EC317 – Labour Economics

Problem Set 11 Solutions

1. Explain why the effect of a negative income shock on property crime rates is theoretically ambiguous. What about violent crimes?

   Answer:

   From Bignon, Caroli & Galbiati (2017):

   > "*According to the standard economic model of crime (Becker, 1968), individuals choose between criminal and legal activities on the basis of the expected utility of each. In this simple framework, returns to legal activity are determined by market earnings (wages for salaried workers and profits for the self-employed), whereas returns to illegal activity depend on the potential pay-off of crime and the expected sanctions imposed by the criminal justice system. Expected sanctions are an increasing function of the probability of getting caught and of legal punishment if caught. Individuals will choose to engage in criminal activities (or increase their involvement at the margin) if the expected return to criminal activity outweighs the expected return to legal activities* "

   So, to answer this question, we should think about the mechanisms through which a negative income shock could affect the expected utilities of both criminal and legal activities. That is, its effects on (i) market earnings, (ii) the potential gains from crime, and (iii) the probability and severity of punishment:

   (i) A large aggregate income shock such as the phylloxera crisis will likely reduce the expected return to legal activities through a reduction in the wages of employees and revenues of self-employed people in the affected industries, and a higher probability of unemployment. All else equal, this would increase the relative incentive to commit property crimes.

   (ii) However, to the extent that it affects the quality and quantity of goods typically targeted by criminals, the income shock will reduce the expected payoff from property crime because of the reduced availability/quality of illegal-income sources. This effect goes in the opposite direction, reducing the relative incentive to engage in property crime.

   (iii) Moreover, the aggregate nature of such a shock may well imply a significant reduction in local tax revenues that could lead to a reduced number of police forces with lower endowments, thereby decreasing the probability of punishment. Finally, if judges —aware that making a living out of legal income opportunities has become harder— respond by becoming more lenient, the severity of punishment will also be reduced. These two effects would increase the relative incentive to engage in criminal activities.

On the other hand, as a less calculated endeavour, violent crime is likely less responsive to economic incentives. However, if it stems from impulsivity, we would expect people to be more prone to commit violent crimes when under the effects of drugs that reduce inhibitions, such as alcohol. Now, to the extent that alcohol is a normal good, a negative income shock will cause a reduction in alcohol consumption, which in turn should lead to lower violent crime rates. In the case of the phylloxera crisis, this effect would be reinforced by a negative direct impact on alcohol (wine) production.

2. Discuss the challenges in empirically assessing the relationship between economic conditions and crime rates. Why do the authors focus on the nineteenth-century France phylloxera crisis?

Answer:

Again from Bignon, Caroli & Galbiati (2017):

> "*Economic theory and casual observation both suggest that economic crises may favour criminal activity as they alter the opportunity costs of engaging in crime. At the same time, higher crime rates are likely to have a negative impact on economic conditions as the prevalence of crime in an area discourages business. Thus, negative income shocks may trigger a vicious circle between deteriorating economic conditions and crime. Although this relation seems to be quite intuitive, it is far from easy to document due to standard endogeneity problems.*"

> "*The massive negative shock to the French economy induced by the phylloxera attack is indeed an ideal natural experiment that helps in solving the major identification problems related to reverse causality and confounding factors.*"

While economic conditions are likely to affect crime rates, crime rates also impact economic conditions, creating a reverse causation problem. It is hard to disentangle the effect of economic conditions on crime from the effect of crime on economic conditions.

The authors argue that the phylloxera crisis in nineteenth-century France provides an ideal natural experiment to single out the causal impact of negative shocks to the economy on crime rates. It constitutes a big productivity shock, unrelated to prevailing crime rates, in an economy largely dependent on agricultural production at the time. Historical research documents how this turned into a major income shock, since the decrease in wine production was not matched by an equivalent increase in wine prices, while the reduction in wine-generated income did not trigger a substantial substitution of wine for other agricultural products. Local credit systems partially collapsed in some *départments* and, in the absence of a welfare state, a large share of the population suffered a major income drop. Furthermore, as phylloxera contamination affected *départments* in different years, the authors can identify the effect of the shock on crime rates from the spatial variation in its timing.

3. Variable `phyll`, defined as a dummy equal to 1 for all years between the year when a *départment* was fully contaminated by phylloxera and 1890, captures full contagion. Variable `lwine` is the logarithm of wine production.

   (a) Restricting the sample to the period 1850–1905, estimate the following fixed-effects regression

   $$\texttt{lwine}_{dt} = \alpha_t + \beta_d + \gamma\,\texttt{phyll}_{dt} + \varepsilon_{dt},$$

   where t and d index years and *départments*, respectively. Cluster your standard errors at the *départment* level.

   Interpret your results. What is the impact of full contamination by phylloxera on wine production?

   (b) Variable `high` indicates wine-intensive *départments*, defined as those where wine production amounted to at least 15% of agricultural production in 1862. Run the regression from part (a), now restricting the sample to wine-intensive *départments*.

   What is the rationale for this exercise? How do your results change?

Answer:

Results are displayed in the table below (code in Appendix).

	Log (wine production)	
	Whole sample	Wine-intensive *départments*
Phylloxera − full contamination	-0.349 ***	-0.487 ***
	(0.101)	(0.118)
Sample size	3,866	1,860

*** p<.01, ** p<.05, * p<.1

We can use the table to answer parts (a) and (b):

(a) Our results indicate that full contamination by phylloxera generated a major decrease in wine production: it was on average 35% lower in full-contagion years as compared to the reference period characterised by zero/partial contagion.

(b) We restrict the sample to wine-intensive *départments* because we would expect a stronger effect on wine production and thus a larger income shock precisely in those locations. Consistent with this idea, we find a 49% decline in wine production in wine-intensive *départments*, which is reassuring since identification comes from comparing *départments* with different levels of expossure to phylloxera —i.e., different "treatment intensity".

These results show that the phylloxera crisis represents a strong negative shock on wine production. The authors argue that this shock turns out to be stronger than that generated by meteorological changes used in a number of papers in the literature.

4. Let c represent some type of crime. Run fixed-effects regressions of the form

$$c_{dt} = \lambda_t + \kappa_d + \delta\, \texttt{phyll}_{dt} + \eta_{dt}$$

for violent crimes, property crimes, and minor offences —i.e., $c \in \{\texttt{violent}, \texttt{property}, \texttt{minor}\}$— over the period 1826–1936, and for more disaggregated types of crime $c \in \{\texttt{homicide}, \texttt{theft\_all}, \texttt{theft\_church}, \texttt{theft\_road}, \texttt{theft\_dom}, \texttt{theft\_other}\}$ over the period 1826–1912. Again, cluster standard errors at the *départment* level.

Discuss your results. What is the impact of full phylloxera contamination on the different types of crime? Compare the effects on property and violent crime rates. Are these results consistent with your discussion in question 1?

Answer:

Results are displayed in the table below (code in Appendix).

	1826–1936			1826–1912					
	Violent	Property	Minor	Homicides	Thefts				
					All	Church	Road	Domestic	Other
Phylloxera	-0.599 ***	1.326 ***	-1.862	-0.134	1.354 ***	0.029	0.031	0.305 *	0.936 ***
	(0.178)	(0.480)	(26.896)	(0.087)	(0.464)	(0.021)	(0.037)	(0.161)	(0.326)
Sample size	8,639	8,639	8,639	7,038	7,038	7,038	7,038	7,038	7,038

*** p<.01, ** p<.05, * p<.1

We find that phylloxera had the following effects on crime rates:

- **Aggregate crime categories:**
  - **Property crimes:** Positive and significant impact on property crimes. This suggests that the negative impact of phylloxera on legal earnings opportunities dominated its potential damage to the quality of illegal activities.

  - **Violent crimes:** Negative and significant impact on violent crimes. This is consistent with other aggregate-level evidence shown by the authors that phylloxera contributed to lower alcohol consumption, which in turn arguably reduced violent crime rates.
  - **Minor offences:** No statistically significant effect on minor offences.
- **Disaggregated crime categories:**
  - **Homicides:** No impact. Negative point estimate but not significant at conventional levels.
  - **Thefts:** Positive and significant effect on "all thefts", while positive effect in all theft subcategories but only signifficant for domestic thefts (10%) and the residual category "other thefts" (1%).

These findings, especially with respect to property versus violent crimes, are broadly consistent with our discussion in question 1. The authors argue that

> "*Taken together, these results suggest that the negative income shock induced by the phylloxera crisis strongly affected French crime rates. It caused a substantial increase in property crimes while inducing a decrease in violent crimes probably due to a reduction in alcohol consumption.*"

5. Estimate fixed-effects regressions of the form

$$c_{dt} = \pi_t + \rho_d + \theta\,\texttt{lwine}_{dt} + \nu_{dt}$$

by IV instrumenting $\texttt{lwine}_{dt}$ with $\texttt{phyll}_{dt}$ for the same types of crime from question 4 over the period 1850–1905, clustering the standard errors at the *département* level.

Discuss your results. Under what conditions is the virus spread a valid instrument? What is the interpretation of θ under the assumption that the phylloxera crisis did not affect wine prices? Are these results consistent with your reduced-form evidence from question 4?

Answer:

Results are displayed in the table below (code in Appendix).

	Violent	Property	Minor	Homicides	Thefts				
					All	Church	Road	Domestic	Other
Log (wine prod.)	1.019 **	-2.576 *	24.950	0.045	-2.209 **	-0.046	-0.131	-0.530	-1.368 **
	(0.457)	(1.393)	(52.930)	(0.210)	(1.093)	(0.066)	(0.104)	(0.421)	(0.696)
Sample size	3,866	3,866	3,866	3,866	3,866	3,866	3,866	3,866	3,866

*** p<.01, ** p<.05, * p<.1

Instrumental variables must satisfy three conditions:

(i) First stage: The instrument has a clear impact on the endogenous regressor.

(ii) Independence: The instrument is as-good-as-randomly-assigned conditional on the included instruments (the covariates).

(iii) Exclusion restriction: The instrument affects the outcome only through the endogenous regressor.

We focus our discussion on the exclusion restriction since the first stage can be estimated (and we did in question 3), and the independence assumption arguably holds for this type of unexpected shock. In this particular context, the exclusion restriction requires that phylloxera affected crime rates only through its impact on wine production. The authors provide aditional evidence that their main reduced-form results are not driven by major changes in socio-economic characteristics, selective migration, radical changes in police force presence, or more lenient/tougher judges — although they find evidence of a change in judge behaviour with respect to minor offences.

The θ coefficients capture the level-change in crime rates due to a percent-change in wine production, so they allow us to estimate the elasticities of crime rates with respect to wine production. Since wine-generated income —i.e., income arising from wine-related activities, is the product of wine production and wine prices, we can interpret θ directly as the level-change in crime rates induced by a percent-change in wine-generated income. This is because

$$\begin{aligned} \mathrm{d}\ln(\texttt{wine income}) &= \mathrm{d}\ln(\texttt{wine production} \times \texttt{wine price}) \\ &= \mathrm{d}\ln(\texttt{wine production}) + \underbrace{\mathrm{d}\ln(\texttt{wine price})}_{=0} \end{aligned}$$

Therefore, under this assumption, the θ coefficients allow us to estimate the elasticities of crime rates with respect to wine-generated income.

Wine production —instrumented by full contagion by phylloxera— has a negative and significant impact on property crimes (significant at 10%) and a positive and significant impact on violent crimes (significant at 5%). Our results are consistent with the reduced form and first stage results from questions 4 and 3 (recall that phylloxera reduced win production).

Appendix: Code

Question 3:

There are many ways to run these fixed-effects regressions in Stata. We will use Stata's `xt` commands for analysis of panel data. We begin by declaring the panel with command `xtset`. Then, we proceed to run the regressions with command `xtreg` and option `fe`. These regressions will automatically include the *département* fixed effects. We include the year fixed effects "manually" with Stata's factor variable notation by including regressor `i.year`. We store the estimates after each regression with command `estimates store`, and later produce a table from these estimates with command `etable`. Finally, we edit the table with some `collect` commands.

Notice that in these fixed-effects regressions, robust standard errors coincide with clustering at the individual —i.e., *département*— level. You will obtain the same standard errors no matter whether you specify option `vce(robust)` or `vce(cluster dept)`. We make use of loops —`forvalues` in this case, `foreach` in later questions— and local macros to reduce the need to repeatedly type almost identical commands, but this is not necessary to obtain the results.

```
xtset dept year
local sample1 inrange(year,1850,1905)
local sample2 `sample1´ & high
forvalues j = 1/2 {
        quietly xtreg lwine phyll i.year if `sample`j´´, fe vce(robust)
        estimates store q1_`j´
}
quietly etable, estimates(q1*) keep(phyll) stars(.1 * .05 ** .01 ***) mstat(N, nformat(%12.0gc))
collect label levels result N "Sample size", modify
collect label levels colname phyll "Phylloxera - full contamination", modify
collect label levels etable_depvar 1 "Whole sample" 2 "Wine-intensive {it:départments}", modify
collect style column, width(equal)
collect label dim etable_depvar "Log (wine production)", modify
collect style header etable_depvar, title(label)
collect style cell cell_type[column-header], border(bottom, pattern(solid))
collect preview
```

Question 4:

We use the same set of commands to run the fixed-effects regressions and produce and edit the table, just taking care of restricting the sample and modifying the table accordingly.

```
#delimit ;
        local crimes
                        violent
                        property
                        minor
                        homicide
                        theft_all
                        theft_church
                        theft_road
                        theft_dom
                        theft_other
        ;
#delimit cr
```

```
local sample
local j = 1
cap est drop q2*
foreach crime of local crimes {
        if ("`crime´" == "homicide") local sample if year <= 1912
        qui xtreg `crime´ phyll i.year `sample´, fe vce(robust)
        est sto q2_`j´
        local ++j
}
local eqbase violent
local eqrecode : list local crimes - local eqbase
foreach eq of local eqrecode {
        local recode `recode´ eqrecode(`eq´ = `eqbase´)
}
qui etable, est(q2*) keep(phyll) stars(.1 * .05 ** .01 ***) mstat(N, nformat(%12.0gc)) `recode´
collect label levels result N "Sample size", modify
collect label levels colname phyll "Phylloxera", modify
collect remap etable_depvar[1 2 3] = agg
collect remap etable_depvar[4 5 6 7 8 9] = dis
collect remap etable_dvlabel[1 2 3 4] = notheft
collect remap etable_dvlabel[5 6 7 8 9] = theft
collect label dim agg "1826{c -}1936", modify
collect label dim dis "1826{c -}1912", modify
collect label dim theft "Thefts"
collect style header theft, title(label) level(label)
collect style header notheft, title(hide) level(label)
collect style header agg dis, title(label) level(hide)
collect label levels notheft 1 "Violent" 2 "Property" 3 "Minor" 4 "Homicides", modify
collect label levels theft      5 "All"        6 "Church"   7 "Road"  8 "Domestic" 9 "Other", modify
collect recode dis 4 = 1 5 = 1 6 = 1 7 = 1 8 = 1 9 = 1
collect style cell cell_type[column-header], border(bottom, pattern(solid))
collect layout (coleq#colname[phyll]#result[_r_b _r_se] result[N]) ((agg dis)#(notheft theft)#stars)
```

Question 5:

Here, we use command `xtivreg` to run the fixed-effects IV regressions. Notice that the syntax of `xtivreg` is similar to that of `xtreg` in the sense that we specify the estimator —`fe` in this case— as an option, in contrast to cross-section IV command `ivregress` where we need to specify the estimator —e.g., 2SLS— as part of the main command.

```
local sample inrange(year,1850,1905)
local j = 1
cap est drop q3*
foreach crime of local crimes {
        qui xtivreg `crime´ i.year (lwine = phyll) if `sample´, fe vce(robust)
        est sto q3_`j´
        local ++j
}
local eqbase violent
local eqrecode : list local crimes - local eqbase
foreach eq of local eqrecode {
        local recode `recode´ eqrecode(`eq´ = `eqbase´)
}
qui etable, est(q3*) keep(lwine) stars(.1 * .05 ** .01 ***) mstat(N, nformat(%12.0gc)) `recode´
collect label levels result N "Sample size", modify
collect label levels colname lwine "Log (wine prod.)", modify
collect remap etable_dvlabel[1 2 3 4] = notheft
collect remap etable_dvlabel[5 6 7 8 9] = theft
```

```
collect label dim theft "Thefts"
collect style header theft, title(label) level(label)
collect style header notheft, title(hide) level(label)
collect label levels notheft 1 "Violent" 2 "Property" 3 "Minor" 4 "Homicides", modify
collect label levels theft       5 "All"         6 "Church"   7 "Road"  8 "Domestic" 9 "Other", modify
collect style cell cell_type[column-header], border(bottom, pattern(solid))
collect layout (coleq#colname[lwine]#result[_r_b _r_se] result[N]) ((notheft theft)#stars)
```