

# Using Qual Vars to analyse the Turkish Business Cycle

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Don Harding

La Trobe University

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# Three hypotheses about the business cycle

- 1 The timing of the beginning and end of recessions are impossible to forecast and will always be difficult to forecast because the actions of rational economic agents make these events unforecastable.
  - 1 Note: This doesn't mean policy research on business cycles is useless. Might, for example, produce a valuable reduction in variability of economic activity.
- 2 The business cycle is the result of a yet undiscovered non linearity in economic processes and if/when that non linearity is discovered the beginning and ends of recessions will be forecastable.
- 3 There is some forecastability of the beginning and end of recessions but this forecastability is less evident in richer economies with better data quality and stronger policy institutions than in developing economies.

# Why don't we have an answer?

These hypotheses have been around for a century and remain unresolved.  
Why?

- 1 Difficulty of measuring business cycle events and of constructing measures that are comparable across countries.
- 2 The way that one constructs business cycles indicators affects the econometric analysis and can lead to false evidence of predictability.
- 3 The set of candidate non-linear models is very large. Difficult task to evaluate them.

# How do Qual Vars fit in

Qual VARs, introduced by Dueker (2005) are an attractive way of jointly studying

- The extent to which recessions are forecastable;
- Whether information about the state of the business cycle is useful in predicting other economic variables;
  - If not the Qual var becomes a VAR with an associated dynamic generalized categorical model.
- Whether fiscal and monetary policy have effects that are different in recessions to those that occur in expansions. This requires a structural Qual Var.
- How the measurement of business cycles affects the econometrics.

## Limitations of Qual Vars:

- Estimation involves some tricky issues: Identification, near unit roots, how to assess whether algorithm has converged.

# Data requirements for Qual Var

- 1 Reliable measure of the state of the business cycle.
  - 1 Desirable that it is a reference cycle that aggregates turning point information in many series.
- 2 Data on variables that are coincident with the business cycle (Eg GDP) and variables that lead GDP (eg slope of yield curve).

# Three approaches to measuring business cycles: 1 Model based

1. Model Based: Eg Markov switching model.
  - a) Recessions begin because economy switches from high growth state to low growth state;
  - b) Recessions end because economy switches from low growth state to high growth state;
  - c) With some probability  $p$  economy switches from low growth to high growth
  - d) With probability  $q$  economy switches from high growth to low growth.

**Advantage:** Integrated approach to defining and forecasting recessions.

**Disadvantage:** Requires that "know true model".

**Comment:** Can relate formula for recession dates to peak and trough dating below (depends on parameters). See Harding and Pagan (2004).

## Example: Senyuz, Z., E. Yoldas and O. Baycan (2010), "Regime-Switching Analysis of Turkish Business and Stock Market Cycles"

- Pagan and Harding (2011) find that model fails simple tests such as capacity to match the average number of periods of negative growth observed in Turkish GDP;
- States in model seemed odd.
  - Low growth state had mean growth of 0.19% and expected duration 14 quarters;
  - High growth state had mean growth of 3.5% and expected duration of 3 quarters;
  - So in model recessions are long and shallow while expansions are short (3 quarters on average) booms.
    - Doesn't look like Turkish economy.
- Similar problems with Markov switching models of US and Euro economies identified in Harding and Pagan (2010).
- Smith and Summers (2004) MS not globally identified.



## Three approaches to measuring business cycles: 2. Peaks and troughs in sample path

2. **Peaks and troughs:** Peaks and troughs in sample path of measure of economic activity GDP.

**Peak:** Expansion ends if GDP below previous peak for a sustained period of time (usually 2 quarters)

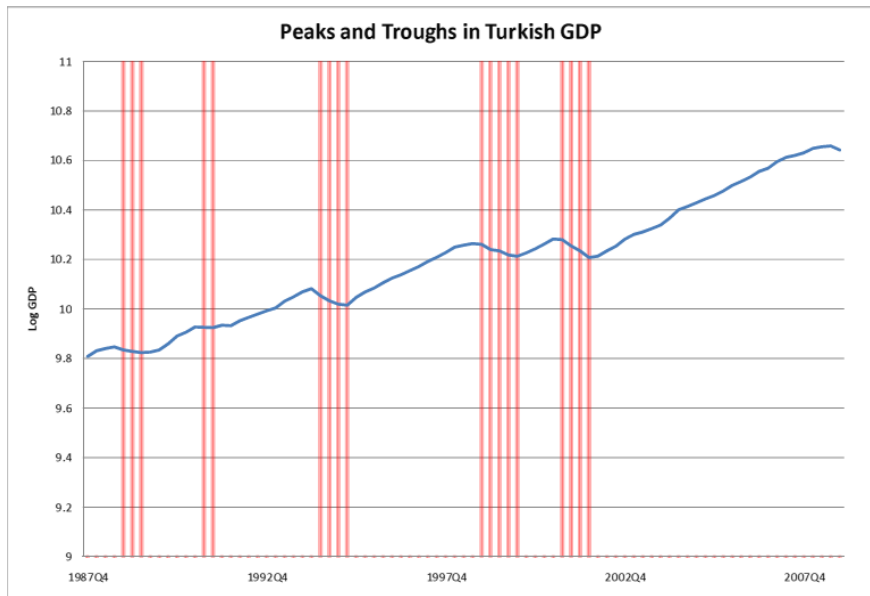
**Trough:** Recession ends if GDP above previous trough for a sustained period of time (usually 2 quarters)

**Advantages:** Doesn't require any model to be true. Implemented via reliable algorithms (Bry Broschan, BBQ etc)

**Disadvantages:** Need to be aware of effects from method of construction when using in econometric analysis. Procedures in algorithm required to implement concept of "**for a sustained period of time**" can be complex.

**Comment:** Great advantage is that method is independent of beliefs about what causes the business cycle and its nature.

# Example:



# Three approaches to measuring business cycles: 3

## Reference cycle

3. **Reference Cycle:** Reference cycle obtained by "aggregating turning points". Simple idea that business cycles occur because the beginning and end of downturns occur together in many series (clustering of turning points).

**Step 1:** Select series that are strongly synchronized.

**Step 2:** Find peaks and troughs in several data series (specific cycles);

**Step 3:** Reference cycle peaks and troughs are dates that represent the centre of clusters of specific cycle peaks and troughs.

**Step 4:** Ensure that peaks and troughs alternate and that implement concept of "**for a sustained period of time**"

**Advantages:** Most comprehensive definition of recessions. Now two good algorithms (Harding and Pagan 2006, Stock and Watson 2011)

**Disadvantages:** Requires data for several synchronized series. Often a problem for developing countries.

**Comment:** This is essentially the method used by the US National Bureau of Economic Research.



## Example: Mediterranean reference cycles

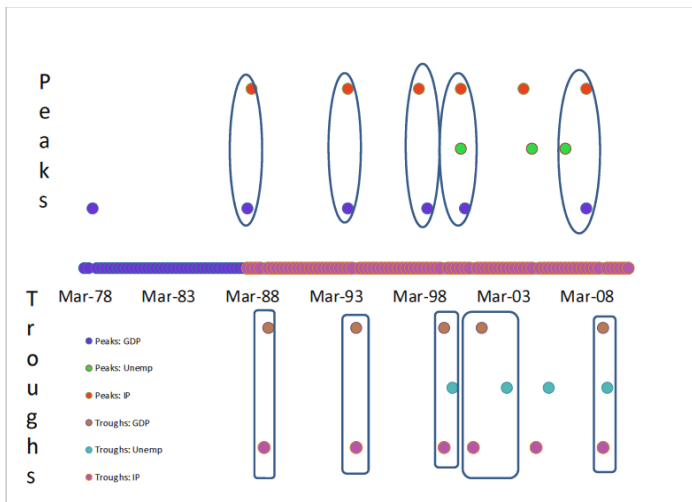
Fabio Canova and Alain Schlaepfer: *Mediterranean Business Cycles: Structure and Characteristics 2011*.

- Apply reference cycle methodology for 19 Mediterranean economies including Turkey.
- Use five series Real GDP, Unemployment, Industrial Production, Real Income, Sales.
  - For Turkey only three series are available: Real GDP, Unemployment, Industrial Production
- Impose minimum completed cycle length and minimum phase length quarters.
- Use two methods to measure distance (makes a big difference which is used)
  - Weighted mean distance;
  - Median distance
    - Note in work on NBER Harding and Pagan (2006) found only median distance measure could replicate NBER business cycle dates.

# Dates for Turkish Business Cycle Established by Canova and Schlaepfer

Canova and Schlaepfer		Pagan			
Method 1: Weighted mean		Method 2: Median		BBQ	
Peaks	Troughs	Peaks	Troughs	Peaks	Troughs
1978Q3	1979Q2				
1987Q4	1989Q1	1987Q4	1988Q4	1988Q3	1989Q2
				1990Q4	1991Q1
1993Q4	1994Q2	1993Q4	1994Q2	1994Q1	1995Q1
1998Q3	1999Q3	1998Q1	1999Q3	1998Q3	1999Q4
2000Q3	2001Q4	2000Q3	2001Q3	2000Q4	2001Q4
2004Q4	2005Q4	2004Q3	2005Q2		
2008Q1	2009Q1	2008Q1	2009Q1		

# Inspecting the components of the Canova and Canova and Schlaepfer Reference cycle for Turkey





# Should unemployment be in the set of indicators used to construct the Turkish reference cycle?

- Visual evidence suggests that unemployment turning points do not cluster with those of IP and GDP
- Correlations of specific cycle in unemployment with specific cycle in GDP and IP support this contention
  - Correlation  $S_t^{Unemp}, S_t^{GDP} = 0.4$
  - Correlation  $S_t^{Unemp}, S_t^{IP} = 0.2$
  - Correlation  $S_t^{GDP}, S_t^{IP} = 0.6$
- Conclusion unemployment does not belong in Turkish reference cycle
- Suggestion: focus on post 1998 period and establish which other variables have specific cycles correlated with specific cycles in GDP and IP. Include these in a reference cycle for Turkey.

# Dates for Turkish reference cycle various methods

Harding Excluding unemp		Canova et al Median		Pagan BBQ GDP	
Peaks	Troughs	Peaks	Troughs	Peaks	Troughs
1987Q4	1988Q4	1987Q4	1988Q4	1988Q3	1989Q2
				1990Q4	1991Q1
1993Q4	1994Q2	1993Q4	1994Q2	1994Q1	1995Q1
1998Q2	1999Q3	1998Q1	1999Q3	1998Q3	1999Q4
2000Q3	2001Q4	2000Q3	2001Q3	2000Q4	2001Q4
		2004Q3	2005Q2		
2008Q1	2009Q1	2008Q1	2009Q1		

- Correlations of ref cyc (ex unemp) with specific cycles in GDP and IP 0.9 and 0.8 respectively. Strong claim to be a reference cycle.

# A simple Qual Var

Let  $S_t$  be reference cycle state,  $S_t = 1$  in expansions and 0 in recessions.  
Let  $y_t$  be variable used to predict  $S_t$  ie growth rate of GDP, yield spread.  
Let  $\psi_t$  be unobservable variable that determines state of business cycle.  
Assume, for simplicity, only one lag in Var. Then

$$y_t = \beta_0 + \beta_y y_{t-1} + \beta_\psi \psi_{t-1} + e_t$$

$$\psi_t = \alpha_0 + \alpha_y y_{t-1} + \alpha_\psi \psi_{t-1} + v_t$$

Where

$$\begin{bmatrix} e_t \\ v_t \end{bmatrix} \sim N \left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_{yy}^2 & \rho \sigma_{yy} \sigma_{\psi\psi} \\ \rho \sigma_{yy} \sigma_{\psi\psi} & \sigma_{\psi\psi}^2 \end{bmatrix} \right)$$

Finally,  $\psi_t$  and  $S_t$  are related by a simple rule. For example, Dueker (2005) assumes that

$$\begin{aligned} S_t &= 1 && \text{if } \psi_t > 0 \\ &= 0 && \text{Otherwise} \end{aligned}$$

# How are Qual Vars related to other models?

- 1 If  $\beta_\psi = 0$  then simplifies to dynamic probit and (V)AR;
- 2 If  $\beta_\psi = 0$  and relationship between  $S_t$  and  $\psi_t$  changed as in Harding and Pagan 2010. Then have generalized dynamic categorical model.

# Conclusions

- Set out some hypotheses regarding (un)predictability of business cycles
- Presented three ways of measuring business cycles
- Discussed the issues with Canova's construction of a reference cycle for Turkey
- Showed how one can construct a better reference cycle for Turkey by excluding the unemployment rate
  - Suggested how this can be improved upon with more data.
- Set out a simple Qual Var and explained why it is interesting and how it is related to other models currently in use.