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2006

Online at http://mpra.ub.uni-muenchen.de/21717/
MPRA Paper No. 21717, posted 28. March 2010 / 11:10

An essay upon business cycle facts: the Turkish case

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Abstract

In our paper, we try to investigate the main determinants of the Turkish business cycles. Having examined some important issues of interest in business cycle theory, we estimate the business cycle stylized facts for the Turkish economy and compare the estimation results obtained in this paper to some benchmark papers chosen in business cycle literature. All in all, our estimation results give support to the importance of supply side models in explaining the Turkish business cycles in line with the contemporaneous Real Business Cycle Theory.

Keywords: Business Cycles, Turkish Economy, Countercyclical Prices, Supply-Driven Models

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Özet

Çalışmamızda, Türk iş çevrimlerinin başlıca belirleyicileri araştırılmaya çalışılmaktadır. İş çevrim kuramlarının önemli bulunan bazı özellikleri açıklandıktan sonra Türkiye ekonomisi üzerine bir deneme gerçekleştirilmiş ve elde edilen tahmin sonuçları iktisat yazınında iş çevrim kuramlarının oluşumunu ortaya koyan başlıca çalışmalarda elde edilen tahmin sonuçları ile karşılaştırılmıştır. Sonuç olarak, tahmin bulgularımız çağdaş reel iş çevrim kuramını destekler nitelikte sonuçlar üretmiş, Türk iş çevrimlerini açıklamaya yönelik arz-yönlü oluşturulacak kuramsal ve uygulama içerikli çalışmaların önemi vurgulanmıştır.

Anahtar kelimeler: İş Çevrimleri, Türkiye Ekonomisi, Tersçevrimsel Fiyatlar, Arz-Yanlı Modeller

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I. INTRODUCTION

Revealing the main determinants of business cycles have been of great importance in assessing the *ex-ante* formation and *ex-post* realization processes of economic policies, especially in an economy that has severely undergone fluctuations and structural (policy) breaks resulted in economic crisis phenomenon by the last 20 years. In this sense, that the policy makers have to determine the extent to which their policy decisions would affect the course of the main macroeconomic indicators, e.g., real income growth path, prices, and external balance, has serious consequences to guide policy actions using various instruments for stabilization purposes.

Considering an economics policy perspective, in this respect, decomposing the business cycles into their non-stationary long-term trend and stationary short-term cycle components between a peak and trough of aggregate economic activity, and estimating the correlations or structural dynamic interactions between the latter type stationary components would easily help researchers cover both the classical cycles and the growth cycles, and determine which kind of policies to be implemented so as to attain the *ex-ante* specified policy targets and to examine whether the effects of stabilization policies would be permanent or transitory, which also lead policy makers to decide whether to respond at all and how to respond to the disturbance occured in the economy (Dornbusch and Fischer, 1994: 450).[1]

Following Cashin and Ouliaris (2001), we can define the classical cycles or cyclical movements in trend-unadjusted output, mainly matched by the classical study of Burns and Mitchell (1946) in economics literature, as the movements in actual economic time series which are recurrent but not periodic, i.e., the identification of recessions, contractions and revivals which merge into the expansion phase of the next cycle in the absolute level of aggregate economic activity. This approach is predominant particularly in the studies of the National Bureau of Economic Research (NBER) using the US historical data concentrating on timing and other aspects of non-seasonal fluctuations in series between groups of leading,

[1] Lucas (1977: 9) attributes the business cycles to the movements about the trend of gross national product in the sense that these movements do not exhibit uniformity of either period or amplitude, which is to say, they do not resemble the deterministic wave motions which sometimes arise in the natural sciences, but can be well-described by stochastically distributed difference equations. In line with Lucas, Fiorito and Kollintzas (1994: 237) and Serletis and Krause (1996: 49) define growth of a variable as its smoothed trend and the cycle components of a variable as the deviation of the actual values of the variable from the smoothed trend.

coincident, and lagging indicators that in many cases show pronounced long-term trends (Zarnowitz and Ataman, 2002). On the other side, the growth cycle or cyclical movement in trend-adjusted output refers to the deviations in economic activity from a long-term trend, so that growth expansions (growth contractions) are described as the periods when the growth rate is above (below) the long-term trend rate of growth in aggregate economic activity (Stock and Watson, 1998). As Stock and Watson emphasize, in such a distinction between the classical and growth cycles, whereas classical cycles tend to have recessions that are considerably shorter than expansions because of the underlying trend growth, the growth recessions and expansions have approximately the same duration.

Such an analysis would enable us to assess the effectiveness of discretionary or rule-based stabilization policies in affecting the course of the boom-bust cycles in the economy, yielding also possible time lags in policy implementation process (Altuğ, 2001: 61). Considering the contemporaneous economics literature, for the last two decades, the benchmark papers for business cycles come especially from the pioneers of the real business cycle (RBC) school, yielding stochastic dynamic general equilibrium models cabaple of generating artifical data (Fiorito and Kollintzas, 1994: 236), and viewing economic variables as the outcomes of the decisions made by many individual agents to maximize their utility subject to production possibilities and resource constraints of which the basic model of economic dynamics is the neoclassical model of capital accumulation (Plosser, 1989: 53-54), and by which the model constructing processes come to be widely used as laboratories for policy analysis, otherwise given the difficulties to experiment within actual economies (Rebelo, 2005).[2]

For this purpose, the next section is devoted to some preliminary problems with which policy makers and researchers face in analysing business cycle facts. Section III tries to reveal the importance of how cyclical are the prices in business cycle analysis. Section IV reveals some methodological issues in estimation procedure, while section V examines the business cycle stylized facts of the Turkish economy and compares the estimation results obtained in this paper to some benchmark papers chosen in business cycle literature. Section VI summarizes results and concludes.

[2] See, of all the others, e.g., Kydland and Prescott (1982: 1345-1370), Long and Plosser (1983: 39-69), King and Plosser (1984: 363-380), Kydland and Prescott (1991: 161-78), Backus et al. (1992: 745-775), Backus et al. (1995: 331-356), and Chari et al. (1995: 357-391). Rebelo (2005) documents an extensive survey for the RBC school, also providing related literature emphasizing many different aspects of this theory.

II. PRELIMINARY PROBLEMS IN BUSINESS CYCLE ANALYSIS

In order to bring out the stylized facts of a business cycle, policy makers have to pay considerable attention to both data availability problems and reliable estimation methods, accounting for whether estimation results highlight what factors are responsible for the path of cycles and whether so designed stabilization policies can lead policy makers to succeed in achieving *ex-ante* specified policy targets or, on the other hand, can destabilize the course of the aggregate economic activity through the lack of identifying the actual path of economic trends and cycles, for instance, due to the some structural changes in cyclical policies which lead systematically to changes in decision rules of economic agents thus to changes in the structure of estimation methods of business cycles in the sense of Lucas (1977: 7-29) and Lucas (1981: 104-130). Following Agénor et al. (1999), at least two factors may help account for this for a developing country perspective. First, availability of relevant data and limitations on data quality and frequency based data problems for researchers would be constraining factors in analyzing the path of cycles. In addition, as expressed above, what is striking for developing countries such as Turkey is that they have frequently subject to sudden crises and marked gyrations in macroeconomic variables, often making it difficult to discern any type of cycle or economic regularities.

Also an important point to be considered here is whether the researchers can obtain general business cycle facts so as to construct the dynamics of economic theory. But such an effort would not be easy due to the different characteristics of macroeconomic fluctuations which require different courses of adjustments to long waves of economic growth in developing countries from those of developed countries, as well. Following Hillinger (1992: 5-46), Woitek (1997: 2) separates this set of stylized facts into three classes, that is, the inventory cycle (or Kitchin-cycle) with a duration of three to four years which refers to Kitchin (1923: 10-17), the equipment cycle (or Juglar-cycle) with a duration of seven to ten years which refers to Juglar (1889), and the building cycle (or Kuznetz-cycle) with a length of about 20 years which refers to Kuznetz (1958: 25-57), of which the length of each cycle is related to the speed with which the level of associated capital stock can be adjusted.

In line with such issues and from a policy perspective, the use of potentially inappropriate conclusions regarding the stylized facts or broad regularities of macroeconomic fluctuations

in different country cases can adversely affect the efficacy of stabilization policies. As Cashin (2004) expresses, economic policy is often contingent on whether or not a country is experiencing a cyclical contraction or expansion, and so it is vital that appropriate tools be used to extract the country-specific business cycle facts from the data. These all, of course, would compel the researchers to take into consideration the stylized facts of various country cases so as to see whether the boom-bust cycles in the level of real output resemble each other, and if so, similar stabilization policies can be advised to different country cases, but if not, different stabilization policies would be required for eliminating the pattern of fluctuations in economic activity.[3]

Especially for a country case such as Turkey which had undergone an instable real income growth process with anomalies in the course of real income and a chronic inflationary framework in a thirty years period till the beginning of 2000s, estimating whether the price level and inflation are pro- or counter-cyclical will provide policy makers with a knowledge of how properties must the stabilization policies have and provided that the price level and inflation turn out to be countercyclical, supply-driven models of business cycles including real business cycle models will be appropriate to analyze the implications of business cycles (Chadha and Prasad, 1994: 240). Otherwise, that the prices move in the same direction with output will point out the importance of demand side disturbances, which enables discretionary Keynesian "leaning against the wind" type fiscal and monetary policy interventions (Alper, 2002: 22-54). On this point, following, e.g., Kydland and Zarazaga (1997: 21-22), supply-driven models can be based on real or supply-side factors which account for the business cycles, such as the amount of resources used by the government, tax policies, technological changes, government regulations, modifications of financial intermediation rules, and even political shocks signaling possible changes in property rights, rather than nominal factors such as the money supply, interest rates, and price rigidities employing a crucial role in the policy design and implementation process of Keynesian and Monetarist interpretation of business cycles.

[3] For an application to the turning points of boom-bust reference cycles in domestic real income generation process in the US and Turkish economy, considering a historical perspective on an ongoing basis, see Stock and Watson (1998), Romer (1999) and Davis (2005) for NBER business cycle reference dates and some adjustments over those, and Özmucur (1987) for his own estimations in an essay upon the Turkish economy, respectively. However, as Cashin and Ouliaris (2001) express, although there is a long tradition of viewing classical cycles in terms of turning points, the recent literature on growth cycles tended to neglect the issue of timing of deviation from trend, prefering instead to concentrate on the analysis of the variances of filtered time series and on the covariances of movements in selected key series with filtered output.

We must also specify that, following again Kydland and Zarazaga (1997: 21-36), science makes progress precisely when it encounters observations that the prevailing paradigm cannot explain. So, for instance, thinking of inflation stabilization by policy makers ought to be, if necessary, subject to changes in minds as to the past explanations of theories and/or policies. Such an assumption would compel the researchers and policy makers to require new paradigms consistent with the stylized facts of the usual economic environment. In line with this, if nominal shocks have not been the predominant characteristics of the business cycles, and rather, if real or supply-side factors have been constituting the main reasons driving economic fluctuations, stabilization programs based on nominal anchors using some variant of monetary aggregates as reference policy tools have been possibly subject to be failed. For the special case of Latin America experiences and in particular for the case of Argentina, Kydland and Zarazaga follow that Monetarist-inspired theoretical models of exchange rate based stabilization (ERBS) programs were quantitatively incabaple of replicating any significant fraction of the economic fluctuations associated with such programs, and also criticize such kind of models in the sense that the dynamics of output immediately after the announcement of an ERBS program were mere continuations of upwings or downturns that had begun earlier under the predominance of factors leading to a RBC model so as to be able to explain business cycles, and that forces other than the adoption of a fixed or pegged exchange rate were already driving the business cycles when the ERBS programs began. For these reasons, in an economics policy perspective, they adduce that it is time to give the real factors their fair chance to account for significant fraction of the business cycles. Following Ahmed and Park (1994: 2), in other words, if external and domestic supply disturbances are found to be important in explaining macroeconomic fluctuations and domestic aggregate demand disturbances are not, this would imply that the policy makers' attempts to fine-tune the economy will prove ineffective.

III. ARE PRICES PROCYCLICAL OR COUNTERCYCLICAL?

Of special emphasis in business cycle literature has been given to whether or not the prices are pro- or counter-cyclical, and determining such facts would affect the design and implementation of stabilization policies. Although Lucas (1977: 9) refers to that prices are generally pro-cyclical as one of the commonly held beliefs among business cycle regularities, which leads to using equilibrium models with monetary policy or price surprises in the policy

implementation process as the main source of fluctuations, such that monetary disturbances would appear to be the only possible source for these fluctuations (Kydland and Prescott, 1990: 3-18), contemporaneous literature considering different country cases upon this issue are able to yield conflicting estimation results revealing the counter-cyclical role of prices and inflation as a fact of business cycles. To deal briefly with empirical literature upon this issue, many studies touch on similar subjects both for developed and developing countries. For instance, Chadha and Prasad (1994: 239-257) and Fiorita and Kollintzas (1994: 235-269) find that the price level is counter-cyclical for G-7 countries, while the former also observe that inflation rate is pro-cyclical, and thus suggest that the cyclical behaviors of the price level and inflation do not provide conclusive grounds for rejecting either demand-determined or supply-determined models of the cycle. Similarly, Kydland and Prescott (1990: 3-18) for the US, Backus and Kehoe (1992: 864-888) for 10 developed countries, Serletis and Krause (1996: 49-54) for the US, Cashin and Ouliaris (2001) for Australia reveal the importance of counter-cyclical prices with output suggestive of predominance of shocks to aggregate supply in the economy.[4] Besides Lopez et al. (1997) estimate that for the case of Spanish business cycles, inflation is mainly supply-driven, and in this line, suggest as a main policy implication that strong disinflationary demand policies could prove both inefficient and very painful for Spain, which needs more active supply policies.

Dealing with the developing country cases, Rand and Tarp (2002: 2071-2088) confirm the negative relationship between the price level and real income for a set of developing countries, providing support for a supply-driven interpretation of the business cycles including real business cycle models. Agénor et al. (1999) also find counter-cyclical variation of prices/inflation and cyclical component of output in many of the developing countries they examine, including Turkey such as Kydland and Zarazaga (1997: 21-36) for the cases of Latin American business cycles. Kim (1996: 69-82) estimates counter-cyclical relationships between the detrended price level and cyclical output for Korea and Taiwan, but finds a positive correlation between inflation and cyclical component of output in line with Chadha and Prasad (1994: 239-257) considering G-7 countries. For the Turkish case, Alper (1998:

[4] Backus and Kehoe (1992: 864-888) estimate different results with respect to the pro-cyclical/counter-cyclical characteristics of the inflation rates in ten developed countries examined with at least a century of annual data on national output, considering pre-World War I, interwar, and post-World War II periods, and conclude that in the prewar and interwar periods output and price level fluctuations are positively correlated in most of the ten countries, however, in the postwar period price fluctuations have been consistently countercyclical. Similar findings can be found in Smith (1992: 413-430).

233-244), Metin-Özcan et al. (2001) and Alper (2002: 22-54) confirm the counter-cyclical pattern of fluctuations of the price level and inflation vis-à-vis real GDP.[5]

From a different point of view identifying the long run effects of structural shocks on output fluctuations, through *a priori* restrictions on economic theory using structural VAR (SVAR) methodology of Blanchard and Quah (1989), Hoffmaister and Roldós (1997) construct a small open economy general equilibrium model and estimate by applying to pooled time series data of 15 Asian and 17 Latin American economies that among the common features of the developing countries is the fact that supply shocks play substantial role in explaining output movements even in the short-run. Applying to a similar methodology, Ahmed et al. (1993: 335-359) and Ahmed and Park (1994: 1-36) provide strong support for one of the propositions of real business cycle theory that even over a very short run horizon, supply-side changes explain the bulk of the movements in aggregate output.

Having briefly examined the general characteristics of business cycle phenomenon in a cursory way and given the importance of the sustainability of price stability or achieving lower inflation rates for a developing country like Turkey, that has undergone chronic two-digits inflationary framework but not to any hyper-inflationary framework from the late-1970s till the very recent times of mid-2006, in this paper our aim is to give an essay on the determinants of business cycles for the Turkish economy and in particular to examine whether the prices and inflation behave in a pro- or counter-cyclical way as to the filtered real income generation process in an economics policy perspective, employing a methodology taken mainly from Kydland and Prescott (1990: 3-18) followed by many researchers examined.

IV. DATA AND METHODOLOGY

In our paper, we employ the data on the Turkish economy considering for most of the time series the period of 1987Q1-2004Q4 with quarterly frequency. For some time series, the

[5] Altuğ and Yılmaz (1998: 81-103) also estimate in their dynamic vector autoregression (VAR) modelling framework that shocks to inflation in Turkey would lead to a significant negative response in real activity proxied by industrial production. Considering a different perspective to business cycles of the Turkish economy, Berument, Kılınç and Yücel (2005) assess how the business cycles in Turkey coincide with the business cycles of member and candidate countries of the European Union, and conclude that there is a negative linkage between the Turkish and European business cycle dynamics if the Turkish crises are taken into consideration.

sample period in our paper begins later than 1987Q1 due to the quarterly data availability problems, but all the time series end with the observation period of 2004Q4 such that the number of observations and thus approximate two standard error bands will be altered for different time series. Thus, below, we will also report the observation numbers when assessing the business cycle facts for the Turkish economy, while considering the population correlation coefficient for the whole sample. The sample period has not been divided into sub-periods since the period in an annual basis is highly small for the Turkish economy when compared with the international evidence especially for developed countries, and as Fiorito and Kollintzas (1994: 241) express, the smoothed trend should be able to capture the most important structural breaks.

All the data are taken from the electronic data delivery system of the Central Bank of the Republic of Turkey (CBRT) except the representative world price level and industrialized countries price level data which are taken from the IMF-IFS CD ROM data base using the index numbers 00164…ZF… and 11064…ZF…, and except the short-term capital flow data of the Turkish economy for which we apply to the State Institute of Statistics (SIS) statistical bulletins in addition to the CBRT electronic data delivery system.

Various estimation methods have been come into use in contemporaneous economics literature to reveal the interactions between the macroeconomic time series, such as structural vector autoregression models and decomposing the macroeconomic time series into their trend and cyclical components after linearizing them and using various filtering approaches of mostly popular filters proposed by Hodrick and Prescott (1997: 1-16) and Baxter and King (1999: 575-593), trying to estimate the correlations between the stationary cyclical series in many papers expressed above. We employ the latter type decomposing techniques to the Turkish data and so aim at extracting the basic characteristics of the Turkish business cycles.[6]

[6] Following Canova (1998: 476-479), a critical point connected with detrending arises from a standard 'measurement without theory' concern leading researchers to the question of a statistical vs. an economic based decomposition, of which the former assumes that the trend and cycle are unobservable but use different statistical assumptions to identify the two components, and the latter requires that a theory explaining the mechanism generating economic fluctuations is needed. But we here should consider that economic-based decomposition of actual time series would give rise to using arbitrary filtering procedures which reflect the preferences of the researcher to establish business cycle facts. However, dynamic economic theory may not indicate the type of economic trend that series may display nor the exact relationship between the secular and cyclical components. See Canova (1998: 475-512) for a technical description and an application of different statistical and economic procedures to alternative detrending methods employing US macroeconomic data. Woitek (1997) also give special emphasis to the distinction of time and frequency domain methods to describe

For this purpose, we first deseasonalize all the time series using U.S. Census Bureau's X12 seasonal adjustment program also available within EViews 5.1, and consider the multiplicative (ratio to moving average) method to extract the seasonal component. But we should specify that this method does not allow for zero or negative data (QMS, 2004: 326), and thus we apply to additive (difference from moving average) method for the variables taking on negative values such as changes in stocks, monthly domestic inflation based on implicit GDP-deflator, monthly industrialized countries consumer price index (CPI)-based inflation and short-term capital flows as the sum of portfolio investments net of assets and liabilities as equity securities and debt securities. Having deseasonalized all the time series, we linearize them by taking natural logarithms to smoothen the changes in those, except the changes in stocks, short-term capital flows, net exports and terms of trade data which can take on negative values, since the papers in business cycle literature are concerned with percentage (rather than absolute) deviations from trend in growing series (Kydland and Zarazaga, 1997: 33). For the changes in stocks, net exports and terms of trade data, we use the ratio of stock changes and net exports to GDP in fixed prices and that of export and import price indices from the national accounts data. We have also not logged the real interest rate series.

Following QMS (2004: 344-349), we apply in our paper to the widely-used Hodrick-Prescott (henceforth, HP) filter to obtain a smooth estimate of the long-term trend component of a series. We can define the HP filter as a two-sided linear filter that computes the smoothed series *s* of *y* by minimizing the variance of *y* around *s*, subject to a penalty that constrains the second difference of *s*. That is, the HP filter chooses *s* to minimize,

$$\sum_{t=1}^{T} (y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1} ((s_{t+1} - s_t) - (s_t - s_{t-1}))^2 \qquad (1)$$

where T is the sample size and λ is a parameter that penalizes the variability of trend. Thus the penalty parameter λ would control the smoothness of the series. The larger the λ, the smoother is the trend path of the series. If λ=0, an extreme real business cycle model is taken into consideration where all of the fluctuations in real output are caused by technology shocks, and in this case the HP trend would be the same as the historical time series itself

the cyclical structure of business cycles and highligts the spectral analysis to describe the business cycle stylized facts.

(Metin-Özcan et al. 2001: 217-253). As $\lambda = \propto$, *s* approaches a linear deterministic trend. Following Canova (1998: 484) and Metin-Özcan et al. (2001: 217-253), the optimal value of λ is $\lambda = \sigma_x^2 / \sigma_c^2$ where σ_x and σ_c are the standard deviation of the innovations in the trend and the cycle. Hodrick and Prescott (1997: 4) assume that a 5 percent cyclical component is moderately large, as is a one-eighth of 1 percent change in the growth rate in a quarter, which lead us to select $\sqrt{\lambda} = 5/(1/8) = 40$ or $\lambda = 1600$ as a value for the smoothing parameter. Thus we set $\lambda = 1600$ of the quarterly data in our paper, as well.[7]

V. STYLIZED FACTS

When examining the case of Turkish business cycles based on the HP-filtered data, we report for each series (a) number of observations (obs), (b) volatility (vol) measured by the standard deviation of the filtered data multiplied by one hundred, (c) the ratio of standard deviations with that of the real output (σ/σ_{GDP}) such as considered in Metin-Özcan et al. (2001) (d) comovement with real output as correlation of the series (X) with real output (Y) in natural logarithms. We give the highest degree of comovement of each variable with real output in bold if the correlation coefficient is significant such as considered in Alper (2002: 22-54). If the cross correlation $\rho(j)$, $j \in \{0, \pm1, \pm2, \dots\}$, between Y_t and X_{t+j} up to four quarters reaches the maximum for a negative j, the series leads the reference cycle, i.e. reaches its turning points j units of time earlier than the GDP. In the other case, if the cross-correlation is maximum for a positive j, the series' cycle lags behind the GDP cycle by j units of time (Woitek, 1997: 10). For example, as Kydland and Prescott (1990) express, productivity is a series that leads the cycle, whereas the stock of inventories is one that lags the cycle. If the cross correlation between Y_t and X_{t+j} is maximum for j = 0, the cycle of X is synchronous. Also if contemporaneous correlation coefficient $\rho(0)$ is positive, zero, or negative, the series X would be considered as procyclical, acyclical, or countercyclical, respectively (Kydland and Prescott, 1990: 10; Fiorito and Kollintzas, 1994: 240). In our sample of 72 observations of the period 1987:Q1-2004:Q4 with quarterly data, the unknown population contemporaneous correlation coefficient is taken to be significant when $0.23 < |\rho(t)| < 1.00$,

[7] However, even though being one of the mostly applied detrending methods in economics literature, HP filter has been criticized in several ways. See e.g. King and Rebelo (1993: 207-231) and Cogley and Nason (1995: 253-278).

leading us to reject at the 5% level of significance the null hypothesis that the population correlation coefficient is zero in a two sided test for bivariate normal random variables.[8]

Following Fiorito and Kollintzas (1994: 235-269) and considering a RBC perspective, we will document the business cycle stylized facts of the Turkish economy in three categories as (a) the components of spending, real income and output, (b) prices and monetary variables, and (c) the factors of production.

We now try to extract the cross correlations between the HP-detrended cyclical component of real output and the components of spending. On this point, we sometimes apply to the comparisons between our estimation results and the international evidence on business cycles. When dealing with components of spending and the real output series as a first component of our analysis in Table 1, the data indicate the autocorrelation function of the real GDP. We see that the detrended GDP are strongly positively autocorrelated, showing strong persistence in the business cycle fluctuations.[9] The findings support the estimation results of Kydland and Prescott (1990: 3-18) and Backus et al. (1992: 745-775) for the US economy, which both estimate the value of first-degree autoregressive coefficient as 0.85, while Fiorito and Kollintzas (1994: 235-269) report also high first-degree autoregressive coefficients for the G-7 countries ranging from the maximum of 0.85 for the US to the minimum of 0.55 for the UK.[10] Agénor et al. (1999) report strong positive autocorrelations for a set of developing countries indicating considerable persistence in the cyclical components, and interpret these results as suggesting that it is appropriate to view these developing countries as having short-term fluctuations that could be reasonably characterized as business cycles. Aguiar and Gopinath (2004) also reveal similar estimation results considering both 13 developed and 13 developing countries including Turkey, with significant first-degree autoregressive coefficients ranging from 0.49 to 0.92. Dealing with the Turkish case, Alper (2002: 22-54) finds the degree of the persistence of the shocks in the cyclical component of the real GDP with a coefficient of 0.58, while Aguiar and Gopinath (2004) estimate the same coefficient as

[8] However, as Agénor et al. (1999) emphasize, estimation results in this paper are based on unconditional correlations between the filtered real output and some other macroeconomic time series, and such correlations do not necessarily imply causal relationships, and thus may require at least some bivariate exogeneity tests, which are out of interest in our paper. Nevetheless, our results will provide *a priori* knowledge for the cyclical characteristics of the business cycles of the Turkish economy.

[9] The first autoregressive coefficient is 0.70.

[10] Backus et al. (1995: 33-334) confirm such a result for 11 developed countries, as well.

TABLE 1: COMPONENTS OF SPENDING

(1) Real GNP/GDP

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	3.65	1.00	-0.19	0.05	0.39	0.70	1.00	0.70	0.39	0.05	-0.19

(2) (Expenditure) Total Private Consumption (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	4.01	1.10	-0.20	0.09	0.39	0.70	**0.92**	0.73	0.46	0.17	-0.08

(3) (Expenditure) Foods and Beverages Consumption (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	2.27	0.62	-0.04	0.10	0.22	0.42	**0.53**	0.26	0.05	-0.16	-0.26

(4) (Expenditure) Total Private Consumption less Durables (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	2.52	0.69	-0.13	0.11	0.36	0.63	**0.88**	0.66	0.41	0.14	-0.13

(5) (Expenditure) Durable Goods (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	16.45	4.51	-0.19	0.08	0.39	0.66	**0.83**	0.63	0.38	0.12	-0.05

(6) (Expenditure) Government Final Consumption (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	3.08	0.84	-0.28	-0.13	0.06	0.32	**0.44**	0.40	0.32	0.04	-0.06

(7) (Expenditure) Gross Fixed Capital Formation (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	11.43	3.13	-0.25	-0.06	0.26	0.62	**0.86**	0.76	0.52	0.20	-0.04

(8) (Expenditure) Machinery (Private Sector) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	22.42	6.14	-0.19	0.04	0.30	0.62	**0.83**	0.74	0.50	0.15	-0.15

(9) (Expenditure) Machinery (Public Sector) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	29.10	7.97	-0.14	-0.08	0.19	0.33	**0.51**	0.45	0.28	0.05	-0.03

(10) (Expenditure) Construction / Building plus House (Private Sector) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	5.48	1.50	-0.20	-0.22	-0.14	0.03	0.09	0.19	**0.25**	0.22	0.22

(11) (Expenditure) Construction / Building plus Other Building (Public Sector) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	12.98	3.56	-0.22	-0.17	0.02	0.28	**0.46**	0.36	0.29	0.19	0.13

(12) Exports (Goods and Services) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	5.57	1.53	-0.02	-0.02	0.15	0.24	**0.33**	0.25	0.26	0.23	0.14

(13) Imports (Goods and Services) (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	12.01	3.29	-0.17	0.12	0.46	0.75	**0.89**	0.61	0.28	-0.03	-0.23

(14) Net Exports (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	3.49	0.96	0.22	0.05	-0.19	-0.47	**-0.72**	-0.63	-0.40	-0.14	0.16

(15) Terms of Trade

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	4.19	1.15	-0.09	0.01	0.23	0.40	0.50	**0.54**	0.43	0.30	0.22

(16) Changes in Stocks (Fixed Prices)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	2.43	0.67	0.04	0.29	0.44	0.43	0.38	-0.03	-0.31	-0.43	**-0.47**

0.67. However, Alper (1998: 233-244) and Agénor et al. (1999) using industrial production data report lower findings for the relevant coefficient such that both find the degree of persistence of output fluctuations about its trend as 0.38.

The percentage standard deviation of real income, 3.65, is in line with the findings of Alper (2002: 22-54) and Aguiar and Gopinath (2004), which estimate 3.48 and 3.57, respectively. When comparing the volatility values of filtered real output of developing and developed countries, Aguiar and Gopinath emphasize that emerging market economies on average have a business cycle two times as volatile as their developed counterparts. Having filtered the real output series, the volatility in developing countries is in general above the value of 2.00 extending to the value of 4.00, whereas for developed countries the standard deviation of output fluctuations is below the value of 2.00, supporting the findings of Backus et al. (1995: 333-334).

The sub-components of real output have in general more volatile characteristics than the real output itself. Total private consumption is about ten percent more volatile than real output, but the most volatile part of the private consumption expenditure is due to the expenditures on durable goods. When the durables are excluded from total consumption, the volatility ratio falls considerably, supporting the findings of Backus et al. (1995: 333-3334) for developed countries, Aguiar and Gopinath (2004) for developing countries, Stock and Watson (1998) for the US, and Alper (2002: 22-54) for the case of Turkey. In this line and consistent with the findings of Stock and Watson, we can easily notice in Table 1 that the total private consumption less durables including consumption of services is considerably less volatile than output over the cycle.

The latter authors also emphasize that the consumption expenditure is more volatile than real income in developing countries, although the findings of Fiorito and Kollintzas (1994: 235-269) and Aguiar and Gopinath (2004) point out that the consumption volatility is in general below the volatility of real income for the developed countries. As emphasized by Kydland and Zarazaga (1997: 26-28) and Alper (2002: 22-54), although theoretically the opposite should hold, that the consumption is more volatile than real income would constitute an anomaly when considered the consumption smoothing behaviour of Life Cycle/Permanent Income hypothesis. Alper attributes such an anomaly to the possible changes in the consumer

behaviour over the life-cycle in the sense that developing countries such as Turkey have a population younger than the population of developed countries and this gives rise to consumption volatilities with an important income uncertainty, while people in developed countries such as the US behave in such a way conforming to the Life Cycle/Permanent Income hypothesis and implying a reduction in the observed relative volatility as the average age of population start to increase. Furthermore, as an alternative for the failure of consumption smoothness, Denizer et al. (2000) using panel data of 70 countries reveal evidence in favor of that financial development would reduce the macroeconomic volatility, and dealing with our subject of interest here, they find that the simple availability of credit to the private sector would hep to smooth consumption and GDP, thus attribute the excess volatility in consumption to credit constraints.

As can be *a priori* expected, components of investment such as the private and public machinery investment, and the gross fixed capital formation, all of which are synchronous and pro-cyclical, constitute the most volatile part of the real income generation process. Private construction investment lags the cycle by two quarters, while correlation between the public sector construction and real output peak at time zero. Both construction components are pro-cyclical, as well. There exists a counter-cyclical relationship between the changes in stocks and real income, and the stock changes lag the cycle by four quarters in a counter-cyclical way.[10]

As Rand and Tarp (2002: 2079) emphasize, the relationship between the public expenditure and the GDP often attracts considerable attention, *inter alia* because of the desire to ensure that fiscal policies help stabilize the economy. Following also Fiorito and Kollintzas (1994: 245) and Alper (2002: 22-54), cyclical correlation between real output and government final consumption may depend on a variety of factors such as the evolution of institutions, the weight of military expenditures in the total budget, and the existence of stabilization

[10] We find a positive significant cross correlation between the private and public sector machinery investment, not reported in this paper, that peak at time zero, i.e. synchronous and procyclical. On this point, we apply to some bivariate Granger causality tests using lag lengths suggested by sequential modified likelihood ratio statistics of Sims' (1980: 1-48), and estimate that public sector machinery investment Granger causes to that of private sector. We also find that private and public sector contruction expenditures are substitutes by their synchronous negative significant correlation, but there exists no causality relationship between each other. Besides, there exists a unidirectional causality relationship between the filtered real output data and changes in stocks, while the former Granger causes to the latter. Following QMS (2004: 376-377), these results can provide some additional information at the extent to which variables precede each other.

programs. Our estimation results give no evidence of a counter-cyclical but a procyclical role of fiscal policy, which are in line with the findings of Alper (2002: 22-54). As Fiorito and Kollintzas (1994: 246) express, we can attribute such a result in a cursory way to that, provided that the direct effect of government spending dominates the decrease in private consumption, aggregate output would rise. Thus, tightening in government finances may not necessarily lead to a "crowding in" effect of private investment and thus to an increase in real output growth. Of course, all these findings require to be further verified in future papers.[11] Although not reported in the paper, the cyclical total private consumption and government final consumption have been found pro-cyclical that peak at time zero, and the latter Granger causes to the former.

Dealing with the items in the trade balance, both exports and imports are pro-cyclical and synchronous. Furthermore, both are more volatile than consumption and real output. Consistent with what Fiorito and Kollintzas (1994: 246-247) express for developed countries is that net exports item, which is the ratio of difference between the merchandise exports and imports in fixed prices to real GDP, is counter-cyclical in a way supporting the findings of Backus et al. (1995: 331-356). These results also give support to the findings of Agénor et al. (1999) and Alper (2002: 22-54) for the Turkish case. When we consider the terms of trade component composed of the ratio of export and import price indices, we find that the terms of trade item lags the cycle by one quarter in a pro-cyclical way. Following Agénor et al. (1999), because middle-income countries are unlikely to affect the world price of any industrial commodities, these results may be interpreted as reflecting demand shifts that lead to simultaneous increases in the world price and in the export demand for the industrial sector output for these countries.

[11] Agénor et al. (1999) give clear evidence of a counter-cyclical role of government consumption expenditure for four developing countries, i.e., Chile, Korea, Mexico and the Philippines, and express that such a result is consistent with the prediction of a variety of models with imperfect capital mobility and flexible prices, in which an increase in public spending leads to a net increase in domestic absorption, a real exchange rate appreciation, and a fall in output of tradeables on impact. They suggest as an alternative policy option that tightening in government finances could lead to increases in future output growth by, for instance, "crowding in" private investment and by signaling the future stability of domestic macroeconomic policy.

In Table 2 below, we report the stylized facts of prices and monetary variables. Of all the components in these factors, prices as expressed briefly above would have one of the primary interests in policy making process. Chadha and Prasad (1994: 239-257) reveal that price level is countercyclical but inflation is procyclical using postwar quarterly data for the G-7 economies and that a clear distinction is required between inflation and the cyclical component of the price level when reporting and interpreting stylized facts regarding business cycles. As so, the procyclicality of inflation rate rather than the price level, therefore, retains the credibility of demand-driven models. But Rand and Tarp (2002: 2071-2088) estimate that the cyclical patterns of inflation and price level are in general same for both the developed and developing countries, and this suggests that supply-driven business cycle models are often appropriate in describing cyclical patterns in developing countries. These arguments are in line with the findings of Hoffmaister and Roldós (1997).[12]

Our estimation results in Table 2 indicate that both deflator-based and CPI-based price level and inflation have a countercyclical characteristic with real output supporting what the supply-driven business cycle models bring out. Even though both inflation rates considered are synchronous, GDP-deflator and CPI lag the cycle by one quarter. For the GDP price deflator and CPI based price levels, bivariate Granger causality tests have been given unidirectional causality from cyclical stationary real output to the price level supporting the cross correlation results in the sense that the stationary real output component precedes the cyclical price level component. We also applied to some unit root rests to see whether the inflation rate is stationary, and find that nonstationarity of inflation especially for CPI-based one cannot be rejected so that following Rand and Tarp (2002: 2085), inflation is therefore detrended in the same manner as the rest of the variables. Thus, as Chadha and Prasad (1994: 240) express, even though it is widely perceived that temporary movements in output are associated with shocks to demand, while longer-term movements are associated with movements in supply, the countercyclical variation of prices suggests that even temporary movements in output may be due to supply disturbances. Nominal exchange rate of TL/US$ turns out to be countercyclical such as implicit GDP deflator, consumer price index and inflation. Similar estimation results can be found in Alper (2002: 22-54).

[12] As Fiorito and Kollintzas (1994: 251-253) emphasize, a benchmark RBC model can easily account for a negative correlation between output and prices, as technology shocks shift the aggregate supply of output upward.

TABLE 2: PRICES AND MONETARY VARIABLES

(17) Implicit GDP Deflator

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	7.50	2.05	0.14	0.13	0.02	-0.18	-0.44	**-0.48**	-0.44	-0.27	-0.03

(18) GDP Deflator-Based Inflation

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
71	5.71	1.56	0.05	-0.01	-0.14	-0.25	**-0.31**	-0.07	0.02	0.14	0.25

(19) Consumer Price Index (CPI)

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	6.59	1.81	0.08	0.05	-0.07	-0.25	-0.45	**-0.46**	-0.41	-0.22	-0.01

(20) CPI-Based Inflation

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
71	3.70	1.01	-0.03	-0.08	-0.18	-0.32	**-0.32**	-0.04	0.05	0.22	0.27

(21) Nominal exchange rate of TL/US$

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	13.85	3.79	0.03	-0.11	-0.30	-0.53	**-0.68**	-0.56	-0.35	-0.05	0.17

(22) Reserve Money

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	5.72	1.57	-0.11	0.01	0.03	-0.03	-0.15	-0.20	-0.18	-0.08	-0.05

(23) Central Bank Money

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	3.56	0.98	-0.01	0.29	0.33	**0.34**	0.14	-0.15	-0.28	-0.22	-0.21

(24) M1

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	6.88	1.88	-0.14	-0.01	0.09	0.09	-0.02	-0.13	-0.14	-0.08	-0.05

(25) M2

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	8.80	2.41	0.17	0.21	0.12	-0.01	-0.22	**-0.29**	-0.22	-0.10	0.06

(26) M2Y

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	7.78	2.13	0.03	0.03	-0.08	-0.26	-0.46	**-0.48**	-0.36	-0.14	0.08

(27) M3

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	8.07	2.21	0.15	0.22	0.15	0.04	-0.15	-0.23	-0.16	-0.05	0.09

(28) Velocity of M1

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	7.63	2.09	0.16	0.17	0.15	0.08	0.06	-0.04	-0.11	-0.17	-0.08

(29) Velocity of M2

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	8.73	2.39	-0.14	-0.07	0.07	0.15	**0.25**	0.16	0.01	-0.10	-0.17

(30) Velocity of M2Y

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	6.89	1.89	0.01	0.15	0.35	0.48	**0.56**	0.37	0.14	-0.10	-0.23

(31) Velocity of M3

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	7.79	2.13	-0.12	-0.07	0.07	0.12	0.20	0.09	-0.07	-0.17	-0.22

(32) Real Effective Exchange Rate

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	8.38	2.30	-0.18	0.10	0.32	0.58	**0.62**	0.38	0.14	-0.11	-0.18

(33) Net Short-Term Capital Flows

obs	vol	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
61	1364.84	0.19	0.22	**0.32**	0.27	0.04	-0.04	-0.09	-0.11	-0.13

(34) Real Interest Rate

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
71	19.50	5.34	-0.11	-0.25	-0.44	**-0.56**	-0.46	0.02	0.26	0.35	0.29

Kydland and Prescott (1990: 3-18) find no evidence for the US nominal stylized facts that either the monetary base or M1 money stock leads the cycle, although some economists still believe this monetary myth. Of the monetary aggregates represented by reserve money, central bank money including open market operations, M1, M2, M2Y and M3 money stock aggregates, and the velocities of the latter money stocks, consistent with the findings of Alper (2002: 22-54), we find in Table 2 that only central bank money, M2 and M2Y money stocks and relevant monetary velocity do not indicate acyclical characteristic such that central bank money leads the cycle and M2 and M2Y money stocks lag the cycle by one period such as the findings of Alper (1998: 233-244).[13] Following Alper, especially during the period 1987-1999, the central bank took the fiscal policy and hence budget deficit as exogenous, and attempted to minimize large fluctuations in the interest and exchange rates leading both monetary policy to be endogenously determined and *a priori* expectations for the cyclical behaviour of the money stock controlled by the central bank to be acyclical. Thus due to the endogenous characteristic of money stock aggregates in developing countries, an RBC model would not attach a very important role to the monetary policy. Also consistent with the findings of Fiorito and Kollintzas (1994: 251-253), the countercyclicality of prices and the weak correlation or acyclical characteristics of monetary aggregates and real output would be consistent with the RBC models with non-neutral money as well as the Quantity Theory. But that the variability of money velocities exceeds that of real GDP fluctuations more than two times would not give support to any approach in favor of Quantity Theory, which require a very low variability of velocity.

There exists a synchronous strong procyclical relationship between cyclical real effective exchange rate and real output. We should specify that an increase in the real effective

[13] Bivariate Granger causality tests not reported here indicate that there exists no causality/precedence relationship between cyclical components of M1and GDP and M2Y and GDP. We find unidirectional causality from reserve money to GDP and from GDP to both M2 and M3 money stocks. Also bidirectional causality does exist between central bank money and GDP.

exchange rate index used by the CBRT indicates real appreciation of the domestic currency.[14] When we deal with correlation between real output and short-term capital flows consisted of portfolio investments net of assets and liabilities as equity securities and debt securities, we see that capital flows lead the cycle by two quarters.[15] This estimation results are also in line with Alper (2002: 22-54).

We consider the real interest rate as a last monetary variable for the Turkish business cycle facts. For this purpose, we use *ex-post* real interest rates adjusted for real output growth and inflation which is calculated by following the estimation procedure in Akçay et al. (2002: 77-96). Real interest rate precedes the real income cycle by one quarter with a countercyclical relationship. Although not reported here, capital flows data considered in this paper lead the real interest rate significantly by one quarter. Besides, the former precedes the latter in the Granger sense. These all may be giving some support to Alper (2002: 22-54) that indicates capital inflows being expectations driven rather than responding to the changes in the real interest rates.

We finally examine in Table 3 the correlations between factors of production in industry and real GDP. Cyclical stationary components of industrial production index (IPI) and manufacturing production index (MPI) have a strong correlation with real GDP as can be expected as well as are synchronous and procyclical. Both seem to be slightly more volatile than real output component consistent with Kydland and Prescott (1990: 3-18) and Fiorito and Kollintzas (1994: 253-259), labour input measured both in terms of workers and in terms of total hours is procyclical and less variable than real GDP, IPI and MPI. Production hours per worker worked in manufacturing industry and total hours worked are also procyclical and synchronous, however Kydland and Prescott (1990: 3-18), Fiorito and Kollintzas (1994: 253-259) and Stock and Watson (1998) report that employment lags output for developed countries. Alper attributes high volatility in total hours worked in manufacturing industry to the existence of labour market restrictions in developing economies in the sense that firms which are faced with high costs of firing labour tend to contract labour hours during

[14] However, when we estimate the Granger causality relationship between cyclical output and real effective exchange rate series, we find that the latter strongly precedes the former, while no information content of the former can be found on the latter.

[15] Similar to the above case, bivariate Granger causality tests reveal that short-term volatile capital flows strongly precede real income generation process.

TABLE 3: THE FACTORS OF PRODUCTION

(35) Industrial Production Index

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	4.53	1.24	-0.05	0.18	0.47	0.73	**0.94**	0.64	0.32	-0.01	-0.23

(36) Manufacturing Production Index

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
72	5.12	1.40	-0.06	0.16	0.46	0.72	**0.93**	0.62	0.31	-0.04	-0.25

(37) Employment in Manufacturing

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	3.82	1.05	0.06	0.16	0.34	0.50	**0.67**	0.64	0.44	0.16	-0.09

(38) Production Hours per Worker Worked in Manufacturing Industry

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	4.14	1.13	0.06	0.18	0.39	0.56	**0.74**	0.61	0.37	0.09	-0.17

(39) = (37)*(38) Total Hours Worked in Manufacturing Industry

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	7.90	2.16	0.06	0.17	0.36	0.53	**0.71**	0.63	0.41	0.12	-0.13

(40) = (36) / (37) Productivity in Manufacturing in Terms of Employment

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	3.65	1.00	-0.12	0.11	0.29	0.50	**0.61**	0.22	-0.03	-0.20	-0.24

(41) = (36) / (39) Productivity in Manufacturing in Terms of Hours

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	5.34	1.47	-0.13	-0.07	-0.10	0.09	0.16	**0.32**	0.31	0.20	0.03

(42) Real Hourly Wages in Manufacturing

obs	vol	σ/σ_{GDP}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}
68	9.40	2.58	-0.14	-0.08	0.03	0.21	0.31	**0.37**	0.30	0.22	0.16

recessions. We do not find that productivity leads output contradicting an RBC approach, but estimation results in Fiorito and Kollintzas (1994: 253-259) for G-7 economies and Alper (2002: 22-54) for Turkey confirm our findings. Further, real wages are pro-cyclical and lags the real GDP cycle by one quarter.

V. CONCLUDING REMARKS

In our paper, we try to reveal the main properties of Turkish business cycles. Such an analysis would help policy makers and researchers in designing and applying economic policies to affect the course of economic activity level. Having identified the importance of such an analysis and examined the general characteristics of business cycle phenomenon giving special emphasis to how cyclical are the prices in business cycle analysis, we conduct an empirical attempt to extract the cyclical components of the Turkish business cycles and to find correlations between these stationary cyclical facts.

Our estimation results indicate that there exists a considerable persistence in cyclical component of real output. Total private consumption expenditures have a more volatile characteristics than real output mainly due to the expenditures on durable goods. Components of investment and gross fixed capital formation constitute, as can be expected, the most volatile part of the real income generation process. No evidence in favor of a countercyclical but procyclical role of fiscal policy has been found and we attribute such an estimation result to that provided that the direct effect of government spending dominates the decrease in private consumption, aggregate output would rise. Net exports are more volatile than consumption and real output, and countercyclical even though sub-components of net exports, i.e. exports and imports, are procyclical in line with what contemporaneous economics literature indicate.

Of all the components in monetary factors, prices as expressed in the paper would have one of the primary interests in policy making process. We find that both deflator-based and CPI-based price level and inflation have a countercyclical characteristic with real output supporting what the supply-driven business cycle models bring out. Nominal exchange rate of TL/US$ turns out to be countercyclical such as implicit GDP deflator, consumer price index and inflation. The countercyclicality of prices and the weak correlation or acyclical characteristics of monetary aggregates and real output found in this paper would be consistent with the RBC models with non-neutral money as well as the Quantity Theory. But that the variability of money velocities exceeds that of real GDP fluctuations more than two times would not give support to any approach in favor of Quantity Theory, which require a very low variability of velocity. There exists a synchronous strong procyclical relationship between cyclical real effective exchange rate and real output, while capital flows lead the reference cycle.

Finally, for the components in fators of production, we find procyclicality of total hours, productivity and the real wage rate. As Fiorito and Kollintzas (1994: 257) emphasize, this result is very much consistent with benchmark RBC models, where good (bad) technology shocks increase (decrease) the physical marginal product of labour, employment, the real wage rate, and output. All in all, our estimation results give support to the importance of supply side models in explaining the Turkish business cycles. Of course, estimation results using cross correlation coefficients as indicators for business cycles in this paper need to be

confirmed by estimating structural economic relationships identified through economics theory, and such an empirical attempt should be elaborately dealt with in future papers.

ACKNOWLEDGEMENT

This paper aims to be an extension of the useful controversies with Professor Dündar M. Demiröz of the Istanbul University Department of Economics upon the business cycles phenomenon. The author would like to thank Mr. Demiröz for invaluable and counter-intuitive criticisms of the arguments advocated in this paper and preliminary discussions of the Turkish business cycles.

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