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Eurozone cycles: an analysis of phase synchronization

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This paper examines the extent of synchronization in business and financial (growth and classical) cycles both across and within a representative sample of Eurozone countries for the period 1960 to 2013. We find evidence of synchronization across classical and growth financial cycles. We also find significant concordance across growth business cycles. No evidence of a classical business cycle was detected confirming that concordance in business cycles arises from synchronized deviations from the trend rather than synchronization of the underlying macroeconomic fundamentals.

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* Queen Mary, University of London Mile End Road, London, E1 4NS, UK (e-mail: b.granville@qmul.ac.uk); (sana.hussain@qmul.ac.uk).

1. Introduction

In 2007-08, many Eurozone members faced a systemic crisis (Reinhart and Rogoff, 2014) prompting research on the interaction of business and financial cycles (Claessens, Kose and Terrones, 2012; Egert, B. and D. Sutherland, 2014). Since then the Eurozone has known periods of recession and major slowdowns in economic activity. These recessions and slowdowns, given their duration and amplitude, have created considerable hardship. If business cycles are not synchronized, a one-size-fits-all monetary policy may not be optimal as some countries will be in the contraction phase while others will be in the recovery phase of their cycles. Existing literature on this topic is divided but tends to point to a lack of evidence of a common business cycle in the Eurozone (Hallett and Richter, 2008).

The motivation of this paper is to shed light on the degree of synchronization in the Economic and Monetary Union (EMU) business and financial (classical and growth) cycles across a subset of ten countries representative of the EMU for the full period 1960-2013 and in different sub-periods for both business and financial cycles. Both classical and growth cycles are examined in order to not only analyze synchronization in recessions and expansions but also synchronization in high-growth and low-growth periods.

Burns and Mitchell (1946: 3) define classical business cycles as the sequential pattern of expansions (the time period from a trough to a peak) and recessions (the time period from a peak to a trough) in the level of economic activity, stating that "this sequence of change is recurrent but not periodic". The Burns and Mitchell rules guided the National Bureau of Economic Research (NBER) procedure for producing the reference dates of the business cycle for the United States. For

classical financial cycles, the expansion phase is termed an upturn and the contraction phase downturn (Claessens, Kose and Terrones, 2012: 180).

While classical and growth cycles are related, the growth cycle measures the changes in growth rates rather than in levels of economic activity and is defined as the deviation of the variable of interest from its long term trend (Kydland and Prescott, 1990). Therefore contrary to classical cycles, the trend and cyclical components have to be separated for identifying growth cycles. This requires identifying "the factors determining long run economic growth from those determining cyclical fluctuations" (Stock and Watson, 1999: 9). However, breaking down the relevant time series into trends and cycles is not easy as both the trend and cycle influence each other and an appropriate filtering technique is required.

Filtering works by preserving or eliminating the movements of time series that are caused by stochastic cycles of specified frequencies. The filtered series is an indicator of the fluctuations in the series, measuring the cyclical component. This cyclical component is the growth cycle whose turning points we are interested in locating. The 'ideal' filter needs an infinite number of past and future observations which is not possible with a finite data set (Stock and Watson, 1999: 12). As a result, the advantages and disadvantages of various filtering techniques have been at the center of a large literature in search of a filter close enough to the 'ideal' filter for finite economic time series (Estrella, 2007; Hodrick and Prescott, 1997; Baxter and King, 1999; Artis, Krolzig and Toro, 2004; Zarnowitz and Ozyildirim, 2006). The time period from a peak to a trough in growth cycles is referred to as a high-rate phase, characterized by a sequence of increases in the positive deviation of the relevant variable from its trend. Similarly the time period from a trough to a peak is referred to as a low-rate phase, characterized by a sequence of increases in the negative deviation of the relevant variable from its trend (Cashin, 2004).

Following this introduction, section 2 presents our data and methodology. Concordance indices are used to investigate the extent of co-movement in economic cycles. Section 3 observes the synchronization of the different phases (recessions and expansions) of business cycles (measured by industrial production series) across our EMU members sample; the different phases (downturns and upturns) of financial cycles (measured by equity prices) across these euro members; and the concordance between business and financial cycles. We test whether this co-movement or concordance is statistically significant and whether it has intensified or diminished over time. Section 4 provides concluding comments.

2. Data and Methodological Considerations

2.1 Data

The data were obtained from the OECD statistics database for ten countries selected as representative of the Eurozone: Austria, Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

For business cycles, we use 10 seasonally adjusted monthly time series of the industrial production index from 1960:1 through 2013:12. Industrial production refers to the volume of output generated by production units classified under the industrial sectors such as mining, manufacturing and electricity, gas and water of the International Standard Industrial Classification (ISIC) of all economic activities. The data measure volume changes over time as indices, seasonally adjusted with 2010 as the base year.

For financial cycles, we consider 10 monthly time series of the share price index from 1957:1 through 2013:12. The OECD database defines the share price index as the prices of companies traded on national or foreign stock exchanges. The share price index is an indicator of fluctuations in the equity market and can

be viewed as a proxy for fluctuations in the overall financial markets. Monthly data are simple arithmetic averages of the closing daily values with 2010 as the base year.

2.2 Methodological considerations

Observed patterns of synchronization depend on the choice of measurement methods. This choice concerns the cycle, classical versus growth, the concordance, correlation versus concordance index, and the detrending technique, linear, band pass or high pass (Hallett and Richter, 2008: 73). We follow Hodrick and Prescott (1997: 2) in assuming "that no one approaches dominates all the others and that it is best to examine the data from a number of different perspectives". Our methods consist of first detecting cycles by identifying turning points and second determining synchronization by calculating concordance indices.

2.2.1 Identifying turning points

For identifying classical cycles we apply the Bry-Boschan algorithm to the natural logarithm y_t , of the monthly index of industrial production Y_t over the years 1960-2013 and the natural logarithm p_t , of the monthly index of share prices P_t over the years 1957-2013. Our censoring rules follow the NBER definition: cycles must have a minimum length of 15 months, phases must have a minimum length of 6 months and the window over which local maxima (peaks) and minima (troughs) are computed is 5 months (table 1).

[Insert table 1 here]

A business cycle peak is defined and occur at time 't' if:

$$\{y_t > (y_{t-5}, y_{t-4} \dots y_{t-1}) \; and \; y_t > (y_{t+1}, y_{t+2} \dots y_{t+5})\}$$

and a trough occur at time 't' if:

$\{y_t < (y_{t-5}, y_{t-4} \dots y_{t-1})\ and\ y_t < (y_{t+1}, y_{t+2} \dots y_{t+5})\}$.

Similarly, a financial cycle peak occur at time 't' if:

$\{p_t > (p_{t-5}, p_{t-4} \dots p_{t-1})\ and\ p_t > (p_{t+1}, p_{t+2} \dots p_{t+5})\}$

and a trough occurs at time 't' if:

$\{p_t < (p_{t-5}, p_{t-4} \dots p_{t-1})\ and\ p_t < (p_{t+1}, p_{t+2} \dots p_{t+5})\}$.

For identifying growth cycles, we first filter y_t and p_t before applying a modified version of the Bry-Boschan algorithm to the filtered series. We use the Baxter-King (BK) and the Hodrick-Prescott (HP) filter methods to extract the cyclical component of our industrial production and share price index series.

The BK is a band-pass linear filter which "isolates the periodic components of an economic time series that lie in a specific band of frequencies"[…] eliminating "very-slow moving ("trend") components and very high-frequency ("irregular") components while retaining intermediate ("business-cycle") components" (Baxter and King, 1999: 576). We adopt the NBER business cycle periodicities which range between 1.5 and 8 years.

The HP filter decomposes the behavior of an economic time series into a growth component (trend) and a stationary cyclical component. Trend movements are removed by the HP filter that allows only high frequency movements but blocks the movements with frequencies lower than the 'cutoff' frequency. The assumption is that the trend "varies "smoothly" over time", adjusted by adapting a parameter, λ, to the frequencies of observations and to the phase of the cycle under study (Hodrick and Prescott, 1997: 3). The bigger λ the smoother is the trend. For quarterly data, the value of λ=1600 proposed by Hodrick and Prescott (1997: 4) seems to be broadly accepted by the literature. With annual and monthly frequencies, the choice of the value for λ is more controversial (Baxter and King, 1999; Ravn and Uhlig, 2002). For our monthly data, the value of λ=14,400 is applied by Zarnowitz and Ozyildirim (2006) while Ravn and Uhlig (2002: 374)

prefer a value of λ=129,600. For greater robustness we use both values. Zarnowitz and Ozyildirim (2006) however note that increasing the value of λ (in their case, from λ=14,400 to λ=108,000) made only minor differences in the HP estimate of the cyclical component.

For the identification of growth cycles in the filtered series, we follow Dungey and Pagan, (2000) in modifying the Bry and Boschan (1971) censoring rules, namely that cycles must have a minimum length of 18 months, phases must have a minimum length of 9 months and the window over which local maxima and minima are computed is 8 months. This modification is carried out given that two quarters of negative growth which characterizes a classical business cycle recession is very different from two quarters of below-trend growth, so the same rules cannot be used to date both classical and growth cycles.

2.2.2 Determining phase synchronization: calculating concordance indices

The determination of the extent of synchronization in cycles involves quantifying the degree of overlap in the phases of our identified cycles. Harding and Pagan (2002) measure co-movement of cycles by the degree of concordance, termed as the concordance index, $I^{\wedge}$. This index indicates the proportion of time that two cycles are in the same phase. The concordance index is calculated by first associating the phases of our identified cycles with a binary random variable S_t that takes the values unity (corresponding to expansions and upturns) and zero (corresponding to recessions and downturns) (Harding and Pagan, 2006). We define binary random variables S_{xt} and S_{yt} for two time series x_t and y_t such that when series x_t is in an expansionary phase, S_{xt} = 1, else S_{xt} = 0, and similarly when series y_t is in an expansionary phase, S_{yt} = 1, else S_{yt} = 0. The expected values of S_{xt} and S_{yt} are denoted by μ_{s_x} and μ_{s_y} respectively, and are interpreted

as the fraction of the time that the relevant series is in the expansion/upturn phase. The concordance index $\hat{I}$ between the two series is then calculated as follows:

$$\hat{I} = \frac{1}{T}\{\sum_{t=1}^{T} S_{xt}S_{yt} + \sum_{t=1}^{T}(1 - S_{xt})\left(1 - S_{yt}\right)\}$$

where T is the sample size.

"The concordance index has a maximum value of unity when $S_{xt} = S_{yt}$, and zero when $S_{xt} = (1 - S_{yt})$"(Harding and Pagan, 2006: 65).

Therefore the value of the index ranges between 0 and 1. A value of 0 indicates perfect discordance whereas a value of 1 indicates perfect concordance. A value of 0.5 indicates that there is no systematic relationship between the two series. To avoid autocorrelation problems, Harding and Pagan (2006: 68) propose to test the significance of the concordance index by the following regression:

$$\hat{\sigma_{s_x}}^{-1}\hat{\sigma_{s_y}}^{-1}S_{yt} = \alpha_1 + \rho_s\hat{\sigma_{s_x}}^{-1}\hat{\sigma_{s_y}}^{-1}S_{xt} + u_t \qquad (1)$$

where $\hat{\sigma_{s_x}}$ and $\hat{\sigma_{s_y}}$ are the estimated standard deviations of S_{xt} and S_{yt} respectively, ρ_s is the correlation coefficient under the assumption of mean independence and the null hypothesis of no concordance corresponds to $\rho_s = 0$. The t-statistic is used to evaluate the statistical significance of the null hypothesis of no concordance between the two series. To get the correct t-statistic associated with $\hat{\rho_s}$ Harding and Pagan (2006: 68-69) suggest the use of heteroscedastic and autocorrelation consistent (HAC) standard errors. Therefore we use GMM estimation with a HAC covariance matrix, selecting the Bartlett kernel and Newey and West fixed bandwidth.

2.2.3. Determining how concordance evolves over time: breaking the full sample time period into sub-periods

To refine our analysis, we examine the evolution of cyclical concordance over time by breaking down the full sample period into sub-periods. For this, we observe the change in the mean and volatility of our industrial production and share price time series over the full sample. Plotting the rolling 24 month standard deviation (SD) and mean of our industrial production and share price index series allows us to identify the major points of change in each of the series and to note the dates at which the series appear to break. After jointly analyzing the break dates for the SD and mean showed in figures 5 and 6, the common break dates that best fit the country overall are chosen. Once we have break dates for each country, we analyze them collectively and select our final subsample periods based on the common break dates that best fit all countries.

3. Concordance Analysis

3.1. Concordance across business cycles

Table 2 shows that the HP growth cycles (col.2) are generally more frequent, whether produced by λ=14,400 or λ=129,600, than BK growth cycles (col.3) and classical cycles. The choice of a higher λ does not make much difference in the number of HP growth cycles. Cogley and Nason (1995) warn about the possibility that the HP filter may generate cyclical patterns in series that are not cyclical while Harvey and Jaeger (1993) highlight the danger of the filter producing arbitrary cycles. In addition, the performance of the HP filter at time series endpoints is seen as sub-optimal by Mise, Kim and Newbold (2005). For these reasons and because the BK band pass filter is theoretically superior eliminating both high and low frequency changes (Scott and Watson, 1999), our subsequent empirical work on growth cycles is conducted using only the cycles identified by

the BK band-pass filter. Figure 1 shows the business cycle plots for each country in our sample. As evident from the graphs, there are more growth cycles compared to classical ones. Also, the latter exhibit greater dissimilarity while the former are more alike. Countries like Greece, Portugal and Spain experience falling levels of output post 2007 as observed in the classical cycle graphs. The growth cycle graphs indicate ever greater instability in the cyclical component of output post 2007 which was a period characterized by the onset of the financial crisis.

[Insert table 2 here]

Table 3 shows that for both classical and growth cycles, the average duration, amplitude, slope and cumulative loss (in case of recessions and low-rate phases only) differ across countries.

[Insert table 3 here]

A growth business cycle low-rate phase varies in duration from 14 months (Greece) to 20.7 months (Austria) while a classical business cycle recession varies in duration from 12.3 months (Ireland) to 18.9 months (Italy). The growth cycle cumulative loss oscillates between 29% (Greece) and 61% (Austria) while for the classical cycle, between 27% (Austria) and 121% (Greece). The former observation may lead one to conclude that Greece is better off compared to Austria, however since these figures correspond to the growth cycle, i.e. they represent the loss resulting from the deviation of output from the trend path. With a higher trend growth of output, such deviations are likely to be bigger.

The range of the growth cycle low-rate phase amplitude (decline in industrial production from peak to trough) is 4% to 6% while the classical one is higher, 5% to 12%. The ratio of amplitude to duration –the slope – measures the strength of a

recession or low-rate phase and varies for growth cycles from 0.28% (Greece) to 0.42% (Italy) and for classical cycles from 0.45% (Austria) to -1.04% (Ireland).

The average duration of high-rate phases of growth business cycles ranges from 17 months (Ireland, The Netherlands, Portugal) to 23 months (Austria) while for classical business cycle expansions, the range is between 16 months (The Netherlands, Denmark, Belgium) and 26 months (Austria). The average amplitude of high-rate phases of growth business cycles also varies between 4% to 6% while the average amplitude of classical cycle expansions is much higher, ranging from 15% to 33%. The slope of the high-rate phase of growth business cycles varies between 0.22% (Spain) to 0.34% (Ireland) and the slope of classical cycle expansions ranges from 0.41% (France) to 1.30% (Ireland).

Tables 4.A and 5.A present the statistics $\{\hat{I}, \hat{\rho_s}, \hat{\mu_s}\}$ for the growth and classical cycles in industrial production over the full sample period 1960-2013. The corresponding t-statistics are shown in tables 4.B and 5.B. The concordance indices $\hat{I}$, are reported above the diagonal while the correlation coefficients $\hat{\rho_s}$, are below the diagonal. The fraction of time the industrial production series spends in the expansion phase (for classical cycles) and the high-rate or above trend growth phase (for growth cycles) denoted by $\hat{\mu_s}$ is provided in the bottom row. The average concordance index for each country with the nine other EMU members is reported in the last column.

[Insert tables 4.A and 4.B here]

Most reported values in table 4.A of average concordance statistics ranged above 65% with the exception of Portugal (58%) indicating that industrial production in 9 countries spends 65% of their time in the same state of the growth cycle. The lowest values are observed for Greece, Ireland and Portugal while the highest average concordance occurs in France (76%).

[Insert tables 5.A and 5.B here]

The concordance indices between classical cycles reported in table 5.A are lower than their growth cycle counterparts in table 4.A, with a greater number exhibiting lack of statistical significance. Cyclical movements in trend-adjusted industrial production are generally more significant than cyclical movements in trend-unadjusted industrial production. Countries spend more time together in the same phase of their growth cycles rather than classical cycles - there are signs of greater co-movement in above trend and below trend growth rates of industrial production compared to classical expansions and recessions. Therefore, concordance across countries is mainly resulting from co-movement of deviations of industrial production from its long-term trend, i.e. countries high-rate and low-rate phases are more synchronized than their recessions and expansions. This suggests that the concordance in business cycles across countries during 1960-2013 arises from synchronized deviations rather than synchronization of the underlying macroeconomic fundamentals.

Tables 6.A and 6.B show how the concordance indices of growth and classical cycles in industrial production evolve over sub-periods based on the common break dates that best fit all countries as shown in figure 5. For each sub-period, the concordance statistic $\hat{I}$ is reported above the diagonal and the t-statistic from regression (1), below the diagonal. The concordance indices marked *, ** and *** indicate significance at 10%, 5% and 1% respectively. The fraction of time spent in expansions (for classical cycles) and high-rate phase (for growth cycles), $\hat{\mu_s}$, is shown in the bottom row for each respective sub-period.

[Insert table 6.A here]

For growth cycle (table 6.A), the average concordance changes over the period 1960-2013: there is a sharp rise in concordance from 1960-67 to 1968-1973, from

49% to 75%, an increase of approximately 53%. Concordance stabilized at 70% over the period 1974 to 1983 and then declined to 61% during 1984-1992. Concordance rises again from 67% in 1993-2002 to 75% in 2003-2008 and peaks in 2009-2013 at 96%, at the time of the Eurozone crisis. If we exclude the period 2009-2013 when almost all countries were contracting, the highest average concordance of 75% is observed in 1968-1973 and 2003-3008. The period 1968-73 was marked by the statistically insignificant concordance indices being more randomly distributed across country pairs while, in the period 2003-2008, insignificant concordance indices are observed for country pairs badly hit by the euro crisis such as Portugal or Ireland.

[Insert table 6.B here]

For classical cycles (table 6.B), the highest average concordance occurs during 1968-73, a period characterized by the majority of our sample countries being in the expansion phase at the same time which biases the concordance index upwards. Excluding 1968-73, the highest average concordance of 72% occurs in 1960-67, followed by 70% in 1974-83 and the lowest in 2003-08 with 60%. In the period 1974-83, when most of the countries were significantly concordant, Greece, Ireland and Portugal exhibited low and mostly insignificant concordance levels.

The average concordance across classical business cycles in 1960-67 is 72% (table 6.B) while that across growth cycles is 49% (table 6.A), suggesting greater concordance in cyclical movements of the trend-unadjusted industrial production. The resulting implication that concordance arises from synchronized trends rather than synchronized deviations seems to contradict our earlier full sample findings. However we note that only Austria and Germany, Belgium and France, and France and Germany classical cycles exhibit concordances that are statistically

significant. Therefore, the 72% concordance may be biased upwards due to the extended time the countries in this period spend in the expansion phase, as indicated by the exceptionally high values of $\hat{\mu_s}$ (mostly greater than 80%), rather than actual co-movement. In the period 2009-2013, the large difference in average concordance levels of growth and classical cycles, 96% and 66% respectively, implies that deviations are more synchronized than trends. This is in line with our expectations as this period corresponds to the ongoing Eurozone crisis characterized by negative deviations from the trend that all EMU countries are experiencing together.

Comparing the average concordance of growth cycles of each country with the other member states highlights that the highest percentage increase (214%) over the period 1960-2013 occurs in Spain and the smallest percentage increase (63%) in France (table 7).

[Insert table 7 here]

While in the case of classical cycle average concordance, it is Belgium which shows the greatest percentage increase in average concordance with the other EMU countries (9%). Greece, Ireland and Portugal exhibited the greatest percentage decrease in average concordance levels: 35%, 22% and 19% respectively (table 8).

[Insert table 8 here]

The comparison of tables 7 and 8 show that average concordance of classical cycles is lower in 2003-08 and 2009-13 for all countries except Ireland and relatively higher before 1993-2002 than for growth cycles. After this period, the average concordance levels of classical cycles gradually diminish whereas growth cycles become relatively more concordant (exhibiting higher levels of average concordance compared to classical cycles). During 2003-2008, most of the

countries' classical cycles exhibited the lowest average concordance while most of the countries' growth cycles showed highest average concordance compared to earlier sub-periods. These results highlight that in the years leading to the crisis, deviations were becoming more synchronized relative to trends.

3.2. Concordance across financial cycles

Given that table 9 shows that the HP growth financial cycles (col.2) are generally more frequent, whether produced by λ=14,400 or λ=129,600, than BK growth financial cycles (col.3) and classical financial cycles, and for the reasons explained above, we chose to use the BK filter in the subsequent empirical work. Figure 2 shows the financial cycle plots for each country in our sample. As evident from the graphs, both classical and growth cycles exhibit similarities across countries. Classical equity cycles demonstrate sharp fluctuations due to the large swings- both upside and downside- in the equity price index. Growth equity cycles are marked by cyclical movements of a relatively larger magnitude compared to their industrial production counterparts.

[Insert table 9 here]

Table 10 records the average duration, amplitude, slope and cumulative loss (in case of downturns only) of both classical and growth financial cycles.

[Insert table 10 here]

A growth financial cycle low-rate phase varies in duration from 15 months (Belgium) to 28.3 months (Italy) while the duration of a classical financial cycle downturn varies from 15.5 months (the Netherlands) to 26 months (Austria). The cumulative loss during low-rate phase ranges between -725% (Italy) and -184% (Belgium) for growth financial cycles and between -1346% (Greece) and -211%

(Netherlands) for classical cycle downturns. The amplitude of low-rate phase of growth financial cycles (decline in share price index from peak to trough) lies between -51.6% (Greece) and -23.5% (the Netherlands) while the classical one lies between -99.7% (Greece) to -32.1% (the Netherlands). The ratio of amplitude to duration –the slope – measuring the strength of a given cyclical phase varies between -2.56% (Greece) and -1.24% (the Netherlands) for growth financial cycle low-rate phase and between -4% (Greece) to -1.5% (Austria) for classical financial cycle downturns.

The average duration of financial cycle high-rate phase lies between 17.9 months (the Netherlands) and 21.7 months (Belgium) for growth cycles and between 21.2 months (Austria) and 30 months (Spain) for classical cycle upturns. The average amplitude of financial cycle high-rate phase varies from 21% (Belgium) to 51% (Greece) for growth cycles and from 46% (the Netherlands) to 123.8% (Greece) for classical cycle upturns. The slope of financial high-rate phase varies between 0.72% (Belgium) and 2.69% (Greece) for growth cycles and between 1.81% (Belgium) and 5.91% (Greece) for classical cycle upturns.

The highest amplitude and slope of financial upturns and downturns is observed in the case of Greece indicating considerable financial instability. This confirms the observation that Greece was one of the countries most severely affected by the Eurozone crisis.

The statistics $\{\hat{I}, \hat{\rho_s}, \hat{\mu_s}\}$ for growth and classical financial cycles are presented respectively in tables 11.A and 12.A, with the corresponding t-statistics in tables 11.B and 12.B.

[Insert tables 11.A and 11.B here]

Tables 11.A and 11.B show that there is significant concordance between countries' financial growth cycles with the exception of between Greece and

Belgium. Most countries spend more than 70% of the time in the same phase of their financial growth cycles as indicating by the values of concordance indices being above 70%. Spain and Greece spent the smallest fraction of time in the upturns phase ($\hat{\mu_s}$ = 0.38 and 0.39) contrary to Belgium which spent the greatest proportion of time in upturns phase ($\hat{\mu_s}$ = 0.53). The average concordances reported in the last column of table 11.A show that the highest and lowest concordances are held respectively by Portugal (0.81) and Greece and Ireland (0.72). Concordance levels for Austria, Belgium, France, Germany, Italy, Netherlands and Spain stand at around 0.75 or above which implies that these countries spend more than 75% of their time in the same financial cycle phase.

Comparing these results with those for growth business cycles, Portugal's growth business cycles have the lowest average concordance with the other EMU member whilst its growth financial cycles have the highest concordance. The contrasting result may be due to data availability as Portugal data was limited to post-1988, a period characterized by increasing levels of average concordance. For business cycles, data on industrial production was available from 1960 onwards and hence the initial sub-periods low levels of concordance reduces the overall average concordance of Portugal's business cycles with the rest of the sample.

[Insert tables 12.A and 12.B here]

Tables 12.A and 12.B evidence significant concordance between countries' classical financial cycles, with all concordance indices being statistically significant, the concordance levels remains high, mostly above 70% as in the case of financial growth cycles and most countries spend more than 50% of time in a financial upturn, with France exhibiting the highest $\hat{\mu_s}$, (0.63).

The comparison of business and financial cycles' concordance results points to greater evidence of concordance, both in magnitude and significance in financial cycles than in business cycles. While there is not much difference in financial growth and classical cycle results, business growth cycles exhibit greater concordance, both in magnitude and significance, than business classical cycles.

[Insert table 13.A here]

Table 13.A reports how the concordance indices of growth financial cycles evolve over the sub-periods: 1957-1964, 1965-1974, 1975-1981, 1982-1993, 1994-2001, 2002-2008 and 2009-2013. The average concordance fell marginally during 1957-1981 from 66% in 1957-64 to 64% in 1965-1974 and 61% in 1975-1981 before increasing to 73% in 1994-2001. This period was marked by the introduction of the euro. Most countries exhibit significant concordance with the exception of Ireland where none of the country pairwise concordance indices is statistically significant. Average concordance level peaks in 2002-2008 at 91% suggesting that during this period the set of EMU countries were in the same phase of their financial cycle 91% of the time on average. In 2009-2013, average concordance level fell slightly to 90% and the only significant concordance indices observed were those between Greece and Ireland, Greece and Spain and Ireland and Spain.

The first sub-period average concordance is much higher in case of financial growth cycles at 66% compared to 49% for business growth cycles.

[Insert table 13.B here]

Table 13.B shows how the concordance indices of classical financial cycles evolve over our selected sample sub-periods. The highest average concordance occurs in the period 2002-2008 (90%) and the lowest in the period 1975-1981

(58%), both results are approximately in line with the growth financial cycle's results. Most countries exhibit significant concordance with most others in 1994-2001 with the exception of Ireland where none of the country pairwise concordance indices is statistically significant. More variability appears in the average concordances calculated over the sub-periods for classical financial cycles compared to growth financial cycles. But overall, growth and classical financial cycle concordance shows more similarity compared to growth and classical business cycles.

Table 14 provides a comparison of the average concordance of growth financial cycles for each EMU country with the other member states over the sample sub-periods. The last column of table 14 indicates that with an increase of 85%, Germany experienced the highest percentage increase in concordance over 1960-2013 while Ireland with an increase of 15% underwent the smallest change.

[Insert table 14 here]

Table 15 reports the average concordance of classical equity cycles for each EMU countries in our sample for each sub-period. We noticed in the case of growth cycles previously that the greatest percentage increase in average concordance over the sub-periods occurred in the case of Germany. This is also true for classical cycles with an increase of 51%. Generally the percentage increase in the average concordance of growth cycles has been greater compared to classical cycles, supporting our observation so far that deviations are more concordant than trends.

[Insert table 15 here]

The comparison of average concordance between business (classical and growth, tables 8 and 9) and financial (classical and growth, tables 14 and 15)

stresses that the percentage increase in average concordance over the sample sub-periods has been much higher for each countries' growth business cycle than for its growth financial cycle. In addition, several countries classical business cycles show a decrease in average concordance levels over the sample sub-periods which is not observed for classical financial cycles.

3.3. Concordance between business and financial cycles

The concordance indices and correlation between business and financial cycles are presented in tables 16.A and 17.A and the corresponding t-statistics in tables 16.B to 17.B.

For the period 1960-2013, tables 16.A and 16.B show that within each country business and financial growth cycles are significantly concordant, being in the same phase at least 60% of the time with the exception of Greece where the concordance index of 0.57 is not statistically significant (table 16.B). Therefore economic slowdowns are accompanied by financial low-rate phase and economic booms by financial high-rate phase more than 60% of the time.

[Insert tables 16.A and 16.B here]

With regards to classical business and financial cycles, table 17.B indicates that most of the concordance indices stated in table 17.A are not statistically significant (with the exception of Germany, Greece and Spain). This signifies that business and financial cycle concordance arises from synchronized deviations from the trend rather than a synchronized trend.

[Insert tables 17.A and 17.B here]

Tables 18.A and 18.B display how the concordance between business and financial cycles has evolved over time. The average level of concordance between

business and financial (classical and growth) cycles is calculated for the following sub-periods: 1960-1967, 1968-1973, 1974-1983, 1984-1992, 1993-2002, 2003-2008 and 2009-2013.

[Insert tables 18.A and 18.B here]

Tendencies of synchronized deviations in business and financial growth cycles are most common in the period 2003-2008, where most of the countries' business and financial growth cycles are significantly concordant with the exception of Italy and Ireland. Germany and Austria display the highest percentage increase in concordance levels over the period 1960-2013, while The Netherlands exhibits a decrease (table 18.A).

Table 18.B shows that for most countries, the concordance levels between business and financial classical cycles recorded in each sub-period are statistically insignificant. While significant concordance was observed between growth business and financial cycles in table 18.A during 2003-2008 with the exception of Ireland and Italy, table 18.B indicates significant concordance in classical cycles only for Germany, Greece and Italy.

This confirms our earlier full sample results that concordance arises from synchronized deviations rather than synchronized trends. The observed concordance is due to co-movement in upturns and downturns phases rather than co-movement in the trend-unadjusted classical recessions and expansions. Countries spend more time together in the same phases of their growth cycles than their classical cycles. Deviations from long-term growth rates are relatively more synchronized than the growth trend.

4. Conclusion

In a monetary union, the synchronization of economic cycles matters. This paper examined the degree of synchronization in business and financial cycles (classical and growth) across a representative sample of EMU countries for the full period and in different sub-periods for both business and financial cycles.

We found no evidence of a classical business cycle in the Eurozone confirming that concordance in business cycles arises from synchronized deviations from the trend rather than synchronization of the underlying macroeconomic fundamentals. Our results highlight the following:

There is greater evidence of concordance in growth business cycles compared to classical business cycles. This result suggests that synchronization in business cycles arises from co-movements in deviations rather than through a common underlying trend.

Financial cycles demonstrate significant concordance in both classical and growth cycles. Most countries spend more than 70% of the time in the same phase of their financial cycles. The only insignificant concordance occurs between the growth financial cycles of Greece and Belgium. Belgium spent the greatest proportion of time in the upturn of its growth financial cycle while Spain and Greece, the smallest fraction of time. France spent the greatest proportion of time, 63%, in the classical financial upturn. These results are consistent with the experiences of Spain and Greece in the Eurozone crisis, whilst France and Belgium were amongst the countries that fared relatively better.

Classical business cycles for several countries actually show a decrease in average concordance levels over the sample sub-periods, suggesting that Eurozone countries are moving away from a classical business cycle. For instance, Greece, Ireland and Portugal exhibited the greatest percentage decrease

in average concordance levels of their classical business cycles which, in the identified sub-periods, were 35%, 22% and 19% respectively.

In the years leading up to the Eurozone crisis, deviations were becoming more synchronized relative to trend. In the pre-crisis period 2003-2008, most of the classical business cycles exhibited the lowest average concordance while most of the growth business cycles showed the highest average concordance compared to earlier sub-periods.

Compared to growth cycles, classical business cycles demonstrate relatively much higher levels of average concordance before 1993-2002 which marks the introduction of the euro.

Concordance between financial and business cycles for each country also arises from synchronized deviations rather than synchronized trends as the majority of the concordance indices between classical business and financial cycles do not demonstrate statistical significance.

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Tables

TABLE 1: BRY BOSHAN (BB) PROCEDURE FOR PROGRAMMED DETERMINATION OF TURNING POINTS

Step	Procedure
1.	Determination of extremes and substitution of values.
2.	Determination of cycles in 12-month moving average (extremes replaced).
	A. Identification of points higher (or lower) than 5 months on either side.
	B. Enforcement of alternation of turns by selecting highest of multiple peaks (or lowest of multiple troughs).
3.	Determination of corresponding turns in Spencer curve (extremes replaced).
	A. Identification of highest (or lowest) value within ±5 months of selected turn in 12-month moving average.
	B. Enforcement of minimum cycle duration of 15 months by eliminating lower peaks and higher troughs of shorter cycles.
4.	Determination of corresponding turns in short-term moving average of 3 to 6 months, depending on MCD (months of cyclical dominance).
	A. Identification of highest (or lowest) value within ±5 months of selected turn in Spencer curve.
5.	Determination of turning points in unsmoothed series.
	A. Identification of highest (or lowest) value within ±4 months, or MCD term, whichever is larger, of selected turn in short-term moving average.
	B. Elimination of turns within 6 months of beginning and end of series.
	C. Elimination of peaks (or troughs) at both ends of series which are lower (or higher) than values closer to end.
	D. Elimination of cycles whose duration is less than 15 months.
	E. Elimination of phases whose duration is less than 5 months.
6.	Statement of final turning points.

Source: Bry and Boschan (1971, p.21; Table 1)

TABLE 2 – CLASSICAL AND GROWTH BUSINESS CYCLES (INDUSTRIAL PRODUCTION): 1960:1-2013:12.

	Classical Cycles (1)		Growth Cycles (HP) (2)		Growth Cycles (BK) (3)	
			λ=14400 (λ=129 600)	λ=14400 (λ=129 600)		
	Peaks	**Troughs**	**Peaks**	**Troughs**	**Peaks**	**Troughs**
Austria	13	12	17 (16)	16 (15)	13	13
Belgium	15	16	18 (15)	19 (16)	16	16
France	12	12	18 (17)	18 (17)	15	15
Germany	13	13	18 (16)	18 (15)	15	16
Greece	12	11	15	15	18	18
Ireland	11	10	13	12	12	12
Italy	12	11	17 (16)	17 (15)	18	18
Netherlands	14	14	19 (15)	19 (15)	16	16
Portugal	13	13	20 (19)	20 (19)	16	17
Spain	9	9	15	15	14	14

TABLE 3: – BASIC FEATURES OF CLASSICAL AND GROWTH BUSINESS CYCLES: 1960:1-2013:12.

	Growth cycles in industrial production: 1960:1-2013:12									
	High-rate phase					Low-rate phase				
	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss
AT	12	22.6	5.65%	0.27%	-	13	20.7	-6.08%	-0.31%	-61.4%
BE	15	18.6	5.20%	0.28%	-	16	16.7	-5.65%	-0.36%	-44.5%
FR	14	19.2	4.83%	0.26%	-	15	18.3	-5.42%	-0.30%	-45.0%
DE	15	20.5	5.59%	0.27%	-	15	16.3	-6.47%	-0.37%	-49.7%
EL	18	16.7	4.01%	0.23%	-	17	14.0	-4.16%	-0.28%	-28.5%
IE	11	16.5	5.44%	0.34%	-	12	14.9	-5.96%	-0.40%	-41.7%
IT	17	17.6	5.60%	0.28%	-	18	13.8	-6.30%	-0.42%	-41.7%
NL	15	17.1	4.47%	0.26%	-	16	17.8	-4.70%	-0.28%	-38.8%
PT	16	17.3	5.10%	0.28%	-	16	17.2	-5.17%	-0.28%	-49.9%
ES	13	18.5	4.53%	0.22%	-	14	16.9	-5.11%	-0.29%	-40.6%
Sample	146	18.4	5.01%	0.27%	-	152	16.6	-5.48%	-0.33%	-43.8%
	Classical cycles in industrial production: 1960:1-2013:12.									
	Expansions					Recessions				
	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss
AT	12	39.0	21.11%	0.53%	-	12	13.3	-5.35%	-0.45%	-27.1%
BE	15	28.3	17.18%	0.70%	-	15	12.6	-6.69%	-0.68%	-35.4%
FR	11	32.1	15.56%	0.41%	-	12	16.8	-9.45%	-0.67%	-42.6%
DE	12	35.1	18.26%	0.52%	-	13	14.0	-9.06%	-0.74%	-45.5%
EL	11	34.4	20.24%	0.70%	-	11	16.1	-11.5%	-0.90%	-121%
IE	10	30.3	33.24%	1.30%	-	10	12.3	-10.9%	-1.04%	-54.7%
IT	11	32.6	18.09%	0.64%	-	11	18.9	-10.4%	-0.73%	-89.3%
NL	13	31.6	19.32%	0.73%	-	14	14.9	-8.45%	-0.59%	-63.2%
PT	12	36.1	22.24%	0.68%	-	13	13.3	-9.94%	-0.90%	-57.0%
ES	8	39.5	15.22%	0.46%	-	9	15.9	-12.3%	-0.88%	-79.3%
Sample	115	33.6	19.96%	0.67%	-	120	14.8	-9.21%	-0.74%	-60.2%

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 4. A: CONCORDANCE INDICES AND CORRELATIONS OF GROWTH CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES	x̄
AT	1	0.81	0.84	0.77	0.64	0.66	0.75	0.82	0.58	0.68	0.73
BE	0.63***	1	0.88	0.74	0.7	0.68	0.78	0.74	0.56	0.7	0.73
FR	0.68***	0.75***	1	0.77	0.73	0.69	0.82	0.77	0.59	0.75	0.76
DE	0.55***	0.49***	0.54***	1	0.74	0.64	0.7	0.73	0.64	0.73	0.72
EL	0.29***	0.39***	0.47***	0.48***	1	0.67	0.71	0.63	0.55	0.7	0.67
IE	0.33***	0.36***	0.39***	0.28***	0.34***	1	0.71	0.63	0.61	0.67	0.66
IT	0.50***	0.55***	0.64***	0.40***	0.42***	0.42***	1	0.71	0.55	0.75	0.72
NL	0.64***	0.49***	0.54***	0.47***	0.27***	0.26***	0.42***	1	0.6	0.64	0.70
PT	0.15***	0.12***	0.18***	0.27***	0.10***	0.22***	0.11***	0.20***	1	0.57	0.58
ES	0.36***	0.39***	0.50***	0.45***	0.40***	0.34***	0.49***	0.28***	0.15***	1	0.69
$\hat{\mu_s}$	0.50	0.50	0.49	0.48	0.48	0.50	0.53	0.48	0.43	0.50	

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 4. B: T-STATISTICS OF GROWTH CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT		10.04	10.55	6.14	3.01	3.69	5.44	8.37	1.41	3.78
BE			15.35	5.18	4.15	3.52	7.54	5.63	1.12	3.92
FR				5.71	5.63	4.39	10.02	7.9	1.53	6.75
DE					5.98	2.64	3.68	4.21	2.22**	5.08
EL						3.83	4.97	3.4	1.32	5.3
IE							4.7	2.49	1.91*	4.07
IT								4.5	1.02	6.8
NL									1.77*	2.58
PT										1.29
ES										

Notes:
Insignificant t-statistics are in red.

AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 5.A: CONCORDANCE INDICES AND CORRELATIONS OF CLASSICAL CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES	x̄
AT	1	0.68	0.71	0.72	0.64	0.61	0.68	0.68	0.65	0.70	0.68
BE	0.26***	1	0.76	0.71	0.64	0.64	0.66	0.64	0.57	0.71	0.67
FR	0.32***	0.47***	1	0.80	0.71	0.61	0.76	0.65	0.64	0.76	0.71
DE	0.32***	0.34***	0.53***	1	0.72	0.65	0.71	0.68	0.72	0.77	0.72
EL	0.12***	0.17***	0.33***	0.32***	1	0.56	0.68	0.55	0.68	0.73	0.66
IE	0.01	0.17***	0.14***	0.06	0.03	1	0.52	0.63	0.58	0.62	0.60
IT	0.28***	0.27***	0.47***	0.37***	0.30***	0.02	1	0.69	0.71	0.80	0.69
NL	0.24***	0.19***	0.21***	0.26***	-0.02	0.21***	0.32***	1	0.63	0.69	0.65
PT	0.11***	0.01	0.17***	0.33***	0.25***	0.02	0.36***	0.14***	1	0.71	0.66
ES	0.23***	0.35***	0.45***	0.44***	0.37***	0.18**	0.58***	0.27***	0.29***	1	0.72
$\hat{\mu_s}$	0.74	0.66	0.67	0.70	0.69	0.72	0.63	0.67	0.71	0.73	

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 5. B: T-STATISTICS OF CLASSICAL CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT		2.43	3.32	3.48	1.35	0.12	3.12	3.64	1.08	3.29
BE			5.00	3.75	3.07	1.71	2.72	2.29	0.08	3.80
FR				7.46	3.64	1.38	4.38	2.20	1.56	4.79
DE					3.27	0.61	3.48	2.60	3.28	5.14
EL						0.28	3.37	-0.23	2.06	3.45
IE							0.17	2.13	0.19	0.85
IT								2.73	3.81	6.87
NL									1.41	2.18
PT										2.11
ES										

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 6.A: SUB-PERIOD CONCORDANCE INDICES OF GROWTH CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

1960-1967 (average= 0.49)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.90	0.81***	0.38	0.33		0.59	0.94***	0.41	0.06
BE		1	0.88	0.27**	0.47		0.7**	0.9	0.3**	0
FR	3.76		1	0.35	0.47		0.78***	0.81***	0.43	0.28
DE	-1.24	-2.33	-1.05	1	0.44		0.2***	0.38	0.89***	0.44
EL			-0.37	-1.32	1		0.54	0.33	0.57	0.39
IE										
IT	0.47	2.47	3.63	-3.54			1	0.59	0.23**	0.72
NL	11.37		3.55	-0.71			0.53	1	0.41	0.14
PT	-0.50	-2.38	-0.27	7.45	0.32		-2.12	0.54	1	0.47
ES										1
$\hat{\mu_s}$	0.60	0.50	0.63	0.35	0.19		0.74	0.60	0.32	1.00
1968-1973 (average=0.75)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.69	0.6	0.75**	0.5**		0.68*	0.78**	0.68	0.67
BE	1.16	1	0.9***	0.86***	0.75**		0.74**	0.83***	0.85	0.94
FR	0.66	6.20	1	0.76***	0.71**		0.72**	0.74**	0.81	0.9
DE	1.90	5.35	2.73	1	0.7		0.63	0.94***	0.85	0.83***
EL	-2.03	2.08	2.04	1.53	1		0.51	0.64	0.82***	0.81**
IE										
IT	1.64	1.95	2.21	0.66	-1.11		1	0.65	0.64	0.71**
NL	2.19	6.64	2.07	25.66	0.72		1.00	1	0.82***	0.81***
PT	0.72				3.46		0.79	4.86	1	0.9
ES	0.79			3.92	2.16		2.20	3.34		1
$\hat{\mu_s}$	0.72	0.64	0.60	0.64	0.75		0.65	0.67	0.79	0.69
1974-1983 (average=0.70)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.78***	0.79***	0.84***	0.63**	0.63***	0.81***	0.92***	0.48	0.72**
BE	4.92	1	0.93***	0.86***	0.83***	0.74***	0.84***	0.83	0.49	0.65**
FR	5.12	15.93	1	0.88***	0.84***	0.72***	0.88***	0.84***	0.47	0.68**
DE	5.19	8.92	13.84	1	0.79***	0.67***	0.87***	0.86***	0.52	0.61
EL	2.45	5.75	7.25	7.16	1	0.74***	0.78***	0.68***	0.44	0.57
IE	2.67	4.28	4.38	2.94	3.03	1	0.66*	0.64**	0.47	0.65***
IT	6.02	11.27	10.43	12.83	5.99	1.65	1	0.78***	0.5	0.64*
NL	16.42		7.73	7.05	3.86	2.46	6.27	1	0.46	0.72***
PT	-0.29	0.00	-0.28	0.08	-0.53	-0.35	0.00	-0.50	1	0.46
ES	2.53	2.41	2.42	1.49	1.21	3.08	1.76	2.73	-0.61	1

$\hat{\mu_s}$	0.44	0.56	0.50	0.45	0.54	0.75	0.50	0.39	0.43	0.41
1984-1992 (average=0.61)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.77***	0.83***	0.76***	0.68*	0.59	0.6	0.8***	0.63	0.45
BE	3.47	1	0.86***	0.73**	0.74***	0.6	0.63	0.56	0.44	0.61**
FR	5.21	6.87	1	0.67*	0.75***	0.59	0.66*	0.63	0.56	0.62
DE	3.01	2.55	1.73	1	0.73***	0.41	0.55	0.67*	0.46	0.55
EL	1.85	3.10	3.01	2.67	1	0.55	0.7*	0.47	0.36	0.72***
IE	0.91	1.15	0.97	-0.90	0.54	1	0.66*	0.5	0.41	0.6
IT	0.94	1.15	1.74	0.30	1.77	1.71	1	0.55	0.6	0.61
NL	4.13	0.99	1.36	1.89	-0.28	0.01	0.55	1	0.78***	0.38
PT	1.19	-0.45	0.45	-0.16	-1.58	-0.96	1.26	3.97	1	0.42
ES	-0.48	1.92	1.43	0.63	3.25	1.18	1.24	-1.53	-1.31	1
$\hat{\mu_s}$	0.52	0.56	0.48	0.59	0.53	0.48	0.56	0.52	0.41	0.42
1993-2002 (average=0.67)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.72***	0.92***	0.87***	0.7***	0.7**	0.79***	0.61	0.49	0.82***
BE	3.50	1	0.75***	0.75***	0.5	0.68***	0.79***	0.51	0.58	0.7**
FR	12.32	3.57	1	0.85***	0.65**	0.7**	0.84***	0.64	0.53	0.8***
DE	9.48	4.63	7.77	1	0.75***	0.68**	0.81***	0.64	0.43	0.82***
EL	2.71	0.02	2.00	3.89	1	0.65*	0.66**	0.74***	0.43	0.67**
IE	2.46	2.79	2.38	2.35	1.89	1	0.73**	0.61	0.66**	0.62
IT	5.96	4.46	6.38	4.80	2.37	2.15	1	0.7***	0.47	0.81***
NL	0.99	0.08	1.58	1.21	3.37	1.02	2.71	1	0.5	0.63
PT	-0.08	0.95	0.24	-0.79	-0.82	2.44	-0.38	-0.02	1	0.36**
ES	4.79	2.45	5.12	7.61	2.08	1.39	9.14	1.28	-1.82	1
$\hat{\mu_s}$	0.52	0.52	0.48	0.55	0.47	0.60	0.54	0.54	0.53	0.57
2003-2008 (average=0.75)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.96	0.94***	0.92***	0.82***	0.49	0.88***	0.79***	0.57	0.78***
BE		1	0.9***	0.88***	0.78***	0.44	0.83***	0.75***	0.53	0.74***
FR	25.85	11.77	1	0.94***	0.88***	0.54	0.93	0.84	0.6	0.83***
DE	9.28	6.07	12.60	1	0.9***	0.57	0.93***	0.82***	0.6	0.83***
EL	3.61	2.98	4.72	7.11	1	0.67***	0.94	0.75***	0.69***	0.88***
IE	0.06	-0.41	0.83	1.04	2.9	1	0.61**	0.53	0.69**	0.63**
IT	5.94	4.53		11.08		2.29	1	0.81***	0.67	0.85***
NL	3.46	2.56		3.50	2.87	0.55	3.46	1	0.47	0.71***
PT	0.83	0.44	1.22	1.03	2.64	1.97	1.61	-0.27	1	0.74
ES	3.72	2.88	4.42	4.85	8.97	2.08	5.48	4.04		1
$\hat{\mu_s}$	0.64	0.60	0.64	0.61	0.63	0.43	0.57	0.49	0.40	0.67
2009-2013 (average= 0.96)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	1	1	1	0.83	1	1	1	1	1
BE		1	1	1	0.83	1	1	1	1	1
FR			1	1	0.83	1	1	1	1	1
DE				1	0.83	1	1	1	1	1
EL					1	0.83	0.83	0.83	0.83	0.83
IE						1	1	1	1	1
IT							1	1	1	1
NL								1	1	1
PT									1	1
ES										1
$\hat{\mu_s}$	0	0	0	0	0.17	0	0	0	0	0

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 6.B: SUB-PERIOD CONCORDANCE INDICES OF CLASSICAL CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12

1960-1967 (average=0.72)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.67	0.73	0.53***	0.63		0.65	0.57	0.55	0.47
BE	0.50	1	0.81**	0.61	0.81		0.69	0.61	0.59	0.72
FR	1.44	2.28	1	0.80*	0.88***		0.77	0.70	0.78	0.58
DE	-2.62	-0.80	1.74	1	0.86		0.72	0.77	0.92	0.61
EL	-0.35	1.36	3.48	6.80	1		0.71	0.61	0.83	0.61
IE										
IT							1	0.78	0.76	1.00
NL								1	0.81	1.00
PT								2.19	1	0.72
ES										1
$\hat{\mu_s}$	0.72	0.76	0.84	0.79	0.81		0.93	0.85	0.83	1.00
1968-1973 (average=0.87)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.68	0.90	0.78	0.83		0.83	0.83	0.83	0.83
BE	0.91	1	0.72	0.60	0.65		0.65	0.65	0.65	0.65
FR	-	-	1	0.88	0.93		0.93	0.93	0.93	0.93
DE	-	-	-	1	0.94		0.94	0.94	0.94	0.94
EL					1		1	1	1	1
IE										
IT							1	1	1	1
NL								1	1	1
PT									1	1
ES										1
$\hat{\mu_s}$	0.83	0.65	0.93	0.94	1		1	1	1	1
1974-1983 (average=0.70)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.85***	0.85***	0.86***	0.70	0.74	0.73***	0.67***	0.71	0.77***
BE	3.46	1	0.80***	0.77***	0.67	0.68	0.68**	0.73***	0.61	0.73**
FR	8.37	6.37	1	0.82***	0.72	0.82*	0.68**	0.62*	0.69	0.82***
DE	6.48	3.72	4.92	1	0.66	0.73	0.68***	0.63**	0.73***	0.75**
EL	1.53	1.34	0.55	0.81	1	0.75	0.66	0.48	0.69	0.68
IE	1.27	0.82	1.83	1.01	0.90	1	0.51	0.52	0.70	0.67
IT	4.27	2.10	2.29	2.59	-	-0.27	1	0.68**	0.52	0.85
NL	2.51	5.44	1.89	2.11	0.17	0.69	1.99	1	0.47	0.77
PT	1.51	0.41	0.83	4.14	-	-	-0.11	-0.05	1	0.63
ES	3.21	2.19	3.31	2.49	0.42	0.57	-	-	0.21	1
$\hat{\mu_s}$	0.67	0.63	0.73	0.66	0.88	0.77	0.54	0.47	0.81	0.69
1984-1992 (average=0.65)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.77***	0.69	0.78**	0.61	0.54	0.60	0.73*	0.62	0.65
BE	2.63	1	0.82***	0.86***	0.68	0.60	0.72*	0.61	0.67	0.73*
FR	1.51	2.69	1	0.78***	0.80***	0.43***	0.75**	0.44	0.62	0.72**
DE	2.49	3.45	2.90	1	0.70	0.52	0.69	0.53	0.71	0.70
EL	0.18	0.96	3.94	1.10	1	0.52**	0.64	0.45	0.56	0.69
IE	-	-0.17	-2.27	-	-1.89	1	0.53	0.68	0.64	0.56
IT	1.05	1.63	1.94	1.57	1.25	0.10	1	0.50	0.72***	0.82
NL	1.83	0.85	-1.13	-0.41	-1.35	0.91	-0.12	1	0.56	0.49
PT	0.00	0.90	0.75	1.61	-0.46	0.01	3.03	-0.09	1	0.82***
ES	0.68	1.80	1.95	1.04	1.14	-1.42	-	-1.05	5.37	1
$\hat{\mu_s}$	0.75	0.70	0.62	0.73	0.69	0.79	0.54	0.63	0.74	0.71
1993-2002 (average=0.62)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES

AT	1	0.68	0.63*	0.71	0.73	0.71	0.68	0.65	0.69	0.86***
BE	1.57	1	0.69***	0.64	0.60	0.71*	0.55	0.63**	0.47	0.69**
FR	-	3.06	1	0.68***	0.56	0.53	0.76***	0.54	0.47	0.60*
DE	1.80	1.57	2.50	1	0.71**	0.53	0.56	0.49	0.55	0.73***
EL	-	0.73	0.71	2.36	1	0.46*	0.60	0.55	0.52	0.73***
IE	-0.18	1.63	0.78	-0.42	-1.84	1	0.51	0.64	0.73	0.57
IT	-	0.50	3.56	0.52	1.12	-0.22	1	0.70**	0.61	0.57
NL	0.19	1.92	0.47	-0.75	0.18	0.43	2.31	1	0.63	0.51**
PT	-	-	-0.34	-0.45	-0.46	0.46	1.37	-0.04	1	0.63
ES	5.16	2.40	1.73	3.52	2.77	-1.58	0.54	-2.19	-0.83	1
$\hat{\mu_s}$	0.86	0.64	0.48	0.60	0.59	0.80	0.54	0.69	0.83	0.75
2003-2008 (average=0.60)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.43	0.61	0.72***	0.54	0.42	0.72***	0.61	0.71	0.53
BE	-0.70	1	0.57	0.57	0.53	0.63	0.46	0.43	0.25**	0.60
FR	0.77	-0.23	1	0.81***	0.54	0.72***	0.56	0.78***	0.38	0.69
DE	2.64	-0.26	3.74	1	0.63	0.67	0.64*	0.78***	0.54	0.78*
EL	0.23	-0.14	-0.02	0.69	1	0.63	0.74***	0.49	0.67	0.85
IE	-0.85	0.96	2.52	1.25	0.71	1	0.50	0.75**	0.29	0.78***
IT	2.81	-0.42	0.69	1.64	4.89	0.06	1	0.44	0.79	0.67***
NL	0.92	-0.86	3.72	3.02	-0.21	2.46	-0.90	1	0.46	0.64
PT	-	-2.36	-0.24	-	-	-1.61	-	-0.17	1	0.51
ES	0.00	-0.09	0.91	1.73	-	2.58	2.96	1.24	-	1
$\hat{\mu_s}$	0.56	0.71	0.72	0.72	0.60	0.64	0.47	0.56	0.26	0.75
2009-2013 (average=0.66)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.53	0.53*	0.63**	0.32	0.60**	0.57	0.75**	0.33	0.48
BE	0.89	1	0.93	0.90***	0.48	0.50	0.97***	0.78***	0.77***	0.92
FR	1.86	-	1	0.90	0.55	0.57	0.93	0.78	0.70*	0.95***
DE	2.43	6.52	-	1	0.45	0.60	0.93***	0.88	0.70***	0.85***
EL	-	-	-	-	1	0.45	0.48	0.33	0.65	0.57
IE	2.11	-0.07	0.48	1.23	-	1	0.53	0.58	0.33***	0.58
IT	1.35	22.13	-	11.03	-	0.33	1	0.82***	0.77***	0.92
NL	2.09	4.76	-	-	-	1.17	4.22	1	0.58	0.73***
PT	-0.31	4.07	1.80	2.60	-	-3.68	3.41	1.42	1	0.68
ES	1.07	-	19.72	5.80	-	1.10	-	3.07	1.33	1
$\hat{\mu_s}$	0.78	0.42	0.35	0.45	0.10	0.45	0.42	0.57	0.25	0.33

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 7: AVERAGE CONCORDANCE OF GROWTH CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

Country	1960-67	1968-73	1974-83	1984-92	1993-02	2003-08	2009-13	% change 1960-13
Austria	0.55	0.67	0.73	0.68	0.74	0.79	0.98	78
Belgium	0.55	0.82	0.77	0.66	0.66	0.76	0.98	78
France	0.60	0.77	0.78	0.69	0.74	0.82	0.98	63
Germany	0.42	0.79	0.77	0.61	0.73	0.82	0.98	134
Greece	0.44	0.68	0.70	0.63	0.64	0.81	0.83	88
Ireland			0.66	0.55	0.67	0.57	0.98	49
Italy	0.54	0.66	0.75	0.62	0.73	0.83	0.98	80
Netherlands	0.56	0.78	0.75	0.59	0.62	0.72	0.98	74
Portugal	0.46	0.80	0.48	0.52	0.49	0.62	0.98	112
Spain	0.31	0.82	0.63	0.55	0.69	0.78	0.98	214

TABLE 8: AVERAGE CONCORDANCE OF CLASSICAL CYCLES IN INDUSTRIAL PRODUCTION: 1960:1-2013:12.

Country	1960-67	1968-73	1974-83	1984-92	1993-02	2003-08	2009-13	% change 1960-13
Austria	0.60	氈愀 82	0.76	0.66	0.70	0.59	0.53	-12
Belgium	0.69	0.66	0.72	0.72	0.63	0.50	0.75	9
France	0.76	0.89	0.76	0.67	0.61	0.63	0.76	0
Germany	0.73	0.87	0.74	0.70	0.62	0.68	0.76	4
Greece	0.74	0.92	0.67	0.63	0.61	0.62	0.48	-35
Ireland			0.68	0.56	0.60	0.60	0.53	-22
Italy	0.76	0.92	0.66	0.66	0.62	0.61	0.77	1
Netherlands	0.73	0.92	0.62	0.55	0.59	0.60	0.69	-5
Portugal	0.75	0.92	0.64	0.66	0.59	0.51	0.61	-19
Spain	0.71	0.92	0.74	0.69	0.65	0.67	0.74	4

TABLE 9 – CLASSICAL AND GROWTH FINANCIAL CYCLES (SHARE PRICES INDEX): 1957:1-2013:12.

	Classical Cycles (1)		Growth Cycles (HP) (2)		Growth Cycles (BK) (3)	
			λ=14400 (λ=129 600)	λ=14400 (λ=129 600)		
	Peaks	**Troughs**	**Peaks**	**Troughs**	**Peaks**	**Troughs**
Austria	14	15	17(15)	18(16)	14	14
Belgium	7	7	11(8)	11(8)	7	7
France	13	13	15(15)	15(15)	16	16
Germany	16	16	16(15)	16(15)	15	15
Greece	6	6	8(8)	8(9)	7	7
Ireland	14	15	18(17)	18(18)	17	16
Italy	16	16	18(15)	19(16)	12	12
Netherlands	16	16	19(18)	19(18)	17	17
Portugal	6	7	8(7)	9(8)	6	6
Spain	6	7	7(7)	8(8)	8	8

TABLE 10: BASIC FEATURES OF CLASSICAL AND GROWTH FINANCIAL CYCLES: 1957:1-2013:12.

	Growth equity cycles (1957-2013)									
	High-rate phase					Low-rate phase				
	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss
AT	13	20.9	26.65%	1.31%	-	14	21.1	-30.6%	-1.41%	-355%
BE	6	21.7	21.02%	0.72%	-	7	15.0	-25.7%	-1.59%	-184%
FR	15	18.5	25.72%	1.44%	-	16	17.9	-26.8%	-1.39%	-266%
DE	14	18.5	26.41%	1.42%	-	15	18.5	-27.4%	-1.44%	-258%
EL	7	19.6	51.00%	2.69%	-	6	18.5	-51.6%	-2.56%	-669%
IE	16	19.1	32.78%	1.79%	-	16	17.9	-33.5%	-1.89%	-282%
IT	11	21.5	42.01%	2.07%	-	12	28.3	-43.5%	-1.60%	-725%
NL	16	17.9	21.43%	1.17%	-	17	17.2	-23.5%	-1.24%	-208%
PT	5	19.8	38.46%	2.01%	-	6	18.0	-35.6%	-2.01%	-355%
ES	8	16.4	23.80%	1.47%	-	7	17.6	-27.6%	-1.48%	-282%
sample	111	19.2	29.71%	1.57%	-	116	19.2	-31.2%	-1.58%	-338%
	Classical equity cycles (1957-2013)									
	Upturns					Downturns				
	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss	No. of events	Average duration	Average Amplitude	Average Slope	Cumulative Loss
AT	14	21.2	55.61%	2.80%	-	14	26.0	-34.1%	-1.5%	-537%
BE	6	25.3	52.49%	1.81%	-	7	16.3	-37.3%	-2.5%	-274%
FR	12	35.3	71.02%	2.05%	-	13	17.4	-46.0%	-3.3%	-383%
DE	15	23.7	48.51%	2.19%	-	16	16.0	-36.7%	-2.4%	-267%
EL	5	29.2	123.77%	5.91%	-	6	25.0	-99.7%	-4.0%	-1346%

IE	14	29.3	71.22%	2.59%	-	14	16.6	-41.2%	-2.5%	-344%
IT	15	21.7	66.19%	3.12%	-	16	20.8	-46.7%	-2.3%	-574%
NL	15	23.8	46.03%	2.11%	-	16	15.5	-32.1%	-2.2%	-211%
PT	6	23.3	67.83%	3.40%	-	6	24.0	-50.9%	-2.6%	-585%
ES	6	30.0	83.39%	3.35%	-	6	24.0	-47.9%	-2.1%	-503%
sample	108	25.8	63.70%	2.71%	-	114	19.4	-43.4%	-2.4%	-444%

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 11.A - CONCORDANCE INDICES AND CORRELATIONS OF EQUITY GROWTH CYCLES: 1957:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES	$\bar{x}$
AT	1	0.77	0.8	0.69	0.76	0.65	0.78	0.7	0.84	0.79	0.75
BE	0.56***	1	0.83	0.76	0.61	0.79	0.78	0.81	0.8	0.7	0.76
FR	0.59***	0.67***	1	0.76	0.7	0.71	0.77	0.78	0.86	0.82	0.78
DE	0.39***	0.54***	0.52***	1	0.76	0.76	0.67	0.83	0.89	0.81	0.77
EL	0.49***	0.23***	0.38***	0.49***	1	0.65	0.74	0.7	0.72	0.81	0.72
IE	0.31***	0.58***	0.42***	0.52***	0.32***	1	0.68	0.82	0.71	0.73	0.72
IT	0.56***	0.58***	0.54***	0.33***	0.45***	0.36***	1	0.69	0.84	0.78	0.75
NL	0.41***	0.63***	0.55***	0.66***	0.38***	0.64***	0.38***	1	0.84	0.8	0.77
PT	0.68***	0.60***	0.72***	0.78***	0.44***	0.41***	0.69***	0.68***	1	0.81	0.81
ES	0.56***	0.43***	0.63***	0.61***	0.60***	0.49***	0.55***	0.60***	0.63***	1	0.78
$\hat{\mu_s}$	0.48	0.53	0.50	0.48	0.39	0.52	0.42	0.49	0.46	0.38	

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 11.B: T-STATISTICS OF GROWTH CYCLES IN EQUITY: 1957:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT		4.22	10.25	3.24	4.08	3.06	8.14	3.88	6.41	5.52
BE			9.53	5.17	1.71	5.95	6.24	7.61	6.43	3.35
FR				5.29	3.00	4.11	7.38	5.42	7.58	6.51
DE					4.43	7.70	2.93	8.63	10.38	10.78
EL						2.07	3.67	2.79	6.50	5.18
IE							4.12	11.23	3.31	6.69
IT								5.20	8.57	5.22
NL									7.98	6.84
PT										5.59
ES										

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 12.A - CONCORDANCE INDICES AND CORRELATIONS OF EQUITY CLASSICAL CYCLES: 1957:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES	$\bar{x}$
AT	1	0.7	0.71	0.66	0.66	0.58	0.68	0.64	0.73	0.64	0.67
BE	0.43***	1	0.85	0.76	0.75	0.71	0.75	0.94	0.73	0.74	0.77
FR	0.48***	0.69***	1	0.76	0.76	0.71	0.76	0.78	0.72	0.74	0.75
DE	0.34***	0.50***	0.51***	1	0.79	0.75	0.77	0.82	0.78	0.76	0.76
EL	0.32***	0.50***	0.54***	0.59***	1	0.82	0.79	0.72	0.87	0.9	0.78
IE	0.20***	0.39***	0.38***	0.50***	0.64***	1	0.66	0.74	0.84	0.83	0.74
IT	0.36***	0.50***	0.55***	0.56***	0.59***	0.33***	1	0.68	0.84	0.76	0.74
NL	0.31***	0.88***	0.53***	0.63***	0.44***	0.46***	0.37***	1	0.72	0.73	0.75
PT	0.46***	0.47***	0.52***	0.60***	0.73***	0.69***	0.69***	0.48***	1	0.92	0.79
ES	0.28***	0.49***	0.50***	0.53***	0.80***	0.66***	0.52***	0.48***	0.84***	1	0.78
$\hat{\mu_s}$	0.43	0.60	0.63	0.56	0.52	0.60	0.49	0.60	0.45	0.52	

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 12.B: T-STATISTICS OF CLASSICAL CYCLES IN EQUITY: 1957:1-2013:12.

	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT		3.61	5.65	3.20	2.17	1.85	4.06	3.36	3.05	1.76
BE			6.51	6.56	5.85	2.54	3.84	28.98	3.87	3.85
FR				5.34	4.24	4.20	7.41	5.41	5.30	4.15
DE					5.10	6.79	5.49	7.04	6.02	5.99
EL						6.83	5.35	3.02	9.74	12.53
IE							3.41	5.28	8.70	6.75
IT								4.08	9.08	4.20
NL									4.14	5.46
PT										16.81
ES										

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 13.A: SUB-PERIOD CONCORDANCE INDICES OF EQUITY GROWTH CYCLES: 1957:1-2013:12.

1957-1964 (average=0.66)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.90***	0.43		0.65	0.83	0.66		
BE										
FR	4.77		1	0.50		0.56	0.85	0.61		
DE	-		0.00	1		0.67	0.30	0.62		
EL										
IE	0.47		-0.57	0.90		1	0.71*	0.93		
IT	-		-	-0.32		1.76	1	0.76***		
NL	0.77		0.50	-		-	2.75	1		
PT										
ES										
μ_s^*	0.71		0.69	0.90		0.77	0.54	0.70		
1965-1974 (average=0.64)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.73**	0.45		0.61	0.66**	0.55		
BE										
FR	2.37		1	0.64**		0.68**	0.73***	0.73***		
DE	-0.50		2.00	1		0.77***	0.38	0.82***		
EL										
IE	1.17		2.37	6.82		1	0.45	0.88***		
IT	1.99		4.07	-1.40		-0.78	1	0.46		
NL	0.53		3.17	7.36		11.56	-0.54	1		
PT										
ES										
μ_s^*	0.52		0.49	0.50		0.34	0.46	0.37		
1975-1981 (average=0.61)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.77***	0.40		0.40	0.51	0.44		
BE										
FR	3.05		1	0.61		0.58	0.55	0.62		
DE	-0.84		0.88	1		0.88***	0.49	0.89		
EL										
IE	-0.90		0.59	10.39		1	0.56	0.87***		
IT	0.23		0.52	-0.30		1.28	1	0.57		
NL	-0.65		0.90	-		14.46	1.03	1		
PT										
ES										

$\mu_s^{\wedge}$	0.55		0.54	0.48		0.55	0.37	0.58		
1982-1993 (average=0.67)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.55	0.63	0.85	0.75	0.67	0.82	0.69	0.63	0.67
BE		1	0.81	0.64	0.32	0.83	0.68	0.72	0.74	0.52
FR			1	0.75	0.47	0.86	0.67	0.75	0.65	0.67
DE				1	0.63	0.75	0.78	0.75	0.71	0.62
EL					1	0.44	0.61	0.53	0.57	0.73
IE						1	0.72	0.79	0.67	0.62
IT							1	0.65	0.64	0.58
NL								1	0.69	0.74
PT	-	-			-				1	0.61
ES									-	1
$\mu_s^{\wedge}$	0.40	0.70	0.53	0.52	0.26	0.56	0.40	0.53	0.82	0.29
1994-2001 (average=0.73)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.67*	0.83***	0.81***	0.59	0.55	0.76***	0.83***	0.86***	0.83***
BE	1.74	1	0.69**	0.63	0.53	0.61	0.61	0.69**	0.66**	0.67**
FR	6.68	2.27	1	0.90***	0.66*	0.55	0.80***	0.85***	0.89***	0.90***
DE	5.15	1.53	9.58	1	0.70***	0.59	0.86***	0.81***	0.93***	0.94***
EL	0.81	0.37	1.79	2.50	1	0.52	0.69**	0.59	0.65*	0.70**
IE	0.44	1.22	0.51	0.92	0.16	1	0.63	0.61	0.56	0.57
IT	3.61	1.61	4.58	11.06	2.12	1.31	1	0.70**	0.90***	0.89***
NL	6.23	2.18	5.54	3.92	0.91	1.56	2.11	1	0.78***	0.77***
PT	7.82	2.19	9.09	15.02	1.80	0.55	6.86	4.56	1	0.95***
ES	6.97	2.20	10.34	17.44	2.42	0.68	7.16	4.04	29.44	1
$\mu_s^{\wedge}$	0.44	0.58	0.48	0.40	0.49	0.47	0.39	0.52	0.43	0.40
2002-2008 (average=0.91)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.99	0.90	0.89	0.90***	0.96***	0.96***	0.92	0.88	0.89***
BE	-	1	0.89***	0.88***	0.89***	0.95***	0.95***	0.90***	0.87***	0.88***
FR	-	4.80	1	0.96***	0.95	0.89***	0.89***	0.99	0.90***	0.94***
DE	-	4.10	23.70	1	0.94	0.86***	0.86***	0.98	0.92***	0.93***
EL	5.55	5.17	-	-	1	0.89***	0.89***	0.96	0.88***	0.94***
IE	14.94	13.56	9.17	6.69	7.74	1	1.00	0.88***	0.85***	0.90***
IT	14.94	13.56	9.17	6.69	7.74		1	0.88***	0.85***	0.90***
NL	-	4.66	-	-	-	4.73	4.73	1	0.92***	0.93***
PT	-	4.44	6.58	6.96	5.35	3.66	3.66	6.37	1	0.85***
ES	5.11	5.02	15.21	19.29	19.06	5.92	5.92	16.93	4.78	1
$\mu_s^{\wedge}$	0.65	0.64	0.56	0.55	0.61	0.64	0.64	0.57	0.54	0.60
2009-2013 (average=0.90)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	1.00	1.00	1.00	0.82	0.78	1.00	1.00	1.00	0.80
BE		1	1.00	1.00	0.82	0.78	1.00	1.00	1.00	0.80
FR			1	1.00	0.82	0.78	1.00	1.00	1.00	0.80
DE				1	0.82	0.78	1.00	1.00	1.00	0.80
EL					1	0.90***	0.82	0.82	0.82	0.95***
IE					5.08	1	0.78	0.78	0.78	0.95***
IT							1	1.00	1.00	0.80
NL								1	1.00	0.80
PT									1	0.80
ES					9.76	17.71				1
$\mu_s^{\wedge}$	0	0	0	0	0.18	0.22	0	0	0	0.2

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 13.B: SUB-PERIOD CONCORDANCE INDICES OF EQUITY CLASSICAL CYCLES: 1957:1-2013:12.

1957-1964 (average=0.61)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.89***	0.33		0.58	0.73*	0.51		
BE										
FR	6.20		1	0.30*		0.47	0.78***	0.56		
DE	-1.37		-1.75	1		0.77	0.62	0.82***		
EL										
IE	0.89		-0.56	-		1	0.48	0.74		
IT	1.85		3.47	-		0.32	1	0.64		
NL	0.35		0.44	3.52		1.52	-	1		
PT										
ES										
$\mu_S^{\wedge}$	0.46		0.55	0.53		0.71	0.38	0.74		
1965-1974 (average=0.76)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.88***	0.82***		0.66*	0.62	0.77***		
BE										
FR	8.47		1	0.89***		0.74***	0.65	0.84***		
DE	4.94		7.16	1		0.78***	0.68*	0.93		
EL										
IE	1.67		4.10	4.86		1	0.57	0.85***		
IT	1.19		1.38	1.76		0.71	1	0.64		
NL	3.95		5.02	-		7.92	1.38	1		
PT										
ES										
$\mu_S^{\wedge}$	0.50		0.43	0.46		0.44	0.40	0.39		
1975-1981 (average=0.58)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1		0.64***	0.38		0.42	0.49	0.48		
BE										
FR	2.79		1	0.60		0.75**	0.65*	0.48		
DE	-0.58		0.44	1		0.82***	0.42	0.83***		
EL										
IE	-0.25		2.14	5.31		1	0.60	0.68**		
IT	-0.14		1.66	-0.75		1.14	1	0.46		
NL	-0.14		-0.30	3.87		2.37	-0.32	1		
PT										
ES										
$\mu_S^{\wedge}$	0.33		0.67	0.64		0.70	0.49	0.52		
1982-1993 (average=0.69)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.52	0.56	0.84	0.63	0.62	0.82***	0.53*	0.79***	0.56
BE	1.03	1	0.76	0.55	0.58	0.67*	0.57	0.93***	0.61***	0.66
FR	-	0.92	1	0.69**	0.58	0.63*	0.69***	0.80*	0.47	0.50
DE	-	0.36	2.48	1	0.69*	0.69*	0.94***	0.64	0.74	0.57
EL	1.18	0.52	0.51	1.73	1	0.90***	0.69	0.55	0.81***	0.82***
IE	1.47	1.89	1.76	1.82	7.44	1	0.74***	0.65**	0.92***	0.89
IT	6.36	0.63	2.71	19.59	1.36	3.02	1	0.62	0.75	0.59
NL	1.76	11.83	1.70	1.28	-0.20	2.20	1.31	1	0.54**	0.59
PT	4.57	2.74	-	-	2.90	10.64	-	2.43	1	0.92***
ES	0.57	-	0.73	0.65	4.79	-	0.82	-	12.09	1
$\mu_S^{\wedge}$	0.41	0.80	0.85	0.57	0.58	0.57	0.56	0.79	0.35	0.44
1994-2001 (average=0.71)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.68	0.41	0.45	0.57	0.25	0.51***	0.57	0.59**	0.50

BE	-	1	0.73	0.75***	0.81***	0.47	0.67	0.90	0.69*	0.76***
FR	-	-	1	0.90***	0.83	0.68	0.81***	0.83	0.77***	0.91
DE	-	3.52	4.80	1	0.85***	0.64	0.92	0.75***	0.83	0.93***
EL	-	3.63	-	7.16	1	0.57	0.77***	0.71	0.79***	0.93
IE	1.02	-0.20	-0.06	-0.31	0.27	1	0.55	0.57	0.66	0.65
IT	2.85	1.60	4.08	-	3.17	-0.99	1	0.67	0.85***	0.84***
NL	-	-	-	3.28	1.43	0.62	1.49	1	0.69**	0.76***
PT	2.46	1.76	3.82	-	3.94	-	9.67	2.37	1	0.86***
ES	-	2.81	-	9.57	-	0.57	5.14	4.30	8.43	1
$\mu_S^{\wedge}$	0.15	0.47	0.74	0.70	0.57	0.88	0.61	0.57	0.53	0.65
2002-2008 (average=0.90)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.88***	0.89***	0.79***	0.89***	0.94	0.88***	0.89***	0.99	0.94
BE	6.10	1	0.99	0.86***	0.89***	0.94***	1.00	0.96***	0.87***	0.82***
FR	5.81	-	1	0.87***	0.90***	0.95***	0.99	0.98	0.88***	0.83***
DE	3.09	4.29	4.43	1	0.89***	0.82***	0.86***	0.89***	0.80***	0.82***
EL	5.37	6.01	7.49	6.75	1	0.93***	0.89***	0.93***	0.90***	0.93
IE	-	8.15	10.84	6.98	7.31	1	0.94***	0.93***	0.93	0.88
IT	6.10	.	-	5.69	5.49	12.60	1	0.96***	0.87***	0.82***
NL	5.97	20.26	-	7.60	8.90	13.72	20.26	1	0.90***	0.86***
PT	-	4.87	6.30	4.57	7.32	-	4.87	6.87	1	0.95
ES	-	4.10	5.06	4.45	-	-	4.10	5.76	-	1
$\mu_S^{\wedge}$	0.67	0.64	0.63	0.62	0.65	0.61	0.64	0.65	0.68	0.73
2009-2013 (average=0.82)										
	AT	BE	FR	DE	EL	IE	IT	NL	PT	ES
AT	1	0.78	0.78	0.78	0.52	0.62	0.65	0.78	0.52	0.55
BE	-	1	1.00	1.00	0.73	0.83	0.87	1.00	0.73	0.77
FR	-		1	1.00	0.73	0.83	0.87	1.00	0.73	0.77
DE	-			1	0.73	0.83	0.87	1.00	0.73	0.77
EL	-	-	-	-	1	0.90	0.87	0.73	1.00	0.97
IE	-	-	-	-	-	1	0.77	0.83	0.90	0.93
IT	-	-	-	-	-	1.13	1	0.87	0.87	0.83***
NL	-				-	-	-	1	0.73	0.77
PT	-	-	-	-		-	-	-	1	0.97
ES	-	-	-	-	-	-	3.44	-	-	1
$\mu_S^{\wedge}$	0.60	0.38	0.38	0.38	0.12	0.22	0.25	0.38	0.12	0.15

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 14: AVERAGE CONCORDANCE OF EQUITY GROWTH CYCLES: 1957:1-2013:12

Country	1957-64	1965-74	1975-81	1982-93	1994-01	2002-08	2009-13	% change 1957-13
Austria	0.69	0.60	0.50	0.70	0.75	0.92	0.93	34%
Belgium				0.65	0.64	0.91	0.93	45%
France	0.68	0.70	0.63	0.70	0.79	0.92	0.93	36%
Germany	0.50	0.61	0.65	0.72	0.80	0.91	0.93	85%
Greece				0.56	0.63	0.92	0.84	50%
Ireland	0.70	0.68	0.66	0.71	0.58	0.91	0.81	15%
Italy	0.69	0.54	0.54	0.68	0.76	0.91	0.93	35%
Netherlands	0.72	0.69	0.68	0.70	0.74	0.93	0.93	30%
Portugal				0.66	0.80	0.88	0.93	42%
Spain				0.64	0.80	0.91	0.83	30%

TABLE 15: AVERAGE CONCORDANCE OF EQUITY CLASSICAL CYCLES: 1957:1-2013:12.

Country	1957-64	1965-74	1975-81	1982-93	1994-01	2002-08	2009-13	% change 1957-13
Austria	0.61	0.75	0.48	0.65	0.50	0.90	0.66	8
Belgium				0.65	0.72	0.91	0.86	32
France	0.60	0.80	0.62	0.63	0.76	0.92	0.86	43
Germany	0.57	0.82	0.61	0.71	0.78	0.84	0.86	51
Greece				0.70	0.76	0.91	0.80	14
Ireland	0.61	0.72	0.65	0.75	0.56	0.92	0.83	36
Italy	0.65	0.63	0.52	0.71	0.73	0.91	0.83	28
Netherlands	0.65	0.81	0.59	0.65	0.72	0.92	0.86	32
Portugal				0.73	0.75	0.90	0.80	10
Spain				0.68	0.79	0.87	0.81	19

TABLE 16.A - CONCORDANCE BETWEEN BUSINESS AND FINANCIAL GROWTH CYCLES: 1960:1-2013: 12

Country	Concordance index
Austria	0.70
Belgium	0.65
France	0.67
Germany	0.62
Greece	0.57
Ireland	0.60
Italy	0.62
Netherlands	0.65
Portugal	0.64
Spain	0.72

TABLE 16.B - T-STATISTICS BETWEEN BUSINESS AND FINANCIAL GROWTH CYCLES: 1960:1-2013:12.

Country	t-stat
Austria	4.42
Belgium	2.63
France	3.90
Germany	2.28
Greece	0.88
Ireland	2.09
Italy	2.89
Netherlands	3.63
Portugal	2.08
Spain	4.17

TABLE 17.A - CONCORDANCE BETWEEN BUSINESS AND FINANCIAL CLASSICAL CYCLES: 1960:1-2013:12.

Country	Concordance index
Austria	0.46
Belgium	0.58
France	0.57
Germany	0.65
Greece	0.64
Ireland	0.57
Italy	0.51
Netherlands	0.49
Portugal	0.58
Spain	0.73

TABLE 17.B – T-STATISTICS BETWEEN BUSINESS AND FINANCIAL CLASSICAL CYCLES: 1960:1-2013:12.

Country	t-stat
Austria	-0.30
Belgium	0.84
France	0.64
Germany	2.89
Greece	2.32
Ireland	0.38
Italy	0.77
Netherlands	-0.75
Portugal	1.35
Spain	4.24

TABLE 18.A: SUB-PERIOD CONCORDANCE INDICES BETWEEN BUSINESS AND FINANCIAL GROWTH CYCLES: 1960:1-2013:12.

	1960-67	1968-73	1974-83	1984-92	1993-02	2003-08	2009-13
AT	0.45	0.65	0.78***	0.71***	0.67**	0.74*	1
BE				0.6	0.47	0.71*	1
FR	0.6	0.76***	0.63	0.52	0.67**	0.74***	1
DE	0.32	0.61	0.42	0.7***	0.72***	0.78***	1
EL				0.4	0.43	0.83***	0.78**
IE			0.68**	0.44	0.56	0.68	0.78
IT	0.58**	0.51	0.56	0.56	0.63*	0.65	1
NL	0.68*	0.65***	0.54	0.6	0.63	0.63**	1
PT				0.6	0.43	0.72***	1
ES				0.63*	0.72***	0.81***	0.8

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

TABLE 18.B: SUB-PERIOD CONCORDANCE INDICES BETWEEN BUSINESS AND FINANCIAL CLASSICAL CYCLES: 1960:1-2013:12.

	1960-67	1968-73	1974-83	1984-92	1993-02	2003-08	2009-13
AT	0.32	0.56	0.37	0.62***	0.28	0.53	0.75***
BE				0.60	0.40	0.54	0.97
FR	0.40	0.54	0.48*	0.60	0.50	0.72	0.97
DE	0.47	0.61	0.66*	0.71***	0.53	0.79**	0.90***
EL				0.52	0.58	0.75***	0.78
IE			0.53**	0.33***	0.70	0.74	0.60
IT	0.39	0.38	0.43	0.56	0.45	0.69*	0.83
NL	0.55	0.47	0.41	0.43	0.36***	0.64	0.78***
PT				0.45	0.57	0.50	0.80
ES				0.61**	0.65	0.93	0.82

Note: AT: Austria; BE: Belgium; FR: France; DE: Germany; EL: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; ES: Spain

Figures

FIGURE 1 - BUSINESS CYCLES

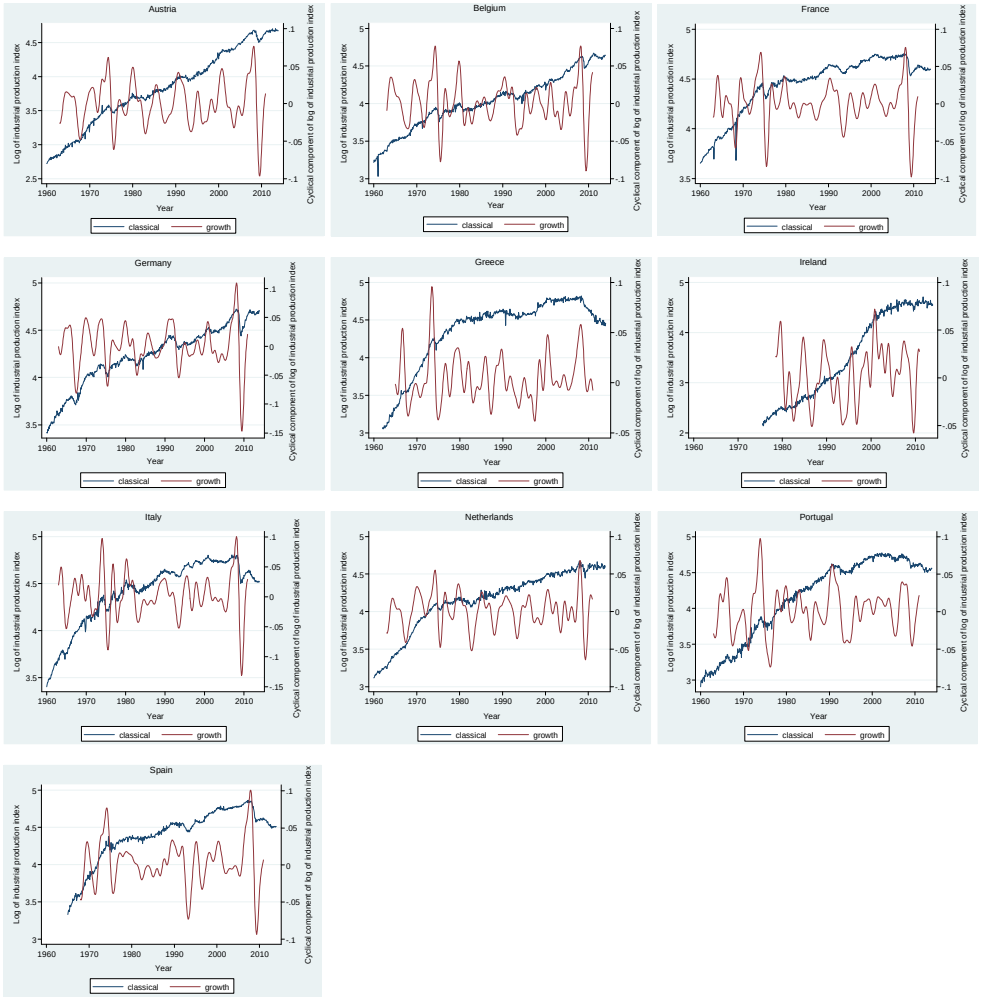

FIGURE 2 – FINANCIAL CYCLES

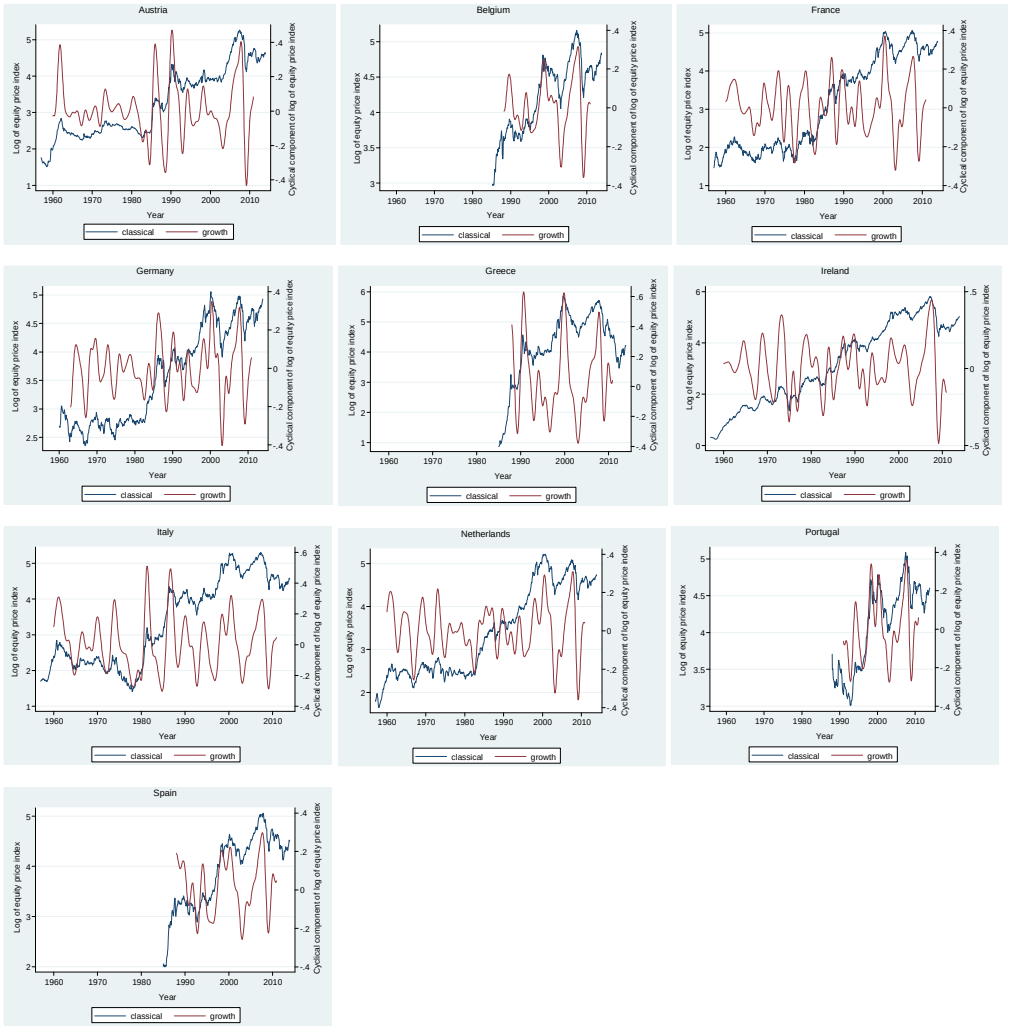

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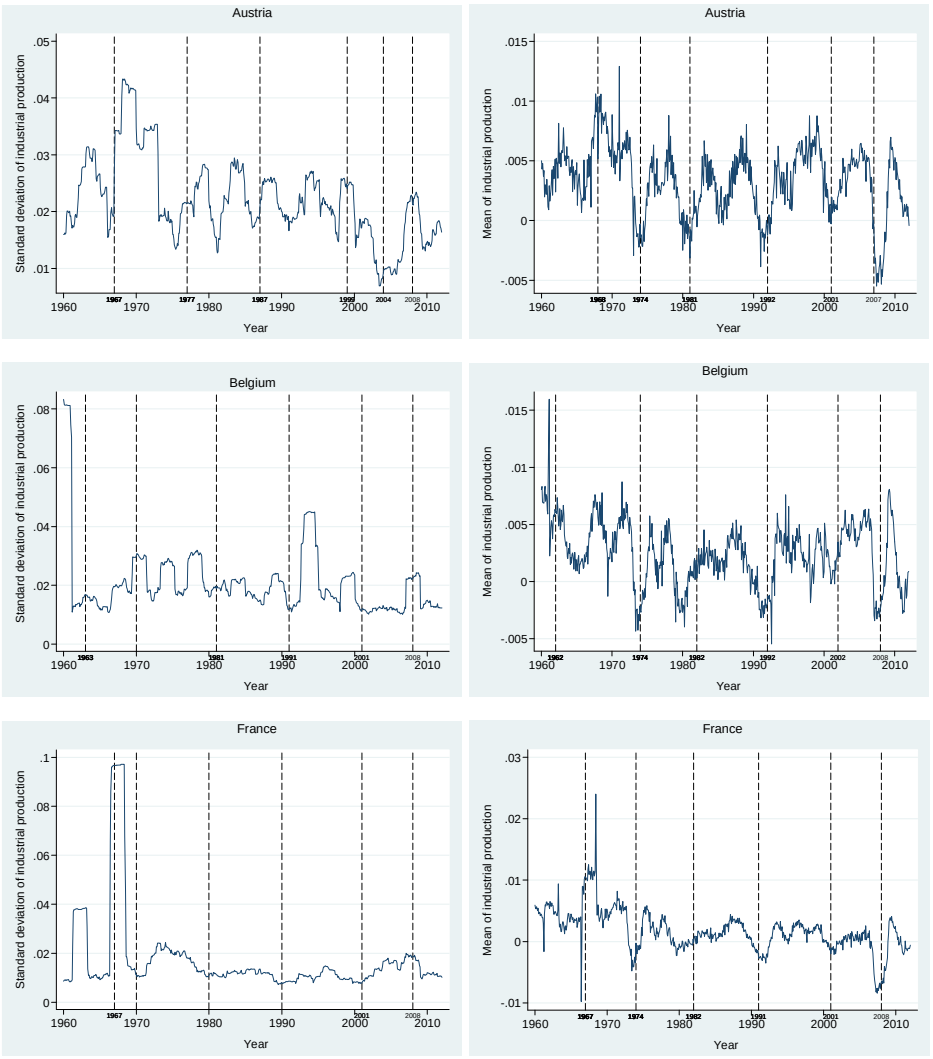
FIGURE 3 - BUSINESS CYCLE BREAK DATES



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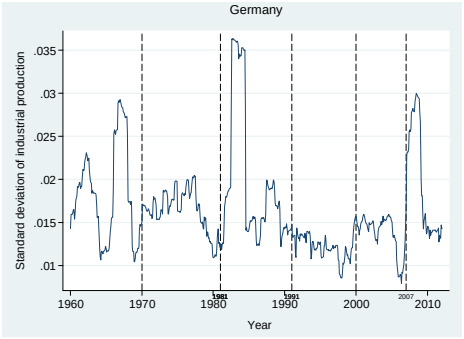
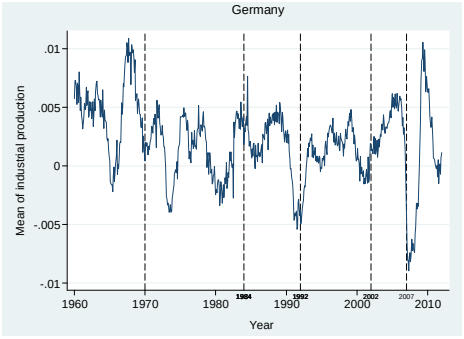
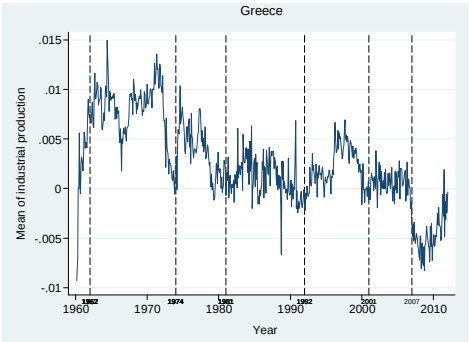
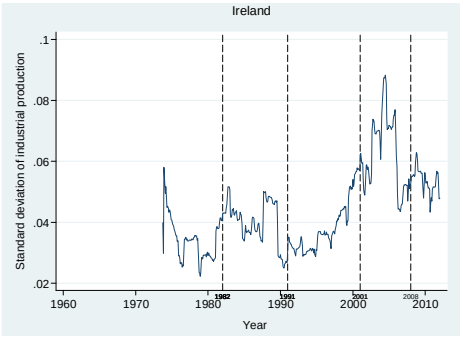
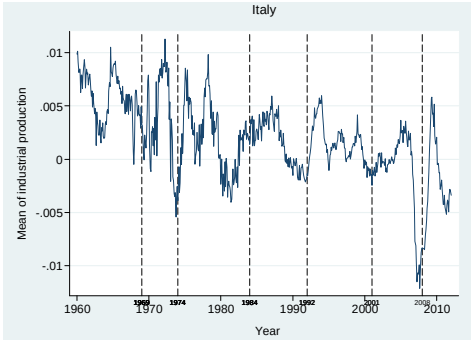
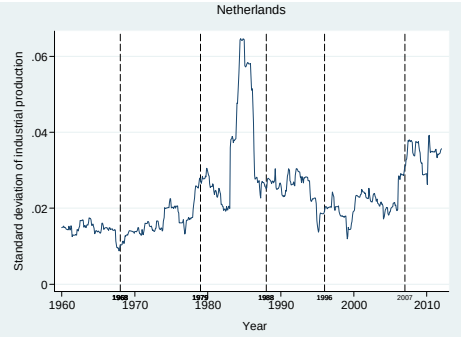


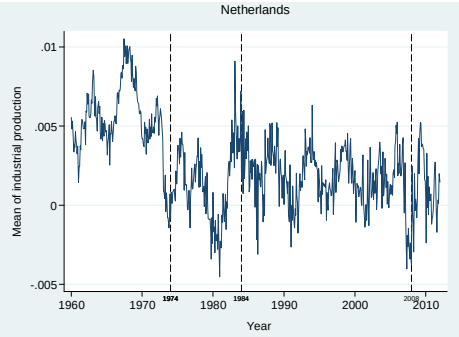


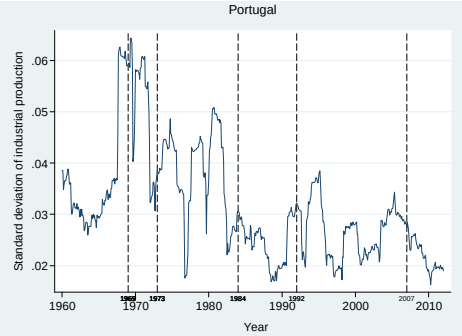


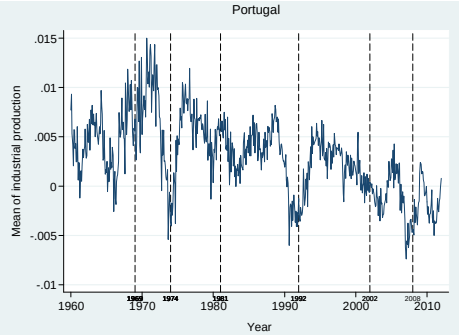


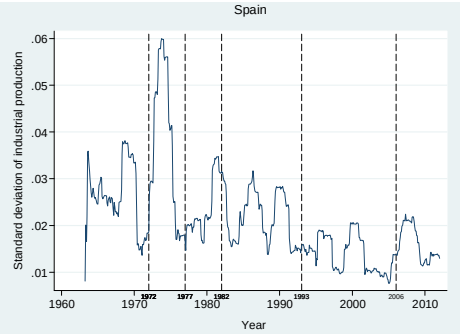



Netherlands
Standard deviation of industrial production
0
.02
.04
.06
1960
1970
1980
1990
2000
2010
Year


Netherlands
Mean of industrial production
-.005
0
.005
.01
1960
1970
1974
1980
1984
1990
2000
2010
Year


Portugal
Standard deviation of industrial production
.02
.03
.04
.05
.06
1960
1970
1973
1980
1984
1990
1992
2000
2007
2010
Year


Portugal
Mean of industrial production
-.01
-.005
0
.005
.01
.015
1960
1970
1974
1980
1981
1990
1992
2000
2002
2008
2010
Year


Spain
Standard deviation of industrial production
.01
.02
.03
.04
.05
.06
1960
1970
1972
1977
1980
1982
1990
1993
2000
2006
2010
Year

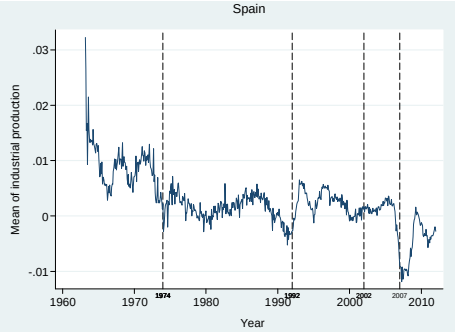
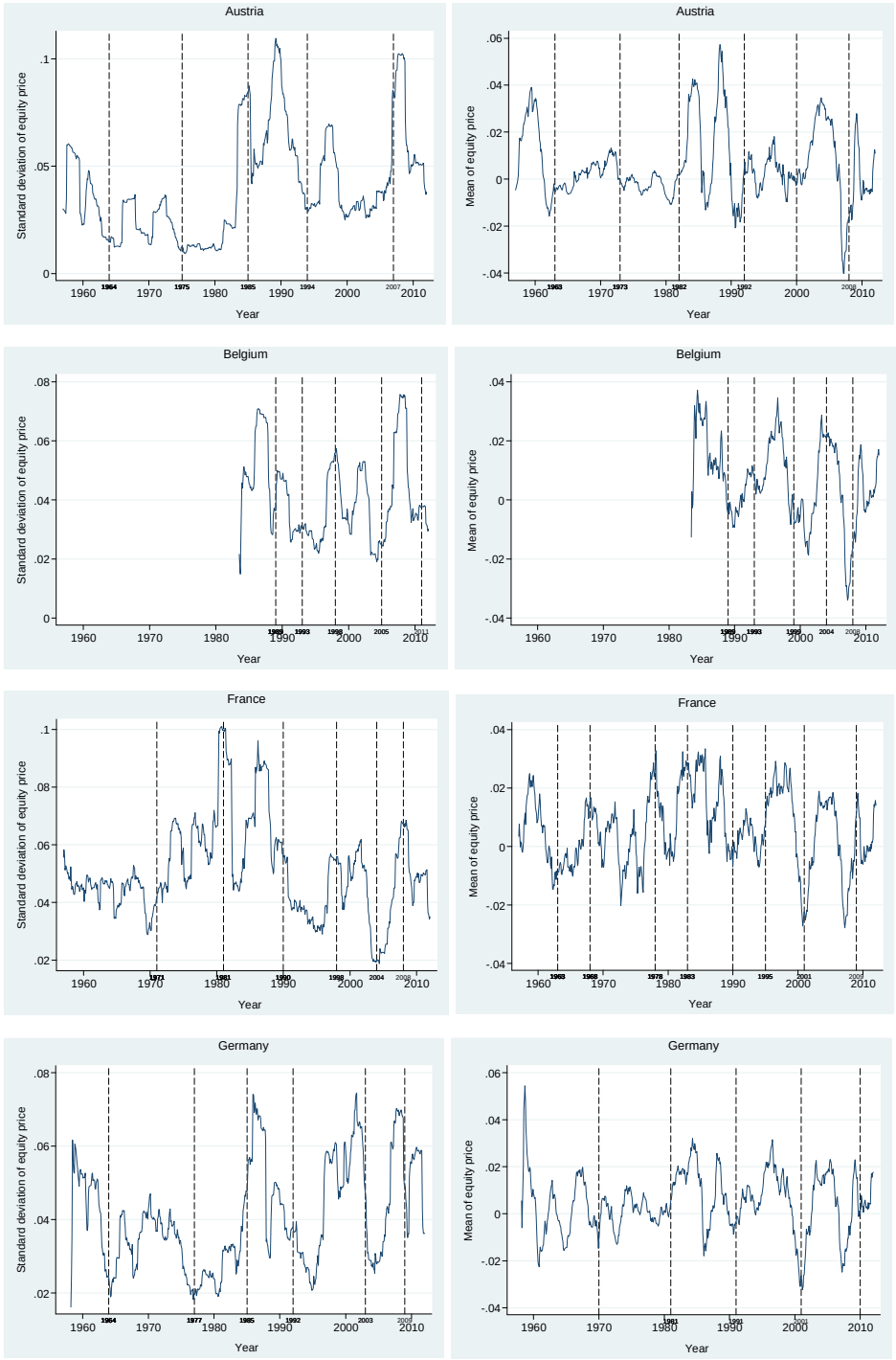

Spain
Mean of industrial production
-.01
0
.01
.02
.03
1960
1970
1974
1980
1990
1992
2000
2002
2007
2010
Year

FIGURE 4 - FINANCIAL CYCLE BREAK DATES



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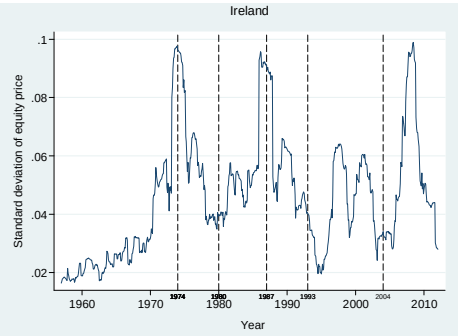

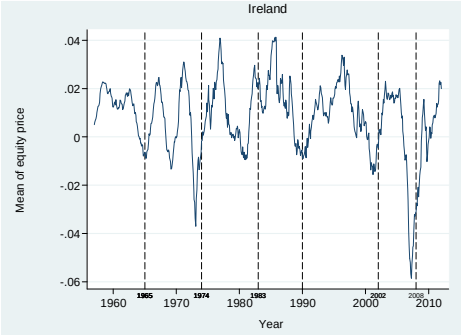

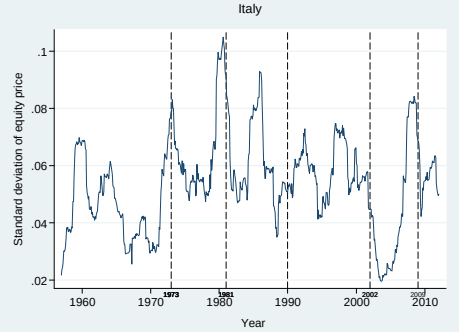

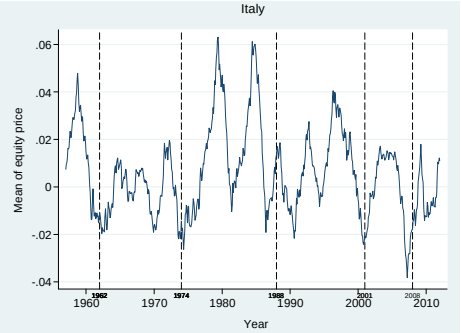

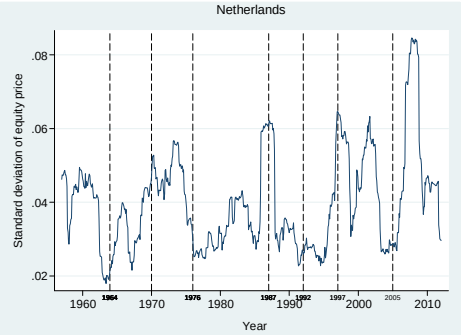

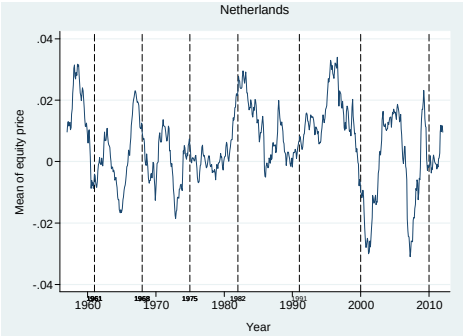

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