BOSTON COLLEGE
Department of Economics
EC 228 Econometrics, Prof. Baum, Ms. Yu, Fall 2003

Problem Set 7 Solutions

Problem sets should be your own work. You may work together with classmates, but if you're not figuring this out on your own, you will eventually regret it.

1. (10.2)

We follow the hint and write

$$gGDP_{t-1} = \alpha_0 + \delta_0 int_{t-1} + \delta_1 int_{t-2} + \mu_{t-1},$$

and plug this into the right hand side of the int_t equation:

$$\begin{aligned} int_t &= \gamma_o + \gamma_1(\alpha_o + \delta_0 int_{t-1} + \delta_1 int_{t-2} + \mu_{t-1} - 3) + \upsilon_t \\ &= (\gamma_0 + \gamma_1\alpha_0 - 3\gamma_1) + \gamma_1\delta_0 int_{t-1} + \gamma_1\delta_1 int_{t-2} + \gamma_1\mu_{t-1} + \upsilon_t \end{aligned}$$

Now by assumption, μ_{t-1} has zero mean and is uncorrelated with all right hand side variables in the previous equation, except itself of course. So

$$Cov(int, \mu_{t-1}) = E(int_t \cdot \mu_{t-1}) = \gamma_1 E(\mu_{t-1}^2) > 0$$

because $\gamma_1 > 0$. If $\sigma_\mu^2 = E(\mu_t^2)$ for all t then $Cov(int, \mu_{t-1}) = \gamma_1\sigma_\mu^2$. This violates the strict exogeneity assumption, TS.2. While μ_t is uncorrelated with int_t, int_{t-1}, and so on, μ_t is correlated with $int_{t+1.}$

2. (10.5)

The functional form was not specified, but a reasonable one is

$$\log(hsestrts_t) = \alpha_0 + \alpha_1 t + \delta_1 Q2_t + \delta_2 Q3_t + \delta_3 Q4_t + \beta_1 int_t + \beta_2 \log(pcinc_t) + \mu_t,$$

Where $Q2_t, Q3_t$,and $Q4_t$ are quarterly dummy variables (the omitted quarter is the first) and the other variables are self-explanatory. The inclusion of the linear time trend allows the dependent variable and $\log(pcinc_t)$ to trend over time (int_t robably does not contain a trend), and the quarterly dummies allow all variables to display seasonality. The β_2 is an elasticity and $100{\cdot}\beta_1$ is a semi-elasticity.

3. (10.8)

(i)

```
(i) . use http://fmwww.bc.edu/ec-p/data/wooldridge/BARIUM

. regress  lchnimp lchempi lgas lrtwex befile6 affile6 afdec6 t

      Source |       SS       df       MS              Number of obs =     131
-------------+------------------------------           F(  7,   123) =    9.95
       Model |  23.0142638     7  3.28775197           Prob > F      =  0.0000
    Residual |   40.637988   123  .330390146           R-squared     =  0.3616
```

```
-------------+------------------------------           Adj R-squared =  0.3252
       Total |  63.6522517   130  .489632706           Root MSE      =   .5748

------------------------------------------------------------------------------
     lchnimp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lchempi |  -.6862247   1.239712    -0.55   0.581    -3.140158    1.767709
        lgas |   .4656256   .8761836     0.53   0.596    -1.268726    2.199977
      lrtwex |   .0782138   .4724404     0.17   0.869    -.8569531    1.013381
     befile6 |   .0904704   .2512888     0.36   0.719    -.4069404    .5878812
     affile6 |   .0970053   .2573132     0.38   0.707    -.4123303    .6063409
      afdec6 |   -.351502   .2825419    -1.24   0.216    -.9107763    .2077723
           t |   .0127058   .0038443     3.31   0.001     .0050963    .0203153
       _cons |  -2.366326   20.78231    -0.11   0.910    -43.50364    38.77099
------------------------------------------------------------------------------
```

Adding a linear time trend to (10.22) gives

$$\begin{aligned}
\log(\widehat{chnimp}) &= \underset{(20.78)}{-2.37} - \underset{(1.240)}{.686}\ \log(chempi) + \underset{(.876)}{.466}\ \log(gas) + \underset{(.472)}{.078}\ \log(rtwex) \\
&\quad + \underset{(.251)}{.090}\ befile6 + \underset{(.257)}{.097}\ affine6 - \underset{(.282)}{.351}\ afdec6 + \underset{(.004)}{.013}\ t \\
n &= 131, R^2 = .362, \overline{R^2} = .325.
\end{aligned}$$

Only the trend is statistically significant. In fact, in addition to the time trend, which has a t statistic over three, only *afdec6* has a t statistic bigger than one in absolute value. Accounting for a linear trend has important effects on the estimates.

(ii)
```
. test lchempi lgas lrtwex befile6 affile6 afdec6

 ( 1)  lchempi = 0.0
 ( 2)  lgas = 0.0
 ( 3)  lrtwex = 0.0
 ( 4)  befile6 = 0.0
 ( 5)  affile6 = 0.0
 ( 6)  afdec6 = 0.0

       F(  6,   123) =    0.54
            Prob > F =    0.7767
```

The F statistic for joint significance of all variables except the trend and intercept, of course, is about .54. The *df* in the F distribution are 6 and 123. The *p*-value is about .78, and so the explanatory variables other than the time trend are jointly very insignificant. We would have to conclude that once a positive linear trend is allowed for, nothing else helps to explain log(*chnimp*). This is a problem for the original event study analysis.

(iii)
```
. regress  lchnimp lchempi lgas lrtwex befile6 affile6 afdec6 t
feb mar apr may jun

jul  aug sep oct nov dec
```

```
      Source |       SS       df       MS              Number of obs =     131
-------------+------------------------------           F( 18,   112) =    4.33
       Model |  26.1337121    18  1.4518729            Prob > F      =  0.0000
    Residual |  37.5185396   112  .33498696            R-squared     =  0.4106
-------------+------------------------------           Adj R-squared =  0.3158
       Total |  63.6522517   130  .489632706           Root MSE      =  .57878

------------------------------------------------------------------------------
     lchnimp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lchempi |  -.4516498   1.271527    -0.36   0.723    -2.971018    2.067718
        lgas |  -.8207313   1.345061    -0.61   0.543    -3.485797    1.844334
      lrtwex |  -.1971642   .5295317    -0.37   0.710    -1.246363    .8520349
     befile6 |   .1648523   .2569788     0.64   0.523    -.3443182    .6740229
     affile6 |   .1534037   .2719856     0.56   0.574     -.385501    .6923083
      afdec6 |  -.2950151   .2994274    -0.99   0.327    -.8882921    .2982619
           t |   .0123389   .0039163     3.15   0.002     .0045793    .0200985
         feb |  -.3554248   .2937527    -1.21   0.229     -.937458    .2266084
         mar |   .0625648   .2548577     0.25   0.807     -.442403    .5675327
         apr |  -.4406177   .2583976    -1.71   0.091    -.9525994    .0713641
         may |   .0313029   .2591999     0.12   0.904    -.4822683    .5448742
         jun |  -.2009461   .2592135    -0.78   0.440    -.7145444    .3126523
         jul |    .011118   .2683778     0.04   0.967    -.5206382    .5428742
         aug |  -.1271059   .2677924    -0.47   0.636    -.6577021    .4034903
         sep |  -.0751912   .2583501    -0.29   0.772    -.5870789    .4366964
         oct |   .0797634   .2570513     0.31   0.757    -.4295508    .5890776
         nov |  -.2603022   .2530622    -1.03   0.306    -.7617125     .241108
         dec |   .0965389   .2615528     0.37   0.713    -.4216944    .6147722
       _cons |    27.3026   31.39722     0.87   0.386    -34.90697    89.51218
------------------------------------------------------------------------------

. test feb mar apr may jun jul aug sep oct nov dec

 ( 1)  feb = 0.0
 ( 2)  mar = 0.0
 ( 3)  apr = 0.0
 ( 4)  may = 0.0
 ( 5)  jun = 0.0
 ( 6)  jul = 0.0
 ( 7)  aug = 0.0
 ( 8)  sep = 0.0
 ( 9)  oct = 0.0
 (10)  nov = 0.0
 (11)  dec = 0.0

       F( 11,   112) =    0.85
            Prob > F =    0.5943
```

Nothing of importance changes. In fact, the p-value for the test of joint significance of all variables except the trend and monthly dummies is about .79. The 11 monthly dummies themselves are not jointly significant: p-value $\approx .59$.

4. (**10.9**)

```
. use http://fmwww.bc.edu/ec-p/data/wooldridge/PRMINWGE

. regress lprepop lmincov  lusgnp lprgnp t

      Source |       SS       df       MS              Number of obs =      38
-------------+------------------------------           F(  4,    33) =   66.23
       Model |  .284429802     4  .071107451           Prob > F      =  0.0000
    Residual |  .035428549    33  .001073592           R-squared     =  0.8892
-------------+------------------------------           Adj R-squared =  0.8758
       Total |  .319858351    37   .00864482           Root MSE      =  .03277

------------------------------------------------------------------------------
     lprepop |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lmincov |  -.2122611   .0401525    -5.29   0.000     -.293952   -.1305703
      lusgnp |   .4860416   .2219838     2.19   0.036     .0344121     .937671
      lprgnp |   .2852399   .0804923     3.54   0.001     .1214771    .4490027
           t |  -.0266632   .0046267    -5.76   0.000    -.0360764     -.01725
       _cons |  -6.663407   1.257838    -5.30   0.000    -9.222497   -4.104317
------------------------------------------------------------------------------
```

Adding log(*prgnp*) to equation (10.38) gives

$$\begin{aligned}\log(\widehat{prepop_t}) &= \underset{(1.26)}{-6.66} - \underset{(.040)}{.212}\ \log(mincov_t) + \underset{(.222)}{.486}\ \log(usgnp_t) + \underset{(.080)}{.285}\ \log(prgnp_t) \\ &\quad - \underset{(.005)}{.027}\ t \\ n &= 38, R^2 = .889, \overline{R^2} = .876.\end{aligned}$$

The coefficient on $\log(prgnp_t)$ is very statistically significant (t statistic ≈ 3.54). Because the dependent and independent variable are in logs, the estimated elasticity of *prepop* with respect to *prgnp* is .285. Including log(*prgnp*) actually increases the size of the minimum wage effect: the estimated elasticity of *prepop* with respect to *mincov* is now -.212, as compared with -.169 in equation (10.38).

5. (**10.13**)

(i)
```
. use http://fmwww.bc.edu/ec-p/data/wooldridge/CONSUMP

.  regress gc gy

      Source |       SS       df       MS              Number of obs =      36
-------------+------------------------------           F(  1,    34) =   71.81
       Model |  .003793616     1  .003793616           Prob > F      =  0.0000
    Residual |  .001796085    34  .000052826           R-squared     =  0.6787
-------------+------------------------------           Adj R-squared =  0.6692
       Total |  .005589701    35  .000159706           Root MSE      =  .00727
```

```
------------------------------------------------------------------------------
          gc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          gy |   .5707806   .0673545     8.47   0.000     .4338998    .7076613
       _cons |   .0080792   .0018991     4.25   0.000     .0042197    .0119386
------------------------------------------------------------------------------
```

The estimated equation is

$$\begin{aligned}\widehat{gc_t} &= \underset{(.0019)}{0081} + \underset{(.067)}{.571\ gy_t} \\ n &= 36, R^2 = .679.\end{aligned}$$

This equation implies that if income growth increases by one percentage point, consumption growth increases by .571 percentage points. The coefficient on gy_t is very statistically significant (t statistic ≈ 8.5).

(ii) `. regress gc gy gy_1`

```
      Source |       SS       df       MS              Number of obs =      35
-------------+------------------------------           F(  2,    32) =   36.51
       Model |  .003855812     2  .001927906           Prob > F      =  0.0000
    Residual |  .001689785    32  .000052806           R-squared     =  0.6953
-------------+------------------------------           Adj R-squared =  0.6762
       Total |  .005545597    34  .000163106           Root MSE      =  .00727

------------------------------------------------------------------------------
          gc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          gy |   .5522502   .0696507     7.93   0.000     .4103763    .6941241
        gy_1 |   .0962134   .0690192     1.39   0.173    -.0443741     .236801
       _cons |   .0063567   .0022616     2.81   0.008     .0017499    .0109634
------------------------------------------------------------------------------
```

Adding gy_{t-1} to the equation gives

$$\begin{aligned}\widehat{gc_t} &= \underset{(.0023)}{.0064} + \underset{(.070)}{.552\ gy_t} + \underset{(.069)}{.096 gy_{t-1}} \\ n &= 35, R^2 = .695.\end{aligned}$$

The t statistic on gy_{t-1} is only about 1.39, so it is not significant at the usual signiicance levels. (It is significant at the 20% level against a two-sided alternative.) In addition, the coefficient is not especially large. At best there is weak evidence lags in consumption.

(iii) `. regress gc gy r3`

```
      Source |       SS       df       MS              Number of obs =      36
-------------+------------------------------           F(  2,    33) =   35.03
       Model |  .00379999     2  .001899995            Prob > F      =  0.0000
    Residual | .001789711    33  .000054234            R-squared     =  0.6798
-------------+------------------------------           Adj R-squared =  0.6604
       Total | .005589701    35  .000159706            Root MSE      =  .00736

------------------------------------------------------------------------------
          gc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          gy |   .5781102   .0715164     8.08   0.000      .432609    .7236114
          r3 | -.0002148   .0006265    -0.34   0.734    -.0014895    .0010599
       _cons |   .0082181   .0019665     4.18   0.000     .0042173     .012219
------------------------------------------------------------------------------
```

If we add $r3_t$ to the model estimated in part (i) we obtain

$$\widehat{gc_t} = \underset{(.0020)}{.0082} + \underset{(.072)}{.578}\, gy_t + \underset{(.00063)}{.00021} r3_t$$
$$n = 36, R^2 = .680.$$

The t statistic on $r3_t$ is very small. The estimated coefficient is also practically small: a one-point increase in $r3_t$ reduces consumption growth by about .021 percentage points.

6. (10.17)

(i) The variable *beltlaw* becomes one at $t = 61$, which correspnods to January, 1986. The variable *spdlaw* goes from zero to one at $t = 77$, which corresponds to May, 1987.

(ii)
```
. use http://fmwww.bc.edu/ec-p/data/wooldridge/TRAFFIC2

. regress ltotacc t feb mar apr may jun jul aug sep oct nov dec

      Source |       SS       df       MS              Number of obs =     108
-------------+------------------------------           F( 12,    95) =   31.06
       Model | 1.00244222    12  .083536851            Prob > F      =  0.0000
    Residual | .255498294    95  .002689456            R-squared     =  0.7969
-------------+------------------------------           Adj R-squared =  0.7712
       Total | 1.25794051   107  .011756453            Root MSE      =  .05186

------------------------------------------------------------------------------
     ltotacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           t |   .0027471   .0001611    17.06   0.000     .0024274    .0030669
         feb |  -.042684   .0244476    -1.75   0.084    -.0912186    .0058505
         mar |   .0798279   .0244491     3.27   0.002     .0312902    .1283656
         apr |   .0184875   .0244518     0.76   0.451    -.0300555    .0670304
         may |   .0320994   .0244555     1.31   0.192    -.0164509    .0806497
         jun |   .0201944   .0244603     0.83   0.411    -.0283653    .0687542
         jul |    .037584   .0244661     1.54   0.128    -.0109874    .0861553
```

```
        aug |   .0539858    .024473     2.21   0.030     .0054007    .1025708
        sep |    .042362    .024481     1.73   0.087    -.0062389    .0909628
        oct |   .0821147     .02449     3.35   0.001      .033496    .1307334
        nov |     .07128      .0245     2.91   0.005     .0226413    .1199187
        dec |   .0961584   .0245111     3.92   0.000     .0474976    .1448191
      _cons |   10.46856   .0190029   550.89   0.000     10.43084    10.50629
------------------------------------------------------------------------------

. test feb mar apr may jun jul aug  sep oct nov dec

 ( 1)  feb = 0.0
 ( 2)  mar = 0.0
 ( 3)  apr = 0.0
 ( 4)  may = 0.0
 ( 5)  jun = 0.0
 ( 6)  jul = 0.0
 ( 7)  aug = 0.0
 ( 8)  sep = 0.0
 ( 9)  oct = 0.0
 (10)  nov = 0.0
 (11)  dec = 0.0

       F( 11,    95) =    5.15
            Prob > F =    0.0000
```

The OLS regression gives

$$\begin{aligned}
\log(\widehat{totacc}) &= \underset{(.019)}{10.469} + \underset{(.00016)}{.00275}\, t - \underset{(.0244)}{.0427}\, feb + \underset{(.0244)}{.0798}\, mar + \underset{(.0245)}{.0185}\, apr \\
&\quad + \underset{(.0245)}{.0424}\, sep + \underset{(.0245)}{.0821}\, oct + \underset{(.0245)}{.0713}\, nov + \underset{(.0245)}{.0962}\, dec \\
n &= 108, R^2 = .797.
\end{aligned}$$

When multiplied by 100, the coefficient on t gives roughly the average monthly percentage growth in *totacc*, ignoring seasonal factors. In other words, once seasonality is eliminated, *totacc* grew by about .275% per month over this period, or, 12(.275) = 3.3% at an annual rate.

There is pretty clear evidence of seasonality. Only February has a lower number of total accidents than the base month, January. The peak is in December:roughly, there are 9.6% more accidents in December than January in the average year. The F statistic for joint significance of the monthly dummies is F = 5.15. With 11 and 95 *df*, this gives a *p*-value essentially equal to zero.

(iii)
```
. regress ltotacc t feb mar apr may jun jul aug sep oct nov dec
wkends unem spdlaw

beltlaw

      Source |       SS       df       MS              Number of obs =     108
```

	SS	df	MS		
				F(16, 91)	57.61
Model	1.14491043	16	.071556902	Prob > F	0.0000
Residual	.113030083	91	.001242089	R-squared	0.9101
				Adj R-squared	0.8943
Total	1.25794051	107	.011756453	Root MSE	.03524

ltotacc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
t	.0011011	.0002579	4.27	0.000	.0005889	.0016133
feb	-.0338326	.0177684	-1.90	0.060	-.0691274	.0014621
mar	.0769563	.0167942	4.58	0.000	.0435967	.1103159
apr	.0104586	.017047	0.61	0.541	-.0234032	.0443204
may	.0237085	.016939	1.40	0.165	-.0099388	.0573558
jun	.0219357	.0172151	1.27	0.206	-.0122599	.0561313
jul	.0499305	.0167037	2.99	0.004	.0167506	.0831104
aug	.0559552	.0168174	3.33	0.001	.0225494	.089361
sep	.04207	.017282	2.43	0.017	.0077414	.0763986
oct	.0817182	.0169555	4.82	0.000	.0480381	.1153983
nov	.0768734	.0172456	4.46	0.000	.042617	.1111297
dec	.0990874	.0170706	5.80	0.000	.0651787	.1329961
wkends	.0033331	.0037762	0.88	0.380	-.0041678	.010834
unem	-.0212174	.0033975	-6.25	0.000	-.027966	-.0144688
spdlaw	-.0537583	.0126037	-4.27	0.000	-.078794	-.0287226
beltlaw	.0954529	.0142352	6.71	0.000	.0671765	.1237293
_cons	10.63987	.0630864	168.66	0.000	10.51455	10.76518

I will report only the coefficients on the new variables:

$$\begin{aligned} \log(\widehat{totacc}) &= \underset{(.063)}{10.469} + \cdots + \underset{(.00378)}{.00333}\, wkends - \underset{(.0034)}{.0212}\, unem \\ &\quad - \underset{(.0126)}{.0538}\, spdlaw + \underset{(.0142)}{.0954}\, beltlaw \\ n &= 108, R^2 = .910. \end{aligned}$$

The negative coefficient on *unem* makes sense if we view *unem* as a measure of economic activity . As economic activity increases - *unem* decreases - we expect more driving, and therefore more accidents. The estimate is that a one percentage point increase in the unemployment rate reduces total accidents by about 2.1%. A better economy does have costs in terms of traffic accidents.

(iv) At least initially, the coefficients on *spdlaw* and *beltlaw* are not what we might expect. The coefficient on *spdlaw* implies that accidents dropped by about 5.4% *after* the highway speed limit was increased from 55 to 65 miles per hour. There are at least a couple of possible explanations. One is that people become safer drivers after the increased speed limiting, recognizing that they must be more cautious. It could also be that some other change - other than the increased speed limit or the relatively new seat belt law - caused a lower total number of accidents, and we have not properly accounted for this change.

The coefficient on *beltlaw* also seems counterintuitive at first. But, perhaps people became less cautious once they were forced to wear seatbelts.

(v)

```
. summm prcfat

    Variable |     Obs        Mean   Std. Dev.       Min        Max
-------------+-----------------------------------------------------
      prcfat |     108    .8856363   .0997777   .7016841   1.216828
```

The average of *prcfat* is about .886, which means, on average, slightly less than one percent of all accidents result in a fatality. The highest value of *prcfat* is 1.217, which means there was one month where 1.2% of all accidents resulted in a fatality.

(vi)

```
. regress  prcfat t feb mar apr may jun jul aug sep oct nov dec
wkends unem spdlaw

beltlaw

      Source |       SS       df       MS              Number of obs =     108
-------------+------------------------------           F( 16,    91) =   14.44
       Model |  .764228341    16  .047764271           Prob > F      =  0.0000
    Residual |  .301019813    91   .00330791           R-squared     =  0.7174
-------------+------------------------------           Adj R-squared =  0.6677
       Total |  1.06524815   107   .00995559           Root MSE      =  .05751

------------------------------------------------------------------------------
      prcfat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           t |  -.0022352   .0004208    -5.31   0.000    -.0030711   -.0013993
         feb |   .0008607   .0289967     0.03   0.976    -.0567377    .0584592
         mar |   .0000923   .0274069     0.00   0.997    -.0543481    .0545327
         apr |   .0582201   .0278195     2.09   0.039     .0029601    .1134801
         may |   .0716392   .0276432     2.59   0.011     .0167293    .1265492
         jun |   .1012618   .0280937     3.60   0.001     .0454571    .1570665
         jul |   .1766121   .0272592     6.48   0.000      .122465    .2307592
         aug |   .1926116   .0274448     7.02   0.000     .1380958    .2471274
         sep |   .1600165    .028203     5.67   0.000     .1039948    .2160382
         oct |   .1010357   .0276702     3.65   0.000     .0460722    .1559991
         nov |    .013949   .0281436     0.50   0.621    -.0419548    .0698528
         dec |   .0092005    .027858     0.33   0.742     -.046136     .064537
      wkends |   .0006259   .0061624     0.10   0.919    -.0116151    .0128668
        unem |  -.0154259   .0055444    -2.78   0.007    -.0264392   -.0044127
      spdlaw |   .0670876   .0205683     3.26   0.002     .0262312     .107944
     beltlaw |  -.0295053   .0232307    -1.27   0.207    -.0756503    .0166397
       _cons |   1.029799   .1029524    10.00   0.000     .8252965    1.234301
------------------------------------------------------------------------------
```

As in part (iii), I do not report the coefficients on the time trend and seasonal dummy variables:

$$
\begin{aligned}
\widehat{prcfat} &= \underset{(.103)}{1.030} + \cdots + \underset{(.00616)}{.00063}\ wkends - \underset{(.0055)}{.0154}\ unem \\
&\quad - \underset{(.0206)}{.0671}\ spdlaw + \underset{(.0232)}{.0295}\ beltlaw \\
n &= 108, R^2 = .717.
\end{aligned}
$$

Higher speed limits are estimated to increase the percent of fatal accidents, by .067 percentage points. This is a statistically significant effect. The new seat belt law is estimated to decrease the percent of fatal accidents by about .03, but the two-sided p-value is about .21.

Interestingly, increases economic activity also increases the percent of fatal accidents. This may be because more commercial trucks are on the roads, and these probably increase the chance that an accident results in a fatality.