ECONOMETRICS II, Fall, 2024
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Midterm Exam 2—October 21, 2024

1. (21%) Consider the simultaneous equation model:

$$y_1 = \alpha_1 y_2 + \alpha_2 x_1 + u_1 \quad (1)$$
$$y_2 = \alpha_3 y_1 + \alpha_4 x_1 + \alpha_5 x_2 + u_2 . \quad (2)$$

a) Explain how you can use Two-Stage Least Squares (2SLS) to estimate equation (1).
b) Explain why the 2SLS estimator can consistently estimate the equation for y_1, but not the one for y_2.
c) Explain in words what the Three-Stage Least Squares estimator does.

2. (21%) a) Explain what a duration model is, including a definition of the survivor function and the hazard function.
b) Derive the hazard function for the exponential duration model.
c) Write down the log-likelihood function for a sample of durations of which some are incomplete spells (truncated at duration T).

3. (21%) a) Write down an ARCH (or GARCH) model.
b) Write down a Stochastic Volatility model.
c) Explain in your own words how on can use an ARCH model to estimate the SV model by EMM. (I am perfectly happy with intuition here, so you don't have to use equations.)

4. (16%)
a) Explain in words why the non-parametric variance-estimator explained in the GMM notes need a bandwidth that go to infinity at a slower rate than T.
b) Consider a sum $\Sigma_{t=1}^{T} x_t$ of correlated stationary observation. We label the variance $\gamma(0)$ and the j-th order covariance $\gamma(j)$. Assume that $\gamma(j) = 0.5^j$.
Using a Bartlett kernel with bandwidth 3, what would be your estimate of $Var(\frac{1}{T}\Sigma_1^T x_t)$?

5. (21%) In the Matlab code below:
a) What is orth?
b) what is xxx and what happens in that line?
c) What is yyy?

```
function crit =subroutine(guess,W)
global lag T
```

```
xxx = ((sum(orth(guess),1))./(T-lag))';
yyy = xxx'*W*xxx;
end
```