Web-based Supplementary Materials for "Comparing trends in cancer rates across overlapping regions" by Y. Li and R. Tiwari

Derivation of Equation (8)

To proceed, we assume that $t_1 \leq t_{s+1} < t_m \leq t_{s+I}$ and note that

$$\begin{aligned} Cov(\hat{\beta}_{11}, \hat{\beta}_{21}) &= \frac{1}{\sigma_1^2 \sigma_2^2} Cov \left\{ \sum_{i=1}^{m} (t_i - \bar{t}_1) y_{1i}, \sum_{s+1}^{s+I} (t_i - \bar{t}_2) y_{2i} \right\} \\ &= \frac{1}{\sigma_1^2 \sigma_2^2} \sum_{s+1}^{m} (t_i - \bar{t}_1)(t_i - \bar{t}_2) Cov(y_{1i}, y_{2i}). \end{aligned} \quad (14)$$

Recall that we use superscript 'O' to denote the intersection of Regions 1 and 2 and 'NO' the non-overlapping subset. We further introduce the following notation. Let n_{kji}, $n_{kji}^{(O)}$ and $n_{kji}^{(NO)}$ be the numbers of underlying population at risk for age group j at time t_i in Region $k(k = 1, 2)$, in the overlapping subregion and in the non-overlapping subregions, respectively. Similarly, define d_{kji}, $d_{kji}^{(O)}$ and $d_{kji}^{(NO)}$ the corresponding numbers of events (e.g. deaths or cancer cases). Denote by $n_{ki} = \sum_{j=1}^{J} n_{kji}, n_{ki}^{(O)} = \sum_{j=1}^{J} n_{kji}^{(O)}, n_{ki}^{(NO)} = \sum_{j=1}^{J} n_{kji}^{(NO)}$. Also define $d_{ki}, d_{ki}^{(O)}$ and $d_{kji}^{(NO)}$ in the similar fashion. In fact, $d_{kji}^{(O)}$ and $n_{kj}^{(O)}$ are independent of index k (for region) as they correspond to the same common subregion for $k = 1, 2$.

Let $y_i^{(O)} = \log(r_i^{(O)}) = \log\left(\sum_{j=1}^{J} w_j \frac{d_{ji}^{(O)} + 1/J}{n_{ji}^{(O)}}\right)$ be the logarithm of the (zero corrected) age-adjusted rate $r_i^{(O)}$ at time t_i for the overlapping region, and let $y_{1i}^{(NO)}$ and $y_{2i}^{(NO)}$ be defined similarly based on $r_{1i}^{(NO)}$ and $r_{2i}^{(NO)}$, respectively, for the non-overlapping regions/intervals for the two groups.

Dropping the subscript i (for time), we assume the age groups have the same distribution across the overlapping and non-overlapping regions, that is,

$$\frac{n_{k1}^{(O)}}{n_{k1}} = \frac{n_{k2}^{(O)}}{n_{k2}} = \ldots = \frac{n_{kJ}^{(O)}}{n_{kJ}} = p_k^{(O)}, \text{ and } \frac{n_{k1}^{(NO)}}{n_{k1}} = \frac{n_{k2}^{(NO)}}{n_{k2}} = \ldots = \frac{n_{kJ}^{(NO)}}{n_{kJ}} = p_k^{(NO)}, \quad (15)$$

for k=1,2. This assumption is common in comparing the age-adjusted rates across different geographical areas (see, e.g., Pickle and White, 1995), under which, we have

$$r_k = \sum_{j=1}^{J} w_j \frac{d_{kj}}{n_{kj}} = \sum_{j=1}^{J} w_j \frac{d_{kj}^{(O)} + d_{kj}^{(NO)}}{n_{kj}}$$

$$
\begin{aligned}
&= \sum_{j=1}^{J} w_j \frac{n_{kj}^{(O)}}{n_{kj}} \frac{d_{kj}^{(O)} + 1/J}{n_{kj}^{(O)}} + \sum_{j=1}^{J} w_j \frac{n_{kj}^{(NO)}}{n_{kj}} \frac{d_{kj}^{(NO)} + 1/J}{n_{kj}^{(NO)}} + c_k \\
&= p_k^{(O)} r_k^{(O)} + p_k^{(NO)} r_k^{(NO)} + c_k,
\end{aligned}
$$

where $c_k = -\frac{1}{J}\sum_{j=1}^{J}\frac{w_j}{n_{kj}}$, a negligible constant. Again, since $r_1^{(O)} = r_2^{(O)}$, let $r^{(O)}$ denote this common value, and let $y^{(O)} = \log(r^{(O)})$. Now, since $Cov(r_1^{(NO)}, r_2^{(NO)}) = 0$ and $Cov(r^{(O)}, r_k^{(NO)}) = 0, k = 1, 2$, using the delta method, we have,

$$
\begin{aligned}
Cov(y_1, y_2) &= Cov(\log(r_1), \log(r_2)) \\
&\approx \frac{1}{E(r_1)E(r_2)} Cov(r_1, r_2) \\
&= \frac{1}{E(r_1)E(r_2)} p_1^{(O)} p_2^{(O)} Var(r^{(O)}) \\
&= \frac{1}{E(r_1)E(r_2)} p_1^{(O)} p_2^{(O)} Var(e^{y^{(O)}}).
\end{aligned}
$$

Let $y^{(O)}$ satisfy the regression model (3), and let $\mu^{(O)} = E(y^{(O)})$. Since $y^{(O)} \sim N(\mu^{(O)}, \sigma^2)$, using the properties of that log normal distribution, we have that

$$
\begin{aligned}
&E(r^{(O)}) = E(e^{y^{(O)}}) = e^{\mu^{(O)}} e^{\sigma^2/2}, \\
&Var(e^{y^{(O)}}) = e^{2\mu^{(O)}} e^{\sigma^2} \left(e^{\sigma^2} - 1\right).
\end{aligned}
$$

Furthermore, the null hypothesis implies that $E(y_1) = E(y_2) = E(y^{(O)})$. Hence, adding back the time index i, we will have

$$
\begin{aligned}
Cov(y_{1i}, y_{2i}) &= \left(e^{\sigma^2} - 1\right) p_{1i}^{(O)} p_{2i}^{(O)} \\
&\approx \sigma^2 p_{1i}^{(O)} p_{2i}^{(O)},
\end{aligned}
$$

when σ^2 is small. For the US population, $p_{1i}^{(O)}$ and $p_{2i}^{(O)}$ were found to be constant over years (as confirmed by the SEER population data base). We then write $p_{ki}^{(O)} \equiv p_k^{(O)}$ for $i = s+1, \ldots, m$, an estimate of which is given by $\hat{p}_k^{(O)} = \frac{n^{(O)}}{n_k}$, where $n_k = \sum_{i=s+1}^{m}\sum_{j=1}^{J} n_{kji}$ and $n^{(O)} = \sum_{i=s+1}^{m}\sum_{j=1}^{J} n_{ji}^{(O)}$. Hence, $Cov(y_{1i}, y_{2i}) \approx \sigma^2 \frac{(n^{(O)})^2}{n_1 n_2}$ for $i = s+1, \ldots, m$. Inserting it back to (14) yields (8).

Tables for Data Analysis

Table A.1: Comparison of Changes in Age-adjusted cancer mortality rates between California (1990-2004) and the US (1988-2002) for males. APC_{us} and APC_{ca} are the annual percent changes for the US and California respectively. σ^2 is the common (residual) variance in the Cancer Rate Regression Models (6) and (7).

sites	APC_{us} (SE)	APC_{ca} (SE)	σ^2	p-value (Z-test)	p-value (t-test)
1 All Malignant Cancers	-1.14529 (0.08562)	-1.69304 (0.05924)	0.01323	0.00000	0.00000
2 Oral Cavity and Pharynx	-2.54187 (0.14183)	-2.36549 (0.30387)	0.04262	0.61088	0.62439
3 Lip	-5.04715 (0.93868)	-2.89026 (2.28470)	0.31393	0.39824	0.41626
4 Tongue	-2.30819 (0.17872)	-1.55945 (0.48771)	0.06602	0.16317	0.17961
5 Salivary Gland	-1.21958 (0.39018)	-2.69678 (0.88342)	0.12274	0.13895	0.15445
6 Floor of Mouth	-8.74256 (0.54619)	-4.60891 (1.60742)	0.21577	0.01850	0.02341
7 Gum and Other Mouth	-3.59892 (0.31909)	-4.57622 (0.45483)	0.07062	0.08882	0.10152
8 Nasopharynx	-2.60014 (0.26453)	-2.52804 (0.67281)	0.09188	0.92313	0.92602
9 Tonsil	-1.62000 (0.39344)	-0.51149 (0.97421)	0.13354	0.30741	0.32600
10 Oropharynx	-1.02095 (0.33416)	-0.57017 (0.97536)	0.13104	0.67232	0.68399
11 Hypopharynx	-5.54162 (0.33743)	-3.08101 (0.99334)	0.13334	0.02327	0.02900
12 Other Oral Cavity and Pha	-1.57741 (0.31890)	-2.39696 (0.72259)	0.10039	0.31547	0.33405
13 Digestive System	-1.00699 (0.03420)	-1.03053 (0.06669)	0.00953	0.76122	0.76996
14 Esophagus	0.74199 (0.04981)	0.03682 (0.26946)	0.03483	0.01279	0.01659
15 Stomach	-3.18066 (0.14032)	-2.74636 (0.15274)	0.02636	0.04280	0.05126
16 Small Intestine	-0.71617 (0.35911)	-2.28962 (0.82727)	0.11462	0.09145	0.10433
17 Colon and Rectum	-1.98524 (0.04743)	-2.30563 (0.10036)	0.01411	0.00523	0.00721
18 Colon excluding Rectum	-2.18078 (0.05359)	-2.36600 (0.11226)	0.01581	0.14974	0.16569
19 Rectum and Rectosigmoid J	-0.88380 (0.07602)	-2.00738 (0.31554)	0.04125	0.00081	0.00127
20 Liver and Intrahepatic Bi	2.70060 (0.16143)	2.85857 (0.19285)	0.03196	0.54342	0.55871
21 Liver	2.31905 (0.13813)	2.71266 (0.22187)	0.03322	0.14513	0.16090
22 Intrahepatic Bile Duct	4.89523 (0.40718)	3.73589 (0.51502)	0.08344	0.08758	0.10019
23 Gallbladder	-2.10738 (0.22285)	-1.53995 (0.48949)	0.06836	0.30742	0.32600
24 Other Biliary	-3.39084 (0.23329)	-3.65275 (0.53714)	0.07443	0.66526	0.67715
25 Pancreas	-0.29431 (0.05214)	-0.39426 (0.19401)	0.02553	0.63031	0.64325
26 Retroperitoneum	-4.12158 (0.58644)	-2.68420 (1.11387)	0.15999	0.26932	0.28778
27 Peritoneum, Omentum and M	-0.90453 (0.66323)	4.60791 (1.42707)	0.20001	0.00070	0.00111
28 Other Digestive Organs	3.32072 (1.36339)	3.54776 (2.10751)	0.31902	0.93027	0.93289
29 Respiratory System	-1.60133 (0.08997)	-2.54261 (0.08343)	0.01559	0.00000	0.00000
30 Nose, Nasal Cavity and Mi	-2.45896 (0.36930)	-3.71470 (1.15055)	0.15358	0.31473	0.33332
31 Larynx	-1.89041 (0.15676)	-2.21785 (0.41215)	0.05604	0.47254	0.48938
32 Lung and Bronchus	-1.57318 (0.08800)	-2.53538 (0.08350)	0.01542	0.00000	0.00000
33 Pleura	-4.76359 (0.69374)	-5.63373 (0.83073)	0.13756	0.43671	0.45418
34 Trachea, Mediastinum and	-4.38175 (0.56495)	-4.21490 (1.43052)	0.19548	0.91642	0.91956
35 Bones and Joints	-0.63050 (0.22877)	0.50710 (0.56841)	0.07787	0.07247	0.08391
36 Soft Tissue including Hea	-0.19405 (0.32414)	-1.86636 (0.56160)	0.08241	0.01260	0.01635
37 Skin excluding Basal and	-0.20217 (0.08928)	-0.92676 (0.29656)	0.03936	0.02362	0.02940
38 Melanoma of the Skin	0.22384 (0.14864)	-1.14511 (0.35312)	0.04870	0.00055	0.00088
39 Other Non-Epithelial Skin	-1.28166 (0.33594)	-0.34737 (0.61161)	0.08869	0.19523	0.21260
40 Breast	0.67233 (0.44829)	-0.35521 (1.08577)	0.14930	0.39743	0.41545
41 Male Genital System	-2.17218 (0.34136)	-3.35652 (0.22018)	0.05163	0.00479	0.00664
42 Prostate	-2.18583 (0.34814)	-3.40124 (0.21988)	0.05233	0.00430	0.00600
43 Testis	-1.32447 (0.42559)	-1.31581 (0.90241)	0.12681	0.99330	0.99355
44 Penis	-1.45769 (0.29383)	0.44102 (1.74277)	0.22463	0.29867	0.31724
45 Urinary System	-0.15872 (0.06568)	-0.46994 (0.10662)	0.01592	0.01621	0.02069
46 Urinary Bladder	-0.39827 (0.07156)	-0.66431 (0.19502)	0.02640	0.21539	0.23318
47 Kidney and Renal Pelvis	0.09973 (0.10326)	-0.20732 (0.16686)	0.02494	0.13010	0.14520
48 Ureter	-1.81235 (0.36063)	-3.05155 (1.85441)	0.24011	0.52571	0.54142
49 Other Urinary Organs	4.67508 (1.32642)	4.13840 (2.59886)	0.37084	0.85877	0.86404
50 Eye and Orbit	-2.59686 (0.51488)	2.06275 (1.37227)	0.18629	0.00210	0.00308
51 Brain and Other Nervous S	-0.59408 (0.07447)	-0.76199 (0.27160)	0.03579	0.56409	0.57886
52 Endocrine System	0.46159 (0.22153)	0.94815 (0.49324)	0.06872	0.38402	0.40219
53 Thyroid	1.31809 (0.32622)	2.55398 (0.66252)	0.09386	0.10545	0.11923
54 Other Endocrine including	-0.51444 (0.26401)	-0.90111 (0.73065)	0.09874	0.63017	0.64311
55 Lymphoma	0.04612 (0.25417)	-0.90577 (0.31011)	0.05096	0.02164	0.02710
56 Hodgkin Lymphoma	-3.77024 (0.29593)	-2.91687 (0.50752)	0.07467	0.15996	0.17630
57 Non-Hodgkin Lymphoma	0.32123 (0.28472)	-0.76903 (0.33308)	0.05569	0.01608	0.02054
58 Myeloma	0.00492 (0.15560)	-0.63384 (0.28698)	0.04149	0.05837	0.06852
59 Leukemia	-0.41114 (0.07777)	-1.16978 (0.18611)	0.02564	0.00027	0.00046
60 Lymphocytic Leukemia	-0.80381 (0.18393)	-1.43414 (0.38148)	0.05383	0.14991	0.16587
61 Acute Lymphocytic Leukemi	-1.88621 (0.15635)	-0.61542 (0.70555)	0.09185	0.08891	0.10162
62 Chronic Lymphocytic Leuke	-0.22980 (0.25973)	-1.58381 (0.39517)	0.06010	0.00561	0.00769
63 Other Lymphocytic Leukemi	-3.11597 (0.26524)	-2.84172 (1.08602)	0.14209	0.81241	0.81935
64 Myeloid and Monocytic Leu	0.38178 (0.10812)	-0.34155 (0.26334)	0.03618	0.01397	0.01801
65 Acute Myeloid Leukemia	1.85239 (0.13780)	1.27926 (0.25779)	0.03715	0.05786	0.06795
66 Acute Monocytic Leukemia	-5.87966 (0.33270)	-5.81060 (1.38431)	0.18095	0.96258	0.96398
67 Chronic Myeloid Leukemia	-4.54161 (0.69213)	-7.48499 (0.97162)	0.15162	0.01699	0.02162
68 Other Myeloid/Monocytic L	3.25551 (1.82360)	4.63431 (2.02953)	0.34678	0.62494	0.63804
69 Other Leukemia	-1.26579 (0.15121)	-2.35890 (0.35968)	0.04959	0.00672	0.00910
70 Other Acute Leukemia	-2.69076 (0.21664)	-4.26489 (0.44006)	0.06234	0.00191	0.00281
71 Aleukemic, Subleukemic an	0.19461 (0.25052)	-0.13660 (0.44085)	0.06445	0.52745	0.54313
72 Miscellaneous Malignant C	-0.06793 (0.38400)	-0.04692 (0.33004)	0.06435	0.96798	0.96919

Table A.2: Comparison of Changes in Age-adjusted cancer mortality rates between California (1990-2004) and the US (1988-2002) for females.

sites	APC_{us} (SE)	APC_{ca} (SE)	σ^2	p-value (Z-test)	p-value (t-test)
1 All Malignant Cancers	-0.4967 (0.06367)	-1.1995 (0.07756)	0.01275	0.00000	0.00000
2 Oral Cavity and Pharynx	-2.3100 (0.09949)	-2.6478 (0.32027)	0.04262	0.33065	0.34845
3 Tongue	-1.7552 (0.20731)	-1.9406 (0.56414)	0.07639	0.76566	0.77390
4 Salivary Gland	-1.5547 (0.28108)	-1.6580 (1.53080)	0.19781	0.94885	0.95070
5 Floor of Mouth	-8.5738 (0.59746)	-10.3092 (1.46769)	0.20140	0.29016	0.30797
6 Gum and Other Mouth	-2.4059 (0.33005)	-3.5480 (0.89911)	0.12173	0.24941	0.26696
7 Nasopharynx	-1.8134 (0.28784)	-1.7402 (1.07235)	0.14112	0.94922	0.95105
8 Tonsil	-2.7779 (0.45408)	-3.0276 (1.09826)	0.15105	0.83921	0.84495
9 Oropharynx	-0.5663 (0.55131)	-1.4113 (1.74661)	0.23279	0.65585	0.66754
10 Hypopharynx	-5.0032 (0.69969)	-2.0945 (2.10828)	0.28233	0.20595	0.22284
11 Other Oral Cavity and Pha	-2.4089 (0.33467)	-2.6857 (0.96831)	0.13021	0.79414	0.80143
12 Digestive System	-0.9999 (0.03521)	-1.0174 (0.08568)	0.01177	0.85554	0.86071
13 Esophagus	-0.1298 (0.09611)	-0.4936 (0.44040)	0.05729	0.43558	0.45237
14 Stomach	-2.4744 (0.08503)	-2.2361 (0.26341)	0.03518	0.40560	0.42281
15 Small Intestine	-0.5498 (0.28495)	-1.1258 (0.59587)	0.08395	0.39957	0.41685
16 Colon and Rectum	-1.7837 (0.03854)	-2.1068 (0.12624)	0.01678	0.01804	0.02266
17 Colon excluding Rectum	-1.9450 (0.04393)	-2.0724 (0.12469)	0.01680	0.35203	0.36973
18 Rectum and Rectosigmoid J	-0.6662 (0.09959)	-2.3023 (0.35657)	0.04705	0.00002	0.00004
19 Anus, Anal Canal and Anor	0.9835 (0.36923)	1.4404 (0.50560)	0.07957	0.48091	0.49693
20 Liver and Intrahepatic Bi	2.1121 (0.22646)	2.8416 (0.25130)	0.04299	0.03727	0.04471
21 Liver	1.0356 (0.23798)	2.2415 (0.30421)	0.04909	0.00256	0.00366
22 Intrahepatic Bile Duct	5.3993 (0.32153)	4.6627 (0.45037)	0.07033	0.19849	0.21523
23 Gallbladder	-2.3486 (0.12983)	-1.7201 (0.32906)	0.04496	0.08616	0.09815
24 Other Biliary	-3.3533 (0.27122)	-3.2242 (0.98554)	0.12992	0.90295	0.90645
25 Pancreas	0.0459 (0.06003)	-0.3244 (0.14192)	0.01958	0.02029	0.02529
26 Retroperitoneum	-3.4767 (0.42605)	-2.4084 (2.15884)	0.27968	0.63910	0.65128
27 Peritoneum, Omentum and M	10.6773 (0.50603)	11.5268 (1.02266)	0.14502	0.47208	0.48827
28 Other Digestive Organs	2.9486 (1.25248)	4.0027 (1.31273)	0.23060	0.57471	0.58863
29 Respiratory System	1.1074 (0.14308)	-0.8987 (0.13886)	0.02534	0.00000	0.00000
30 Nose, Nasal Cavity and Mi	-2.7924 (0.50534)	-1.6394 (0.87092)	0.12798	0.26870	0.28641
31 Larynx	-0.9160 (0.31894)	-3.1695 (0.99551)	0.13286	0.03732	0.04476
32 Lung and Bronchus	1.1684 (0.14263)	-0.8594 (0.13851)	0.02527	0.00000	0.00000
33 Trachea, Mediastinum and	-4.1474 (0.51934)	-3.7029 (1.76282)	0.23357	0.81526	0.82183
34 Bones and Joints	-0.3413 (0.23101)	-0.0312 (0.59852)	0.08154	0.64064	0.65278
35 Soft Tissue including Hea	-0.3137 (0.50341)	-2.3136 (0.59262)	0.09883	0.01298	0.01665
36 Skin excluding Basal and	-0.6894 (0.10824)	-1.7968 (0.25599)	0.03532	0.00012	0.00021
37 Melanoma of the Skin	-0.6677 (0.13053)	-2.2282 (0.27928)	0.03918	0.00000	0.00000
38 Other Non-Epithelial Skin	-0.7827 (0.28864)	0.1701 (0.86128)	0.11545	0.31098	0.32882
39 Breast	-2.1080 (0.09911)	-2.4052 (0.12810)	0.02059	0.07627	0.08752
40 Female Genital System	-0.7757 (0.06950)	-0.8266 (0.13887)	0.01974	0.75116	0.75988
41 Cervix Uteri	-2.5485 (0.16808)	-2.7864 (0.30711)	0.04450	0.51164	0.52704
42 Corpus and Uterus, NOS	-0.3500 (0.08836)	-0.4197 (0.22008)	0.03014	0.77630	0.78419
43 Corpus Uteri	-0.9847 (0.10858)	-1.6515 (0.29045)	0.03941	0.03779	0.04529
44 Uterus, NOS	0.2709 (0.20775)	0.6246 (0.30305)	0.04670	0.35242	0.37012
45 Ovary	-0.4497 (0.10827)	-0.3897 (0.19006)	0.02780	0.79108	0.79847
46 Vagina	-1.4893 (0.30881)	-0.0450 (1.12439)	0.14820	0.23152	0.24885
47 Vulva	0.3715 (0.21886)	-0.4401 (0.74207)	0.09833	0.31091	0.32875
48 Other Female Genital Orga	1.0285 (0.89011)	-2.8798 (1.05902)	0.17583	0.00636	0.00854
49 Urinary System	-0.1898 (0.10186)	-0.3737 (0.25074)	0.03440	0.51161	0.52701
50 Urinary Bladder	-0.3297 (0.12862)	-0.2421 (0.36919)	0.04969	0.82869	0.83480
51 Kidney and Renal Pelvis	-0.0759 (0.17167)	-0.5114 (0.23849)	0.03735	0.15231	0.16770
52 Ureter	-1.1593 (0.53854)	-0.4319 (1.29441)	0.17819	0.61627	0.62909
53 Other Urinary Organs	0.97551 (0.98382)	0.51241 (1.65580)	0.24479	0.81634	0.82288
54 Eye and Orbit	-2.29495 (0.51385)	-1.09212 (1.83285)	0.24193	0.54163	0.55636
55 Brain and Other Nervous S	-0.60288 (0.15861)	-0.78950 (0.24186)	0.03676	0.53314	0.54807
56 Endocrine System	-0.03612 (0.17458)	-0.82845 (0.57794)	0.07673	0.20493	0.22180
57 Thyroid	0.19503 (0.22603)	-0.11015 (0.52083)	0.07216	0.60363	0.61680
58 Other Endocrine including	-0.40304 (0.20725)	-2.21315 (0.99215)	0.12882	0.08453	0.09640
59 Lymphoma	0.01028 (0.29109)	-1.31900 (0.40750)	0.06365	0.01035	0.01347
60 Hodgkin Lymphoma	-2.55202 (0.28254)	-1.53544 (0.79565)	0.10731	0.24484	0.26234
61 Non-Hodgkin Lymphoma	0.18531 (0.30940)	-1.29605 (0.41882)	0.06618	0.00600	0.00809
62 Myeloma	0.19767 (0.15648)	-0.87526 (0.33092)	0.04652	0.00464	0.00636
63 Leukemia	-0.47456 (0.09093)	-1.19624 (0.15836)	0.02321	0.00013	0.00023
64 Lymphocytic Leukemia	-0.71969 (0.22034)	-1.55322 (0.35934)	0.05357	0.05613	0.06563
65 Acute Lymphocytic Leukemi	-1.33321 (0.27870)	-0.40742 (0.54511)	0.07781	0.14412	0.15920
66 Chronic Lymphocytic Leuke	-0.11289 (0.28829)	-1.78207 (0.46202)	0.06922	0.00307	0.00433
67 Other Lymphocytic Leukemi	-4.18929 (0.22281)	-5.55778 (1.60359)	0.20577	0.41424	0.43134
68 Myeloid and Monocytic Leu	0.19180 (0.09133)	-0.37999 (0.29947)	0.03979	0.07772	0.08909
69 Acute Myeloid Leukemia	1.60735 (0.11928)	1.22486 (0.30773)	0.04195	0.26296	0.28063
70 Acute Monocytic Leukemia	-7.75354 (0.82563)	-9.06558 (3.75654)	0.48884	0.74178	0.75081
71 Chronic Myeloid Leukemia	-4.29532 (0.63553)	-7.22987 (0.99391)	0.14994	0.01628	0.02057
72 Other Myeloid/Monocytic L	1.78219 (1.33592)	5.14116 (1.49323)	0.25465	0.10538	0.11859
73 Other Leukemia	-1.37872 (0.11477)	-2.39493 (0.25479)	0.03552	0.00044	0.00071
74 Other Acute Leukemia	-3.25827 (0.25236)	-4.90300 (0.39909)	0.06001	0.00077	0.00118
75 Aleukemic, Subleukemic an	0.67118 (0.13108)	0.46868 (0.40711)	0.05436	0.64745	0.65939
76 Miscellaneous Malignant C	-0.11415 (0.29840)	-0.54259 (0.28608)	0.05254	0.31678	0.33461

Table B.1: Comparison of Changes in Age-adjusted cancer mortality rates between California (1990-2004) and the US (1980-1994) for males. APC_{us} and APC_{ca} are the annual percent changes for the US and California respectively. σ^2 is the common (residual) variance in the Cancer Rate Regression Models (6) and (7).

sites	APC_{us} (SE)	APC_{ca} (SE)	σ^2	p-value (Z-test)	p-value (t-test)
1 All Malignant Cancers	0.13395 (0.05004)	-1.69304 (0.05924)	0.00986	0.00000	0.00000
2 Oral Cavity and Pharynx	-2.09739 (0.12845)	-2.36549 (0.30387)	0.04193	0.46045	0.44932
3 Lip	-6.33929 (0.87302)	-2.89026 (2.28470)	0.31086	0.20026	0.18925
4 Tongue	-2.22245 (0.15640)	-1.55945 (0.48771)	0.06510	0.23971	0.22816
5 Salivary Gland	-0.45950 (0.39389)	-2.69678 (0.88342)	0.12294	0.03566	0.03129
6 Floor of Mouth	-6.78522 (0.25603)	-4.60891 (1.60742)	0.20688	0.22460	0.21323
7 Gum and Other Mouth	-3.05074 (0.23408)	-4.57622 (0.45483)	0.06501	0.00676	0.00550
8 Nasopharynx	-1.06262 (0.31636)	-2.52804 (0.67281)	0.09449	0.07342	0.06652
9 Tonsil	-2.82023 (0.38469)	-0.51149 (0.97421)	0.13312	0.04528	0.04017
10 Oropharynx	0.19700 (0.37195)	-0.57017 (0.97536)	0.13267	0.50446	0.49387
11 Hypopharynx	-4.45059 (0.48011)	-3.08101 (0.99334)	0.14022	0.25954	0.24782
12 Other Oral Cavity and Pha	-0.22622 (0.32481)	-2.39696 (0.72259)	0.10069	0.01282	0.01075
13 Digestive System	-0.68619 (0.03274)	-1.03053 (0.06669)	0.00944	0.00003	0.00002
14 Esophagus	1.02825 (0.06092)	0.03682 (0.26946)	0.03511	0.00112	0.00083
15 Stomach	-2.03063 (0.11464)	-2.74636 (0.15274)	0.02427	0.00066	0.00048
16 Small Intestine	0.73969 (0.33065)	-2.28962 (0.82727)	0.11323	0.00201	0.00155
17 Colon and Rectum	-1.24173 (0.08356)	-2.30563 (0.10036)	0.01660	0.00000	0.00000
18 Colon excluding Rectum	-0.98791 (0.12656)	-2.36600 (0.11226)	0.02150	0.00000	0.00000
19 Rectum and Rectosigmoid J	-2.60904 (0.19370)	-2.00738 (0.31554)	0.04706	0.13996	0.13033
20 Liver and Intrahepatic Bi	3.05617 (0.12756)	2.85857 (0.19285)	0.02939	0.43764	0.42628
21 Liver	2.31517 (0.14534)	2.71266 (0.22187)	0.03371	0.17348	0.16298
22 Intrahepatic Bile Duct	9.01465 (0.30636)	3.73589 (0.51502)	0.07616	0.00000	0.00000
23 Gallbladder	-2.64656 (0.24536)	-1.53995 (0.48949)	0.06959	0.06641	0.05990
24 Other Biliary	-2.81449 (0.18682)	-3.65275 (0.53714)	0.07228	0.18065	0.17000
25 Pancreas	-0.40317 (0.05874)	-0.39426 (0.19401)	0.02576	0.96816	0.96737
26 Retroperitoneum	-5.63701 (0.49823)	-2.68420 (1.11387)	0.15509	0.02796	0.02427
27 Peritoneum, Omentum and M	-0.31829 (0.89814)	4.60791 (1.42707)	0.21431	0.00797	0.00653
28 Other Digestive Organs	-4.00785 (0.30807)	3.54776 (2.10751)	0.27071	0.00127	0.00096
29 Respiratory System	0.15618 (0.10760)	-2.54261 (0.08343)	0.01730	0.00000	0.00000
30 Nose, Nasal Cavity and Mi	-2.16152 (0.27623)	-3.71470 (1.15055)	0.15039	0.23318	0.22170
31 Larynx	-0.63743 (0.09716)	-2.21785 (0.41215)	0.05382	0.00070	0.00051
32 Lung and Bronchus	0.20164 (0.11152)	-2.53538 (0.08350)	0.01771	0.00000	0.00000
33 Pleura	0.49245 (0.40844)	-5.63373 (0.83073)	0.11766	0.00000	0.00000
34 Trachea, Mediastinum and	-3.84059 (0.35496)	-4.21490 (1.43052)	0.18733	0.81758	0.81310
35 Bones and Joints	-1.03432 (0.41720)	0.50710 (0.56841)	0.08961	0.04708	0.04183
36 Soft Tissue including Hea	1.03457 (0.10806)	-1.86636 (0.56160)	0.07269	0.00000	0.00000
37 Skin excluding Basal and	1.48499 (0.21683)	-0.92676 (0.29656)	0.04669	0.00000	0.00000
38 Melanoma of the Skin	1.65189 (0.13590)	-1.14511 (0.35312)	0.04809	0.00000	0.00000
39 Other Non-Epithelial Skin	1.10131 (0.47089)	-0.34737 (0.61161)	0.09811	0.08827	0.08060
40 Breast	0.40317 (0.47453)	-0.35521 (1.08577)	0.15060	0.56104	0.55129
41 Male Genital System	1.38340 (0.11120)	-3.35652 (0.22018)	0.03135	0.00000	0.00000
42 Prostate	1.45612 (0.11206)	-3.40124 (0.21988)	0.03137	0.00000	0.00000
43 Testis	-3.17493 (0.29347)	-1.31581 (0.90241)	0.12061	0.07517	0.06817
44 Penis	-2.15477 (0.41309)	0.44102 (1.74277)	0.22764	0.18806	0.17726
45 Urinary System	-0.28045 (0.08727)	-0.46994 (0.10662)	0.01751	0.21163	0.20044
46 Urinary Bladder	-1.12675 (0.16025)	-0.66431 (0.19502)	0.03208	0.09612	0.08809
47 Kidney and Renal Pelvis	1.00260 (0.09281)	-0.20732 (0.16686)	0.02427	0.00000	0.00000
48 Ureter	-1.06126 (0.43471)	-3.05155 (1.85441)	0.24208	0.34258	0.33066
49 Other Urinary Organs	-2.59350 (0.62897)	4.13840 (2.59886)	0.33984	0.02222	0.01909
50 Eye and Orbit	-1.74425 (0.43342)	2.06275 (1.37227)	0.18291	0.01627	0.01379
51 Brain and Other Nervous S	0.85214 (0.10548)	-0.76199 (0.27160)	0.03703	0.00000	0.00000
52 Endocrine System	-0.08767 (0.18546)	0.94815 (0.49324)	0.06698	0.07421	0.06726
53 Thyroid	0.06835 (0.26616)	2.55398 (0.66252)	0.09075	0.00157	0.00119
54 Other Endocrine including	-0.24578 (0.25539)	-0.90111 (0.73065)	0.09837	0.44189	0.43057
55 Lymphoma	2.05381 (0.10812)	-0.90577 (0.31011)	0.04174	0.00000	0.00000
56 Hodgkin Lymphoma	-3.66815 (0.28420)	-2.91687 (0.50752)	0.07393	0.24076	0.22921
57 Non-Hodgkin Lymphoma	2.66716 (0.12986)	-0.76903 (0.33308)	0.04544	0.00000	0.00000
58 Myeloma	1.44945 (0.08579)	-0.63384 (0.28698)	0.03807	0.00000	0.00000
59 Leukemia	-0.31509 (0.08696)	-1.16978 (0.18611)	0.02611	0.00016	0.00011
60 Lymphocytic Leukemia	-0.06745 (0.15905)	-1.43414 (0.38148)	0.05253	0.00267	0.00208
61 Acute Lymphocytic Leukemi	-1.07408 (0.23533)	-0.61542 (0.70555)	0.09453	0.57541	0.56590
62 Chronic Lymphocytic Leuke	0.88433 (0.25397)	-1.58381 (0.39517)	0.05970	0.00000	0.00000
63 Other Lymphocytic Leukemi	-4.22759 (0.26089)	-2.84172 (1.08602)	0.14196	0.25976	0.24804
64 Myeloid and Monocytic Leu	-1.23576 (0.19512)	-0.34155 (0.26334)	0.04166	0.01321	0.01109
65 Acute Myeloid Leukemia	-0.78771 (0.25898)	1.27926 (0.25779)	0.04644	0.00000	0.00000
66 Acute Monocytic Leukemia	-5.35300 (0.52077)	-5.81060 (1.38431)	0.18798	0.77870	0.77332
67 Chronic Myeloid Leukemia	-0.58622 (0.16262)	-7.48499 (0.97162)	0.12521	0.00000	0.00000
68 Other Myeloid/Monocytic L	-7.31063 (0.43678)	4.63431 (2.02953)	0.26385	0.00000	0.00000
69 Other Leukemia	1.00458 (0.22000)	-2.35890 (0.35968)	0.05359	0.00000	0.00000
70 Other Acute Leukemia	1.57263 (0.29680)	-4.26489 (0.44006)	0.06746	0.00000	0.00000
71 Aleukemic, Subleukemic an	0.37945 (0.25853)	-0.13660 (0.44085)	0.06496	0.35908	0.34720
72 Miscellaneous Malignant C	-0.10363 (0.23525)	-0.04692 (0.33004)	0.05151	0.89888	0.89637

Table B.2: Comparison of Changes in Age-adjusted cancer mortality rates between California (1990-2004) and the US (1980-1994) for females.

sites	APC_{us} (SE)	APC_{ca} (SE)	σ^2	p-value (Z-test)	p-value (t-test)
1 All Malignant Cancers	0.40400 (0.03737)	-1.1995 (0.07756)	0.01094	0.00000	0.00000
2 Oral Cavity and Pharynx	-1.35357 (0.09378)	-2.6478 (0.32027)	0.04241	0.00042	0.00031
3 Tongue	-1.33078 (0.19952)	-1.9406 (0.56414)	0.07605	0.35408	0.34273
4 Salivary Gland	-0.79551 (0.27112)	-1.6580 (1.53080)	0.19759	0.61392	0.60550
5 Floor of Mouth	-4.07290 (0.32488)	-10.3092 (1.46769)	0.19106	0.00016	0.00011
6 Gum and Other Mouth	-1.43953 (0.25762)	-3.5480 (0.89911)	0.11887	0.04038	0.03585
7 Nasopharynx	-0.88013 (0.29470)	-1.7402 (1.07235)	0.14135	0.48192	0.47154
8 Tonsil	-3.36049 (0.37876)	-3.0276 (1.09826)	0.14765	0.79443	0.78964
9 Oropharynx	0.53419 (0.70546)	-1.4113 (1.74661)	0.23941	0.34767	0.33631
10 Hypopharynx	-3.84815 (0.54731)	-2.0945 (2.10828)	0.27684	0.46413	0.45355
11 Other Oral Cavity and Pha	-0.08469 (0.37118)	-2.6857 (0.96831)	0.13180	0.02257	0.01954
12 Digestive System	-1.05530 (0.04113)	-1.0174 (0.08568)	0.01208	0.71694	0.71049
13 Esophagus	-0.02695 (0.10507)	-0.4936 (0.44040)	0.05755	0.34862	0.33726
14 Stomach	-2.19679 (0.11168)	-2.2361 (0.26341)	0.03636	0.90055	0.89819
15 Small Intestine	0.49738 (0.23347)	-1.1258 (0.59587)	0.08134	0.02110	0.01822
16 Colon and Rectum	-1.71438 (0.06537)	-2.1068 (0.12624)	0.01807	0.01207	0.01017
17 Colon excluding Rectum	-1.56494 (0.09316)	-2.0724 (0.12469)	0.01978	0.00303	0.00240
18 Rectum and Rectosigmoid J	-2.70471 (0.26231)	-2.3023 (0.35657)	0.05626	0.40840	0.39733
19 Anus, Anal Canal and Anor	1.54210 (0.37044)	1.4404 (0.50560)	0.07966	0.88270	0.87993
20 Liver and Intrahepatic Bi	2.41870 (0.16904)	2.8416 (0.25130)	0.03849	0.20425	0.19367
21 Liver	1.17094 (0.20476)	2.2415 (0.30421)	0.04661	0.00794	0.00657
22 Intrahepatic Bile Duct	8.52092 (0.33496)	4.6627 (0.45037)	0.07134	0.00000	0.00000
23 Gallbladder	-2.94543 (0.15996)	-1.7201 (0.32906)	0.04650	0.00233	0.00182
24 Other Biliary	-3.13665 (0.17143)	-3.2242 (0.98554)	0.12714	0.93656	0.93505
25 Pancreas	0.34744 (0.06179)	-0.3244 (0.14192)	0.01967	0.00008	0.00005
26 Retroperitoneum	-4.32978 (0.40012)	-2.4084 (2.15884)	0.27906	0.42619	0.41525
27 Peritoneum, Omentum and M	4.51348 (0.89926)	11.5268 (1.02266)	0.17308	0.00000	0.00000
28 Other Digestive Organs	-4.25304 (0.33605)	4.0027 (1.31273)	0.17223	0.00000	0.00000
29 Respiratory System	3.61472 (0.13458)	-0.8987 (0.13886)	0.02458	0.00000	0.00000
30 Nose, Nasal Cavity and Mi	-0.70758 (0.43469)	-1.6394 (0.87092)	0.12371	0.38404	0.37282
31 Larynx	1.21371 (0.25728)	-3.1695 (0.99551)	0.13068	0.00011	0.00007
32 Lung and Bronchus	3.71166 (0.13993)	-0.8594 (0.13851)	0.02502	0.00000	0.00000
33 Trachea, Mediastinum and	-2.31106 (0.38885)	-3.7029 (1.76282)	0.22944	0.48327	0.47290
34 Bones and Joints	-0.48883 (0.37556)	-0.0312 (0.59852)	0.08981	0.55596	0.54658
35 Soft Tissue including Hea	1.54851 (0.22162)	-2.3136 (0.59262)	0.08042	0.00000	0.00000
36 Skin excluding Basal and	0.13866 (0.14570)	-1.7968 (0.25599)	0.03744	0.00000	0.00000
37 Melanoma of the Skin	0.17192 (0.15360)	-2.2282 (0.27928)	0.04051	0.00000	0.00000
38 Other Non-Epithelial Skin	0.00164 (0.23994)	0.1701 (0.86128)	0.11363	0.86394	0.86073
39 Breast	-0.08345 (0.12945)	-2.4052 (0.12810)	0.02315	0.00000	0.00000
40 Female Genital System	-0.70389 (0.07288)	-0.8266 (0.13887)	0.01993	0.47665	0.46621
41 Cervix Uteri	-1.81997 (0.12578)	-2.7864 (0.30711)	0.04218	0.00810	0.00671
42 Corpus and Uterus, NOS	-1.45753 (0.09517)	-0.4197 (0.22008)	0.03047	0.00008	0.00006
43 Corpus Uteri	-1.25283 (0.14610)	-1.6515 (0.29045)	0.04132	0.26488	0.25367
44 Uterus, NOS	-1.66602 (0.18009)	0.6246 (0.30305)	0.04480	0.00000	0.00000
45 Ovary	0.12034 (0.07301)	-0.3897 (0.19006)	0.02588	0.02274	0.01969
46 Vagina	-1.52270 (0.33520)	-0.0450 (1.12439)	0.14912	0.25213	0.24101
47 Vulva	-0.19144 (0.26520)	-0.4401 (0.74207)	0.10016	0.77419	0.76896
48 Other Female Genital Orga	-0.51159 (0.45107)	-2.8798 (1.05902)	0.14630	0.06138	0.05545
49 Urinary System	0.12841 (0.07580)	-0.3737 (0.25074)	0.03329	0.08136	0.07437
50 Urinary Bladder	-0.88939 (0.15915)	-0.2421 (0.36919)	0.05110	0.14319	0.13390
51 Kidney and Renal Pelvis	1.17505 (0.15240)	-0.5114 (0.23849)	0.03597	0.00000	0.00000
52 Ureter	-0.86113 (0.44480)	-0.4319 (1.29441)	0.17396	0.77551	0.77031
53 Other Urinary Organs	-1.59386 (0.32699)	0.51241 (1.65580)	0.21451	0.25648	0.24533
54 Eye and Orbit	-2.35049 (0.44521)	-1.09212 (1.83285)	0.23973	0.54409	0.53454
55 Brain and Other Nervous S	0.96806 (0.12100)	-0.78950 (0.24186)	0.03437	0.00000	0.00000
56 Endocrine System	-0.64446 (0.20063)	-0.82845 (0.57794)	0.07776	0.78450	0.77950
57 Thyroid	-1.08132 (0.26928)	-0.11015 (0.52083)	0.07452	0.13204	0.12308
58 Other Endocrine including	0.07706 (0.22568)	-2.21315 (0.99215)	0.12932	0.04069	0.03613
59 Lymphoma	1.61631 (0.06812)	-1.31900 (0.40750)	0.05251	0.00000	0.00000
60 Hodgkin Lymphoma	-3.46456 (0.24364)	-1.53544 (0.79565)	0.10576	0.03503	0.03091
61 Non-Hodgkin Lymphoma	2.11389 (0.06817)	-1.29605 (0.41882)	0.05393	0.00000	0.00000
62 Myeloma	1.31123 (0.08985)	-0.87526 (0.33092)	0.04358	0.00000	0.00000
63 Leukemia	-0.32315 (0.08684)	-1.19624 (0.15836)	0.02295	0.00001	0.00001
64 Lymphocytic Leukemia	-0.11952 (0.19751)	-1.55322 (0.35934)	0.05212	0.00148	0.00113
65 Acute Lymphocytic Leukemi	-0.90026 (0.28043)	-0.40742 (0.54511)	0.07791	0.46476	0.45419
66 Chronic Lymphocytic Leuke	0.91209 (0.23062)	-1.78207 (0.46202)	0.06563	0.00000	0.00000
67 Other Lymphocytic Leukemi	-4.62562 (0.39316)	-5.55778 (1.60359)	0.20985	0.60770	0.59917
68 Myeloid and Monocytic Leu	-1.23508 (0.15510)	-0.37999 (0.29947)	0.04286	0.02114	0.01826
69 Acute Myeloid Leukemia	-0.75770 (0.17158)	1.22486 (0.30773)	0.04478	0.00000	0.00000
70 Acute Monocytic Leukemia	-4.54293 (0.54879)	-9.06558 (3.75654)	0.48252	0.27871	0.26741
71 Chronic Myeloid Leukemia	-0.77315 (0.24368)	-7.22987 (0.99391)	0.13007	0.00000	0.00000
72 Other Myeloid/Monocytic L	-7.61620 (0.54563)	5.14116 (1.49323)	0.20206	0.00000	0.00000
73 Other Leukemia	1.14041 (0.20278)	-2.39493 (0.25479)	0.04139	0.00000	0.00000
74 Other Acute Leukemia	1.45185 (0.30917)	-4.90300 (0.39909)	0.06416	0.00000	0.00000
75 Aleukemic, Subleukemic an	0.75916 (0.16949)	0.46868 (0.40711)	0.05605	0.54922	0.53974
76 Miscellaneous Malignant C	-0.36323 (0.16305)	-0.54259 (0.28608)	0.04185	0.62040	0.61209