

AN INTERNATIONAL INVESTIGATION OF THE AUSTRIAN THEORY OF THE BUSINESS CYCLE

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Abstract

In this paper we investigate the validity of the Austrian theory of business cycle. We use international data that span 1980-2005 and we utilize the available information in the most efficient manner via unit panel root and panel cointegration analysis. The relationships among the variables of the Austrian theory of business cycle are investigated using cointegrating techniques. Our results are in favour of the Austrian theory. JEL Classifications: E32, E51.

Keywords: Austrian theory, business cycles, causality, cointegration.

1. Introduction

In this paper, we will put the Austrian theory of the business cycle to the test. This theory emphasizes the role of credit in economic fluctuations. The Austrian theoretical approach followed the tradition of the neoclassical system, the dominant economic school in the '20s and the '30s. It was formulated and fully developed by the Austrian economist Ludwig von Mises in 1912 in his monumental work "Theory of Money and Credit." Friedrich A. Von Hayek contributed considerably to the spread of this theory with the publication of "Monetary Theory and the Trade Cycle (1933)" and "Prices and Production" (1935), which further elaborated the Mises cycle theory.

As a first approximation, the Austrian Business Cycle (ABC) theory is based on the "misperception of the level of interest rates", as it claims that the upward phase of the cycle is the result of mistakes in intertemporal allocations caused by an interest rate that is "lower than it should be". The error lies in the fact that firms initiate production processes that presuppose the existence of a specific desire on the part of consumers to postpone consumption, although this is in fact incompatible with the actual profile of their time-preferences. The imminent abandonment or abridgment of the processes already initiated triggers the

downward phase of the cycle. This model reflects in a unified manner, on one hand, the typical presentation of the production process by Bohm-Bawerk, and, on the other hand, Wicksell's theory on the relationship between the natural and market interest rates.

The paper is organized as follows. Section 2 presents the theoretical assumptions of the Austrian monetary theory of cyclical fluctuations. Section 3 presents the econometric methods implemented here, and illustrates their findings. The conclusions are presented in section 4.

2. Theoretical Assumptions of the Austrian Theory

The ABC theory adopted the Wicksellian interest rate, that is, the natural interest rate. The natural interest rate is the equilibrium price determined by the supply of savings and the demand for loanable funds. In a free market, this clearing price is fully determined by the (subjective) "time-preference" of all the individuals that make up the market economy. As regards the term "time-preference", we should note that it reflects the degree to which an individual prefers the present to the future¹. Thus, the (subjective) time-preference plays an important role in the extent to which individuals save and invest, as compared to the extent they consume. It is obvious that when their time-preferences fall, individuals tend to reduce their consumption and increase their savings and investments. At the same time, the interest rate tends to decrease. (Hayek, 1931, 1933). Nevertheless, the ability of banks to create credit does not depend on savings, so that the "market interest rate", that is the interest rate applied on credit, can differ from the natural interest rate.

However, an essential and natural question that arises, and will be analyzed later is what happens to the economy when interest rates fall not because of lower time-preference but because of credit expansion.

We should note here that, according to Hayek (1935, 1941), changes in individuals' time-preferences (or the productivity of new technology) are the sole cause of permanent real changes in economic activity, since the savings resulting from the time-preference changes are consistent with the consumers' plans.

An interesting notion the Austrian school of economic thought introduced is that of the "time dimension" in consumption and production activities, from which stems the notion of "time-preference" as well as the hypothesis that the least direct production methods yield greater productivity (Hayek, 1933, 1935).

The above features relate directly to the Austrian theory of capital, whose destiny at the end of the 19th century and beginning of the 20th century was to be determined by "Capital and Interest", a book written by Bohn-Bawerk (1889). The contribution of Bohn-Bawerk's work lies in the idea that the primary element of all production activities using capital, in the sense of a set of reproducible means of production, is the *temporal correlation among events to form temporal event sequences*. In this case, the eventual technological transformations are characterized by complementarity and not interchangeability.

Time is considered to be a non-reversible succession of moments, so that the production structure at any given moment depends not only on the investments already made but also on the temporal sequence of these investments. The temporal structure of the production process studied by Bohn-Bawerk belongs to the continuous input-point output type. In the Austrian theory, capital is in fact considered in almost all cases as circulating capital. There is no place for fixed capital. The fact that there is another way to introduce time in the production process (the period of time during which the "machine" functions) was ignored. Thus, Bohn-Bawerk introduced the element of time in the analysis of consumption and the decisions concerning production.

The roundaboutness of Bohn-Bawerk's production (multidimensional in value and time), Mises and Hayek added the heterogeneous concept of physical capital. However, before analyzing this concept, we should refer to Hayek's "structure of production" and the relevant right triangle, which is fully compatible with Bohn-Bawerk's concept of capital as multidimensional in value and time. The horizontal base of the triangle represents the time dimension of the production process; the vertical leg represents the value of the consumable products. The time dimension is divided into a number of "stages of production," the output of one stage being the input of the next. A single "project" that converts (early-stage) raw materials into (final-stage) consumables concentrates the plans of several producers that are mutually coordinated by the price system, including the rate of interest (Garrison, 2001).

With a heterogeneous concept of capital, there are differential shifts in demand by capital type, in response to a change in the interest rate. Hayek related the interest rate directly to price margins between stages in the production structure. "The price of a factor which can be used in most early stages and whose marginal productivity there falls very slowly will rise more in consequence of a fall in the rate of interest than the price of a factor which can only

be used in relatively lower stages of reproduction or whose marginal productivity in the earlier stages falls very rapidly" (Hayek, 1967).

A basic hypothesis of the ABC theory is that when the market interest rate falls below the natural interest rate, investors prefer turning to capital intensive investment and expanding their investment in durable equipment, in capital goods, in industrial raw materials, and in construction (in other words to more capital intensive production processes) as compared to their direct production of consumer goods (less capital intensive production processes).

2.1 Credit-Induced Boom (Mises 1912)

What happens when the monetary authority injects new money / liquidity with the objective to reduce interest rates? Can this action result in market interest rates that are lower than natural interest rates? The artificial lowering of interest rates is not perceptible by the individuals of the market economy, who mistakenly consider the change in market interest rates to be permanent and genuine. As a result, consumers want to reduce their saving i.e. to shift consumption to the present, while entrepreneurs want to increase their investment spending. Thus, investment that used to seem unprofitable, especially those on longer production processes, now seem profitable. We cannot but observe a point of inconsistency here, as consumers want to consume less in the future, although there will be more output available in the future (because firms have undertaken longer production processes). Obviously, there is not a transfer of resources between savers and investors. Moreover, at a later stage, entrepreneurs, having this cheaper money, pay higher wages to the workers of the capital good industry. Once the workers start to spend this additional income, a series of troubles appear. However, their time-preference remains the same, which means that they do not want to save more than they have. So the workers set about to consume most of their new income, in short to re-establish the old consumer/saving proportions. This means that they redirect spending back to consumer goods industries, and they don't save and invest enough to buy newly produced machines, capital equipment, and industrial raw materials. A demand for consumer goods is thus created before these goods are available. As a result, the increase in the demand for consumer goods pushes upwards the current prices relating to future consumption goods, which corresponds to a rise in market interest rates.

Such firms, who overinvested in capital goods (and underinvested in consumer products), following the rise of interest rates realize that their investments have become unprofitable. Their next step is to reduce the demand for

workers employed in the production of capital goods, which in turn leads to the reduction of the workers' income. When firms attempt to return to their previous production structure, such a recession appears.

In fact, the artificially low interest rates created by the expansion of money supply lead to malinvestment or mismatch (a phrase used repeatedly by Mises (1966)) between investment and future consumption plans. This mismatch is the cause of the subsequent burst.

Could the recession phase be avoided? How could the monetary policy contribute to this?

The Austrian theorists claim that, once malinvestment takes place, any monetary effort such as a new injection of liquidity - Hayek calls this situation a secondary deflation -only postpones the associated recession, which is an inevitable (Hayek, 1933, 1935). To them, the economy should enter the phase of recession, so that the structure of production is readjusted to match the inter-temporal spending plans of consumers.

3. Empirical Investigation of the ABC Theory

3.1 Introduction

The structure of econometric analysis is the following: First, we detect the nature of the underlying stationary properties of each time series, using several unit root tests such as ADF and panel unit root tests; the latter are inevitable, because as they are suggested as a solution to the poor power problem of the previous test. Second, we apply cointegration analysis. The Johansen procedure (Johansen, 1988) is followed to find how many cointegrating relationships there are (and if there are) among their variables. Moreover, we use panel cointegration tests because of the beneficial effects in terms of power. The estimation of cointegration vectors has been performed using the fully modified (FM) OLS estimation technique for heterogeneous cointegrated panels (Pedroni, 2000). In order to study for causality at various horizons we apply the recent method of Dufour, Pelletier and Renault (2006).

All data come from the International Monetary Fund (IFS), cover the 1980:1-2005:4 period and concern the USA, Australia, Canada, the UK, Japan, Germany, Spain, France and Italy. The variables used in our analysis are: gross domestic product, gross fixed capital formation, credit, and interest rates (see Table 6 for more details).

Before, we start studying in detail the various econometric methods we will implement and their results, it is necessary to clearly define the ABC theory. As we have noted, the ABC theory follows a chain of economic events. The more interesting links of this chain are those connecting credit with investment and real output. We suppose that artificial changes of credit influence investment, which in turn give an impulse to the economic activity. These artificial changes of credit can be the result of changes in money supply or (directly) in interest rates, we note that changes in money supply can result in interest rates. The tools of the monetary policy that will be used depend on the monetary policy each country implements. In fact, the artificially induced-credit is the stimulated mechanism of economy.

Thus, we must investigate the relationships among the variables, which can be formed as follows:

$$y_{it} = \beta_{0i} + \beta_{1i}I_{it} + \beta_{2i}C_{it} + \beta_{3i}r_{it} + \beta_{4i}m_{it} + u_{it} \quad (1)$$

where y_{it} is output in country i and quarter t , I_{it} is the investment, C_{it} is the credit, m_{it} is the money supply and r_{it} is the interest rate.

3.2 Testing for Integration

In our paper, we initially use Dickey-Fuller (ADF) tests to testing for integration. Moreover, we apply three panel unit root tests: the IPS test, suggested by Im, Pesaran and Sin (2003), the MW test, suggested by Maddala and Wu (1999) and a test belonging to the same category, the Choi test, suggested by Choi (2001). These tests take non-stationarity as the null hypothesis.

The results from the ADF tests (see Table 1) indicate that at levels all the variables that are of interest to our analysis are non-stationary except for money in the United Kingdom. In their first differences, they do not contain unit roots according to the same test.

However, when we conduct the panel unit roots tests the results are clearer (see Table 2), so at levels the null hypothesis (unit root) is accepted for all the variables, while in the first differences of time series, the null hypothesis (unit root) is rejected. Therefore, all variables are integrated of order one in levels.

3.3 Testing for Cointegration

The strategy we follow in order to investigate the existence of long-run equilibrium relationships among the variables is presented below. We conducted

the Johansen (1988) and the panel cointegration (Pedroni, 1999) tests on variables.

In Table 3, we present country-specific Johansen cointegration results. The null hypothesis of at least one cointegration vector is accepted. Therefore, we concluded that the existence of a long-run equilibrium to which our variables in each country converges over time.

The results of Pedroni's panel cointegration tests (see Table 4) support the existence of one cointegration vector when using as dependent variables the output, investment and money supply and credit, if a heterogeneous specific trend is included.

3.4 Estimating the Cointegration Vector

For the estimation of the long-run relationship among the variables there are various estimators that can be used, which include within-and between-group fully modified OLS (FMOLS) and dynamic OLS (DOLS) estimators. FMOLS is a non-parametric approach to dealing with correlation for serial correlation, while DOLS is a parametric approach where lagged first-differenced terms are explicitly estimated².

In our study, we follow the method of fully modified OLS appropriate for heterogeneous cointegrated panel (Pedroni, 2000) in order to estimate (1). This method does not present the drawbacks of the OLS method of estimation. These drawbacks, as Pedroni notes, are associated with the fact that a standard panel OLS estimator is asymptotically biased and its distribution is dependent on nuisance parameters associated with the dynamics underlying processes of variables. To eliminate the problem of bias due to the endogeneity of the regressors, Pedroni developed the group-means FMOLS estimator by incorporating the Phillips and Hansen (1990) semi-parametric correction to the OLS estimator. He also adjusted the heterogeneity in the short run dynamics and fixed effects.

Consider the following cointegrated system for a simple two variable panel of $i = 1, \dots, N$ members,

$$y_{it} = \alpha_{it} + \beta x_{it} + \mu \tag{2}$$

$$x_{it} = x_{it-1} + \varepsilon_{it} \tag{3}$$

where the vector error process $\xi_{it}=(\mu_{it},\varepsilon_{it})$ is stationary with asymptotic covariance matrix Ω_i .

The FMOLS estimator is:

$$\hat{\beta}_{i,FMOLS}=N^{-1}\sum_{i=1}^N\left(\sum_{t=1}^T(x_{it}-\bar{x}_i)^2\right)^{-1}\left(\sum_{t=1}^T(x_{it}-\bar{x}_i)y_{it}^*-T\hat{y}_i\right) \quad (4)$$

where

$$y_{it}^*=(x_{it}-\bar{x}_i)-\frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}\Delta x_{it} \quad (5)$$

$$\hat{y}_{it}=\hat{\Gamma}_{21i}-\hat{\Omega}_{21i}^0-\frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}\left(\hat{\Gamma}_{22i}-\hat{\Omega}_{22i}^0\right) \quad (6)$$

where the $\hat{\Omega}$ and $\hat{\Gamma}$ are covariances and sums of autocovariances obtained from the long-run covariance matrix for the model.

The estimation of panel cointegration regression is done by imposing (and alternatively by not imposing) common time dummies in the regression. The common time dummies are different to common time trends, but these still impose homogeneity in this aspect across the i dimension of the panel, whereas heterogenous time trends allow for more general structure (Sollis and Harris, 2003). Fully modified OLS estimates of the cointegrating relationships are presented in Table 5 on a per country basis as well as for the panel as a whole.

For the panel, and including the time dummies, the coefficients of all variables are statistically significant when normalizing the equation so that output is the a dependent variable. Moreover, the effect of investment on output is positive and the estimated coefficient is 0.68 with t-statistic of 32.32. Credit has also a positive impact (0.18) on output. Money supply is statistically significant for output and the t-statistic is 2.94. However, interest rate has a negative impact (-0.08) on output. On a per country basis, investment has a positive impact on output but the relation is not statistically significant in Australia. The impact of credit on output is positive in all countries, but the relation in Italy

and Spain it is statistically insignificant. Moreover, in the USA, the estimated coefficient of credit is 0.22 with t-statistic of 2.76. In Japan, the corresponding estimated coefficient is 0.41 with t-statistic of 3.67. Money supply is statistically significant for output in the majority of countries, with only exception the case of Australia. In particular, money supply has a positive impact on output in the USA, Canada, Germany, France and Italy, but a negative impact upon the UK, Japan and Spain. Finally, interest rate is statistically significant in all countries. The sign of estimated coefficient is negative in the USA, Australia, Canada and Italy and the corresponding sign is negative in all other countries.

When investment is a dependent variable, we observe that all variables are statistically significant. The impact of credit on investment is positive (0.23) with t-statistic of 3.41. Interest rate has a marginally negative effect (-0.03) on investment. However, output and money supply have positive effect on output while the estimated coefficients are 1.04 in the case of output and 0.04 in the case of money supply. The t-statistics are 31.99 and 3.89, respectively. On a per country basis, we observe same differences with regard to the above findings, thus credit is statistically insignificant for investment in the case of Canada and Spain. Interest rates, respectively, in the case of Japan, while the sign of estimated coefficient is marginally positive in the case of the UK, Germany, Spain and France. Money supply is not statistically significant for investment in Australia. Moreover, the positive sign remains in the USA, the UK, Japan, Germany and Spain.

When credit is a dependent variable, all variables are statistically significant. The estimated coefficient of money supply is 0.21 with t-statistic of 9.00. Output has a positive effect (0.79) on credit. Moreover, investment has also a positive impact on credit. However, the sign of the estimated coefficient of interest rate is negative. On a per country basis, we observe that money supply is not supposed to be statistically significant in Canada and Germany. However, money supply has a negative impact on credit in Australia. Additionally, interest rate does not affect credit in Australia, Japan, France and Spain. In addition, investment does not influence credit in the case of Australia, Canada and Spain. The same behavior is observed in output (output does not affect credit), in the cases of Australia, Canada, Italy and Spain.

In the case of money supply, all the estimated coefficient are statistically significant. The corresponding coefficient of credit is 1.07 with t-statistic of 6.33. Interest rate has a negative impact on money supply. In addition, output has also a negative impact on money supply. However, the sign of estimated coefficient of investment on money supply is positive (2.24). On a per country basis,

the findings differentiate across the country. Particularly, credit has no impact on money supply in the case of Australia, Canada, Germany and Spain. Interest rate is not statistically significant in the UK, France and Italy.

Therefore, *the findings from the panel indicate that the sequence of events predicted by the Austrian business cycle theory is verified*. More specifically, we observe that, the main links of chain are verified, thus, investment has a positive impact on output. The impact of credit on output and investment is also positive. In addition, credit is positively influenced in a significant degree by money supply.

On a per country basis, there are minor differences amongst the countries according to our findings. In the USA, in the UK, Japan, France and Italy, the ABC theory is verified, while in Spain, Canada, Australia and Germany not all parts of the chain of the ABC theory seem to match.

4. Summary of the Findings

In this paper we have combined cross-sectional and time series data in order to verify the Austrian theory of the business cycle in nine countries. For this purpose, we have implemented several econometric methods.

We used the method of fully modified OLS appropriate for heterogeneous cointegrated panel in order to estimate the relationships among the variables, which describe the ABC theory. The findings from the panel indicate that the chain of events in the ABC theory is verified. More specifically, the main links of chain are verified, thus, investment has a positive impact on output. The impact of credit on output and investment is also positive. Credit is positively influenced in a significant degree by money supply. On a per country basis, there are minor differences amongst the countries according to our findings. In the USA, in the UK, Japan, France and Italy, the ABC theory is verified, while in Spain, Canada, Australia and Germany not all parts of the chain of the ABC theory seem to match.

Our results favour the Austrian theory when FOLMS estimation is used.

Notes

1. The product of time-preference is the originary rate of interest, as noted by Mises (1966), who argued that there is always a discount in the price of future goods compared to the price of those same goods in the present. This discounting process is applied to all goods, not just money or capital. "If future goods were not bought and sold at a discount as against present goods, the

buyer of land would have to pay a price which equals the sum of all future net revenues and which would leave nothing for a current reiterated income."

2. Pedroni (2001) has suggested a between-dimension, group-means panel DOLS estimator that incorporates corrections for endogeneity and serial correlation parametrically. He used the following regression model which includes lead and lag dynamics:

$$y_{it} = \alpha_i + \beta_i x_{it} + \sum_{j=K_i}^{K_i} \gamma_{ik} \Delta x_{i,t-k} + e_{it} \quad \text{where}$$

$$\hat{\beta}_{i,DOLS} = \left[N^{-1} \sum_{i=1}^N \left(\sum_{t=1}^T z_{it} z_{it}' \right)^{-1} \left(\sum_{t=1}^T z_{it} \bar{y}_{it} \right) \right]_1 (*) \quad \text{and } z_{it} \text{ is the } 2(k+1) \times 1 \text{ vector of}$$

regressors $z_{it} = \left\{ (x_{it} - \bar{x}_i), \Delta x_{it}, \dots, \Delta x_{it+K} \right\}$; $\bar{y}_{it} = y_{it} - \bar{y}_i$; the subscript 1 outside the brackets in (*) indicates that only the first element of the vector is taken to obtain the pooled slope coefficient.

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TABLE 1: Unit Root Tests for the Variables of the ABC Theory

Countries	Levels	First Differences	Money Supply	Levels	First Differences	Credit	Levels	First Differences
United States	-2,366	-3,12***		-1,673	-3,151***		-1,925	-3,974**
Australia	-2,906	-10,737*		-2,494	-10,862*		-1,702	-2,903***
Canada	-2,635	-3,444***		-1,853	-12,032*		-2,359	-10,987*
United Kingdom	-2,570	-3,81**		-3,412***	-11,008*		-2,159	-3,509***
Japan	-2,254	-5,3*		-1,038	-5,123*		-2,182	-4,635*
Germany	-2,322	-4,244*		-1,758	-4,335*		-2,390	-4,278**
France	-2,598	-5,901*		-1,813	-4,127*		-1,05	-2,592***
Italy	-2,124	-10,321*		-1,783	-3,497**		-2,233	-2,98***
Spain	-1,823	-5,974*		-2,383	-3,456**		-1,820	-2,656***
United States	-2,273	-4,164*	Leading Rates	-1,906	-5,974*			
Australia	-2,916	-6,541*		-2,020	-5,921*			
Canada	-2,737	-4,336*		-2,980	-5,36*			
United Kingdom	-3,179	-10,188*		-2,343	-9,087*			
Japan	-2,567	-5,676*		-1,301	-2,88***			
Germany	-1,975	-4,179*		-3,224	-7,218*			
France	-2,837	-10,518*		-1,506	-7,034*			
Italy	-2,902	-10,094*		-1,862	-10,532*			
Spain	-2,315	-5,055*		-1,823	-2,208***			

Note: (*), (**), (***) signify rejection of the unit root hypothesis at the 1%, 5% and 10% levels, respectively.

TABLE 2: Panel Unit Root Tests for the Variables of the ABC Theory

Variables	IPS		MW		Choi	
	Levels	First Differences	Levels	First Differences	Levels	First Differences
GDP	-0,663	<i>-13,611</i>	15,939	206,981	-0,558	<i>-11,162</i>
Money Supply	-0,126	<i>-16,574</i>	16,267	262,356	0,086	<i>-12,691</i>
Credit	-1,391	<i>-16,225</i>	13,104	270,132	0,261	<i>-13,179</i>
Lending Rate	-0,414	<i>-22,821</i>	15,277	193,111	-0,338	<i>-13,372</i>
Investment	-0,945	<i>-16,994</i>	18,179	291,909	-0,877	<i>-14,533</i>

Note: The critical values for MW test are 37,57 and 31,41 at 1% and 5% statistical levels respectively. *Italics values signify rejection of the null hypothesis.*

TABLE 3: Johansen Cointegration Tests

Country	H0: rank = r								
1980:1-2005:4									
(a) Trace Statistic	$r=0$ (69,818)	$r \leq 1$ (47,856)	$r \leq 2$ (29,797)	$r \leq 3$ (15,494)	$r \leq 4$ (3,841)				
(b) Max Eigenvalue Statistic	$r=0$ (33,876)	$r \leq 1$ (27,584)	$r \leq 2$ (21,131)	$r \leq 3$ (14,264)	$r \leq 4$ (3,841)				
United States	(a) 123,183	80,690	50,744	21,188	3,687	6 lags	Lending Rate,		
	(b) 42,493	29,946	29,556	17,501	3,687		Money Supply,		
Australia	(a) 89,532	53,311	25,123	6,255	0,538	4 lags	Investment,		
	(b) 36,221	28,188	18,868	5,717	0,538		GDP		
Canada	(a) 80,446	45,252	25,786	8,249	3,006	2 lags			
	(b) 35,193	19,466	17,537	5,243	3,006				
United Kingdom	(a) 74,322	40,937	17,475	9,898	4,310	5 lags			
	(b) 33,985	23,462	7,577	5,588	4,310				
Japan	(a) 101,776	63,315	35,043	13,304	1,355	6 lags			
	(b) 38,461	28,272	21,739	11,949	1,355				
Germany	(a) 100,335	56,495	35,062	19,303	8,350	6 lags			
	(b) 43,840	21,433	15,759	10,953	8,350				
France	(a) 100,818	62,208	29,093	12,689	0,078	5 lags			
	(b) 38,611	33,114	16,405	12,611	0,078				
Italy	(a) 132,782	68,393	28,002	12,318	0,131	4 lags			
	(b) 64,390	40,390	15,684	12,187	0,131				
Spain	(a) 87,857	47,147	24,287	10,323	0,439	5 lags			
	(b) 40,710	22,859	19,965	9,884	0,439				

Note: Numbers in parentheses represent the 5% critical values of the two test statistics, r denotes the number of cointegrating vectors. The eight column contains the optimal lag for the VARs that were selected by minimising the AIC criterion. Finally, boldface values detect evidence in favor of cointegration.

TABLE 4: Panel Cointegration Tests

Dependent variable:		no trend	trend
Output	PP rho-statistic	1,389	2,763
	PP t-statistic	1,230	3,379
	ADF t-statistic	2,863	3,967
Investment	PP rho-statistic	1,492	2,344
	PP t-statistic	1,112	2,638
	ADF t-statistic	1,235	2,932
Credit	PP rho-statistic	2,992	4,679
	PP t-statistic	3,150	4,389
	ADF t-statistic	0,857	2,422
Money supply	PP rho-statistic	1,274	2,784
	PP t-statistic	1,391	2,859
	ADF t-statistic	1,420	2,731
Interest Rates	PP rho-statistic	0,769	-0,038
	PP t-statistic	-1,233	-0,984
	ADF t-statistic	-1,743	-1,271

Note: Boldface values detect evidence in favor of cointegration.

TABLE 5: FMOLS Results

Fully modified OLS estimates (dependent variable is output)

common time dummies included

	Investment	Credit	Lending Rate	Money Supply
United States	0,67 [13,51]	0,22 [2,76]	-0,05 [-3,93]	0,13 [3,45]
Australia	0,01 [0,42]	0,08 [1,35]	-0,09 [-4,25]	0,01 [0,42]
Canada	0,72 [10,94]	0,14 [1,93]	-0,03 [-3,38]	0,04 [2,16]
United Kingdom	1,01 [8,94]	0,08 [2,52]	-0,08 [-2,52]	-0,13 [-2,75]
Japan	0,70 [7,27]	0,41 [3,67]	0,00 [-1,88]	-0,17 [-4,83]
Germany	0,36 [4,56]	0,02 [3,28]	0,01 [2,92]	0,15 [3,53]
France	0,62 [6,37]	0,06 [1,87]	0,00 [-2,37]	0,06 [2,59]
Italy	0,56 [3,92]	0,08 [0,4]	-0,15 [-5,72]	0,08 [1,53]
Spain	0,69 [23,07]	0,02 [0,43]	0,00 [-2,2]	-0,02 [-7,31]
	0,68 [32,32]	0,18 [4,46]	-0,08 [-5,95]	0,11 [2,94]

Fully modified OLS estimates (dependent variable is investment)

common time dummies included

	GDP	Credit	Lending Rate	Money Supply
United States	1,28 [12,3]	0,07 [2,68]	-0,05 [-4,52]	0,08 [1,67]
Australia	1,19 [17,44]	0,06 [2,17]	-0,01 [-4,71]	0,00 [-0,04]
Canada	1,20 [11,87]	0,00 [-0,05]	-0,04 [-2,78]	-0,05 [-1,88]
United Kingdom	0,78 [9,34]	0,06 [1,96]	0,01 [4,14]	0,08 [1,75]
Japan	0,96 [7,75]	0,08 [3,55]	0,00 [0,54]	0,23 [6,18]
Germany	1,08 [4,34]	0,36 [2,53]	0,01 [1,61]	0,11 [2,72]
France	0,96 [6,39]	0,43 [3,12]	0,00 [2,23]	-0,12 [-3,71]
Italy	0,56 [3,66]	0,64 [3,49]	-0,03 [-1,87]	-0,11 [-1,99]
Spain	1,39 [22,87]	0,01 [0,19]	0,01 [2,06]	0,03 [8,87]
	1,04 [31,99]	0,23 [3,41]	-0,03 [-4,16]	0,04 [3,89]

Fully modified OLS estimates (dependent variable is credit)

common time dummies included

	GDP	Investment	Lending Rate	Money Supply
United States	1,60 [2,53]	0,22 [1,68]	-0,02 [-1,78]	0,31 [6,15]
Australia	0,45 [0,49]	-0,21 [-0,29]	0,00 [-0,68]	-0,27 [-1,89]
Canada	0,83 [1,38]	0,03 [0,07]	-0,11 [-3,12]	0,01 [0,2]
United Kingdom	2,71 [2,83]	-1,08 [-2,1]	0,04 [2,4]	0,92 [3,81]
Japan	0,94 [3,88]	-0,20 [-1,81]	0,00 [-1,21]	0,26 [2,34]
Germany	0,03 [0,06]	0,68 [2,77]	-0,04 [-3,17]	-0,10 [-0,73]
France	-0,10 [3,37]	0,63 [3,37]	0,00 [0,09]	0,21 [10,05]
Italy	0,04 [0,23]	0,48 [3,31]	0,00 [2,25]	0,21 [6,14]
Spain	0,64 [0,8]	-0,05 [-0,09]	0,00 [0,07]	0,02 [1,91]
	0,79 [3,95]	0,15 [1,85]	-0,08 [-1,84]	0,21 [9,00]

continues

TABLE 5: FMOLS Results**Fully modified OLS estimates (dependent variable is money supply)**

common time dummies included

	GDP	Investment	Credit	Lending Rate
United States	0,78 [2,11]	1,12 [0,81]	1,23 [4,43]	-0,09 [-2,35]
Australia	0,98 [0,8]	-0,23 [-0,23]	-0,01 [-1,40]	-0,51 [-1,97]
Canada	4,37 [2,58]	-2,82 [-1,99]	0,07 [0,11]	-0,08 [-2,28]
United Kingdom	-1,94 [-3,1 8]	1,41 [1,93]	0,32 [3,13]	0,02 [1,26]
Japan	-1,86 [-5,4]	2,67 [6,23]	1,1 6 [2,53]	-0,01 [-1,54]
Germany	1,75 [3,20]	0,32 [0,94]	-0,28 [-1,04]	-0,06 [-5,64]
France	1,90 [1,81]	-2,50 [-3,27]	3,65 [9,68]	0,00 [0,65]
Italy	0,91 [1,47]	-1,11 [-1,84]	2,69 [6,01]	0,01 [0,92]
Spain	-2,99 [-7,07]	22,21 [8,69]	0,20 [0,12]	-0,11 [-3,82]
	-0,58 [-2,58]	2,34 [3,75]	1,07 [6,33]	-0,09 [-4,55]

Fully modified OLS estimates (dependent variable is leading rate)

common time dummies included

	GDP	Investment	Credit	Money Supply
United States	-60,02 [-2,71]	53,02 [3,71]	-0,46 [-0,07]	-2,83 [-1,1 7]
Australia	72,73 [-3,47]	66,33 [4,22]	-4,88 [-0,92]	-4,92 [-1,24]
Canada	-7,41 [-0,63]	9,93 [1,05]	-2,46 [-0,60]	-2,12 [-1,73]
United Kingdom	-18,64 [-2,58]	32,13 [4,13]	3,22 [2,37]	2,47 [1,1 8]
Japan	18, 10 [0,99]	5,86 [0,36]	-14,55 [-1,17]	-6,30 [-1,36]
Germany	41, 99 [2,71]	18,24 [1,97]	-25,51 [-3,88]	-20,08 [-5,37]
France	-10,80 [-3,09]	80,33 [2,82]	3,21 [0,13]	4,43 [0,78]
Italy	-66,14 [-5,68]	8,46 [0,57]	3,12 [0,70]	49,83 [3,42]
Spain	58,63 [-1,89]	40,62 [1,90]	1,62 [0,90]	-2,47 [-3,22]
	-36,83 [-5,45]	34,99 [6,97]	1,11 [-0,18]	-3,19 [-3,81]

Note: Figures in brackets are t-statistics.

TABLE 6 : Data Description

1990Q1--2005Q4	Billions	GDP	Investment	Credit	Interest Rates	Money Supply	Exchange Rates
							National Currency per US Dollar
1	USA	GROSS DOMESTIC PRODUCT 111995 CZF 158995 CZF	GROSS FIXED CAPITAL FORMATION 11193E CZF 15893E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	11134_ZF 16635_ZF 16635_ZF	QUASH-MONEY 11135_ZF 16635_ZF
2	Australia	GROSS DOMESTIC PRODUCT SA 163995 CZF 158995 CZF	GROSS FIXED CAPITAL FORMATION SA 16399E CZF 15893E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	16634_ZF 16635_ZF	QUASH-MONEY 166_AE_ZF 166_AE_ZF
3	Canada	GROSS DOMESTIC PRODUCT SA 158995 CZF 158995 CZF	GROSS FIXED CAPITAL FORMATION SA 15893E CZF 15893E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	16634_ZF 16635_ZF	QUASH-MONEY 156_AE_ZF 156_AE_ZF
4	UK	GROSS DOMESTIC PRODUCT SA 112995 CZF 112995 CZF	GROSS FIXED CAPITAL FORMATION SA 11293E CZF 11293E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	11236L_ZF MONEY PLUS QUASH-MONEY	112_AE_ZF MARKET RATE
5	Germany	GROSS DOMESTIC PRODUCT SA 134995 CZF 134995 CZF	GROSS FIXED CAPITAL FORMATION SA 13493E CZF 13493E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	13434_ZF 13435_ZF	QUASH-MONEY 134_AE_ZF 134_AE_ZF
6	Japan	GROSS DOMESTIC PRODUCT SA 158995 CZF 158995 CZF	GROSS FIXED CAPITAL FORMATION SA 15893E CZF 15893E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	15834_ZF 15835_ZF	QUASH-MONEY 158_AE_ZF 158_AE_ZF
7	France	GROSS DOMESTIC PRODUCT SA 163995 CZF 163995 CZF	GROSS FIXED CAPITAL FORMATION SA 16399E CZF 16399E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	16234_ZF 16235_ZF	QUASH-MONEY 162_AE_ZF 162_AE_ZF
8	Italy	GROSS DOMESTIC PRODUCT SA 136995 CZF 136995 CZF	GROSS FIXED CAPITAL FORMATION SA 13693E CZF 13693E CZF	Global FinData of the SDW at the ECB Loans for Investment	Global FinData of the SDW at the ECB Lending Rate	13634_ZF 13635_ZF	QUASH-MONEY 136_AE_ZF 136_AE_ZF
	Euro Area						163_AE_ZF MARKET RATE

Sources: A) International Monetary Fund, International Financial Statistics. B) SDW at ECD.