MACS30150 Assignment 1

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Problem 1

(a) For this problem, I have selected to review "Banking, Liquidity, and Bank Runs in an Infinite Horizon Economy" by Mark Gertler and Nobuhiro Kiyotaki. This is a 2015 paper in the *American Economic Review*.

(b) A detailed citation is given in the **References** section below.

(c) For simplicity, I will provide the baseline model described in Gertler and Kiyotaki (2015) that does not incorporate bank runs. There are two types of agents in this model: households and bankers. The household optimization problem is as follows:

$$\begin{aligned}\max U_t = &\max_{C_t^h, K_t^h, D_t} \mathbb{E}_t\Big[\sum_{i=0}^{\infty}\beta^i \ln C_{t+i}^h\Big]\\ &\text{s.t.}\quad C_t^h + D_t + Q_t K_t^h + f(K_t^h) = Z_t W^h + R_t D_{t-1} + (Z_t + Q_t)K_{t-1}^h\end{aligned}$$

where the household – to maximize overall utility, U_t – chooses C_t^h, K_t^h, and D_t, which indicate household consumption, direct capital holdings, and bank deposits respectively. In addition, $\beta \in (0,1)$ stands for discount rate, Q_t market price of capital, Z_t the aggregate productivity shock, R_t the rate on deposit, and function $f(K_t^h) = \frac{\alpha}{2}(K_t^h)^2$ is the management cost for households to directly hold capital (to motivate that households are less efficient at managing capital than bankers).

The banker optimization problem (in its "reduced" form) is as follows:

$$\begin{aligned}\max \psi_t = &\max_{\phi_t} \mathbb{E}_t\Big[\beta(1-\sigma+\sigma\psi_{t+1})\big\{(R_{t+1}^b - R_{t+1})\phi_t + R_{t+1}\big\}\Big]\\ &\text{s.t.}\quad \theta\phi_t \le \psi_t\end{aligned}$$

where the banker chooses ϕ_t, the ratio of assets to net worth, to maximize Tobin's q (i.e. the ratio of franchise value to net worth) denoted by ψ_t. In addition, $\sigma \in (0,1)$ denotes the probability of a banker surviving until the next period, R_t^b realized rate of return on bank assets, and $\theta \in (0,1)$ the ratio of asset diversion.

(d) In the above specification of the model by Gertler and Kiyotaki (2015), exogenous variables (or parameters) are β, σ, θ, Z_t, and α (or the functional form of $f(\cdot)$ in general). Other variables are determined endogenously.

(e) The model described in Gertler and Kiyotaki (2015) is a **dynamic**, **deterministic** model. Because the said model is not an econometric (or statistical) model, I was not able to classify it fully as a linear or a nonlinear model. However, I argue below that it could qualify more as a **linear** model, along with providing reasons why it would be a dynamic and deterministic one.

Dynamic. As observed from part (c), the model has time subscripts (i.e. $t, t+1, ...$), indicating that it is a dynamic one rather than a static one. In fact, the authors explain that the model dealt with in the paper will be one in an infinite horizon setting (Gertler and Kiyotaki 2015, p. 2012).

Linear (?). As explained above, it is hard to classify this model as a linear or a non-linear one as the model is not an econometric or statistical model. However, I would like to consider it as linear model because the variables that agents determine (i.e. C_t^h, D_t, K_t^h, and ϕ_t) are linear or log-linear in the objective functions that agents seek to maximize.

Deterministic. While there exists a parameter σ that is the probability of a banker surviving until the next period, the model would not be qualified as a "stochastic model." This is because a certain set of values for the parameters will always return a specific set of steady-state values.

(f) While I believe that the model is detailed enough, I suggest a minor tweak to the aforementioned parameter σ. Depending on how the financial market is performing, it may be that a banker is more (or less) likely to survive until the next period. Therefore, I suggest that the said variable should adopt a time subscript, and be some function of a market index. For simulation purposes, the said market index could be modeled to follow an autoregressive process.

Problem 2

(a) For the sake of better prediction and precision, I limit my model to include young adults (of ages 25 to 35) who have marriage candidates or partners. I provide a very simple binary logistic regression as follows:

$$\begin{aligned} M_i =& \frac{1}{1 + e^{-(\beta_0 + X_i^T \beta)}} \\ \text{where} \quad X_i^T \beta =& \beta_1 F_i + \beta_2 |E_i^s - E_i| + \beta_3 C_i + \beta_4 \ln (W_i + W_i^s) \end{aligned}$$

in which M_i equals to 1 if one decides to get married (and 0 if not). In addition, the independent variables are as follows: F_i equals 1 if female (0 if male); E_i and E_i^s each indicating years of education for oneself and for the potential spouse; C_i equals 1 if one or one's potential spouse has children (0 if not); W_i and W_i^s indicate monthly income for oneself and for the potential spouse. Parameters β_1 to β_4 are regression coefficients associated with the said independent variables; β_0 is a constant.

(b) I have made sure that M_i, the endogenous (or dependent) variable of the model, takes a binary value (i.e. either 0 or 1).

(c) While the model indicated in part (a) can be considered a data generating process (DGP), I argue that it would not be a very good idea to plug arbitrary values in for the parameters β_0 to β_5. Instead, I suggest estimating the parameters first using preexisting data.[1] Once the model has been fitted, the estimated coefficients will be used for simulation. If one wants to observe the the DGP behaves with other values for coefficients, I suggest using the said estimated coefficients as benchmark and "tweaking" within the neighborhood of the benchmark.

(d) While I believe that the independent variables that I have selected – F_i, $|E_i^s - E_i|$, C_i, $\ln(W_i + W_i^s)$ – are all somewhat important, I believe that the more significant ones will be $|E_i^s - E_i|$ and $\ln(W_i + W_i^s)$. I will explain in part (e) on why this is the case.

(e) As economic ability (or the ability to provide to the family) is an important factor for marriage, I have decided to put measures of income into my model. The reason to consider the logged sum of incomes, as opposed to individual incomes separately, is to convey the idea that the married couple will seek to maximize the total utility of the couple rather than being egotistic and caring only about one's own utility.

    As for $|E_i^s - E_i|$, I wanted to convey some idea of assortative mating. For instance, Becker (1974) suggests that there can be positive or negative relationship (rather than random) between the traits of potential spouses (pp. 311-312). Eika, Mogstad, and Zafar (2017) suggest that there is evidence of positive educational assortative mating across the years 1962 to 2013; therefore, I suspect that the chance of marriage will be higher as $|E_i^s - E_i|$ is closer to 0.

(f) As partly argued in part (c), fitting the model using existing data and observing metrics such as pseudo-R^2 (as this is a logistic regression) would be useful. In addition to this, I believe that dividing the dataset into training and testing subsets and observing whether the model behaves well across the said subsets.

    Another suggestion, which may be more relevant when using datasets that have multiple "vintages" such as the National Longitudinal Survey of Youth (NLSY), is to estimate the model using an older set of data and testing whether the coefficients estimated from it work well with a newer set of data. This would be similar to the division between training and testing subsets, and could be useful if to see whether one's estimations "stand the test of time" and provide reliable predictions.

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[1] For this step, I suggest using datasets such as that from National Longitudinal Survey of Youth, which contains information such as biological sex, education level, marital and cohabitation status, and so forth.

References

Becker, Gary S. 1974. "A Theory of Marriage." In *Economics of the Family: Marriage, Children, and Human Capital*, edited by Theodore W. Schultz, 299-351. Chicago: University of Chicago Press.

Eika, Lasse, Magne Mogstad, and Basit Zafar. 2017. "Educational Assortative Mating and Household Income Inequality." *Federal Reserve Bank of New York Staff Reports* 682, March.

Gertler, Mark, and Nobuhiro Kiytoaki. 2015. "Banking, Liquidity, and Bank Runs in an Infinite Horizon Economy." *American Economic Review* 105 (7): 2011–2043.