

ETF5200 Applied time series econometrics

Project 2

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Contents

Part I	1
Question 1	1
Question 2	2
Part II	4
The main ideas proposed	4
The main techniques used	4
The main data used	4
The main results obtained	5
Representations	5
Estimation	5
Testing	5
The conclusion made	5
My own models and proposals	5

Part I

Personal capita consumption and income data are more likely to be inter-dependent dynamically, therefore vector autoregressive model (VAR) will be used to study their behavior in this project. By looking at the data summary, we can see we have 251 observations, there are no missing values. The period of this data set is from the first quarter 1947 to the third quarter 2009. All data is in log form.

Question 1

We start with checking the time plots of these two series, which are shown in figure 1. We can see the increasing time trend clearly. The VAR model needs to be stationary. We first difference the series. The graph after first difference is shown in figure 2, we can see the first-differenced series are stationary. Hence the interested model form is as below:

$$\Delta Y_t = A_0 + A_1 \Delta Y_{t-1} + A_2 \Delta Y_{t-2} + \epsilon_t$$

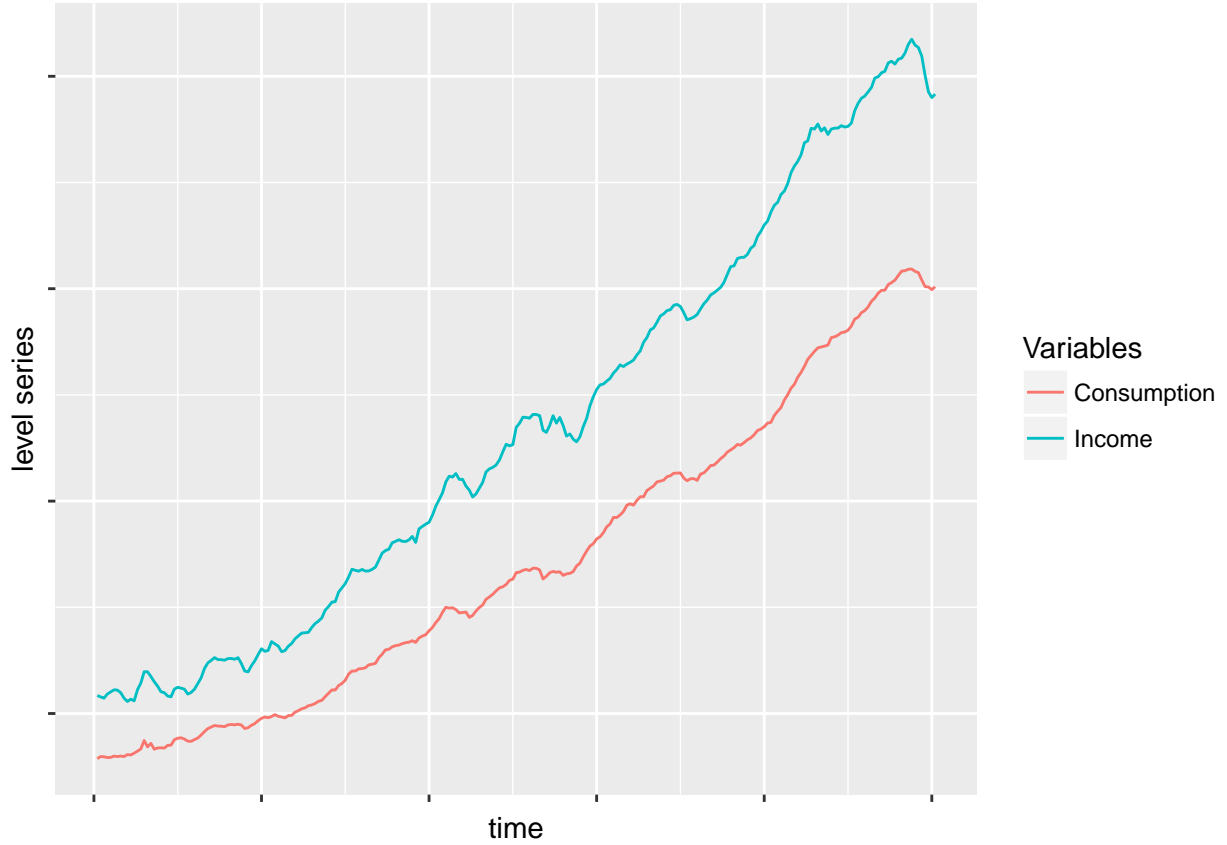


Figure 1: Time plots of personal capita consumption and income shows clear trend.

where

$$\Delta Y_t = \begin{pmatrix} \Delta Consumption_t \\ \Delta Income_t \end{pmatrix} \quad \epsilon_t = \begin{pmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{pmatrix}$$

and A_0 , A_1 , A_2 are coefficient matrices. First we want to estimate the intercept vector (A_0) and the coefficient matrices (A_1 and A_2) for the VAR(2) model.

Table 1: Coefficient matrix A1

	Consumption lag 1	Income lag 1
Consumption	0.1952427	0.0113313
Income	0.7963569	0.0165428

Table 2: Coefficient matrix A2

	Consumption lag 2	Income lag 2
Consumption	0.2881978	0.0047035
Income	0.4113396	0.0324140

Table 3: Intercept matrix

	Intercept
Consumption	0.044288507

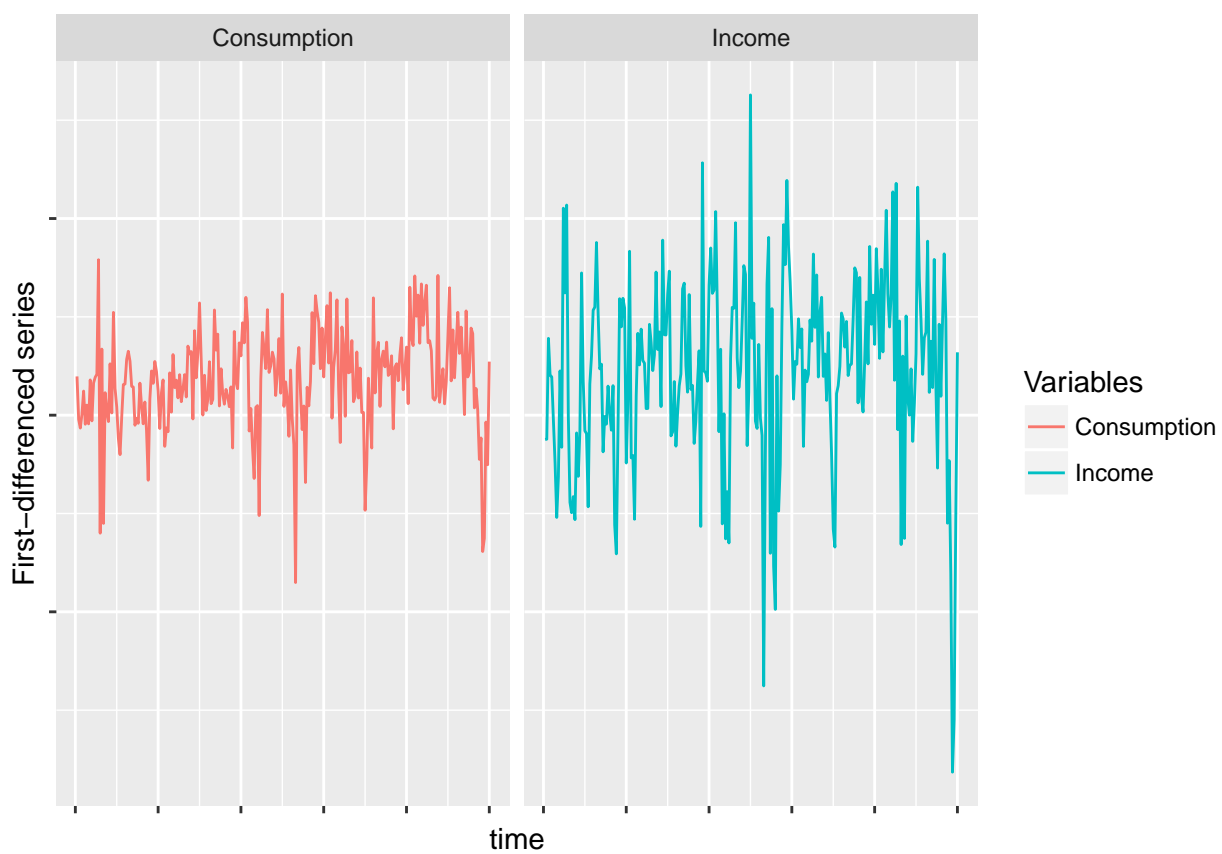


Figure 2: Time plots of first-differenced personal capita consumption and first-differenced income.

Part II

The main ideas proposed

In 1981, Granger first introduced the idea of co-integration in Granger (1981). He believed that “the practice of data-mine should be brought out into the open” and this co-integration idea was “potentially very important”. He was curious about if prices and wages were co-integrated or not, and he suggested appropriate investigation was needed to find out which pairs of economic variables are co-integrated. (Granger 1981) In 1983, Granger and Weiss did further study on this topic, some error-correction model forms and testing methods were discussed, three applications were conducted which including employees’ income and national income; M3 and GNP; prices, wages and productivity. However the results in the three applications in that paper were all unsatisfactory indicating the model structure may not be appropriate. (Granger and Weiss 1983)

Therefore, in 1987, Engle and Granger wrote this paper (Engle and Granger 1987) to formally define the conception error-correcting models and co-integration. It was proven in this paper that $I(1)$ variables had a vector error correction representation if and only if they were cointegrated. Properties of co-integration variables associated with several representations were discussed. Estimating and testing methods were also established. What’s more, a two step estimator was proposed and proven to be as efficient as MLE based on a known value of co-integrating vector (α).

The main techniques used

The main data used

Four examples were given to show the performance of the tests introduced in this paper. Thus four types of data were involved.

- The relationship between consumption and income in U.S. The U.S. quarterly real per capita consumption on nondurables and real per capita disposable income from 1947-I to 1981-II.
- Monthly wages and prices in U.S. Logs of the consumer price index and production worker wage in manufacturing over the three decades of 50’s, 60’s, and 70’s. For each of the decades there are 120 observations.
- Short and long term interest rates in U.S. Monthly yields to maturity of 20 years treasury bonds (long term rate R_t) and the one month treasury bill rate (short rate r_t) from February, 1952 to December, 1982.
- Money supply and Output Four measure of money: M1, M2, and M3, and L, total liquid assets. In each case, the sample period was 1959-I through 1981-II, quarterly.

The main results obtained

Representations

T

Estimation

Testing

In the four examples mentioned above, “it is found that consumption and income are co-integrated, wages and prices are not, short and long interest rates are, and nominal GNP is not co-integrated with M1, M3, or total liquid assets, although it is possibly with M2.” (???)

The conclusion made

My own models and proposals

Engle, Robert F, and Clive WJ Granger. 1987. “Co-Integration and Error Correction: Representation, Estimation, and Testing.” *Econometrica: Journal of the Econometric Society*. JSTOR, 251–76.

Granger, Clive WJ. 1981. “Some Properties of Time Series Data and Their Use in Econometric Model Specification.” *Journal of Econometrics* 16 (1). North-Holland: 121–30.

Granger, Clive WJ, and Andrew A Weiss. 1983. “Time Series Analysis of Error-Correction Models.” In *Studies in Econometrics, Time Series, and Multivariate Statistics*, 255–78. Elsevier.