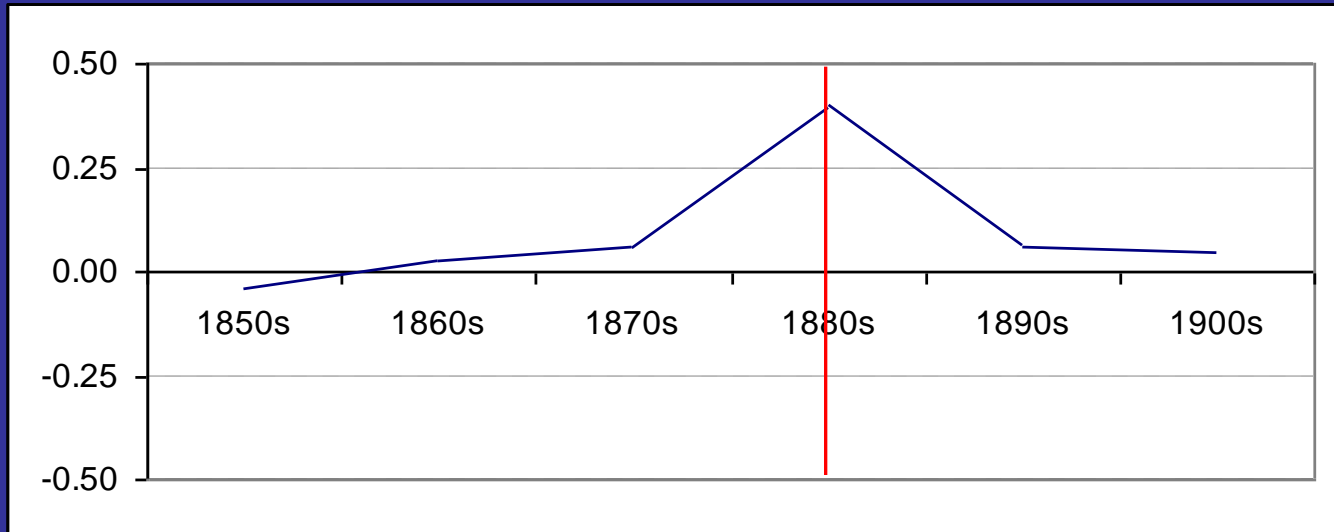
- BUT: Very unrealistic assumption.

Barrow upon Soar

Interpolated
population

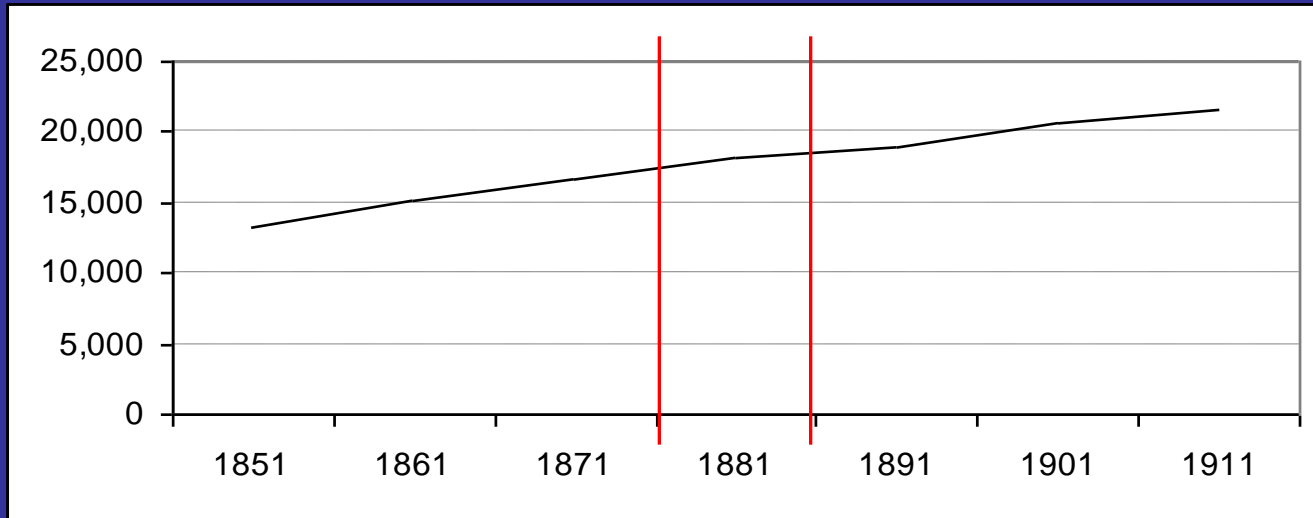


Population
Change
 $(y_2 - y_1) / (y_2 + y_1)$

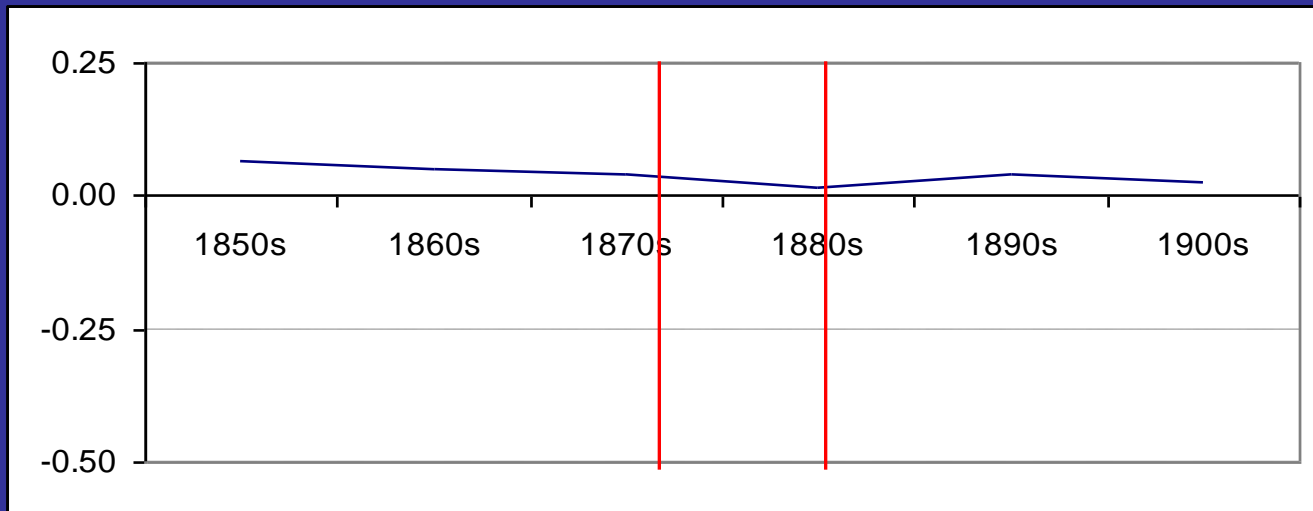


West Ashford

Interpolated
population



Population
change



Interpolating parish-level data for England & Wales

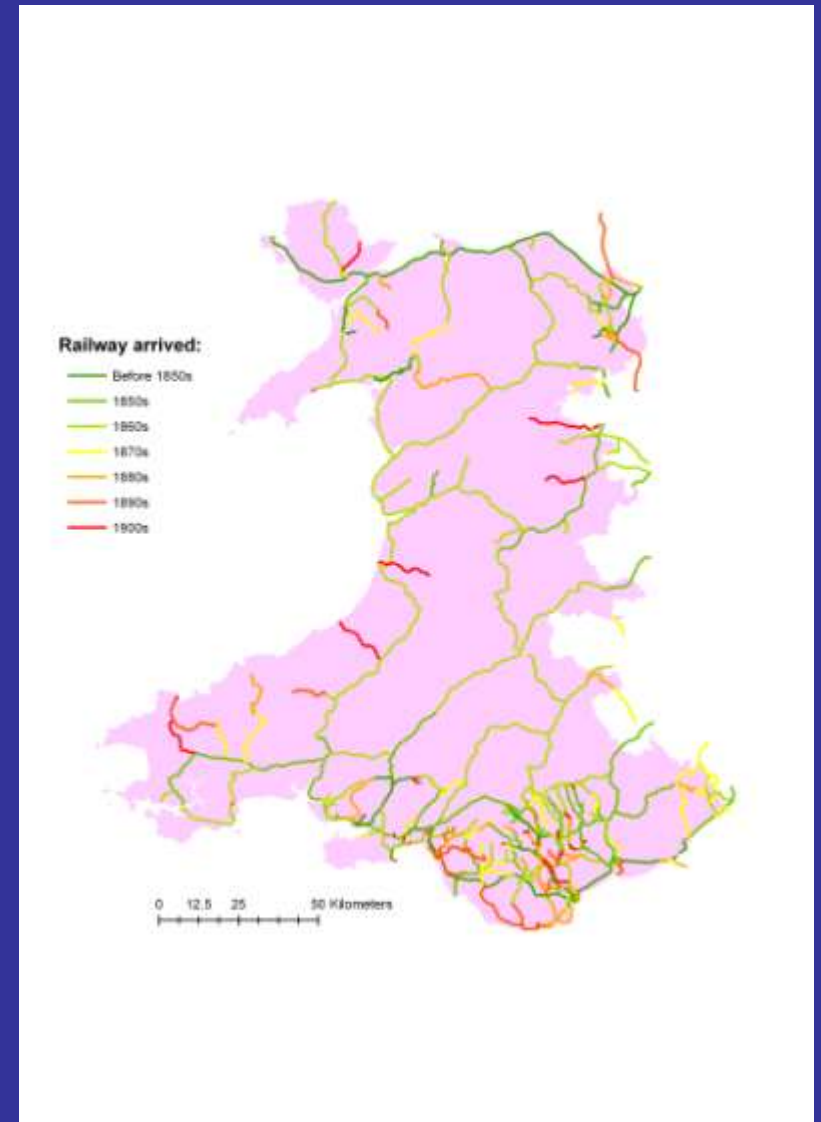
- Target units: 1911 parishes
- 1911 census published 1901 data so these did not need to be interpolated:
 - 1881 was published in 1891 and 1861 in 1871 so these are done together.
- 1851 and 1841 data also published together and taken from a different source.
- EM algorithm using 32 ancillary classes based on pop. density

Testing for reliability

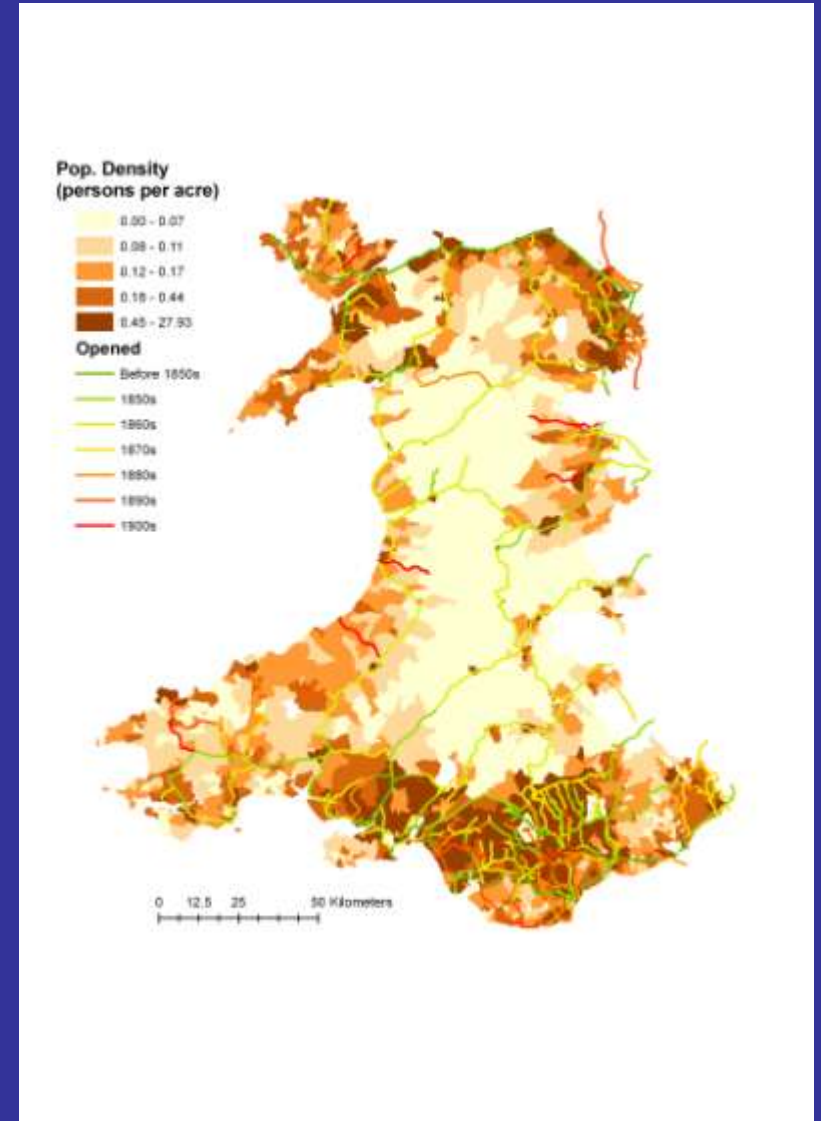
- For spikes with no boundary change:
 - Sample size: 36,842
 - Mean change (μ_y): 0.16%
 - Standard deviation (s_y): 12.76%
 - $z = (y - \mu_y) / s_y$
 - Values of > 2.58 are only 1% likely to have occurred at random and MAY be considered errors
- For England & Wales:

	No. parishes	% parishes	Pop	% of Pop.
1900s	0	0.00	0	0.00
1890s	316	2.16	1,313,752	4.55
1880s	0	0.00	0	0.00
1870s	98	0.67	152,713	0.68
1860s	0	0.00	0	0.00
1850s	1,692	11.54	5,717,234	26.66
1840s	41	0.28	156,581	0.81

The Growth of the Network

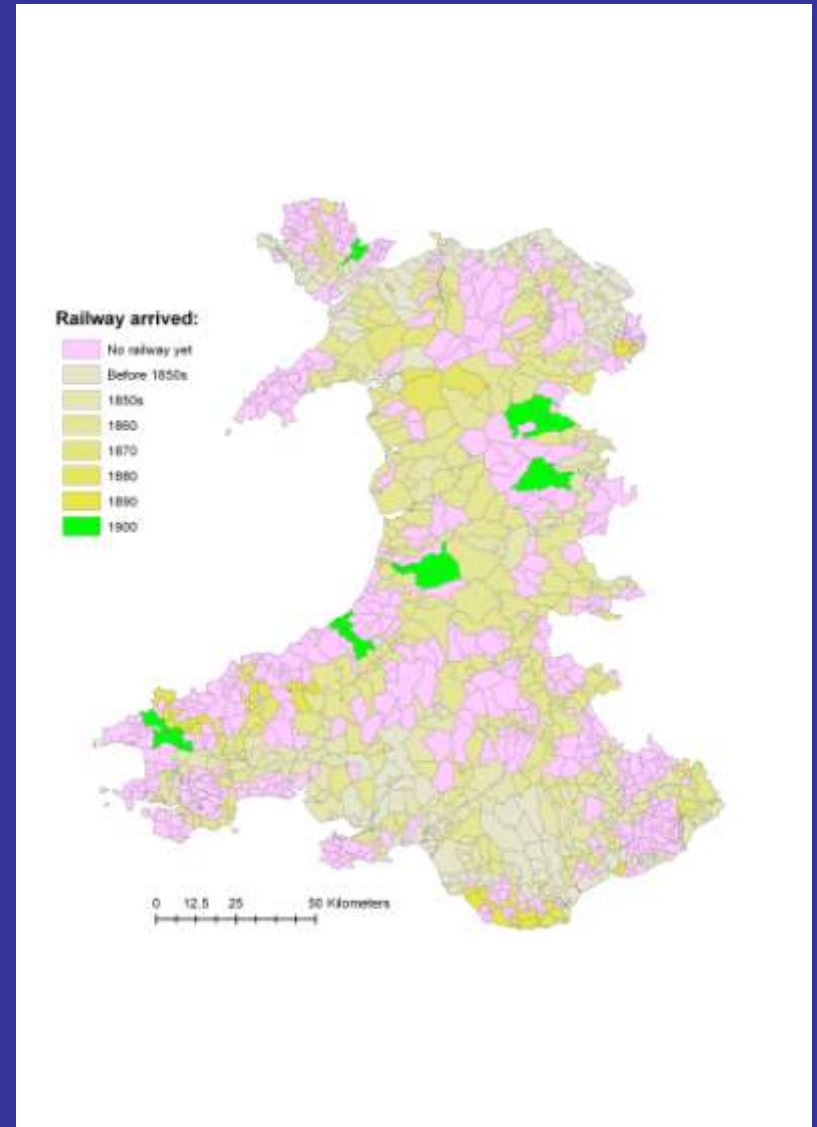


Rail growth and Population



Growth of the Network by Parish

Before 1800s



Growth of the Network by Parish

	Already had railway	Gained railway	No railway
1851 and before		147	1093
1850s	147	158	935
1860s	305	252	683
1870s	557	29	654
1880s	586	20	634
1890s	606	31	603
1900s	637	27	576
After 1911	664	3	573
Never	667		573

N=1240

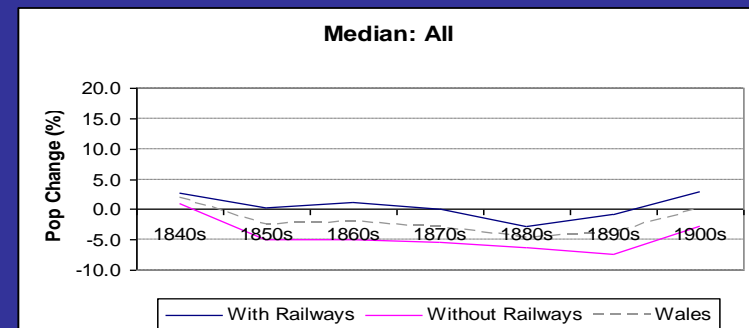
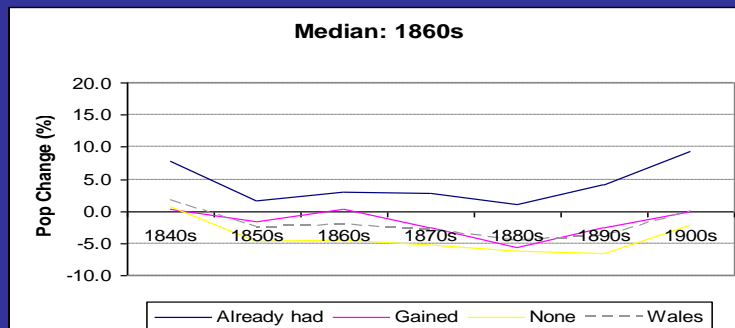
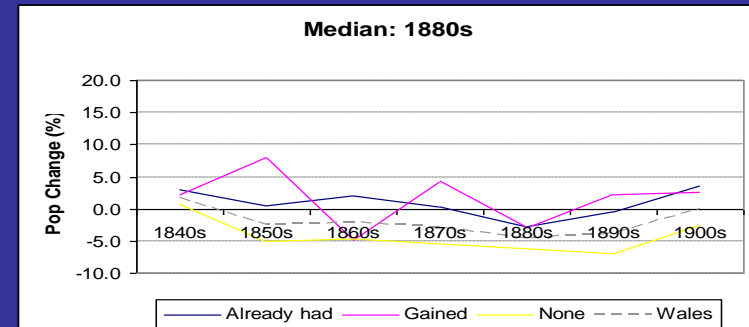
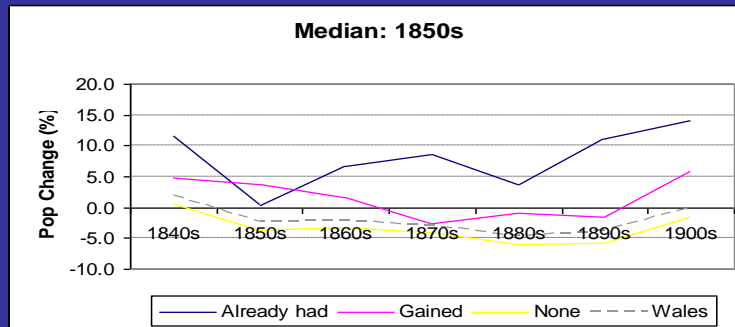
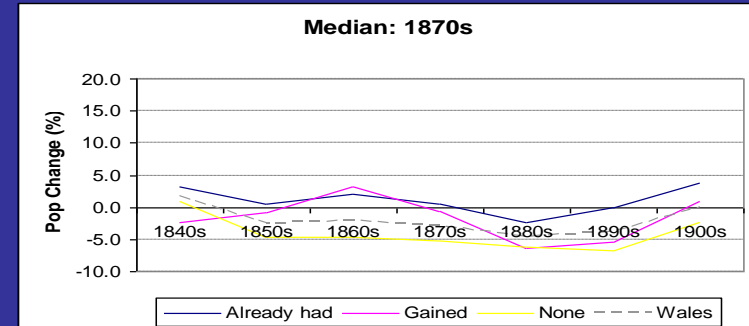
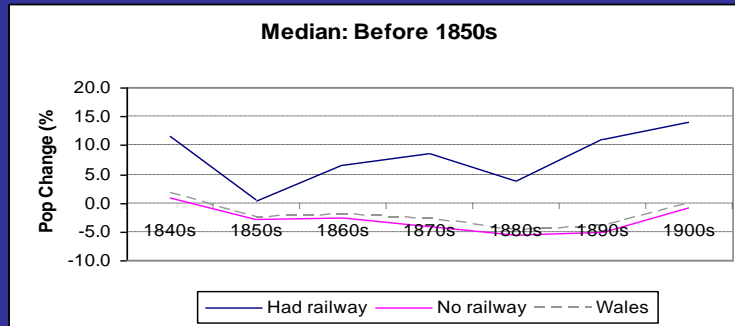
The Railway and Population

	% Pop. gaining railway	Cum. % pop with railway
1851 and before	30.8	30.8
1850s	10.5	41.3
1860s	20.8	62.1
1870s	1.6	63.8
1880s	1.7	65.4
1890s	1.4	66.8
1900s	0.6	67.4

Populations are by parish as measured by previous census (1850s is 1851) expressed as % of total pop. of Wales

The Impact of the Arrival of a Railway

Each graph charts median population growth for parishes that gained their first railway in the decade



Population growth before, during and after the arrival of a railway

Median parish population growth (%) relative to Welsh average.

	Before 1850s	1850s	1860s	1870s	1880s	1890s	1900s	Never
Before		3.11	-0.30	0.90	3.88	-0.73	-3.43	-2.36
Arrival decade	9.87	6.21	2.55	2.20	1.79	-0.19	-2.53	
After	10.14	3.25	0.23	-0.73	4.40	2.76		
N	147	158	252	29	20	31	27	576

Example: Parishes that gained a railway in the 1860s grew by 2.55% above the Welsh average in that decade. In the decades prior to that they had grown at 0.3% below average and in the decades afterwards they grew at 0.23% above average.

“Never” includes parishes that did not gain a railway until after the 1900s

Conclusions

- Parish-level data can be interpolated but error must be handled
- Can roll this out for the whole of England & Wales
- Can integrate net migration data for Registration Districts
- Need better techniques to handle error in data
- Need better techniques to handle spatial time-series