

ETC3450

Time Series Econometrics

Assignment 2

Housing Data: Time Series Properties

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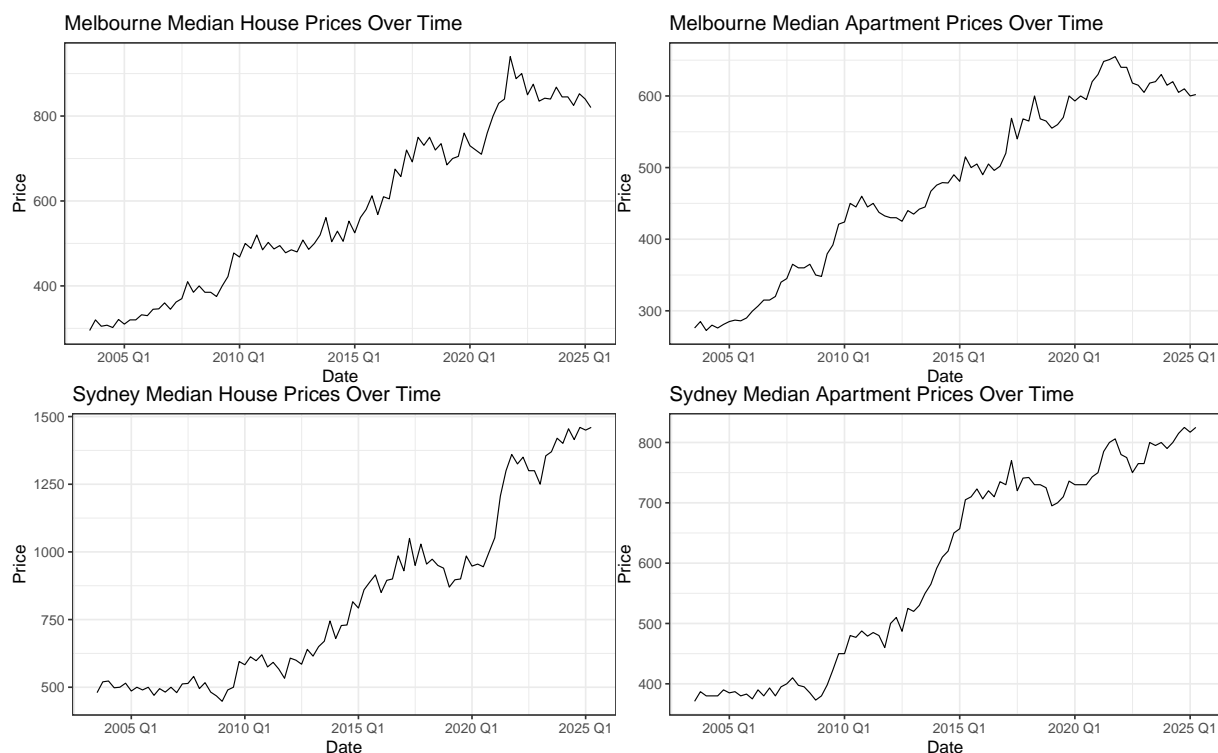
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1 Stationarity:

Determine whether series are stationary (use visualisation and hypothesis tests)



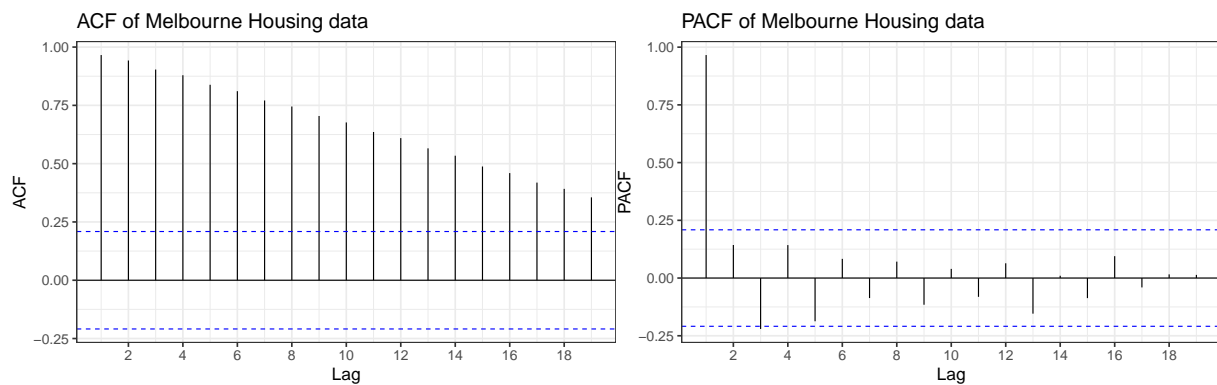
Visually, all series look non-stationary as their means are clearly time dependent and all series exhibit an upwards trend. Doesn't seem to be any seasonality.

1.1 Formal Hypothesis tests

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1.1.1 Melbourne Housing Prices



a: The ACF has very slow decay, indicating non stationarity.

b: Significant spike at lag 1 in PACF indicates we use 1 lag for an ADF test.

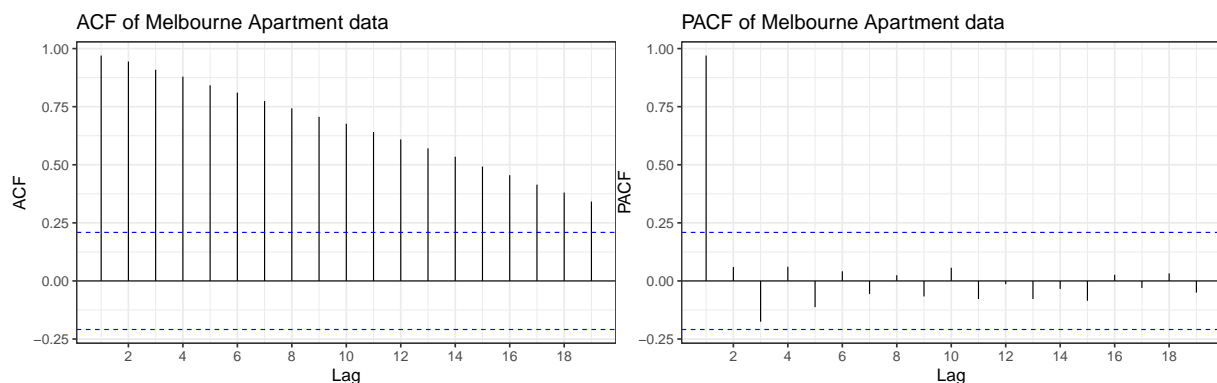
Figure 1: ACF and PACF plots of Melbourne housing prices

For the ADF test: The τ statistic was given as -0.6 , which is greater than the critical value of -2.89 at the 5% significance level. Thus, we fail to reject H_0 and conclude that the series may have a unit root and differencing is necessary.

For the KPSS test: the p -value was given as 0.01 , so we reject the null in favour of the series being non stationary, which supports the conclusion from the ADF test.

From the PACF, the strong spike at lag 1 suggests the presence of persistence in the series, which is consistent with non-stationary behaviour. Combined with formal unit root tests, this indicates that the series likely becomes stationary after first order differencing. Therefore, the Melbourne housing series is likely $I(1)$.

1.1.2 Melbourne Apartment Prices



For the ADF test: The τ statistic was given as -1.35 , which is greater than the critical value of -2.89 at the 5% significance level. Thus, we fail to reject H_0 and conclude that the series may have a unit root and differencing is necessary.

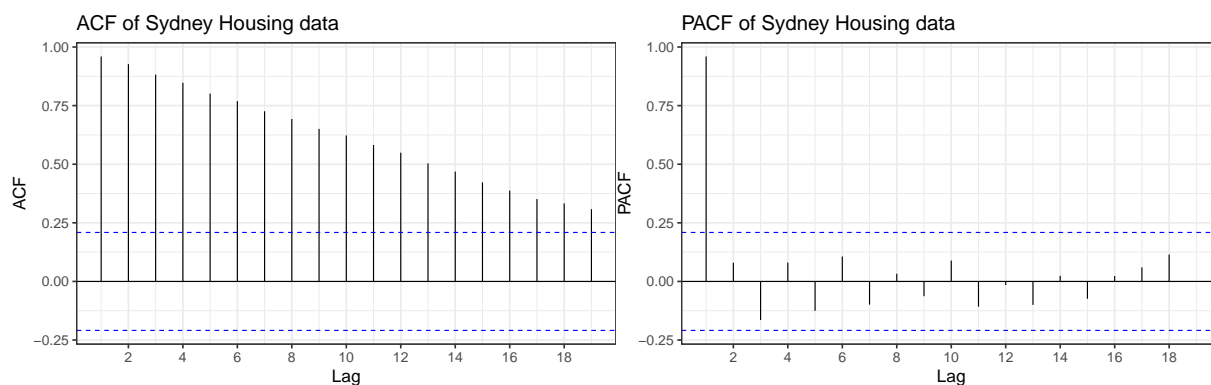
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For the KPSS test: the p -value was given as 0.01, so we reject the null in favour of the series being non stationary, which supports the conclusion from the ADF test.

From the PACF, the strong spike at lag 1 suggests the presence of persistence in the series, which is consistent with non-stationary behaviour. Combined with formal unit root tests, this indicates that the series likely becomes stationary after first differencing. Therefore, the Melbourne apartment series is likely $I(1)$.

1.1.3 Sydney Housing Prices

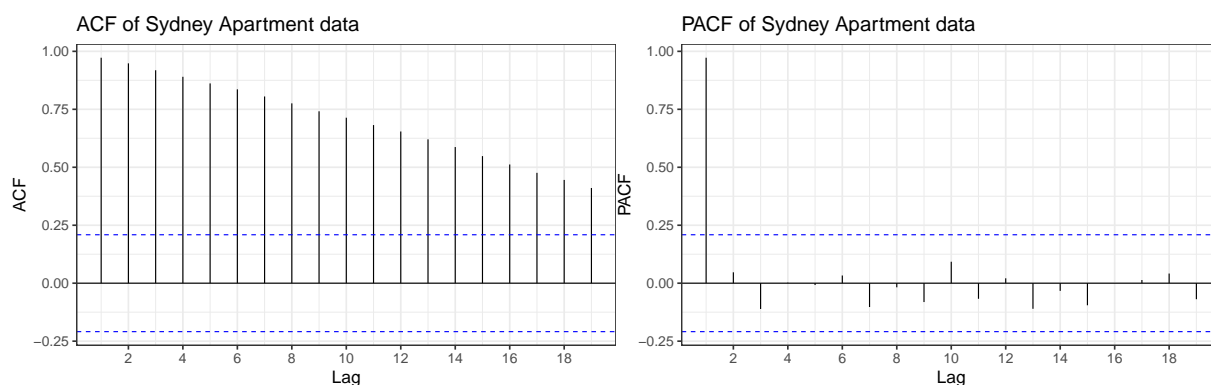


For the ADF test: The τ statistic was given as 1.07, which is greater than the critical value of -2.89 at the 5% significance level. Thus, we fail to reject H_0 and conclude that the series may have a unit root and differencing is necessary.

For the KPSS test: the p -value was given as 0.01, so we reject the null in favour of the series being non stationary, which supports the conclusion from the ADF test.

From the PACF, the strong spike at lag 1 suggests the presence of persistence in the series, which is consistent with non-stationary behaviour. Combined with formal unit root tests, this indicates that the series likely becomes stationary after first differencing. Therefore, the Sydney housing series is likely $I(1)$.

1.1.4 Sydney Apartment Prices



For the ADF test: The τ statistic was given as -0.2 , which is greater than the critical value of -2.89

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at the 5% significance level. Thus, we fail to reject H_0 and conclude that the series may have a unit root and differencing is necessary.

For the KPSS test: the p -value was given as 0.01, so we reject the null in favour of the series being non stationary, which supports the conclusion from the ADF test.

From the PACF, the strong spike at lag 1 suggests the presence of persistence in the series, which is consistent with non-stationary behaviour. Combined with formal unit root tests, this indicates that the series likely becomes stationary after first differencing. Therefore, the Sydney apartment series is likely $I(1)$.

1.2 Conclusion on Stationarity:

All series are determined to be non-stationary and have unit roots. All are integrated of order 1- $I(1)$; meaning that taking the first difference of each series should make each series stationary.

2 Cointegration

Pairs: - Houseprices in Melbourne and Sydney - Apartment prices in Melbourne and Sydney - Apartment prices in Melbourne and house prices in Melbourne - House prices in Sydney and house prices in Sydney

2.1 Test for cointegration of each pair

Use Engle-Granger procedure as dealing with pairs 1. Run long run regression $y_t = a + \beta x_t + u_t$
2. Save u_t 3. Test the residuals for stationarity (ADF test on u_t) H_0 : resids have a unit root (no cointegration) H_1 : resids are stationary (cointegration)

2.1.1 Houseprices in Melbourne and Sydney

p -value was given as 0.93 meaning there is insufficient evidence to reject H_0 , indicating that the residuals may be non stationary. Thus, there is no evidence of cointegration between house prices in Melbourne and Sydney

2.1.2 Apartment prices in Melbourne and Sydney

p -value was given as 0.46 meaning there is insufficient evidence to reject H_0 , indicating that the residuals may be non stationary. Thus, there is no evidence of cointegration between apartment prices in Melbourne and Sydney

2.1.3 Apartment prices in Melbourne and house prices in Melbourne

p -value was given as 0.44 meaning there is insufficient evidence to reject H_0 , indicating that the residuals may be non stationary. Thus, there is no evidence of cointegration between apartment

prices and house prices in melbourne

2.1.4 Apartment prices in Sydney and house prices in Sydney

p -value was given as 0.92 meaning there is insufficient evidence to reject H_0 , indicating that the residuals may be non stationary. Thus, there is no evidence of cointegration between apartment prices and house prices in Sydney

2.2 CONCLUSION

No cointegration between the given pairs, meaning the two price series only move together in the short run and don't move around a common long run equilibrium.