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University of Stellenbosch

BUSINESS CYCLES IN EMERGING MARKET ECONOMIES: A NEW VIEW OF THE STYLISED FACTS

S.A. DU PLESSIS[1]

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Stan du Plessis
Department of Economic
University of Stellenbosch
E-Mail: stan@sun.ac.za

[1] Professor, Department of Economics, University of Stellenbosch. This paper was prepared for the annual meetings of the AFEA in Boston during January 2006. I am grateful for very helpful comments by Geoff Woglom as well as by participants at the 10th Annual Conference on Econometric Modeling for Africa, the bi-annual conference of the South African Economic Society and a seminar held at UCT. The usual disclaimer applies.

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Abstract

This paper builds on an earlier work in business cycle theory – explicitly in the classical cycle tradition of Burns and Mitchell (1946) and the more recent work by Harding and Pagan (e.g.: 2002a; 2005b; 2005a) – to identify and analyse business cycles in emerging market economies. The goal is to revisit the work of for example Agénor, McDermott and Prasad (2000), whom have established a set of stylised facts for business cycle fluctuations in developing countries. Agénor, et. al. (2000) established these stylised facts using the presently standard method of analysing the features of serially correlated deviations from trends (identified with statistical techniques such as the Hodrick-Prescott filter) in certain macroeconomic time series, including real GDP, the price level, and components of final demand. The alternative method, implemented in this paper, uses an algorithm of Bry and Boschan (1971), and the recent work of Harding and Pagan to identify the various stylised facts regarding the duration, steepness, amplitude and concordance of these fluctuations in emerging market economies.

JEL Codes: C25; C41; E32

Key words: Business cycles; turning points; emerging market economies; quantitative analysis of business cycles; time series econometrics; regression with binary variables;

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BUSINESS CYCLE research covers the wide range of intellectual activity from abstract conceptualisation to the quantitative description of business cycles, from theorising about the causes and propagating mechanisms leading to cycles, to the modelling of such cycles and finally to the design of policy to ameliorate potential welfare losses. This paper is concerned with a small part of this project, that is the description of stylised facts about the business cycle in emerging market economies. To that end the conceptualisation of the business cycle as provided in the earlier work of, for example, Burns and Mitchell (1946) and the techniques that have more recently been proposed by Harding and Pagan in various papers (e.g.: Harding and Pagan, 2002a; 2005b; a) are used. However, this conceptualisation, as well as the techniques used, stand in contrast to academic business cycle research of the last two decades and it is the goal of this paper to investigate whether prevailing views are consistent with a description of the cycle using older techniques.

The first section contrasts the different approaches to descriptive business cycle research and provides a summary of recent papers that applied these techniques to emerging markets (or to developing countries more generally). Section two describes the analytical techniques used in this paper to implement the earlier approach to business cycle description. A third section described the data used, while a fourth reports results.

1. BUSINESS CYCLES IN DEVELOPING COUNTRIES

In their classical text on the topic, Burns and Mitchell acknowledged that there were rival conceptualisations of the business cycle, though they all shared one "…ultimate aim – namely, to attain better understanding of the recurrent fluctuations in economic fortune that modern nations experience" (Burns and Mitchell, 1946: 4). Though business cycles are conceptualised as actual phenomena associated with modern market economies, the phenomenon as such is never observed. Fluctuations in economic activity are easily observed, but analytical tools have to be applied to the data in order to extract those fluctuations we call the business cycle and which can, in the almost poetic words of Burns and Mitchell "…be seen through a cloud of witnesses only by the eye of the mind" (Burns and Mitchell, 1946: 12).

This paper proposes to look afresh at the stylised facts of business cycles in emerging market economies, by (i) returning to the conceptualisation of the business cycle proposed by Burns and Mitchell and used by policy makers (such as central banks) and research institutes such as the NBER and (ii) by analysing the cycles thus identified using analytical techniques proposed by Harding and Pagan in various recent papers. The conceptualisation of the business cycle that is at the core of this approach was stated formally by Burns and Mitchell:

> "Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organise their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycle vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitude of approximately their own". (Burns and Mitchell, 1946: 3)

Business cycles defined in this way: as successive periods (with a certain duration) of relative expansion and decline in aggregate economic activity, are called "classical cycles". The usual method is to define turning points (troughs and peaks) which separate the periods of relative prosperity and relative decline in the level of economic activity. A full cycle is defined either from trough to trough or from peak to peak and consists of two phases, an expansion (trough to peak) and contraction (peak to trough). There are two critical aspects to this conceptualisation: first, "duration" is a crucial criterion for distinguishing business cycles from other fluctuations[2]. Burns and Mitchell's framework required a full cycle to last at least 15 months as well as minimum requirement of 5 months on every single phase. These duration requirements are usually called "censoring rules" (Harding and Pagan, 2001). Second, the business cycle refers to periods of expansion and contraction in the level of aggregate economic activity, and this can only be operationalised when a reliable measure of aggregate economic activity is available over a long enough horizon. But this was not the case during the forties, and the elaborate construction of reference cycles, using information from many series and noting the clustering of their individual turning points[3] was developed instead (Burns and Mitchell, 1946: 76).

This pragmatic argument for the reference-cycle method has since lost force in the industrialised world where relatively reliable measures of aggregate economic activity (in the form of GDP) are available going back decades. And the same is true for a number of developing countries which have lately been grouped under the heading of emerging markets. For these economies, in the industrialised and developing world, a simple algorithm applied to GDP data might provide an adequate identification of the turning points that separate the expansionary and contractionary phases of the business cycle. Such an algorithm is introduced in the next section and applied to GDP data from emerging market economies later in this paper.

In contrast with the Burns and Mitchell conceptualisation the presently dominant conceptualisation of the business cycle in the academic literature involves the calculation of "deviation cycles". This technique involves identifying the business cycle with "serially correlated deviations of output from trend" as Blinder and Fischer (1981) suggested.

Formally the technique involves the creation of a new stochastic variable by subtracting a permanent component from (log) real GDP.

$$z_t = \ln(y_t) - P_t \qquad (1)$$

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[2] "Our basic criterion of distinguishing these three types of movement is duration;… Intermediate between the persistent drifts that often cover decades and the oscillations that occur every few months, there appear in most series well-defined movements of rise and fall, the duration of which from trough to trough and from peak to peak is rarely less than two or more than seven years" (Burns and Mitchell, 1946: 56-57).

[3] Burns and Mitchell stated the problem as follows:

> "The conclusion to be drawn from this condensed review of statistical data bearing on aggregate economic activity is obvious. If there is no monthly or quarterly series in any of our countries that can serve by itself as a criterion for setting a reference scale of business cycles, whether because the series is not long enough, or not accurate enough, or not broad enough in its coverage, or not stable enough in its relation to business cycles, or for all these reasons, then it is necessary to use a more laborious method; that is, a reference scale of business cycles must be extracted from the fallible indications provided by time series for varied economic activities" (1946).

The identification of a permanent component, {Pt}, is a crucial part of this method and a number of different filters have been proposed to that end, including: the Hodrick-Prescott filter, the Band-Pass filter, the Beveridge-Nelson filter and so on. Serially correlated deviations from such permanent components represents a very different conceptualisation of the business cycle from that described above and to make this distinction explicit this method is said to identify "deviations cycles" or sometimes "growth cycles" instead of the "classical cycles" described above[4].

The method of deviation cycles has also been used to identify business cycle fluctuations for developing countries. Once identified the stylised facts of these cyclical fluctuation could then be analysed, as has been done in the literature. A prominent recent example of this method is Agénor, McDermott and Prasad (2000) where a set of stylised facts for business cycles in developing counties was constructed from an analyses of deviation cycles[5] in the 12 middle-income developing countries[6]. The data for Agénor et al.'s (2000) analysis was taken form the IFS database and was collected at a quarterly frequency for a sample window of 1978Q1 until 1995Q4 (where available). As a proxy for aggregate economic activity they used the IFS index for industrial production (or manufacturing production in some of the countries)[7]. The deviation cycle for aggregate output was then correlated with the deviation cycle from a number of other macroeconomic series of interest, including: a proxy for world industrial production, a proxy for the world real interest rate, various measures of fiscal policy, various labour market measures, various monetary policy measures, and finally measures relevant to international trade such as the trade balance and the terms of trade.

The major stylised facts established by Agénor et al. (2000) are: (i) there is great variation in the volatility of business cycle fluctuations in developing countries, but on the average these fluctuations are considerably more volatile than comparable fluctuations in developed countries. (ii) Industrial country business cycle fluctuations has a significant effect on developing country business cycle fluctuations (iii) government expenditure is mostly counter-cyclical, which yields a counter-cyclical fiscal impulse as government revenue was found to be mostly a-cyclical. (iv) Though there is no clear result for nominal wage deviations, real wage deviations appear to be significantly pro-cyclical. (v) They found no consistent relationship between output fluctuations and deviations for inflation or for the price level. (vi) Monetary aggregates are broadly pro-cyclical while the velocity of broad money was found to be mostly anti-cyclical. (vii) Finally, the terms of trade was strongly pro-cyclical for those four counters for which data on import and export prices were available.

In a more recent study on the nature of business cycles in developing countries Rand and Tarp (2002) combined the classical and deviation cycle methods in an analysis of the business cycle in

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[4] This is not the place to consider the relative merits and shortcomings of these methods. Pagan (2004) and Harding and Pagan (2002a; 2002c) provide thorough discussions. See also Burns and Mitchell (1946) for a discussion of the non-uniqueness of deviations cycles. It is however important to note that Blanchard and Fischer's (1989) claim that the turning point method does not generate statistics with "well-defined statistical properties" is incorrect as has been demonstrated by Harding and Pagan.

[5] Agénor et al. (2000) used both the Hodrick-Prescott and Band-Pass filters.

[6] The 12 countries in Agénor et al.'s (2000) dataset are: Chile, Columbia, India, Korea, Malaysia, Mexico, Morocco, Nigeria, The Philippines, Tunisia, Turkey and Uruguay.

[7] Agénor et al. (2000) supported the use of this proxy for aggregate output with the argument that industrial production was a significant part of aggregate economic activity in all of these economies and that industrial production was a proxy for the traded goods sector which would be an important source of business cycle shocks in developing countries.

15 developing countries[8]. Rand and Tarp (2002) used data at a quarterly frequency with sample windows starting in the early sixties for some of the countries and running until 1999. Industrial production is used as the proxy for aggregate economic activity and the IFS database was the principal data source. As a first step, Rand and Tarp (2002) used a dating algorithm of Bry and Boschan (see section 2 below) to find the turning points for the level of aggregate activity in these economies. The striking result of this exercise is their conclusion that business cycles are significantly shorter in developing countries than the cycles observed in developed countries.

In the second part of their analysis Rand and Tarp (2002) used their result on the duration of business cycles to recalibrate the Hodrick-Prescott filter. This adjusted Hodrick-Prescott filter was then used to construct deviation cycles for the same economies. The main results from this analysis are: (i) Aggregate economic activity is considerably more volatile in the developing world when compared with developed countries. (ii) More surprisingly, consumption is more volatile than output at business cycle frequencies in developing countries. (iii.) Developed country shocks are very important for business cycles in developing countries. (iv) Inflation (and the price level) are countercyclical in developing countries[9].

Finally Kose, Prasad and Terrones (2003) investigated co-movement and volatility of business cycles in 21 developed and 55 developing countries. Real per capita GDP served as their proxy for aggregate economic activity in a sample of annual data with a window from 1960 to 1999. As a filter Kose et al. (2003) calculated the annual growth rates of per capita GDP to identify deviation cycles. The most important results of their study are: (i) while output volatility declined for all groups of countries with increasing globalisation, the same is not true of the volatility of consumption expenditure. In developing countries Kose et al. (2003) observed an increase of consumption volatility with rising globalisation. (ii). The deeper trade and financial linkages that constitute rising globalisation led to greater co-movement for the growth cycle of industrialised countries, though Kose et al. (2003) observed a decline in the co-movement of developing country growth cycles with world aggregates.

In addition to papers which attempt a general description of business cycles in developing countries – and of which the most prominent are discussed above - there is also a large literature that analyses more narrowly defined questions about developing country business cycles, for example Bulir and Hamann (2001) and Pallage and Robe (2001). These studies are not considered in detail here as they deal mainly with the impact of aid flows on developing country business cycles and that is a less relevant topic for the group of emerging market economies selected for investigation in this study.

2. EXTRACTING AND ANALYSING BUSINESS CYCLE INFORMATION

The dating algorithm used here is by Bry and Boschan (1971) as suggested by Harding and Pagan in various recent papers[10]. This algorithm identifies local minima (troughs) and local maxima (peaks) in a single time series, or {yt} after a log transformation. Peaks are found where y is larger than k values of {yt} in both directions [t-k, t+k] and troughs where y is smaller than k values of {yt} in both directions. The size of k is set by the censoring rule of the algorithm.

[8] Rand and Tarp's (2002) sample consist of: South Africa, Malawi, Nigeria, Ivory Coast, Zimbabwe, Uruguay, Columbia, Peru, Chile, Mexico, India, Korea, Morocco, Pakistan, Malaysia.
[9] From which Rand and Tarp (2001) concluded that supply shocks must be playing major role in developing country business cycles.
[10] To be more precise, Harding and Pagan (2002b) suggested using part V of the "procedure for programmed determination of turning points" in Bry and Boschan (1971, Table 1, 21).

There is no optimal size for k, but Bry and Boschan (1971) suggested a value of 5 at a monthly frequency which Harding and Pagan (2001) translated to 2 for quarterly series.

A censoring rule is also required to ensure that each cycle (and each of its phases) have a minimum duration. Following Harding and Pagan (2001) the minimum duration for a single phase was set at 2 quarters and the minimum duration for a complete cycle at 5 quarters. The Bry-Boschan algorithm therefore identifies turning points according to the requirements in equation 2, subject to the above-mentioned censoring rules.

$$\begin{aligned}&\text{Peak at } t \text{ if } \{(y_{t-2}, y_{t-1}) < y_t > (y_{t+1}, y_{t+2})\}\\&\text{Trough at } t \text{ if } \{(y_{t-2}, y_{t-1}) > y_t < (y_{t+1}, y_{t+2})\}\end{aligned} \tag{2}$$

This algorithm will struggle to identify turning points in the level of a series that is strongly upward sloping, for example the (log of) real GDP in Japan during the eighties. The Bry-Boschan algorithm is likely to yield turning points implausibly far apart in such cases to identify business cycle fluctuations. One way of addressing this problem is to remove a deterministic trend. Harding and Pagan (2001) recommended subtracting a deterministic trend if any components are to be removed. In this paper the Bry-Boschan algorithm was applied to the levels of (log) real GDP, this algorithm was augmented with an application of the same algorithm to a series from which a deterministic linear component had been removed in cases where the levels series yielded implausibly long cycles. In all such cases the turning points identified by the levels algorithm were retained.

Once the turning points of the cycle have been identified it is possible to describe the characteristics of the cycle in terms of duration, amplitude, steepness, non-linearity, and synchronisation with the business cycles of other economies or of the phases of cyclical patterns in other macroeconomic magnitudes within the same economy. Analytical tools are required to calculate the amplitude, co-movement and so on of business cycles.

Following Harding and Pagan (2001) the average amplitude of each phase of the business cycle is defined as[11]:

$$\hat{A} = \frac{\sum_{t=1}^{T} s_t \Delta y_t}{K} \tag{3}$$

Where:
s_t: a binary variable which takes the value of 1 when the series is an expansion (contraction)
K: the number of peaks (troughs)

Any single figure index such as the average amplitude or the average duration of business cycle phases risk hiding much information behind the averaging. Pagan (2004) has suggested an index, CV_D, to quantify the diversity of the duration between different specific cycles. A similar index, CV_A, could also be used to quantify the diversity of the amplitude between different specific cycles. Equation 4 shows the index that quantifies the diversity between the expansions and contractions of different specific cycles and equation 5 shows the index that quantifies the

[11] The amplitude is only measured for completed phases of the cycle.

diversity of amplitude.

$$CV_D^{Expansion} = \frac{\sqrt{\left[\frac{1}{K}\sum_{i=1}^{K}\left(D_i^{Expansion} - \overline{D}^{Expansion}\right)^2\right]}}{\frac{1}{K}\sum_{i=1}^{K}D_i^{Expansion}}$$

$$CV_D^{Contraction} = \frac{\sqrt{\left[\frac{1}{K}\sum_{i=1}^{K}\left(D_i^{Contraction} - \overline{D}^{Contraction}\right)^2\right]}}{\frac{1}{K}\sum_{i=1}^{K}D_i^{Contraction}} \tag{4}$$

Where:
$D_i^{Expansion}$: The duration of the expansionary phase of specific cycle i
$\overline{D}^{Expansion}$: The average duration of expansionary phases

$$CV_A^{Expansion} = \frac{\sqrt{\left[\frac{1}{K}\sum_{i=1}^{K}\left(A_i^{Expansion} - \overline{A}^{Expansion}\right)^2\right]}}{\frac{1}{K}\sum_{i=1}^{K}A_i^{Expansion}}$$

$$CV_A^{Contraction} = \frac{\sqrt{\left[\frac{1}{K}\sum_{i=1}^{K}\left(A_i^{Contraction} - \overline{A}^{Contraction}\right)^2\right]}}{\frac{1}{K}\sum_{i=1}^{K}A_i^{Contraction}} \tag{5}$$

Where:
$A_i^{Expansion}$: The duration of the expansionary phase of specific cycle i
$\overline{A}^{Expansion}$: The average duration of expansionary phases

Both indices indicate greater diversity when high a small diversity when low.

A metric of the co-movement between business cycles is also required. In the literature such co-movement is usually measured with the cross-correlogram between the deviations cycles of various series (for example, Agénor, McDermott et al., 2000). However the turning-point method yields a different kind of business cycle data in which the basic unit of analysis is a binary time-series that indicates when a particular series is in an expansionary (trough to peak) or a contractionary (peak to trough) phase. Harding and Pagan (2002b) recently drew attention to the a concordance index discussed in Bry and Boschan (1971: 107) (equation 6 below) which measures the proportion of time two binary series spend in the same phase as a proportion of the sample period[12].

$$\hat{I} = \frac{1}{T}\left[\sum_{t=1}^{T} s_{xt}s_{yt} + \sum_{t=1}^{T}(1-s_{xt})(1-s_{yt})\right] \tag{6}$$

where:
Sxt: is 1 when the first series indicates an expansion
Syt: is 1 when the second series indicates an expansion

This concordance index ranges from zero to one, with a score of 0.5 indicating no concordance between the two series, while 1 indicates perfect positive concordance and 0 perfect negative concordance. However, there is a well-known problem with this kind of concordance index, that is that the long periods spent in any one phase might bias the concordance index upwards in a form of spurious regression for binary variables. This is especially problematic when measuring the concordance between two series where one of the two spend a long time in expansions, as often happens for a strongly growing developing country. To deal with this potential bias it is important to "mean correct" the concordance index, after which the concordance index changes to the expression in equation 7.

$$\hat{I}^* = \frac{2}{T}\left[\sum_{t=1}^{T}(s_{xt}-\bar{s}_x)(s_{yt}-\bar{s}_y)\right] \tag{7}$$

The adjusted concordance index ranges form –1 (perfect negative concordance) to +1 (perfect positive concordance). But it is not enough to know the size of the concordance index as inference requires a test statistic for the significance of the concordance index. There are various strategies for obtaining such a test statistic, with McDermott and Scott (2000), for example, providing a response surface function that generates critical values for the concordance index given the mean and standard deviation of the series as well as the sample size. Alternatively Harding and Pagan (2005b) observed that coefficient ρs in the following regression is monotonic in the mean adjusted concordance index and that we could, therefore, usefully focus attention on $\hat{\rho}_s$ instead of $\hat{I}$.

$$\left(\frac{s_{y,t}}{\hat{\sigma}_{S_y}}\right) = \eta + \rho_s\left(\frac{s_{x,t}}{\hat{\sigma}_{S_x}}\right) + u_t \tag{8}$$

A null hypothesis of zero concordance between {Sxt} and {Syt} corresponds to a null hypothesis that ρs is zero in (6). The test statistic for the latter is easily obtained as long as the standard errors of the regression are adjusted for the expected autocorrelation of the data and the expected conditional heteroskedasticity of the error term. The heteroskedastic and autocorrelation consistent (HAC) estimation procedure of Newey and West (1987) was followed here to make allowance for this potential problem[13].

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[12] One advantage of this measure of synchronisation is that it can be used even when the two underlying series are non-stationary.
[13] In the presence of autocorrelation and heteroskedasticity the standard t-test risks over-rejecting the null of no correspondence. To demonstrate this risk the standard and NW-adjusted p-value for the null hypothesis is reported in the results section.

3. DATA

This study focuses on the subset of developing countries that are integrated with the world's financial markets, the group of emerging market economies. The most recent MSCI emerging market index contained the following countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela (www.msci.com/equity/indexdesc.html). However, not all of these countries could be included in the study and the final selection was driven by the following considerations.

(i) Economies that were formerly centralised (such as Poland) were excluded as they would at most have a decade or so of macroeconomic data as market economies.

(ii) Real GDP is used as indicator of aggregate economic activity and must be available at a quarterly frequency back to the early 1980s.

(iii) The IFS database was the chief data source (except for South Africa, where the SARB's quarterly bulletin provided consistent data back to the early seventies).

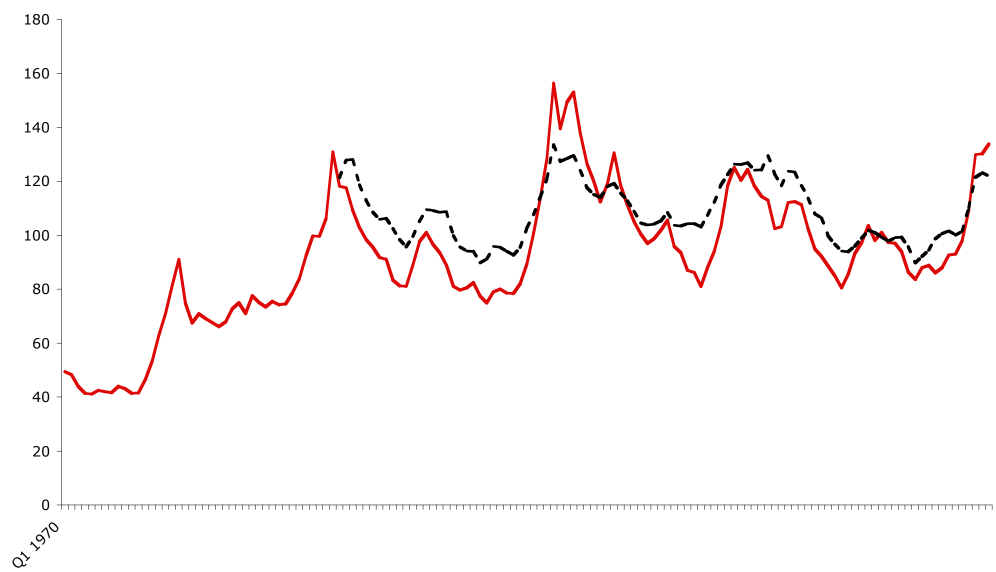
Only seven of the MSCI countries satisfied these criteria on the IFS database, they are: Hong Kong, Israel, Korea, Mexico, Peru, The Philippines, and South Africa. The levels algorithm was augmented with an application to a detrended series (as described above) in the cases of Hong Kong, Israel, Korea, the Philippines and South Africa. In addition to GDP the following series were also compiled at the same frequency (the data appendix provides a full description and references to the IFS database):

1. Real private consumption expenditure (calculated from the nominal series by using the GDP deflator, since the consumer expenditure deflator is not available on the IFS). The levels algorithm was augmented with an application to a detrended series (as described above) for consumption expenditure in the cases of Hong Kong, Israel, Korea, the Philippines and South Africa.
2. Real consumption expenditure by government (converted to a real series where required in the same way as private consumption expenditure).
3. Real gross fixed capital formation (converted to a real series where required in the same way as private consumption expenditure).
4. Real GDP for the USA (OECD database), Japan (IFS database) and the EMU area (OECD database).
5. Consumer price index from the IFS database. An inflation rate was calculated as the 4-quarter percentage change of this index.
6. Nominal interest rates from the IFS data base. The criterion was to select a short run market determined interest rate for which a long quarterly time series was available. It does not matter if the particular interest rate is consistently higher/lower than other interest rates of interest in the economy, since the spread does not influence the dating of the turning points. The following interest rates were selected: Hong Kong (none suitable), Israel (IFS lending rate), Korea (IFS money market rate), Mexico (IFS Treasury Bill rate)[14], Peru (IFS lending rate), Philippines (IFS Treasury Bill rate), South Africa (IFS Treasury Bill rate).

[14] The IFS database missed a data point for 1986Q3. Duplicating the data for 1986Q2 filled in this point. This decisions had no impact on any turning points.

7. A real interest rate was calculated by assuming static inflation expectations and a 1 year horizon.
8. IFS commodity price index. The all commodities index (IFS;00176AYDZF...) is only available at a quarterly frequency from 1980Q2, while the metals index (IFS;00176NFDZF...) is available from 1970Q1. Since these two series yielded essentially the same turning points with the Bry-Boschan algorithm the metals series was used a proxy for all commodity prices (see figure 1 below). This facilitated the construction of a longer commodity cycle index.

Figure 1 The IFS All Commodities and Metals Price indices yield the same turning points



Before applying the Bry-Boschan dating algorithm seasonal fluctuations have to be removed from the data (Burns and Mitchell, 1946: 12, 40).

Three problems occurred in the practical application of the Bry and Boschan dating algorithm: first, since the algorithm does not guarantee alternating peaks and troughs the application of the algorithm has to be sensitive to that that possibility. In practice the censoring rule removes the bulk of the ambiguous turning points, but where there is residual ambiguity the following rule was adopted: if there are two potential peaks (troughs) within 2 quarters then select the highest peak or lowest trough, else select the first peak (trough).

A second problem was that the BBQ algorithm might yield turning points for the classical cycle that are implausibly far apart to identify the business cycle fluctuations consistent with the intuition described by Burns and Mitchell (1946). To solve this problem the classical cycle turning points were augmented by turning points identified through a growth cycle algorithm, by subtracting a deterministic trend from the (log) output series before implementing the same BBQ algorithm as used to identify turning points of the classical cycles. This pragmatic solution is consistent with Harding and Pagan's (2001) advice to subtract a deterministic trend if any trend is to be removed. Whether this is a reasonable solution depends on the practical merit of the phases for the business cycle identified in this manner, i.e. whether they represent periods of relative expansion and relative decline for the economy under consideration. Where turning points from growth cycles were used to augment the classical cycle turning points a hierarchical approach was followed whereby growth cycle turning points were only adopted when they did not override of interfere with turning points identified by the classical cycle algorithm.

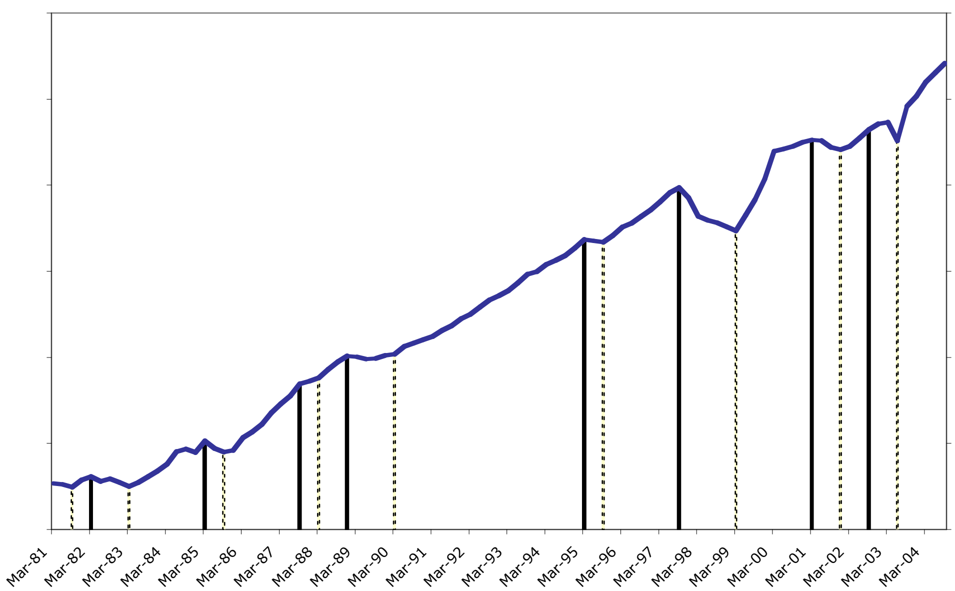
This combination of classical and growth cycle techniques raised the possibility of a third practical problem, i.e. that the growth cycle algorithm might identify too many turning points. In this sample the problem occurred in the attempt to identify turning points for Korea. However, there is no optimal size for the horizon (k) over which the Bry and Boschan (1971) algorithm should be implemented. As mentioned above, Harding and Pagan (2001) suggested value of to 2 for quarterly series, but In Korea's case this algorithm identified an implausibly large number of turning points. To circumvent this problem Harding and Pagan (2002c) observed that the value of k might have to be extended when applying the BBQ algorithm to developing countries. Following this suggestion the horizon k=3 was used in the case of Korea, reducing the number of completed cycles over the relevant period by 2[15].

Appendix A lists the turning points for all the countries studied here and also distinguishes between the classical cycle turning points and those turning points that were identified using the growth cycle algorithm.

4. RESULTS

Figures 1 to 7 show the level of real GDP turning points for each economy as identified using the BBQ algorithm (peaks are marked with a solid vertical line while troughs are marked with a broken vertical line).

Figure 1 Turning points for the business cycle in Hong Kong



[15] I am grateful to Geoff Woglom for suggesting this solution.

Figure 2 Turning points for the business cycle in Israel

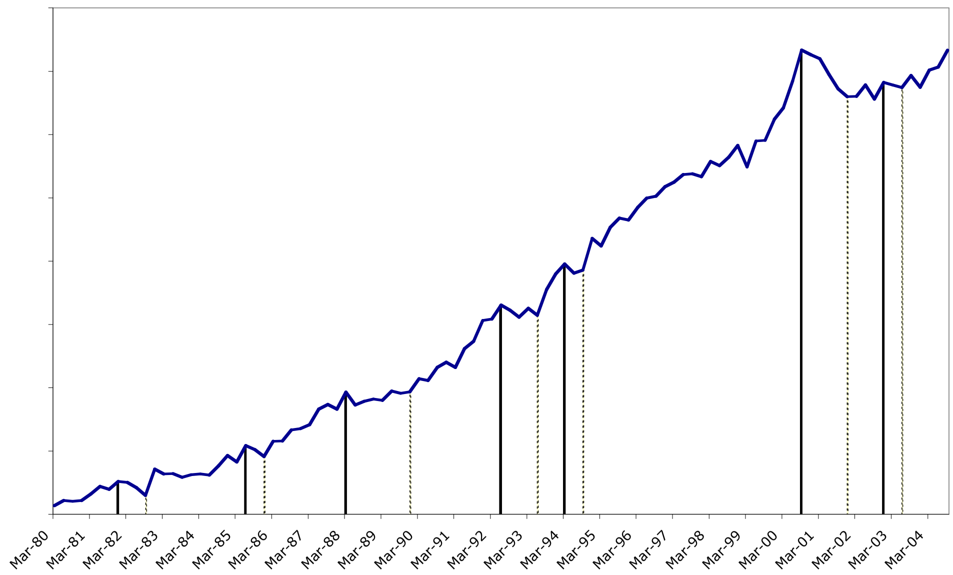


Figure 3 Turning points for the business cycle in Korea

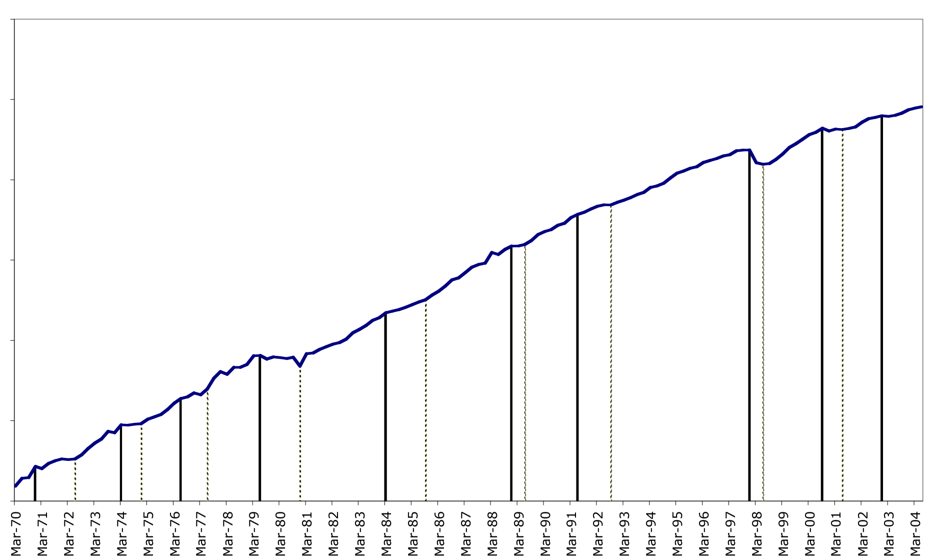


Figure 4 Turning points for the business cycle in Mexico

Figure 5 Turning points for the business cycle in Peru

Figure 6 Turning points for the business cycle in Philippines

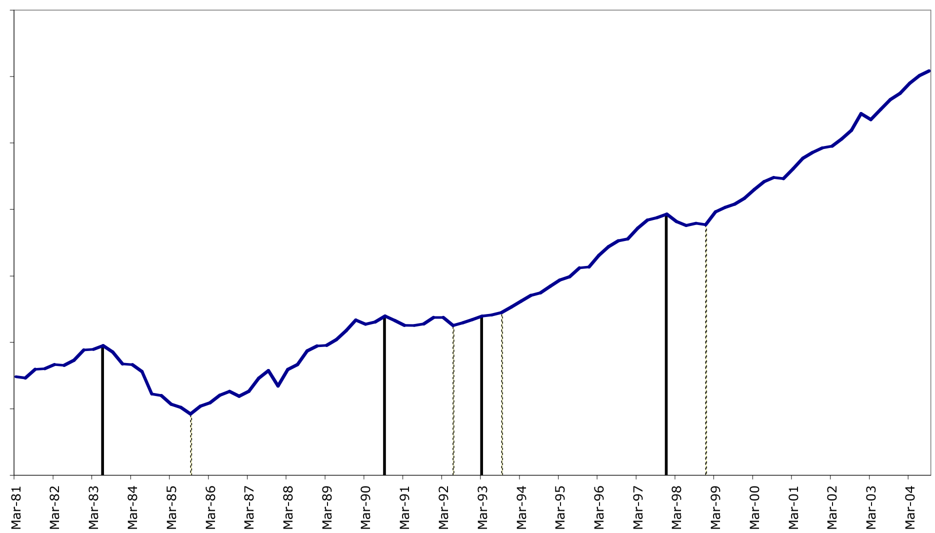
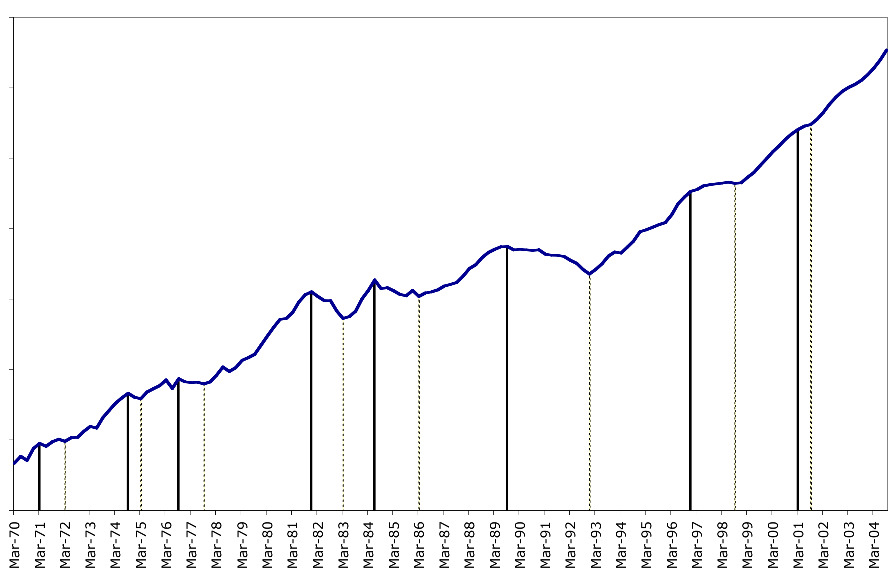


Figure 7 Turning points for the business cycle in South Africa



4.1 Basic characteristics of the business cycle

The first table shows basic characteristics of the business cycle in the emerging market economies under consideration as well as comparable figures for the USA, the EMU Area and Japan.

Table 1 Basic characteristics of business cycles in emerging market economies

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa	USA	EMU	Japan
				Average duration (quarters)						
Expansions	7.5	10.17	10.11	14.75	7.86	13.33	11.14	12.25	11.89	13
Contractions	3.38	3.57	4.11	4.4	3.88	5	5.5	3.88	3.13	4.17
				Measure of diversity in duration, CV_D						
Expansions	0.74	0.67	0.45	0.58	0.61	0.41	0.39	0.54	0.62	0.57
Contractions	0.42	0.49	0.39	0.37	0.37	0.71	0.61	0.75	0.25	0.53
				Amplitude						
Expansions	12.78	11.49	20.02	16.49	20.38	15.3	10.49	11.13	8.36	10.73
Contractions	-1.71	-1.32	2.18	-5.12	-14.4	-4.01	-1.11	0.23	0.18	0.03
				Measure of diversity in amplitude, CV_A						
Expansions	0.62	0.62	0.36	0.65	0.72	0.33	0.44	0.58	0.57	0.67
Contractions	-1.00	-1.18	3.24	-0.51	-0.77	-1.21	-1.3	-5.3	-1.64	0.99

Though expansions were, on the average, just over a quarter longer in the developed economies than in the emerging market economies, such a comparison of means hides the most interesting feature of the data, i.e. the considerable variation in the emerging market economy experience. Contractions had a similar duration in the two groups, though two of the emerging market economies (The Philippines and South Africa) experienced contractions that were, on average, about a quarter longer than other emerging market economies as well as the developed economies.

Taken together, the evidence of both phases does not support Rand and Tarp's (2002) unequivocal claim that business cycles are significantly shorter in the developing world. It seems more accurate, as a stylised fact, to say that the emerging markets experience is spread over a wide ranging, with the some emerging market economies experiencing business cycles that are very similar in duration to that observed in develop economies.

The fifth line of table 1 shows the estimated average amplitude for expansions. Business cycles in emerging market economies had higher amplitude in most of the cases studied here (especially with respect to expansions), though Hong Kong, Israel and South Africa experienced cycles with similar amplitude to that of developed economies. This result is consistent with Agénor et al.'s (2000) and Rand Tarp's (2002) observation of greater volatility in the business cycles of developing countries.

4.2 Consumption and investment

Table 2 shows basic information for the cycle of private consumption expenditure in the emerging market economies under consideration.

Table 2 Characteristics of the consumption cycle in emerging market economies

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
				Average duration (quarters)			
Expansion	6.5	8.14	6.54	8.14	7.38	5.3	9.75
Contractions	3.8	3.42	3.31	3.38	4.33	4.13	5.56
				Amplitude			
Expansion	12.7	13.9	15.7	13.16	20.03	7.16	14.02
Contractions	-1.42	-2.84	-0.98	-5.48	-10.92	-1.07	-1.05

While the duration of contractions in aggregate consumption expenditure are comparable to (if slightly shorter than) the duration of contractions in aggregate expenditure the duration of expansions in aggregate consumption expenditure are clearly shorter than output expansions in the emerging markets group (by as much as 3 quarters on average).

Table 2 shows very similar amplitude (both for expansions and contractions) in the cyclical experience of consumption in emerging market economies to the amplitude of output reported in table 1. The combination of shorter expansions of consumption expenditure with comparable amplitude implies steeper consumption expansions than output expansions in the emerging market economies. The results provide no evidence in support of strong views of consumption smoothing. Only one period is investigated here so these results cannot provide evidence one way or the other about Kose et al.'s (2003) observation of rising consumption volatility in developing countries during the period of increasing international integration.

In table 3 the (mean adjusted) concordance indices between the consumption and output cycles are shown.

Table 3 Concordance between the consumption and output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance	0.34	0.226	0.28	0.403	0.455	0.452	0.53
P-value (NW)	0.051*	0.165	0.036**	0.028**	0.001***	0.006***	0.000***
P-value (unadj)	0.002***	0.03**	0.003***	0.000	0.000	0.000***	0.000***

The table shows the mean-adjusted concordance index.
Significance calculated using the method described in the text, and was measured using a lag length of 5.
Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

In all of the countries table 3 shows positive concordance between the output cycle and the cycle of private consumption expenditure. This concordance is statistically significant for all the emerging market economies studied here except Israel at conventional levels when using the Newey-West HAC standard errors. For Israel the concordance is substantial, if not significant at conventional levels. A reasonable conclusion seems to be that business cycle fluctuations of consumption and output have positive and significant relationship in emerging market economies.

Table 4 is similar to table 2, but with the phases of gross fixed capital formation (investment) taking the place of private consumption expenditure.

Table 4 Characteristics of the investment cycle in emerging market economies

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
				Average duration (quarters)			
Expansion	10.2	8	10.33	9.6	5.25	9	10.5
Contractions	4.83	6.67	4.5	5.33	5.11	7.6	7.67
				Amplitude			
Expansion	31.73	26.22	41.45	29.66	29.50	34.86	21.03
Contractions	-17.94	-15.38	-16.29	-23.25	-25.37	-33.41	-15.96

With the exception of Hong Kong and Korea the average duration of an expansions in investment expenditure is shorter than output expansions. At the same time the contractionary phase of investment has been longer in the emerging market economies (without exception in this group). The final two rows on table 4 show that the amplitude of investment is much higher than the amplitude of the output cycle and that this has been true for expansions (on average twice as large), but even more dramatically so for contractions.

The investment cycle has long been thought to play an important role in output expansions, with the greater amplitude (and steeper cycle) of investment expenditure leading to an impact for investment on the output cycle, more than proportional with the size of investment in aggregate expenditure (Romer, D.H., 2001). This uncontroversial expectation is consistent with the positive and significant concordance between the investment cycle and output cycle reported in table 5. It is not just that the relationship is generally significant statistically, but also the correspondence index shows a higher degree of correspondence with the output cycle than was the case with the consumption relationship.

Table 5 Concordance between the investment and output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance	0.42	0.337	0.31	0.637	0.498	0.528	0.393
P-value (NW)	0.002***	0.049**	0.015**	0.001***	0.000**	0.008***	0.009***
P-value (unadj)	0.000***	0.003***	0.001***	0.000***	0.000***	0.000***	0.000***

The table shows the mean-adjusted concordance index
Significance calculated using the method described in the text, and was measured using a lag length of 5
Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

4.3 Association with international factors

The following table investigates the concordance between the output cycles in emerging market economies and the output cycles in industrialised economies. Agénor et al. (2000) as well as Rand and Tarp (2002) found a significant influence for industrialised country output on output fluctuations in developing countries. In contrast, Kose et al.

(2003) found that the co-movement of developing country output with developed country output declined with increased globalisation.

Table 6 shows the concordance index for the output cycles in emerging market economies and those of the three large industrial economies. The striking message from the first three panes of table 6 is that, apart from Israel's significant and positive co-movement with the USA, Mexico's nearly significant (at conventional levels) comovement with the USA, Korea's significant and positive co-movement with the EMU, and South Africa, Mexico and Hong Kong's significant comovement with Japan, there is little evidence of co-movement between the output cycles of industrialised economies and those of emerging market economies.

The final pane of table 6 shows concordance index between emerging market output and the cycle of commodity prices. For South Africa and Hong Kong this relationship is significant (and almost significant so for Israel and the Philippines) and positive in the group of countries considered here. This conflicts with strong claims about the importance of the commodity price cycle for business cycles in developing countries (for example, Agénor and Montiel, 1999).

This evidence could be harmonised with strong claims about the influence of commodity prices on the business cycle of developing countries (for example by Agénor and Montiel, 1999) by noting that this study focuses on a group of emerging market economies for which industry and services have become dominant sectors. The stylised fact reported in Agénor and Montiel (1999) may still hold for less developed economies where the primary sector is more important. Taking into consideration the structure of the economies studied here, the observed concordance with the commodities index might even seem surprising and could be due to third factors, such as the world demand for exportables from emerging market economies.

Table 6 Concordance between emerging market business cycles and industrial country cycles

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
				Concordance with USA cycle			
Concordance	0.048	0.172	0.094	0.182	-0.05	0.031	0.099
P-value (NW)	0.591	0.189	0.627	0.127	0.392	0.779	0.273
P-value (unadj)	0.538	0.037**	0.501	0.027**	0.534	0.667	0.147
				Concordance with EMU cycle			
Concordance	-0.03	0.055	0.116	-0.119	-0.032	-0.018	0.032
P-value (NW)	0.558	0.623	0.033**	0.002***	0.634	0.703	0.665
P-value (unadj)	0.566	0.436	0.05**	0.091*	0.606	0.804	0.566
				Concordance with Japanese cycle			
Concordance	0.23	0.166	-0.128	0.34	0.139	-0.044	0.314
P-value (NW)	0.066*	0.282	0.31	0.07*	0.91	0.676	0.019**
P-value (unadj)	0.018**	0.095*	0.235	0.001***	0.849	0.604	0.000***
				Concordance with commodities cycle			
Concordance	0.32	0.232	0.073	-0.055	0.07	0.234	0.195
P-value (NW)	0.015**	0.104	0.76	0.696	0.652	0.125	0.063*
P-value (unadj)	0.003***	0.043**	0.698	0.652	0.517	0.057	0.017**

The table shows the mean-adjusted concordance index
Significance calculated using the method described in the text, and was measured using a lag length of 5
Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

4.4 Inflation and monetary policy

The relationship between inflation and output cycles hold important implications for business cycle theories. While there is little support for theories that propose long run trade-offs between inflation and output, business cycle theories that attribute a major role for demand shocks in short run fluctuations usually imply a short-run trade-off between inflation and unemployment (Mankiw, 2001) and pro-cyclical inflation. In the present context such a short-run trade-off would translate into a significant and positive correspondence between the output cycle and the cycle of inflation. Table 7 reports on a test of the latter relationship.

Table 7 Concordance between the inflation and the output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance		-0.194	-0.123	-0.308	-0.331	-0.206	0.103
P-value (NW)	NA	0.19	0.434	0.134	0.007***	0.226	0.471
P-value (unadj)	NA	0.096*	0.27	0.009***	0.002***	0.097*	0.27

The table shows the mean-adjusted concordance index
Significance calculated using the method described in the text, and was measured using a lag length of 5
Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

Table 7 suggests that the correspondence between output and inflation cycles is often negative in emerging market economies – a relationship also observed by Agénor et al. (2000) as well as Rand and Tarp (2002). However the results do no support the latter's strong conclusion that supply shocks dominate demand shocks in these economies as the negative correspondence is usually statistically insignificant after estimating HAC standard errors.

Tables 8 and 9 investigate the pro-cyclicality or anti-cyclicality of nominal and real interest rates in the emerging market economies. At stake is an investigation into the relationship which the Romers had had identified between interest rates and output for the USA, i.e. that both nominal and real short term interest rate increased after troughs and declined after peaks in economic activity (Romer, C.D. and Romer, 1994; Romer, C.D., 1999). Such a pattern for short term interest rates is consistent with an anti-cyclical monetary policy. The concordance indices reported in tables 8 and 9 shows evidence of a similar relationship for 3 of the emerging market economies: Israel, Korea and Mexico, as measured by the concordance between the cycle of real interest real interest rates and output. South Africa shows an almost significant correspondence at conventional levels. This result provides tentative evidence that monetary authorities in at least some of the emerging market economies shave had the same scope to achieve anti-cyclical monetary policy than the Romers identified in the US.

Table 8 Concordance between the nominal interest rate and the output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance		0.366	0.153	-0.33	-0.069	0.011	0.094
P-value (NW)	NA	0.008***	0.228	0.063**	0.701	0.951	0.261
P-value (unadj)	NA	0.001***	0.17	0.006***	0.605	0.927	0.6

Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

Table 9 Concordance between the real interest rate and the output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance		0.329	0.29	0.462	0.121	0.125	0.179
P-value (NW)	NA	0.02**	0.019**	0.000***	0.384	0.415	0.145
P-value (unadj)	NA	0.004***	0.002***	0.000***	0.351	0.3	0.034**

Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

4.5 Fiscal policy

The investigation into the comovement between the cycle of real interest rates and output could be repeated for fiscal policy as one measure of the success form discretionary fiscal policy (as stabilisation tool). To do so we need a single variable summary of the discretionary[16] stance of fiscal policy though. Agénor et al. (2000)

[16] The effect of automatic stabilisers is not investigated here.

define the fiscal impulse as the ratio of government expenditure to government revenue. They found evidence of a countercyclical fiscal impulse, but only due to countercyclical government expenditure. For that reason, and to avoid the complications of identifying the cyclical components of government revenue – explore more fully in Fatas and Mihov (2003) – government consumption relative to GDP is the measure used here to indicate the stance of fiscal policy.

Table 10 Concordance between the fiscal stance and output cycle

	Hong Kong	Israel	Korea	Mexico	Peru	Philippines	South Africa
Concordance		0.103	-0.382	0.132	0.012	0.412	-0.209
P-value (NW)	N/A	0.501	0.000***	0.411	0.928	0.024**	0.142
P-value (unadj.)	N/A	0.382	0.000***	0.276	0.911	0.001***	0.022**

The table shows the mean-adjusted concordance index
Significance calculated using the method described in the text, and was measured using a lag length of 5
Significant statistics are indicated with asterisks (*** at 1%, ** at 5% and * at 10%).

Table 10 indicates that only Korea showed consistent and significant anti-cyclical fiscal policy among this set of emerging market economies. South Africa's fiscal policy cycle is almost significant and also suggests a stabilising comovement between the measure of fiscal policy used here and the output cycle.

In the Philippines the stance of fiscal policy has been pro-cyclical, i.e. fiscal policy might have exacerbated the output cycle. The evidence presented here supports the conventional view that monetary policy is a more flexible stabilization tool than discretionary fiscal policy.

5. CONCLUSION

This paper identified classical business in emerging market economies using an algorithm originally suggested by Bry and Boschan and recently applied by Harding and Pagan in various papers. The chief results of the paper are as follows:

1. The duration of business cycles in emerging markets experience is spread over a wide ranging, with the some emerging market economies experiencing business cycles that are very similar (in terms of duration) to that observed in develop economies.
2. Business cycles have greater amplitude in most emerging market economies.
3. The cyclical components of output and consumption expenditure are positively related and mostly significant. The positive relationship between business cycle fluctuations in investment and output is more clearly significant for these countries.
4. Consumption expenditure has steeper expansions than output in the emerging market economies and does not provide evidence in support of strong views on consumption smoothing.
5. Investment expenditure in emerging market economies have a cycle with much larger amplitude than output fluctuations. Combined with the shorter duration of expansions in investment expenditure this yields very steep investment expansions and contractions in these economies.

6. There is little evidence that the output cycle of emerging market economies in this sample move jointly with those in industrial economies. Exceptions to this result are Israel and Mexico (with the USA) and Hong Kong, Mexico and South Africa (with Japan).
7. The comovement between the business cycle in emerging market economies and the cycle of the commodity price index is less emphatic than would be consistent with strong claims about the influence of commodity prices on these economies.
8. The correspondence between inflation and output is often negative in emerging market economies, though this relationship is seldom significant, which does not support the strong conclusions of, for example Rand and Tarp (2002), about the dominance of supply shocks in developing counties.
9. There is evidence of consistent anti-cyclical monetary policy in some of the emerging market economies, similar to that observed by the Romers for the USA.
10. Though there is some evidence of stabilising discretionary fiscal policy in Korea and South Africa the results presented here supports the conventional view that monetary policy is a more flexible stabilization tool than discretionary fiscal policy.

APPENDIX A

Table 11 Turning points for the business cycle of 7 emerging market economies

Trough	Peak	Trough	Peak	Trough	Peak
Hong Kong		*Israel*		*Korea*	
1981Q3	1982Q1		1981Q4		1970Q4*
1983Q1	1985Q1	1982Q3	1985Q2	1972Q2*	1974Q1*
1985Q3	1987Q3*	1985Q4	1988Q1	1974Q4*	1976Q2*
1988Q1*	1988Q4	1989Q4*	1992Q2	1977Q2*	1979Q2
1990Q1*	1995Q1	1993Q2*	1994Q1	1980Q4	1984Q1*
1995Q3	1997Q3	1994Q3*	2000Q3	1985Q3*	1988Q4*
1999Q1	2001Q1	2001Q4	2002Q4	1989Q2*	1991Q2*
2001Q4	2002Q3*	2003Q2		1992Q3	1997Q4
2003Q2				1998Q2	2000Q3
				2001Q2	2002Q4
Mexico		*Peru*		*The Philippines*	
	1981Q4		1979Q3		1983Q2
1983Q2	1985Q3	1980Q1	1982Q2	1985Q1	1986Q1
1986Q4	1987Q4	1983Q1	1984Q3	1986Q3	1987Q3
1988Q3	1994Q4	1986Q1	1987Q3	1988Q2	1990Q2*
1995Q2	2000Q3	1989Q1	1990Q1	1991Q3*	1993Q2*
2002Q1		1990Q3	1991Q3	1994Q2*	1995Q3*
		1992Q3	1997Q2	1996Q3*	1997Q3
		1998Q2	2000Q1	1999Q3	2001Q4*
		2001Q1		2002Q2	
South Africa					
	1971Q1*				
1972Q1*	1974Q3				
1975Q1	1976Q3				
1977Q3	1981Q4				
1983Q1	1984Q2				
1981Q1	1989Q3				
1992Q4	1996Q4*				
1998Q3					

* Turning point identified using the growth cycle algorithm.

DATA APPENDIX

The data series were all extracted from the IFS database with the exception of the data for South Africa which was extracted from the Quarterly Bulletin of the South African Reserve Bank.

Table 12 Data series used in this study

Series	Hong Kong	Israel	Korea	Mexico	Peru	The Philippines	South Africa
Nominal GDP	IFS;53299B..Z F...	IFS;43699B..Z F...	IFS;54299B..Z F...	IFS;27399B.C ZF...	IFS;29399B..Z F...	IFS;56699B..Z F...	
GDP Deflator	IFS;53299BIP ZF...	IFS;43699BIP ZF...	IFS;54299BIP ZF...	IFS;27399BIR ZF...	IFS;29399BIP ZF...	IFS;56699BIP ZF...	
Real GDP							RBQN;RB600 6D
Private consumption	IFS;53296F..Z F...	IFS;43696F..Z F...	IFS;54296F..Z F...	IFS;27396F.C ZF...	IFS;29396F..Z F...	IFS;56696F..Z F...	RBQN;RB600 7D
Gross fixed capital formation	IFS;53293E.. ZF...	IFS;43693E.. ZF...	IFS;54293E.. ZF...	IFS;27393E.C ZF...	IFS;29393E.. ZF...	IFS;56693E.. ZF...	RBQN;RB600 9D
Consumer price index	IFS;53264...Z F...	IFS;43664...Z F...	IFS;54264...Z F...	IFS;27364...Z F...	IFS;29364...Z F...	IFS;56664...Z F...	IFS;19964...Z F...
Nominal interest rate	NA	IFS;43660P..Z F...	IFS;54260B..Z F...	IFS;27360C.. ZF...	IFS;29360P..Z F...	IFS;56660C.. ZF...	IFS;19960C.. ZF...
Government consumption expenditure	NA	IFS;43691F..Z F...	IFS;54291F..Z F...	IFS;27391F.C ZF...	IFS;29391F..Z F...	IFS;56691F..Z F...	RBQN;RB600 8D

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