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Living to Save Taxes

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Abstract

Does taxation affect the timing of death? This is important as an example of how behavior might be affected by economic incentives. We study how three changes in Swedish inheritance taxation 2004-2005 have affected daily all-cause mortality. Our first main result is that mortality decreased by 16 percent the day before the beginning of expected tax reductions. Second, there was no corresponding effect before an unexpected tax reduction.

Keywords: Behavioral responses to taxation, estate tax, inheritance tax, tax avoidance, timing of death

EconLit subject descriptors: D640, H240, I190

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I. Introduction

Economic incentives more or less affect the behavior, and timing of behavior, for each of us and each and every day. But is it reasonable to assume that even the timing of death can be affected? This question has recently been raised by Kopczuk and Slemrod (2003) and Gans and Leigh (2006). They investigated whether death responds to changes in estate and inheritance taxes. Although this may seem farfetched at first, both papers produce some evidence that this might be the case.

In their seminal paper, Kopczuk and Slemrod (2003) present evidence that potential tax savings from an estate tax reform does increase the probability of dying in the lower-tax regime. Their study involves a series of US tax changes implying both decreases as well as increases of the estate tax. Gans and Leigh (2006) study the repeal of inheritance taxes in Australia in 1979. They estimate that about 5 percent of the deaths were shifted from the week preceding the tax repeal to the following week. They conclude that the evidence "suggests that over half of those who would have paid the inheritance tax in its last week of operation managed to avoid doing so" as only a small fraction of all decedents actually had to pay inheritance taxes.

It is commonly believed that terminally ill people to some extent are able to hold on or give up on life. However, the scientific evidence on whether humans really have such volitional control over the timing of death via psychosomatic processes is still contradictory.[1] A series of articles have investigated mortality patterns around symbolically meaningful occasions such as birthdays and religious holidays. Phillips and Smith (1990) show that mortality among Chinese dips in the week before the Harvest Moon Festival and peaks by the same amount in the week after. Smith's (2004) reexamination, however, does not support this finding. Idler and Kasl (1992) find that some elderly Christians and Jews are able to postpone their deaths until after the celebration of religious holidays. A similar dip-peak patter of mortality among Jews is found around the Jewish holiday of Passover in Phillips and King (1988). In a recent study Young and Hade (2004) investigate cancer deaths around holidays and birthdays, but fail to provide evidence that cancer patients are able to postpone death until after such events.

The Swedish inheritance tax was recently repealed in two steps.[2] On December 17, 2003, the Parliament decided to repeal the tax on inheritances between spouses and cohabitants[3] from January 1, 2004. Then the following year, on December 16, the inheritance tax was decided to be repealed altogether from January 1, 2005. Parliament, however, passed a law, on April 13 2005, on inheritance tax exemption for the period December 17 to December 31, 2004, because of the large number of Swedes killed in the Asian Tsunami on December 26, 2004.[4] [5]

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[1] See Skala and Freedland (2004) for an overview of the literature.

[2] The inheritance tax was progressive with a top rate of 30 percent. Both tax schedules and the deductible amount were based on, among other things, consanguinity.

[3] According to Swedish civil law a spouse can freely bequeath 50 percent of the sum of (i) separate property and (ii) half of the joint property. The other 50 percent are to be divided between legal heirs in predetermined shares. What is considered as joint property depends, among other things, on if the couple is married/registered partners or not and on whether the couple has joint children.

[4] As of today, 527 Swedish residents have been identified and confirmed deceased by the Identification Commission in Thailand while 16 persons are still missing.

This provides a unique opportunity to investigate three natural experiments:

(i) an ex ante expected repeal of the inheritance tax for spouses and cohabitants, de facto implemented (tax reform 1);
(ii) an ex ante expected repeal of the inheritance tax altogether, de facto *not* implemented (tax reform 2); and
(iii) an ex ante unexpected ex post facto repeal of the inheritance tax altogether (tax reform 3).

If we believe that death can and will be postponed for reason of saving taxes[6] we would expect event (i) and (ii) to be preceded by a drop in mortality and possibly followed by a peak, but no effect at all around event (iii).

II. Descriptive analysis

We have used data on daily all-cause mortality to study whether and how changes in inheritance taxation affected the timing of deaths around the days of these events.[7] Swedish statistics on causes of deaths are among the oldest worldwide and comprises all deaths of Swedish residents, irrespective of both citizenship and whether they occurred in Sweden or not. The empirical analysis starts with a descriptive investigation of the daily number of deaths between December 3 and January 14 for the two years of inheritance tax reforms (i.e., 2003/04 and 2004/05) compared to the average of the four preceding years, 1999/2000-2002/2003, and 2005/06.

Daily mortality is increasing until it peaks around New Year's. This can bee seen from the solid line in Figure 1 depicting the average number of deaths during the comparison years. This is consistent with temporal mortality patterns in other countries. High mortality rates in the northern hemisphere during this period have sometimes been explained by influenza epidemics and cold winter climate.[8] But research has also shown increased mortality during the winter holiday, and especially a peak at New Year's, when controlling for temperature or investigating regions with a mild winter (Kloner, Poole & Perritt, 1999; Milne, 2005). Several other potential explanations have been suggested, as inappropriate delay in seeking medical attention, reduced levels of healthcare staffing, increased emotional stress, and overindulgence (Kloner, 2004).[9] We need to take this increased mortality during the winter holiday and, especially, the peak around New Year's, into account when testing for the effects of the changes in inheritance taxation.

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[5] The Asian Tsunami is also known as the Sumatra-Andaman earthquake, the Boxing Day Tsunami, and the 2004 Indian Ocean earthquake.

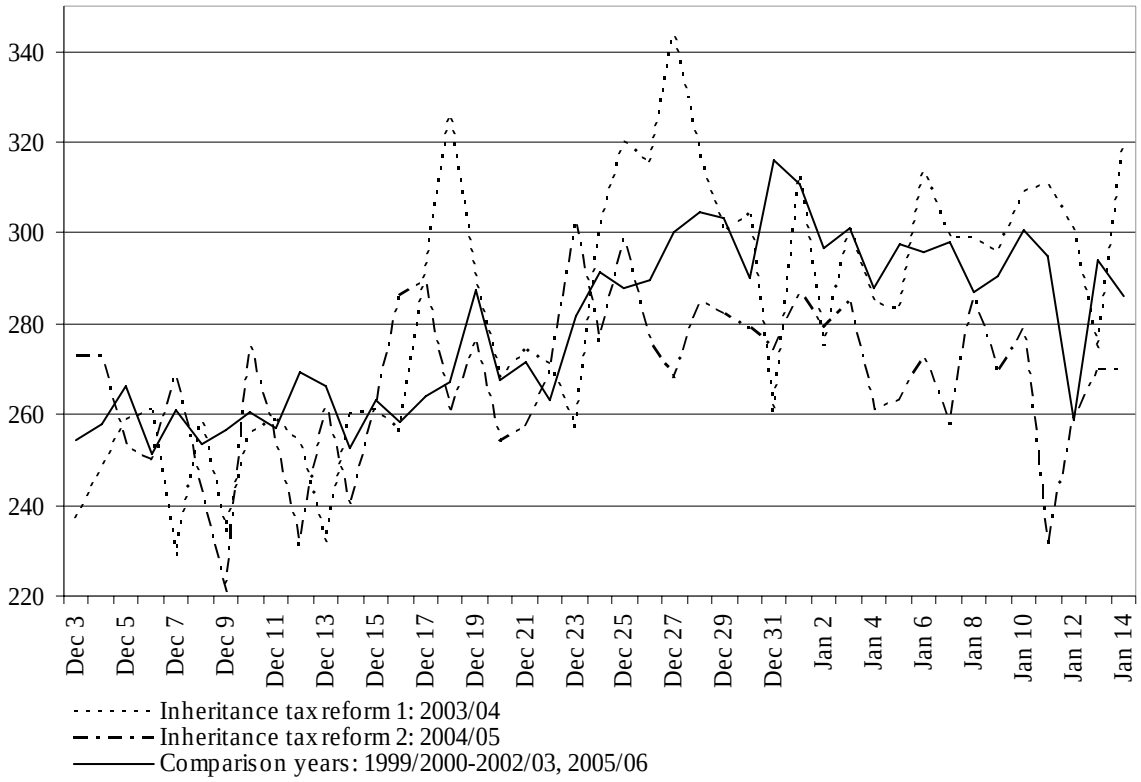
[6] In most cases during these years there were no inheritance taxes paid. For example, 95,000 people died in 2002. Their estates were divided in 427,000 inheritance lots. Inheritance taxes were levied on 98,000 lots, corresponding to 23 percent of all lots. This is reported in the Official Central Government Report SOU 2004:66.

[7] Although the register is supposed to include information on the underlying cause of death as well as multiples of other causes in a chain leading to death neither is yet available for the years of the tax reforms. Hence we are obliged to focus on daily all-cause mortality figures.

[8] The association between temperature and mortality seems to be weak in the Scandinavian countries (Laake & Sverre, 1996).

[9] Higher rates of suicide and fatal traffic accidents have also been suggested as a partial explanation especially of a peak at New Year's.

Figure 1. Daily all-cause mortality figures for the periods including the inheritance tax reforms and an average over comparison years.



The mortality figures for the two tax reform years, depicted with dashed lines in the same figure, seem broadly to follow the same pattern as the average of the comparison years. Larger day-to-day variations are observed, however, with two peaks on December 18 and December 27 in 2003 and a drop on January 11 in 2005. The most striking difference, otherwise, from the comparison figures is the dip in mortality on December 31.[10] There are decreases both 2003 and 2004, although much larger in 2003, while mortality actually peaks at this day for the comparison years. Hence, a more formal investigation of the deaths around New Year is warranted.

III. Estimations and Results

To formally test whether the tax reforms had an impact on the timing of deaths we estimate a log-linear model of observed mortality:

$$\ln Deaths_t = \beta^0 + \sum_{i=s1-7}^{s1+6} \beta_i^1 I_{it}^{TaxReform1} + \sum_{j=s2-7}^{s2+6} \beta_j^2 I_{jt}^{TaxReform2} + \sum_{k=s3-7}^{s3+6} \beta_k^3 I_{kt}^{TaxReform3} + \\ + \Gamma^1 \mathbf{I}_t^{DayOfWeek} + \Gamma^2 \mathbf{I}_t^{DayOfYear} + \Gamma^3 \mathbf{I}_t^{Year} + \\ + \beta^4 ILI_{t,t-6} + \beta^5 LD_{t,t-6} + \beta^6 Temp_t + \beta^7 Temp_{t-1,t-6} + \varepsilon_t$$

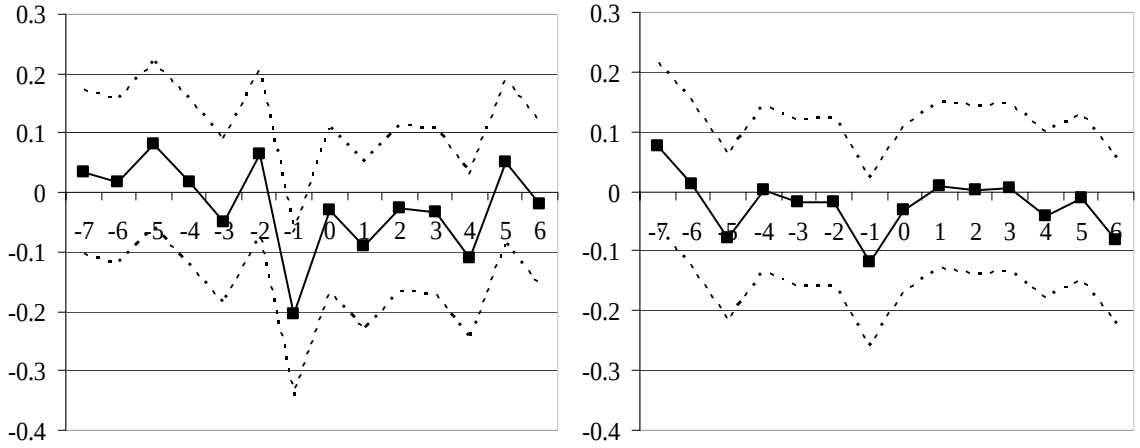
[10] The 527 Swedish residents that have been confirmed deceased in the Asian Tsunami on December 26, 2004, has been excluded from this descriptive analysis as well as the following analysis.

The independent variables of main interest are three sets of indicator variables corresponding to the 14-day periods around the days of the tax changes (denoted by *s*1, *s*2, and *s*3). The control variables contain three additional sets of indicators corresponding to the day of the week, the day of the year, and the year (e.g., 1999/2000, 2000/2001), as well as measures of temporal variation in temperature and epidemic influenza periods.[11]

The two temperature variables are defined as the current day's mean 24-hour temperature ($Temp_t$) and the average of the previous six days ($Temp_{t\text{-}1,t\text{-}6}$),[12] while the two indicators of existence of influenza epidemics are approximations of the percentage of patients showing influenza-like illness ($ILI_{t\text{-}1,t\text{-}6}$), and the number of laboratory confirmed diagnoses of influenza ($LD_{t\text{-}1,t\text{-}6}$), during the last seven days.[13]

Figure 2. The estimated effect on daily all-cause mortality around the event of the tax reforms with 95 percent confidence intervals. Each graph shows the effect in log points (multiplying by 100 approximately yields the effect in percentage points).

A. Inheritance tax reform 1 (January 1, 2004). **B.** Inheritance tax reform 2 (January 1, 2005).

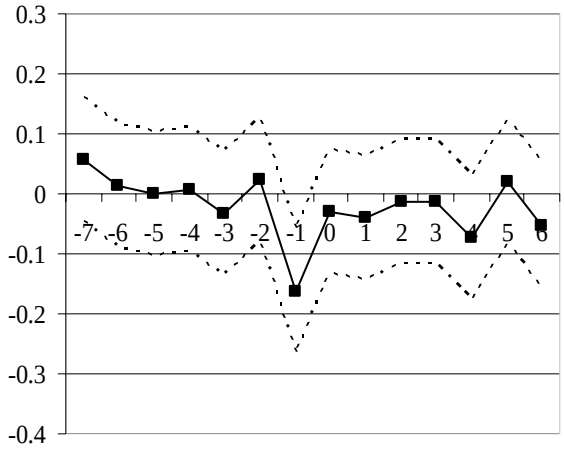


[11] Graphs similar to the one for mortality are to be found in the Appendix for these variables.

[12] As we consider the aggregate number of daily deaths in Sweden, it becomes exceedingly problematic to design an ideal measure of temperature. One possibility would be the average of the temperatures from a number of observational cites weighted by the particular population density or a similarly weighted index of the incidence of temperatures below some threshold. By sake of simplicity and availability of data, however, we only consider the temperature for Uppsala. Uppsala has the longest Swedish record of measured daily temperature in Sweden and data for the years 1722-2004 are available at http://www.smhi.se/sgn0102/n0205/uppsala_temperatur.htm. Data including also 2005 and 2006 were provided to us by Hans Bergström at the Department of Earth Sciences, Uppsala University.

[13] Both the weekly percentage of patients showing influenza-like illness, collected from a number of sentinel physicians, and the weekly number of laboratory confirmed diagnoses of influenza, from University Hospitals, the Swedish Institute for Infectious Disease Control (SMI) and a number of microbiological laboratories, are publicly available in the weekly influenza reports from SMI (http://www.smittskyddsinstitutet.se/SMItemplates/Article 3022.aspx). We have, however, used the numbers reported in Andersson, Bock and Frisén (2006) for 1999/2000-2004/2005 as these are adjusted for any errors in the reporting. For 2005/2006 we were confined to the unadjusted numbers in the weekly reports. Moreover, as the time unit for these measures is the calendar week, we have adjusted the measures to approximately reflect the current and the previous six days such that if *t* is the *i*th day of the week then $X_{t,t-6} = (i/7)\,X_{week} + (7-i/7)\,X_{week-1}$, where X=*ILI, LD*.

C. Inheritance tax reforms 1 and 2.



The estimates of the effects of the tax reforms are depicted in Figure 2 and 3, but for brevity the other estimates are to be found in the Appendix and will not be further discussed here. As already indicated by the descriptive analysis there is a decrease in mortality on the day before the inheritance tax reforms takes place. For the first reform, i.e., when the inheritance tax for spouses was repealed, we observe (see Figure 2.A.) a statistically significant decrease in the number of deaths corresponding to 20.5 percent (95% CI: 6.7 – 34.3).[14] For the next reform, i.e., when the inheritance tax was repealed altogether, we again observe (see Figure 2.B.) a decrease in mortality in the day immediately preceding the scheduled repeal. This effect, however, is not statistically significant at the five percent level; nonetheless, it is the largest estimated effect (-11.9 percent; 95 % CI: -25.9 – 2.0) during the days surrounding this tax repeal.

The estimated joint effects of the two reforms depicted in Figure 2.C. obviously show a similar pattern with a significantly lower mortality on day -1 corresponding to -16.3 percent (95 % CI: -26.7 – -5.9), whereas the absolute value of no other estimate exceeds 7.5 percent. We conclude that none of the two dips in mortality before the inheritance tax was repealed was followed by a peak (or even a slight increase) in mortality during the following week. Hence, deaths do not seem to be shifted from the week before the repeal to the following as found in Gans and Leigh (2006).

We will now turn to the findings from the estimates of the effect of tax reform 3 (see Figure 3.A.). Recall that we here mean the change of date of when tax reform 2 took an effect and as the decision was taken ex post, we would not expect any impact on mortality at all.[15] As around the previous tax reforms the largest estimated effect (12.5 percent, 95 % CI: -1.7 – 25.8) is found for the day immediately preceding the reform. The sign is positive, however, and it is also statistically non-significant.

Tax reform 3 may also serve as an additional control in what could be labeled a "double natural experiment". As described in the Introduction, of the two reforms of 2004/05 reform 2 was ex ante expected, but de facto not implemented and reform 3 was an ex ante unexpected and ex post facto reform. As one would not expect any effect on mortality due to reform 3 we will take advantage of this double natural experiment by estimating a "difference-in-difference" version of the previous regression. Thus, we take the difference of each variable measured in day *t* and in day *t*-15 implying that the mortality in the day of reform 2 is subtracted by the mortality in the day of reform 3 and so forth.

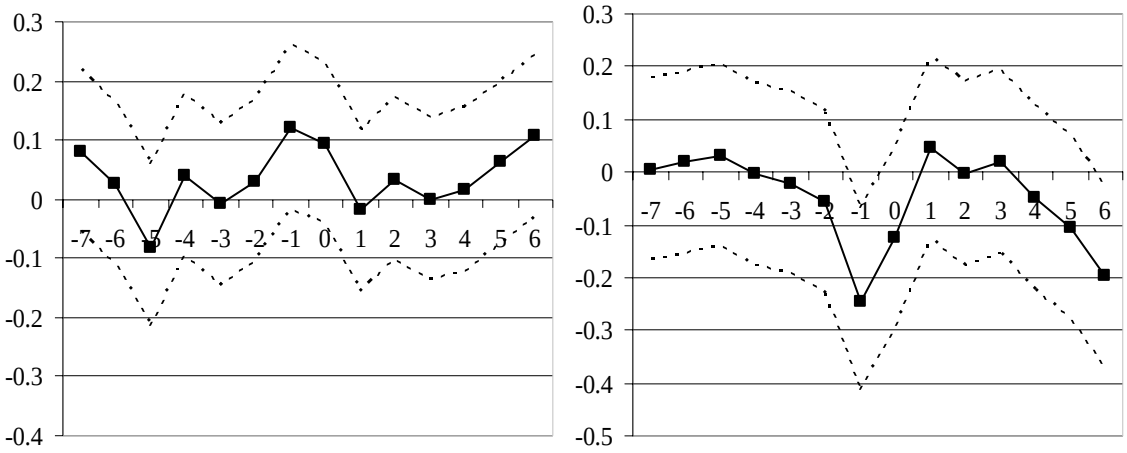
[14] In the text we will interpret the coefficients, in the figures, times hundred as the effect in percent although this is only approximately correct.

[15] As the death certificate should be sent to the local tax authorities the following weekday any ex post manipulation of the reported date of death seems unlikely as the decision to change the effective date of the tax repeal was taken several months later.

The estimated effects on the difference in log mortality are presented in Figure 3.B. It is clear from the figure that there is a significant reduced mortality day *t*-1. The estimated effect corresponds to -.245, 95 % CI: -.417 – -.072.

Figure 3. The estimated effect on daily all-cause mortality around the event of the tax reforms with 95 percent confidence intervals. Each graph shows the effect in log points (multiplying by 100 approximately yields the effect in percentage points).

A. Inheritance tax reform 3 (December 17, 2004). **B.** Inheritance tax reform 2 – tax reform 3.



IV. Summary and discussion

Economic research has shown that financial considerations affect not only the timing of economic decisions but also other events such as childbearing and marriage. The question has been raised whether the timing of death to some extent also can be affected. The evidence is not overwhelming although Kopczuk and Slemrod (2003) and Gans and Leigh (2006) find support for that the timing of death is responsive to changes in inheritance taxes.

Whether terminally ill persons are able to postpone their death by will is also a controversial issue. Some studies have shown that deaths seem to be postponed until after symbolically meaningful occasions such as birthdays and religious holidays, but there is no consensus in the literature. In this paper where we have studied the daily all-cause mortality patterns around the times of the changes in Swedish inheritance taxes one could, however, expect other mechanisms behind an apparent dip or peak in mortality around the event than terminally ill persons postponing death just by will. Such mechanisms may involve incentives for family members (i.e., heirs) to advocate withholding of life support and the manipulation of death certificates.

We find evidence supporting the hypothesis that economic incentive may affect the timing of death. On the day immediately preceding repeal of inheritance taxes we find a 16.3 percent (95 % CI: 5.9–26.7) decrease in the number of deaths, whereas no effect is found in any other day in the investigated 14-day period surrounding the repeal.

A corresponding peak in mortality in the days immediately following the repeal would be expected if the observed dip was due to life support being withheld,[16] death certificates manipulated for the reason of heirs to receive larger inheritance, and probably also if terminally ill has been able to postpone death. However, we do not find any support for such an increase in mortality during a 7-day period following the repeal.

The hanging question is whether postponed deaths are spread during the days after reform in such a way that it is not possible to isolate significant increases, otherwise offset by mechanisms not observed and controlled for in the analysis, or if the one-day-dip in mortality before the reforms is a statistical artifact. As the tax repeals coincide with New Year's, a holiday associated with the highest mortality figures during the year, potentially explained by a large set of various mechanisms, it becomes increasingly difficult to isolate any of the many mechanisms in effect at the same time. As recognized in Young and Hade (2004) cancer mortality exhibit little temporal variation and as cancer patients seldom are maintained on life support the influence of family members' decisions on withdrawal or withholding life support are limited. Thus, a possibility to, instead, study cancer mortality around the abolition of the inheritance tax would probably shed more light on whether altruistic bequest motives to any extent may induce people to postpone their death until after the repeal.[17]

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[16] Swedish guidelines, however, emphasize the physician's role as the decision-maker and in a Swedish survey study 61 percent of the responding physicians also answered that they alone should be the ones to make the decision (Sjökvist et al. 1999).

[17] Intentional postponement of death can also be assumed most likely among terminally ill persons.

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Appendix

Table A1. Estimates with 95 % confidence intervals (CI) on log daily all-cause mortality.

	Model I		Model II	
	Coef.	95 % CI	Coef.	95 % CI
Temperature variables				
Temp	.002	.000 - .004	.002	.000 - .004
Temp(t-1,t-6)	-.006	-.010 - -.003	-.006	-.010 - -.003
Influenza variables				
ILI(t,t-6)	.008	-.007 - .024	.009	-.006 - .024
LD(t,t-6)	.000	.000 - .001	.000	.000 - .001
Year indicators				
Year 99/00	.070	.031 - .108	.072	.035 - .109
Year 00/01	.023	-.006 - .052	.022	-.007 - .050
Year 01/02	.025	-.001 - .052	.026	.000 - .052
Year 02/03	.089	.059 - .119	.091	.061 - .120
Year 03/04	.011	-.041 - .063	.015	-.036 - .067
Year 04/05	.017	-.023 - .057	.016	-.019 - .052
Year 05/06	ref.		ref.	
Day-of- week indicators				
Monday	.033	.004 - .061	.029	.001 - .057
Tuesday	.001	-.028 - .030	.003	-.025 - .030
Wednesday	.011	-.018 - .040	.011	-.017 - .039
Thursday	.033	.004 - .062	.029	.001 - .057
Friday	.027	-.002 - .056	.025	-.002 - .052
Saturday	.021	-.008 - .050	.022	-.006 - .050
Sunday	ref.		ref.	
Day-of-year indicators				
Dec-2	ref.		ref.	
Dec-3	.015	-.050 - .080	.015	-.050 - .079
Dec-4	.038	-.028 - .103	.038	-.026 - .103
Dec-5	-.015	-.080 - .050	-.014	-.078 - .051
Dec-6	.012	-.053 - .077	.012	-.053 - .076
Dec-7	-.010	-.075 - .055	-.009	-.073 - .056
Dec-8	-.034	-.099 - .032	-.032	-.097 - .033
Dec-9	.008	-.060 - .076	.008	-.059 - .075
Dec-10	-.003	-.071 - .065	-.002	-.070 - .065
Dec-11	.030	-.038 - .098	.031	-.036 - .098
Dec-12	.001	-.068 - .069	.001	-.066 - .069
Dec-13	-.018	-.087 - .050	-.017	-.085 - .050
Dec-14	.015	-.053 - .084	.017	-.050 - .085
Dec-15	-.002	-.072 - .067	.001	-.067 - .069
Dec-16	.035	-.034 - .104	.036	-.031 - .104
Dec-17	.057	-.012 - .127	.059	-.009 - .127

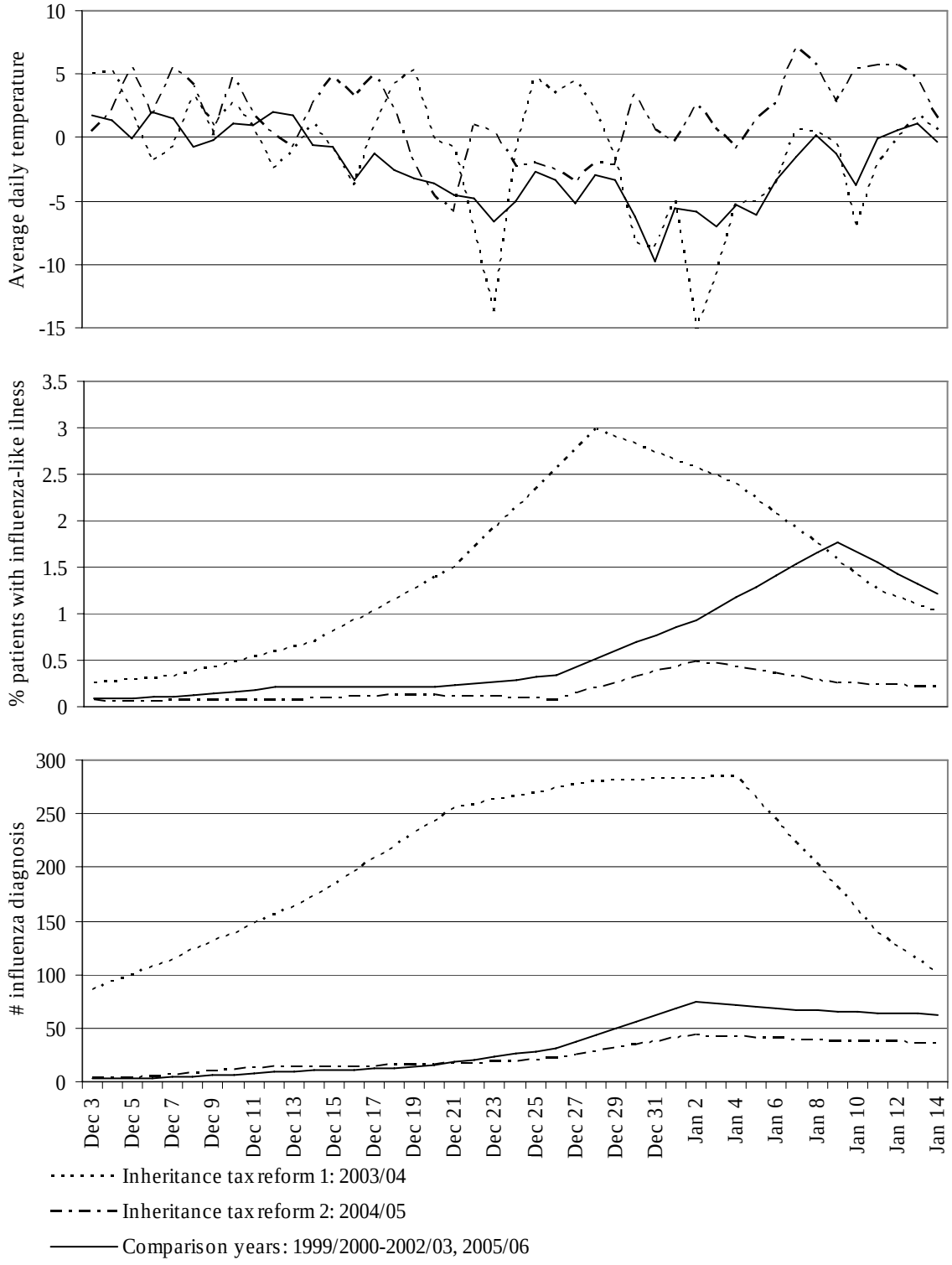
Table A1. (Cont'd)

	Model I		Model II	
	Coef.	95 % CI	Coef.	95 % CI
Dec-18	.095	.026 - .165	.098	.030 - .166
Dec-19	.016	-.055 - .086	.019	-.050 - .088
Dec-20	.036	-.035 - .107	.039	-.030 - .109
Dec-21	.003	-.069 - .075	.007	-.063 - .077
Dec-22	.051	-.022 - .125	.057	-.015 - .128
Dec-23	.092	.022 - .162	.096	.027 - .164
Dec-24	.077	.001 - .153	.079	.005 - .153
Dec-25	.085	.009 - .161	.088	.014 - .163
Dec-26	.115	.038 - .192	.119	.044 - .194
Dec-27	.125	.049 - .202	.128	.053 - .203
Dec-28	.122	.046 - .199	.126	.051 - .201
Dec-29	.074	-.003 - .152	.080	.004 - .156
Dec-30	.173	.093 - .253	.179	.101 - .257
Dec-31	.141	.062 - .220	.145	.068 - .222
Jan-1	.088	.008 - .168	.093	.015 - .171
Jan-2	.095	.014 - .175	.101	.022 - .179
Jan-3	.041	-.039 - .122	.045	-.033 - .124
Jan-4	.082	.001 - .164	.087	.008 - .166
Jan-5	.063	-.017 - .144	.067	-.011 - .145
Jan-6	.081	.002 - .159	.082	.006 - .159
Jan-7	.056	-.015 - .128	.057	-.013 - .127
Jan-8	.069	-.001 - .139	.071	.002 - .139
Jan-9	.110	.040 - .179	.113	.045 - .181
Jan-10	.077	.009 - .145	.078	.010 - .145
Jan-11	-.006	-.074 - .061	-.005	-.071 - .061
Jan-12	.080	.013 - .147	.082	.016 - .148
Jan-13	.094	.028 - .161	.096	.030 - .161
Average of inheritance tax reform effects:				
Tax reform 1				
Pre-reform effects	-.006	-.064 - .052		
Post-reform effects	-.037	-.094 - .021		
Difference	-.030	-.103 - .042		
Tax reform 2				
Pre-reform effects	-.021	-.082 - .041		
Post-reform effects	-.021	-.084 - .041		
Difference	-.001	-.073 - .072		
Tax reform 1+2				
Pre-reform effects			-.014	-.058 - .031
Post-reform effects			-.029	-.073 - .015
Difference			-.015	-.069 - .039

Table A1. (Cont'd)

	Model I		Model II	
	Coef.	95 % CI	Coef.	95 % CI
Tax reform 3				
Pre-reform effects	.030	-.031 - .090	.030	-.027 - .087
Post-reform effects	.042	-.019 - .103	.042	-.015 - .099
Difference	.012	-.058 - .083	.012	-.058 - .081
Wald test statistics (*p*-value):				
Tax reform 1				
Pre-reform effects	1.73	(.10)		
Post-reform effects	.72	(.66)		
Tax reform 2				
Pre-reform effects	.80	(.59)		
Post-reform effects	.27	(.97)		
Tax reform 1+2				
Pre-reform effects			1.69	(.11)
Post-reform effects			.55	(.80)
Tax reform 3				
Pre-reform effects	.92	(.49)	.98	(.45)
Post-reform effects	.69	(.68)	.74	(.64)
No of obs.	301		301	
Prob > F	.00		.00	
Adj. R2	.61		.63	

Figure A1. Average daily temperature ($Temp_t$), 7-day moving average of percentage of patients showing influenza-like illnesses ($ILI_{t-1,t-6}$) and weekly number of influenza diagnosis ($LD_{t-1,t-6}$) for the periods including the inheritance tax reforms and the average over the comparison years.



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