Institutions and Business Cycles

Sumru Altug, Koç University and CEPR

Mustafa Emin, Bocconi University

Bilin Neyapti, Bilkent University*

November 26, 2011

Abstract

This paper investigates the relationship between the main features of business cycles and the institutional and structural characteristics of countries of up to 62 industrial, emerging and formerly centrally planned economies from all continents. We derive the business cycle characteristics using the nonparametric Harding-Pagan approach. Our analysis reveals that institutional factors have significant associations with the duration and amplitude of business cycles. Examining the determinants of business cycle synchronization for the countries in our sample, we also demonstrate that the bilateral proximity of institutional and policy environments matters in addition to the gravity arguments and bilateral trade intensity found to be important in earlier studies.

Keywords: Institutions, business cycles, synchronization, nonparametric analysis

JEL Codes: C32, E32, E37

*We are grateful to Erhan Uluceviz for assistance with the computations in this paper, and to Sumru Öz and Monica Schwartzman for helpful comments on an earlier draft.

1 Introduction

This paper investigates the relationship between the main *business cycles features* and the institutional and structural characteristics of countries in which they are observed. The role of institutions in determining macroeconomic outcomes has been discussed extensively in the literature. There are numerous studies that show that institutional features such as property rights and the rule of law have positive effects on economic performance – see Knack and Keefer (1995), Hall and Jones (1999), Easterly and Levine (2003), and Rodrik, Subramanian and Trebbi (2002). There is also a large literature on the effect of monetary and financial institutions on macroeconomic performance for both developed and developing countries. Bade and Parkin (1988), Alesina (1988, 1989), Grilli, Masciandro and Tabellini (1991), Cukierman, Miller and Neyapti (1992, 2002), Eijffinger and Schaling (1993) and Neyapti (2009) examine the impact of monetary institutions on inflation. In addition, Neyapti and Dincer (2005), Allen and Gale (2007), De Haan and Shehzad (2010), and Dincer and Neyapti (2010) focus on the impact of bank regulation on economic performance.

Yet there has been relatively little work that examines the institutional underpinnings of business cycle fluctuations. A notable exception is the work of Krainer (2000), who relates corporate governance structures to the financial business cycle characteristics of the G-7 countries. As another contribution in this regard, Giannone *et al.* (2010) relate the extent of market liberalization to the severity of the recent global financial crisis. They consider the relationship between various rating and regulatory indices and GDP growth during 2008-2009 for 102 countries. Even after controlling for the effects of such variables as income per capita, financial market depth, banking competition, liquidity, and financial macroeconomic imbalances, they find that the set of policies that favor credit market liberalization correlate negatively with countries' resilience to the current financial crisis. In a related work, de Carvalho Filho (2011) examines post-crisis growth for 51 developed and emerging economies and finds that inflation targeting countries outperformed their peers in terms of either GDP growth or the behavior of industrial production. Her results indicate that this result is robust to a variety of pre-crisis determinants of post-crisis growth. Authors such as Diamond and Rajan (2009) have also argued that the emerging market economies were able to avoid the worst effects of the 2007-2008 crisis due to the many institutional and policy changes that they undertook in response to previous crises.[1] However,

[1]Fratzscher (2011) argues that the "pull" factors determining the extent of capital flows in the post-crisis era are related to factors such as the quality of domestic institutions and the strength of macroeconomic fundamentals, amongst

these analyses only refer to a specific episode - the 2007-2008 financial crisis - and its aftermath and do not seek to understand more generally the institutional underpinnings of average business cycles across countries. Our focus is precisely on this latter question.

There are alternative approaches to characterizing business cycle features. The Real Business Cycle approach pioneered by Kydland and Prescott (1982) has been concerned with matching the correlations and cross-correlations of a set of key macroeconomic variables with those generated by fully specified dynamic equilibrium models. Hamilton (1989) proposed a simple nonlinear regime-switching framework for modeling postwar US GDP growth. Factor models or vector autoregression models with a factor structure can also be used to derive measures of cycles that are common across regions. See, for example, Köse, Otrok and Whiteman (2003) or more recently, Canova (2010). Harding and Pagan (2002a,b) have argued that such parametric approaches which directly specify a statistical model for the series in question may produce different business cycle characteristics relative to linear models depending on assumed features such as conditional heteroscedasticity, persistence, and non-normality of the process. They have instead advocated a nonparametric approach to characterizing business cycles that has closer parallels with the Burns-Mitchell (1946) methodology.

In this paper, we examine the extent to which the business cycle characteristics of 62 countries, measured across differing periods of time, can be attributed to institutional factors, after controlling for structural and macroeconomic factors. We use the nonparametric Harding-Pagan (2002a,b) approach to examine the business cycle characteristics of the countries in terms of the turning points of the business cycle for each country, the duration and amplitude measures for each phase of the business cycle, as well as synchronization of business cycles across countries. Our study extends Altug and Bildirici's (2010) study to examine the determinants of business cycles in a mixed sample of countries that includes industrial, emerging and formerly centrally planned economies from all continents.[2] The sample period that we consider ranges from the 1960's until 2009, depending on data availability for each country. We first investigate how the different factors affect business cycle characteristics such as duration and amplitude in the expansionary and contractionary phases separately. Since the business cycle features are obtained as averages over relatively long sample periods, our approach to this empirical investigation does not seek to assign causality.

---

others.

[2]There are few studies that have examined business cycle characteristics for developing or emerging economies. Some exceptions include Rand and Tarp (2002), Girardin (2005), and Canova (2010).

Second, we examine the determinants of business cycle synchronization across countries. A numerous set of factors have been hypothesized to affect business cycle synchronization across countries. Some of the variables under study have constituted trade intensity (Frankel and Rose, 1998), sectoral structure (Imbs, 1999,2003), bilateral financial linkages (Imbs, 2004, 2006), the presence of currency unions (Rose and Engel, 2002; De Pace, 2010) as well as those deriving from distance and gravity arguments. In a comprehensive study, Baxter and Kouparitsas (2004) use robust methods of inference to determine the importance of a large set of variables used in determining business cycle synchronization. They find that bilateral trade between countries and a gravity variable measured as distance between countries are found to be robust determinants of business cycle synchronization. In this paper, while we control for the impact of variables found to be important in the earlier studies, we also examine the impact of proximity in their institutional and policy environments. Specifically, we investigate the role of the quality of monetary institutions and structural factors. To our knowledge, our paper is the first to quantitatively analyze how such factors affect the synchronization of business cycles across countries.

The remainder of this paper is organized as follows. Section 2 summarizes the business cycle characteristics used in our study. Section 3 describes the institutional, structural and macroeconomic variables and presents regression results that correlate them with the business cycle characteristics. Section 4 provides evidence on the determinants of business cycle synchronization while Section 5 concludes.

2 Business cycle characteristics

This section is devoted to an analysis of the business cycle characteristics of the countries in our sample. Section 2.1 first describes the methodology employed in the measurement of business cycles while Section 2.2 provides a description of the results.

2.1 Methodology

The data used to derive the business cycle characteristics for our study is comprised of a representative set of developed and developing countries. Appendix A provides the data sources and some specific observations on the sample countries. Table A.1 presents the list of countries used in our study as well as the sample period in question. As shown in Appendix A, data for a subset of the countries are available

in de-seasonalized form. For the remainder, we used the X11 linear de-seasonalization approach to eliminate seasonal components in quarterly GDP. As the next step, we apply the nonparametric Bry-Boschan (1971) procedure to obtain the turning points for classical cycles, as defined by the NBER methodology. Recently, Harding and Pagan (2002b) have proposed a modification to the Bry-Boschan algorithm – the so-called BBQ algorithm – that can be used to identify the peaks and troughs of the classical cycle at a quarterly frequency. According to the BBQ algorithm, the peak of a business cycle is identified if $\{y_{t-1} - y_{t-2} > 0, y_t - y_{t-1} > 0, y_{t+1} - y_t < 0, y_{t+2} - y_{t+1} < 0\}$ where $y_t = \ln(Y_t)$ and Y_t denote real GDP measured at the quarterly interval. Likewise, a trough is identified at time t if $\{y_{t-1} - y_{t-2} < 0, y_t - y_{t-1} < 0, y_{t+1} - y_t > 0, y_{t+2} - y_{t+1} > 0\}$. A *complete* business cycle is defined as alternating peaks and troughs with a minimum duration of five quarters.[3]

Harding and Pagan (2002b) have proposed a variety of measures to examine the characteristics of the phases of a business cycle based on the implementation of the BBQ algorithm. These include the *duration* and *amplitude* as well as a *concordance index* that measures the extent of synchronization of business cycles between pains of countries.[4] Once the turning points have been determined according to this data-based approach, the different measures of business cycle activity can be computed. To describe these measures, let D_i be the duration of a business cycle phase, say a recession or an expansion, and let A_i denote its amplitude. If the consecutive turning points fall on the dates t and $t + d$, then $D_i = d$ and $A_i = y_{t+d} - y_t = \Delta_d y_t$.[5]

2.2 Sample characteristics

The measures of average business cycle characteristics are available only for countries that exhibit complete business cycles.[6]

[3] An alternative approach is to use yearly changes to identify business cycle facts (see Stock and Watson, 2005). Likewise, Altug and Bildirici (2010) use year-to-year changes measured at the quarterly frequency for determining business cycle dates and characteristics based on both the nonlinear Markov switching model as well as the nonparametric Harding-Pagan approach.

[4] The concordance index is described more fully in Section 4.

[5] Harding and Pagan (2002b) also provide a measure that describes the shape of each phase of the business cycle. If the duration and amplitude are thought to form a triangle, then the area of the triangle measures the loss (gain) of a recession (expansion). The difference between the actual cumulated movements and the triangle approximation (as a percentage of the actual cumulated movements) is denoted as the excess cumulated movements.

[6] Countries in our sample that do not satisfy this criterion include Bolivia, Georgia, Indonesia, Ireland, Latvia, Lithuania, and Slovenia. A subset of these countries only experience downturns in economic activity associated with the 2008 global financial crisis. These are typically European countries which were exposed to the financial shock through banks portfolios and credit market conditions such as Ireland, and Slovenia. For the remainder of the countries which do not exhibit complete business cycles, we observe the impact of different global and local conditions on their cyclical performance. For example, Indonesia experiences a downturn only during the 1997 East Asian crisis and its aftermath.

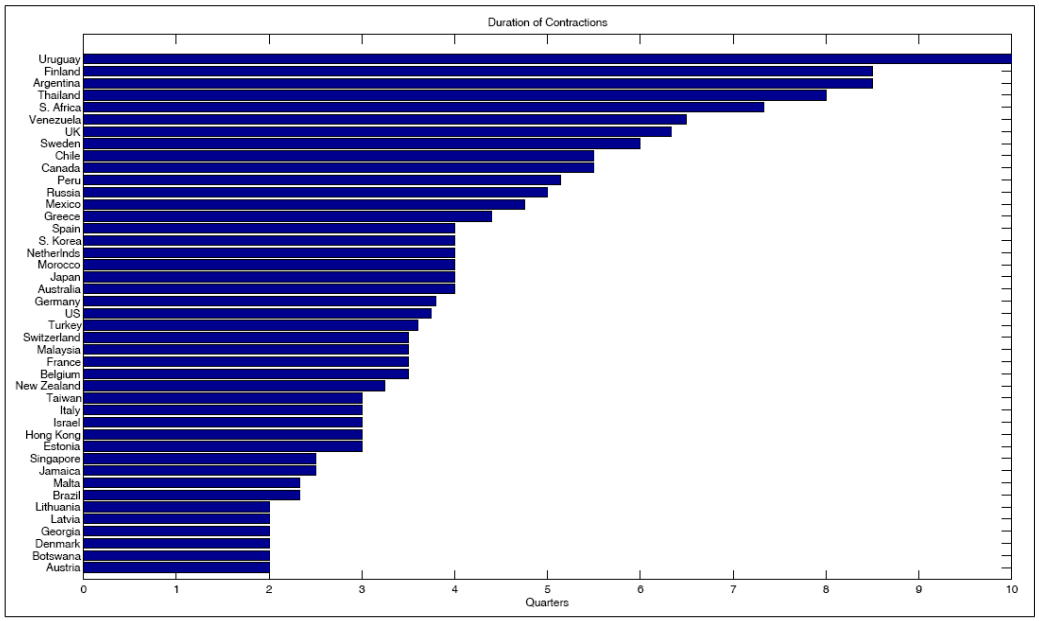

Figure 1: Duration of Contractions

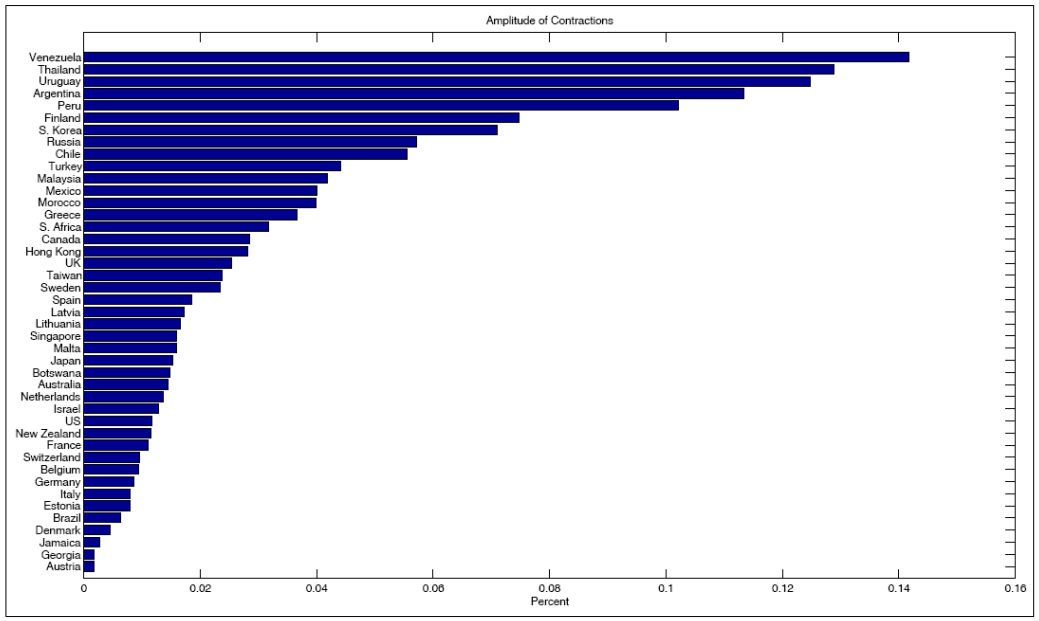

Figure 2: Amplitude of Contractions

We begin by examining the duration and amplitude of contractions and expansions for all of the countries that have multiple recessions and expansions. These are displayed in Figures 1 through 4.

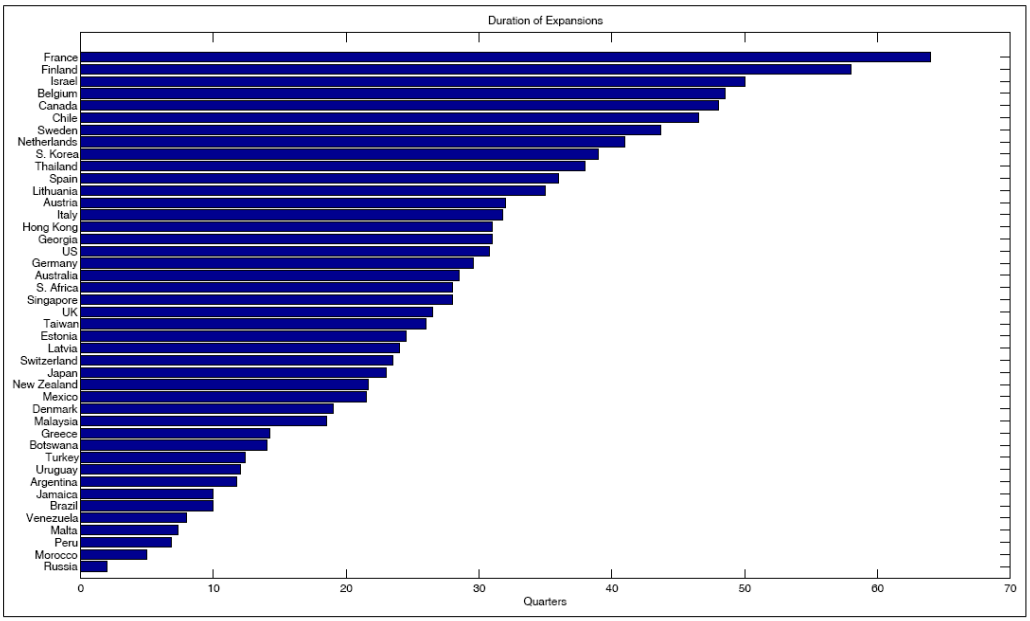

Figure 3: Duration of Expansions

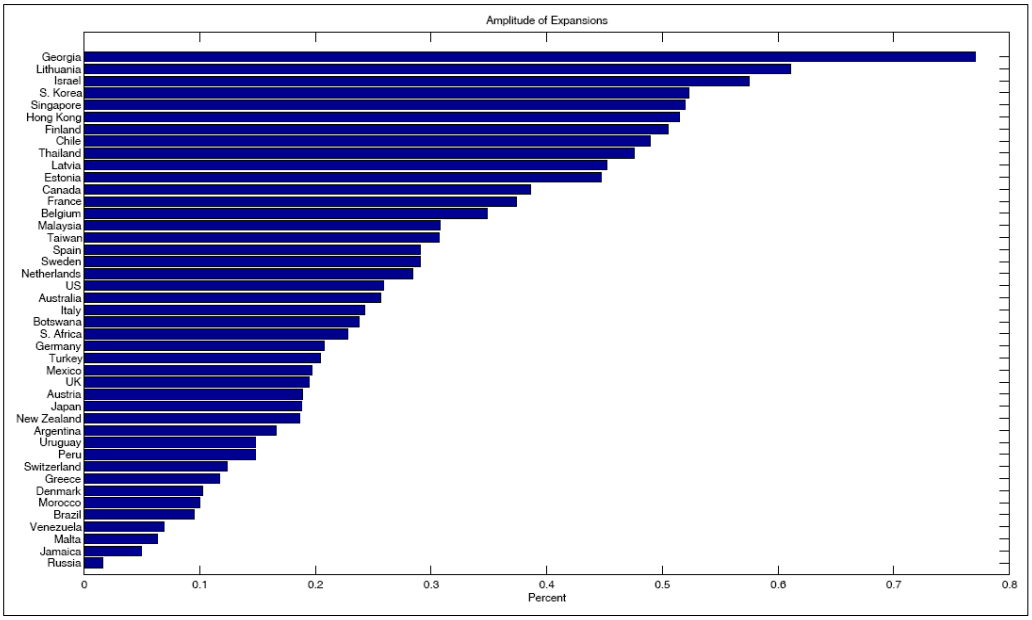

Figure 4: Amplitude of Expansions

We rank the duration of contractions and expansions from shortest to longest, and the corresponding amplitudes from smallest to largest. First, we note that the duration and amplitude of expansions

displays much more heterogeneity compared those for contractions. From the longest duration of expansions of 35 to 60 quarters for countries such as Austria, S. Korea, France, Thailand and a set of East European and transition countries to the shortest durations of 2 to 10 quarters for Latin American and emerging countries such as Venezuela, Russia, Morocco, Jamaica, and Uruguay, we observe a wide variety of experiences for the countries included in our sample. By contrast, the duration of contractions ranges from 2 to 8 quarters. Not surprisingly, developing countries tend to experience longer contractions although there some exceptions to this rule. Figure 1 shows that Sweden, Finland and Canada have tended to experience longer contractions over the relevant sample periods compared to other developed countries. This is most likely due to the severe recessions that these countries endured during the 1990's.

Considering the amplitude of expansions versus contractions, we find that there is also significant heterogeneity in the amplitude of expansions compared to contractions but this finding is not as pronounced as it is in the case of the durations of the different phases. Part of the reason for large amplitude of expansions may arise from catch-up or transition effects for various developing countries. Indeed we observe that fast-growing countries such as S. Korea, Thailand, Singapore, and a set of transition countries have the largest amplitude of expansions. Likewise, countries that have short duration of expansions also tend to have small amplitudes during such phases. Observe, for example, the very small amplitude of expansions for Russia, Jamaica, Venezuela, Morocco, and Columbia. Examining the amplitude of contractions, we observe that developing countries such as Thailand, Venezuela, Peru, Argentina, and Uruguay as well as transition countries such as Bulgaria and Romania have tended to experience the largest declines in output during recessions. However, some developing or transition countries such as Hungary or Jamaica display the smallest output losses during contractions, suggesting that there is a less clear-cut case for ordering the behavior of contractions based on a country's level of development.

Table 1 also displays the business characteristics of six main groups of countries. This table shows that the G7 and EU countries have very similar business cycle characteristics. This appears in contrast to the findings of Krolzig and Toro (2005), who use quarterly GDP data to estimate univariate and multivariate Markov Switching models for Germany, UK, France, Italy, Austria, and Spain for the period 1970-1996. These authors find that recessions tend to be milder in the core EU countries relative to the other developed countries such as the US. Part of the reason for our finding of slightly

	Contraction		Expansion	
	duration†	amplitude‡	duration†	amplitude‡
G7	3.37	-2.38	27.83	22.32
EU	3.78	-2.94	28.72	22.96
Other Industrialized	3.20	-3.11	22.75	31.33
Latin American	4.18	-8.53	14.78	19.16
Other Emerging	3.72	-6.41	15.11	22.72
Transition	4.06	-7.83	23.59	41.84

† in quarters; ‡ in percent

G7: US, UK, Japan, Canada, France, Germany, Italy

EU: Austria, Belgium, Denmark, Finland, Greece, Luxembourg, Netherlands, Portugal, Spain, Sweden

Other industrialized: Australia, Hong Kong, Iceland, Israel, Malta, New Zealand, Norway, Singapore S. Korea, Switzerland, Taiwan

Latin American: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela

Other Emerging: Botswana, Jamaica, Morocco, Malaysia, Philippines, S. Africa, Thailand, Turkey

Transition: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kyrgyzstan, Slovakia, Romania, Russia

Table 1: Summary of Business Cycle Characteristics

more severe recessions for the EU countries may be the experience of periphery countries in the EU. Altug and Bildirici (2010) find that the business cycle characteristics of core and periphery EU countries tend to display significant differences.[7] The industrialized countries outside of the G7 and the EU tend to have greater amplitudes during expansions. This finding partly reflects the experience of countries such as Israel, S. Korea, Singapore and Taiwan, which have experienced strong growth and convergence to the per capita income levels of G7 and other developed countries in the EU in the postwar period. Indeed, S. Korea appears as an outlier in terms of the amplitude of its expansions. One could argue that some of these countries should be grouped with the emerging economies based on their initial per capita income over the sample period. However, their overall business cycle characteristics are more similar to the G7 and EU countries when we consider the entire sample period.

For the developing countries, the Latin American countries have the worst measures across business cycle characteristics - the longest and deepest recessions as well as the shortest and weakest expansions. These measures reflect more fully the experience of countries such as Argentina, Mexico, Peru, Uruguay and Venezuela. Countries such as Brazil and Chile have slightly differing characteristics, though. Brazil appears to be among the most volatile countries but its recessions tend to be shorter and milder than the other Latin American countries.[8] Countries such as Chile and Ecuador have long expansions

[7]For example, Finland and Sweden are observed to suffer sharp and prolonged declines in GDP, which is most likely due to their experience during the Nordic banking crisis of the 1990's (see Drees and Pazarbaşıoğlu, 1998).

[8]Our sample period reflects the end of the hyperinflationary experiences in Brazil. See Chauvet (2010) for a further

characterized by large output gains. The highly heterogeneous group of emerging market economies tends to have only slightly better business cycle characteristics than those of the Latin American countries. However, there are disparities among this group of countries as well. While Thailand tends to have longer and/or stronger expansions, Turkey experiences short recessions amid short expansions. The transition and CIS countries are similar to the Latin American and other emerging economies in terms of the duration and amplitude of their contractions. However, Croatia, Estonia and Slovakia tend to display longer and more robust expansions, reflecting the economic gains that these countries have made in the aftermath of market reforms and liberalization.

3 Determinants of business cycle characteristics

The role of institutional factors in determining economic outcomes has recently gained prominence. According to some, "institutions rule" (see Rodrik *et al.*, 2002). Yet there has been relatively little work that has examined the impact of institutions on business cycle characteristics across countries. As Giannone *et al.* (2010) state: "In principle market orientation, a stable political system and good governance should make countries more resilient to large shocks and thereby mitigate output losses due to recessions." We could also conjecture that such characteristics should lead to more stable and prolonged expansions and/or shorter and less severe downturns, which appear to be a concomitant aspect of the process of convergence of per capita incomes that has been studied so extensively in the growth literature.

In this paper, our aim is to understand the association of institutional factors and business cycle characteristics. The institutional variables are intended to measure the *constraints* on the actions of the relevant agents (see North, 1990). The issue of the appropriate measurement of institutions in empirical work has created much controversy.[9] The efficacy of formal and informal institutions in a society may be captured by a general notion of governance. However, institutional factors may also be correlated with other variables, making it difficult to identify their separate effects. As an example, the new institutionalist literature has argued that strong institutions cause growth. However, there may exist reverse causality in that countries with higher income may have also developed better and more resilient institutions. Furthermore, the underlying structural characteristics of the different economies

discussion of the determinants of business cycles in Brazil.

[9]See Glaeser *et al.* (2004) for a discussion of this issue in the context of the growth literature.

such as the degree of openness or the industrial base may matter for the ultimate impact of alternative institutional arrangements.

It could be argued that the *outcomes* of alternative institutional arrangements may also have an effect on business cycle characteristics over and above those that can be attributed to the arrangements themselves. Many studies that seek to understand the role of institutions on short term performance also control for the impact of macroeconomic factors. The problem with using average values of such macroeconomic factors to explain average business cycle characteristics is that these factors may themselves be affected by the state of the business cycle. Whereas institutional or structural variables may be expected to change slowly over time and show relatively little feedback from cyclical phenomena, the state of macroeconomic variables may be affected more directly by a country's business cycle. In what follows, we initially consider specifications that control for the structural characteristics of the different economies alongside the institutional factors but do not explicitly introduce macroeconomic variables. Subsequently, we include the principal components of a set of macroeconomic variables to control for the effects of such variables.

We denote the average business cycle characteristics of country i for the period under study as $Edur_i$, $Eampl_i$, $Cdur_i$, and $Campl_i$. In these expressions, the E and C prefixes stand for expansion and contraction, and *ampl* and *dur* stand for the amplitude and duration of a given country's business cycle. Also define the institutional indicators for country i by $Inst_i$, its structural variables by $Struc_i$, and the first principal component of its macroeconomic indicators by $PCMacro_i$, all calculated as an average over the relevant sample period for the country. In all of the models that we estimate, each of the characteristics $y_i = Edur_i, Eampl_i, Cdur_i, Campl_i$ enter separately as the dependent variable. Each regression also includes a set of explanatory variables $X_i = Inst_i$ as well as a set of potential control variables denoted $Z_i = Struc_i, PCMacro_i$. Hence, the model we estimate is given by

$$y_i = \alpha_1 + \alpha_2 X_i + \alpha_3 Z_i + \epsilon_i, \quad i = 1, \ldots, N, \tag{3.1}$$

where the error terms are assumed to be independent across countries. Since the business cycle features are measured in average terms, the data are cross-sectional. The estimations are performed using OLS method with White-heteroskedasticity corrected error terms for possible heterogeneity in the cross-sectional data.

3.1 Data

In this section we describe the variables that are used to measure institutional, structural and macroeconomic factors. These variables are used as the determinants of average business cycle characteristics as well as the determinants of business cycle synchronization.

3.1.1 Institutional variables

In view of the recent macroeconomic literature that has emphasized the role of monetary institutions in affecting economic stability, we consider measures of governance as well as indicators of the quality of monetary policy institutions. The following lists the variety of the institutional measures employed in our empirical study.

- The Worldwide Governance indices provided by the World Bank (see Kaufman, Kraay and Mastruzzi, 2009) constitute a widely used aggregate measure of governance. It measures different dimensions of governance grouped as (i) voice and accountability, (ii) political stability and absence of violence/terrorism, (iii) government effectiveness, (iv) regulatory quality, (v) rule of law, and (vi) control of corruption.[10] We combine these six groups of governance indicators under one index, denoted as Gov, by taking the average of the normalized indices such that a number close to one indicates good governance.

- The Institutional Profiles Database 2009 (IPD) developed by the French Development Agency[11] presents a set of indicators on the institutional characteristics of 123 developed and developing countries covering 96% of the world population and 99% of world GDP. The database covers a broad spectrum of institutional characteristics and goes beyond measuring governance. In the regression results, we focus on indices regarding the level of development of labor and capital markets (denoted $ipdlm$ and $ipdkm$, respectively). In Appendix B, we also provide some graphical evidence regarding indicators of public institutions and civil society ($ipdpc$) and the nature of goods and services markets ($ipdgs$).[12]

[10] This indicator is constructed for 212 countries and territories bi-annually for 1996, 1998, 2000 and annually for 2002-2008.

[11] See http://www.cepii.fr/anglaisgraph/bdd/institutions.htm

[12] The index of labor markets and labor relations examines such characteristics as freedom of association and trade union pluralism, flexibility in the labor market, retraining and re-skilling measures, adaptive education system, respect for workers' rights, contract rigidity, wage bargaining at the individual level, strikes, management of labor as well as characteristics pertaining to labor market segmentation and mobility while the index of capital markets encompasses such

- The Civil Liberties Index prepared by the Freedom House (FH).[13]

- indices of central bank independence (CBI) provided by Cukierman *et al.* (1992, 2002) and extended by Arnone *et al.* (2007). This is a legal index that aggregates 16 characteristics of central bank (CB) charters, including variables measuring the allocation of authority over monetary authority, procedures for resolution of conflicts between the CB and the government, the relative importance of price stability in the charter of the CB, the nature of limitations on lending by the CB to the government, and procedures for the appointment and dismissal of the governor of the CB.[14]

- dummies for inflation targeting (IT) or currency boards and currency union regimes (CB and CU). The main sources for the IT, CB and CU dummies are Petursson (2004) and Roger and Stone (2005), besides other IMF and online resources.[15]

These indices of governance and institutional quality have been used in the recent literature. In trying to identify the factors that led to the large drops in GDP during the recent global financial crisis, Giannone *et al.* (2010) focus on one of the sub-indicators of the Worldwide Governance Index, namely, regulatory quality in the pre-crisis period. Frankel and Saravelos (2010) use an index of legal rights and an index of business disclosure as a potential leading indicator for the 2008-2009 financial crisis. Since our aim is to understand average behavior of longer periods, the use of an aggregate measure of governance to overcome possible measurement errors seems more appropriate.

3.1.2 Structural/macroeconomic characteristics

In our analysis, we also control for the role of structural and macroeconomics characteristics. The data on the structural and macroeconomic variables are derived from the World Bank's World Economic Indicators. The variables are comprised of (i) openness (*open*) measured as the sum of exports and imports as a percentage of GDP, (ii) the income share of industrial value added (*iva*) and (iii) country

characteristics as privatizations and nationalizations in the financial sector since 2006, competition and regulation in the banking system, financial information and financial openness, amongst others.

[13]Note that unlike the rest of the institutional indicators, greater values of the FH index indicate less freedom or lower quality of governance.

[14]As noted by Cukierman *et al.* (2002), this measure may be a poor proxy for actual independence if there are substantial deviations between the law and practice.

[15]See Neyapti (2009) for the list of countries under these regimes. Note that only Estonia and Lithuania have currency board regimes.

group dummies. The rationale for including these variables is as follows. Countries that have greater levels of openness may also have greater capability in mitigating the impact of shocks on their national economies. For example, greater openness may help reduce the severity of national business cycles by providing more risk sharing opportunities. Second, if countries with a larger industrial base are also able to mitigate the impact of shocks on their business cycles, then omitting the variable *iva* will lead us to to attribute such a role to institutions. Finally, our analysis in Section 2 suggests that there are important differences in business cycle characteristics across the various country groupings, especially the developing ones. The country groups whose effects are controlled via dummies are the Group of Seven ($G7$), the Latin American countries (LA), and the transition countries (CEE).

In our analysis, we control for the effect of various macroeconomic factors by including their principal component as an additional explanatory variable. We consider the following macroeconomic variables in constructing this indicator: (i) inflation (D)[16], (ii) credit extended to the private sector as a ratio to GDP (cr/Y), (iii) current account balance as a ratio to GDP (ca/Y), (iv) the ratio of FDI to GDP (fdi/Y) and (v) the log of real GDP per capita. The rationale for including these variables is that they may capture effects over and above those implied by the existing institutional framework. The variable D for inflation captures the outcome of monetary institutions. Because formal institutions are not adhered to in countries where the rule of law is weak, lower (higher) values of D may be considered to capture the (lack of) soundness of economic policy in general and hence, its (lack of) ability to mitigate business cycles. Likewise, including per capita income may help control for the fact that countries that have higher per capita income typically have better institutions.

3.1.3 Measurement

To determine the data range of the structural and macroeconomic variables, we consider the period of coverage that leads to the measurement of business cycle features reported in Table 1. Hence, all the macroeconomic variables, as well as *open* and *iva* are in averages over the time period indicated for each country, where available.[17] The use of sample averages to measure the structural/macroeconomic

[16]Following Cukierman *et al.* (1992), we use the rate of depreciation of the real price of money, which is defined by the inflation rate/(1+inflation rate). This transformation is used to eliminate the estimation problems that may arise from the large range of inflation values in the data set.

[17]The averages are taken to represent the period so long as sufficient data points exists; if most of the data are unavailable, the variable is reported as non-available. In the case of Hong Kong, the macroeconomic variables are available over a shorter period compared to the business cycle characteristics. In this regard, data on cr/Y is available over the period 1990-2008 while data on fdi/Y is available for 1998-2008.

factors mitigates to a certain extent the endogeneity of such factors to the business cycle characteristics. There are 54 countries with complete business cycle characteristics that are reported in Table 1. Of these countries, the macroeconomic/structural variables are available for a majority of them. An exception is Taiwan, for which many of the macroeconomic series are not available. Dropping this country reduces our sample size to 53. Data on *iva* are also missing for Israel and Malta, indicating a further reduction in the sample size when this variable is included in the regressions.

The coverage of the institutional variables requires some compromising, since many of these variables are not available in a time series format during the period investigated in the current analysis. The index of CBI is used when the date of the banking law establishing central bank independence covers the majority of the period considered; the data are coded as "non-available" otherwise (for a discussion of this procedure, see Cukierman *et al.*, 1992, 2002, and Arnone *et al.*, 2007). The variable *Gov* is calculated in averages of the period from 1996 to 2007. One way of reconciling our approach regarding the measurement of institutions is that especially informal institutions, such as *Gov*, change very slowly over time. Only data on CBI are missing for Ecuador and Kyrgyzstan. The use of the other indicators of governance are more problematic. For one, the IPD indicators are only available for 2009 and they exist for only 47 countries with complete business cycles. Likewise, data on the Freedom House indicator are missing for France, Hong Kong, South Africa and Turkey. As a further means of accounting for these deficiencies, we use the first principal component of the set of institutional variables (IT, CBI, CU, and *Gov*) in addition to the baseline regressions where we use all the available information.

3.2 Regression results

Table 2 considers the institutional factors individually after controlling for the effects of the structural variables. This table shows that the institutional variables when considered individually have significant associations with business cycle characteristics. We find that the indicators *Gov* and *ipdlm* are positively associated with the duration of expansions and the amplitude of contractions. Hence, countries with better governance or ones that score more favorably on the IPD labor markets indicator tend to have longer expansions and experience smaller output losses during contractions. We find another version of this result based on the Freedom House indicator. Recall that greater values of FH denote a lower rating on the freedom index or a lower quality of governance. Thus, increases in FH are associated with a lower duration of expansions and a greater amplitude of contractions. Taken to-

gether, these findings suggest that countries that score better on a variety of governance indicators tend to experience longer expansions and to display a smaller declines in real output during contractions. Interestingly, countries that have the inflation targeting regime (IT) in place during the sample period also tend to display similar characteristics, namely, longer expansions and contractions with smaller amplitudes. However, we do not find significant effects of membership in a currency union (CU) or central bank independence (CBI) on business cycle characteristics.

Second, we can examine the effects of structural factors such as openness and the country group dummies. Table 2 shows that countries that are more open tend to experience contractions that shorter than average. We also observe that the transition countries have amplitudes during both expansions and contractions that are larger than the average. For some specifications, the G7 country dummy enters with a significant positive coefficient in the regression for the amplitude of contractions while the Latin American and the transition countries dummies enter with a significant negative coefficient. There is also some evidence that the transition countries have amplitudes during expansions that are larger than average. We also note that the $\bar{R}^2$'s for the regressions involving the duration of expansions and the amplitude of contractions tend to be several fold larger than those for the amplitude of expansions and the duration of contractions, suggesting the role of more idiosyncratic or non-systematic factors in affecting these latter characteristics. Finally, the degrees of freedom in the different regressions varies with the existence of missing observations on some variables, with the greatest number of missing observations occurring for the IPD indicators.

Table 3 considers the impact of the full set of institutional factors. These results are in the top part of Table 3, which show that the institutional factors on the whole continue to have the effects described in Table 2. The exception is that inflation targeting no longer appears as a significant determinant of the amplitude of contractions once governance is accounted for. Including the indicator FH reduces the degrees of freedom in the regressions without adding to the fit over and above that provided by the other institutional indicators. Hence, we drop this variable in our remaining analysis.[18]

In the bottom part of Table 3, we seek to control for the effect of the macroeconomic factors. Since including them individually leads to a loss of the degrees of freedom, we represent them with their first principal components.[19] In these regressions, we retain the structural variables *open*, and the country

[18]We also tried to control for the industrial base in each country by including the indicator *iva* in the regressions reported at the top of Table 3. However, the coefficient on this indicator was never estimated to be significant.

[19]The method of principal components involves the construction of new variables $P_j, j = 1, \ldots, k$ called principal

group dummies as they were observed to have significant effects in determining at least a subset of the business cycle characteristics. What emerges from these results is that the macroeconomic factors as a whole do not contribute to explaining the business cycle characteristics. By contrast, a variety of the institutional and structural attributes do. This occurs regardless of whether the institutional factors are included individually or represented by their first principal component.

In summary, our study shows that once institutional factors are taken into account, macroeconomic factors do not matter for determining average business cycle characteristics. This result appears more noteworthy in the light of the importance that has been attached to macroeconomic factors in accounting for crises past and present - see, for example, Corsetti, Pesenti and Roubini (1999) or Rose and Spiegel (2009). Our empirical results, however, go beyond these analyses to show that institutional factors such as governance and inflation targeting do not have uniform associations with business cycle characteristics. Our approach of examining the determinants of expansions and contractions separately thus finds justification in the nature of the empirical results.[20] Our results also indicate that much further study is needed to elaborate the mechanisms by which institutional and structural variables impinge on business cycles, and that a focus on examining only the macroeconomic factors - which themselves are the outcomes of alternative institutional arrangements - may not be revealing of the ultimate determinants of cyclical fluctuations.

4 Business cycle synchronization

Much of the recent macroeconomics literature has been concerned with the extent and determinants of business cycle synchronization across countries. If we take a simple Real Business Cycle approach with perfect risk sharing across countries and country-specific technology shocks, then the implication is that consumption should be correlated across countries but there should be no discernible correlations in output or investment flows. (See Backus, Kehoe and Kydland, 1992.) Yet the cross-country evidence

components, which are linear combinations of the original variables $X_i, i = 1, \ldots, n$ as $P_j = a_{j1}X_1 + a_{j2}X_2 + \ldots + a_{jn}X_n, \quad j = 1, \ldots, k$. The new variables P_j are uncorrelated among themselves, and the maximum number of new variables that can be formed is equal to the number of original variables, $j \leq n$. The weights a_{jk} are denoted the factor loadings and are constructed so that (i) they are orthogonal to each other, (ii) The first principal component P_1 absorbs the greatest possible variance, the second principal component P_2 absorbs the greatest possible variance among those not correlated with the first, an so on until the last principal component absorbs all the remaining variance.

[20]The properties of the different phases of the business cycle are also documented by Canova, Ciccarelli, and Ortega (2007), who show that expansions tend to have large individual-specific components whereas declines in economic activity have common timing and dynamics, both within and across countries. Likewise, Altug and Bildirici (2010) show that there is a wide variety of experiences characterizing the cyclical behavior of different countries, but that their behavior appears more closely correlated during recessions.

seems to be at odds with this prediction (for a recent review of the RBC approach, see Altug, 2009).

In a comprehensive analysis, Baxter and Kouparitsas (2005) examine a large set of potential determinants of business cycle synchronization. They conclude that a gravity variable measured as the distance between countries and bilateral trade are among the most robust variables. Imbs (2010) considers the role of trade and financial linkages as a determinant of business cycle synchronization in the 2008-2009 financial crisis. Yet, to our knowledge, the role of institutional proximity has not been investigated as a factor in determining bilateral business cycle synchronization across countries. In the following, we therefore consider not only the geographical, trade and financial proximity, but also the institutional proximity between countries in order to explain the synchronization of their business cycles.

4.1 The concordance index

To define business cycle synchronization, we continue to follow the approach that dichotomizes the phases of economic activity according to recession and expansion. Specifically define the random variable S_{it} as

$$S_{it} = \begin{cases} 0 & \text{if country } i \text{ is in a recessionary phase} \\ 1 & \text{otherwise.} \end{cases} \tag{4.2}$$

Thus, S_{it} is a binary random variable that is associated with the phases of the business cycle. One approach to defining business cycle synchronization is the *concordance index* which measures the fraction of time that two series are jointly in phase over the business cycle (see Harding and Pagan, 2006):

$$I_{ij} = \frac{1}{T}\left\{\sum_{t=1}^{T} S_{it}S_{jt} + \sum_{t=1}^{T}(1 - S_{it})(1 - S_{jt})\right\}, \tag{4.3}$$

where T is the minimum of the sample sizes for variables i and j, that is, $T = \min(T_i, T_j)$. This implies that the synchronization measure between country i and country j is computed over the sample period of the country with the shortest sample. It is easy to see that the concordance index has a maximum value of one when $S_{it} = S_{jt}$ and zero when $S_{it} = (1 - S_{jt})$.[21]

[21] Harding and Pagan (2006) also relate the concordance index to the correlation coefficient ρ^S between the random variables S_{it} and S_{jt} using relations based on the unconditional density of S_{it} and S_{jt}, and show that a value of $I = 1$ corresponds to a value of $\rho^S =$ and $I = 0$ corresponds to $\rho^S = -1$. They also show that the concordance index equals 0.5 when the correlation coefficient is zero only when the means of the random variables S_{it} and S_{jt} equal 0.5. Since $\mu_i = Pr(S_{it} = 0)$ gives the probability of being in an expansion, they argue that this is likely to be higher than 0.5, thereby imparting some upward bias to the concordance measure.

4.2 Robust analysis

Our approach in this section is to associate the bilateral concordance index between the business cycles of countries i and j with a set of structural and institutional variables. We implement a robust estimation procedure as in Baxter and Kouparitsas (2005) or Levine and Renelt (1992). This is based on the Extreme Bounds Analysis (EBA) proposed by Leamer (1983). Our approach is to see which institutional variables remain significant once we control for other potential determinants of business cycle synchronization.

The Extreme Bounds Analysis (EBA) is implemented by considering the following regression:

$$Y = I\beta_i + M\beta_m + Z\beta_z + u. \tag{4.4}$$

The first group of explanatory variables is comprised of the always-included variables denoted by I. These may be variables that have been found to be robust in previous studies. The next variable denoted the M-variable is the one being tested for robustness. The third group includes the control variables Z which are other potential determinants of Y. The robustness analysis is performed by varying the set of Z variables for a given M variable. From these regressions, the EBA determines the highest and lowest values of confidence intervals constructed from the estimated β_m's. We say that an M-variable is *robust* if these highest and lowest values are of the same sign, i.e. they do not contain zero which would imply that the variable in question is not significantly related to Y.

In their robust estimation, Baxter and Kouparitsas (2005) examine the role of gravity variables, bilateral trade, total trade, similarity of sectoral structure, similarity in the basket of goods, factor endowments, and currency union. Based on their results, the baseline specifications include a gravity variable as well as measure of trade intensity. Following Imbs (2010), we also include a control for the impact of the size of the respective economies.[22]

The (always-included or) I-variables included in our analysis are given by (i) the size of the respective economies defined as the logarithm of the sum of the GDP of country i and country j, $\ln(GDP_i + GDP_j)$, (ii) a gravity variable defined as the (logarithm of the) distance between country i and j divided by 1000, d_{ij}, and (iii) a measure of trade intensity between countries i and j defined as:

$$T_{ij} = \frac{X_{ij} + X_{ji}}{X_i + X_j}, \tag{4.5}$$

[22]Baxter and Kouparitsas (2005) also allow for fixed effects models to control for country-specific measurement error which may arise due to using estimated values of the bilateral business cycle correlations instead of their true values in the regressions. However, their results are not sensitive to the inclusion of the fixed effects.

where X_{ij} denotes total merchandise exports from country i to j and $X_i = \sum_j X_{ij}$.[23]

For the institutional variables, we consider the proximity between the overall institutional environment for country i versus j as defined as the (absolute) difference between the institutional factors, ΔGov_{ij}, ΔFH_{ij}, ΔCBI_{ij}, $\Delta ipdkm_{ij}$ and $\Delta ipdlm_{ij}$, the similarity of alternative monetary institutions such as the presence of a currency union in both countries i and j ($BOTHCU$) and whether countries i and j both practice inflation targeting ($BOTHIT$), as well as an average measure of institutional proximity defined by the (absolute) difference between the first principal components of Gov, IT, CU, CBI, $ipdkm$ and $ipdlm$ denoted $\Delta PCInst_{ij}$.

We also control for the impact of a set of structural and macroeconomic factors. These include the (i) the absolute difference between our measure of openness for country i and j, $\Delta open_{ij}$ as well as the absolute difference of the first principal components of their macroeconomic factors $\Delta PCMacro_{ij}$. This is intended to capture differences in the outcomes of the institutional arrangements and policy environments of countries i and j.[24]

We begin by reporting the baseline specification for our analysis. This includes distance, trade intensity and the total size of the respective economies as well as the specific indicator for which we seek to conduct a robust analysis. The results are in Table 4, which reveal that both trade intensity and distance are significant and enter the estimated regressions with the correct signs. Specifically, we find that the distance between countries i and j reduces business cycle synchronization and trade intensity tends to increase it. The coefficient on the sum of the GDP for countries i and j is also positive and usually significant. Thus, the size of the economies matters for business cycle synchronization. With respect to the specific indicators, we find that the further countries i and j are with regards to their governance indicators (ΔGov_{ij}), the less synchronized are their business cycles. By contrast, if both countries practice inflating targeting ($BOTHIT_{ij}$), then their business cycles tend to be synchronized. Moreover, these effects are significantly estimated. Whether countries i and j are part of a currency union ($BOTHCU_{ij}$) has a positive effect on the synchronization of their business cycles while divergence of their capital market institutions ($\Delta ipdkm_{ij}$) has a negative effect. However, differences in their labor

[23] Bilateral trade data are available from the IMF's Direction of Trade database, and show the exports of each country i to countries j for 61 countries (see the Appendix). However, these data are not available for every country for each year of the sample. Hence, we compute the measure of bilateral trade linkages between country i and j for the years in which these data are available, and then take an average across the years.

[24] We could also investigate the impact of the similarity in their industrial structure. However, as this variable is not found to be robust by Baxter and Kouparitsas (2005), we chose to omit it.

market institutions ($\Delta ipdlm_{ij}$) or their scores on the Freedom House index do not have significant effects on the synchronization of their business cycles.

We consider another set of regressions that control for the effects of financial integration between countries i and j in addition to the trade, gravity, size, and institutional variables. Following Imbs (2010), we include a measure of bilateral financial linkages defined as

$$\phi_{ij} = \frac{F_{ij} + F_{ji}}{F_i + F_j}, \tag{4.6}$$

where F_{ij} denotes the consolidated foreign claims of reporting banks, reported on individual countries by nationality of the reporting banks, and $F_i = \sum_j F_{ij}$.[25] However, this measure is only available for 25 countries. The results of this estimation are provided in the second part of Table 4. We find that the measure of bilateral financial linkages is never significant. The effect of the remaining variables is similar to those reported in the top part of Table 4. However, due to the reduction in the sample sizes, it is more difficult to make inferences about the effects of the different variables. Hence, in our EBA analysis, we exclude the measure on bilateral financial integration.

In Table 5, we report the results of the EBA. Of the seven variables considered in the robust analysis, we find that countries that are closer in their overall level of governance (ΔGov_{ij}) and capital market institutions ($\Delta ipdkm_{ij}$) or ones that have adopted the inflation targeting regime ($BothIT_{ij}$) emerge as the robust determinants of business cycle synchronization. However, the coefficient on the differences in the status of central bank independence (ΔCBI_{ij}), labor market institutions ($\Delta ipdlm_{ij}$) or the Freedom House indicator (ΔFH_{ij}) are not found to be robust determinants of business cycle synchronization. Likewise, as in Baxter and Kouparatsis (2005), we do not find a significant effect of membership in a currency union ($BOTHCU_{ij}$).

Before concluding this section, it appears worthwhile commenting on the nature of the results. The role of inflation targeting in delivering favorable economic outcomes has been studied recently by a variety of authors. Although Ball (2010) cannot attribute a strong role for inflation targeting in the Great Moderation period, other authors such as Decressi and Laxton (2009) have argued that countries that were pursuing inflation targeting regimes during the 2007-2008 global crisis may have been better able to withstand the impact of deflationary shocks (see also de Carvalho Filho, 2011).

[25] We make use of the bilateral locational banking statistics from the Bank of International Settlements (see the Appendix) We construct an exact measure of the bilateral financial linkage between country i and j at each date for which the relevant data are available, and average the resulting measures to obtain the time-invariant measure used in our study. These measures are the analogues of the bilateral trade intensity measures.

Neyapti (2009) finds that currency boards and the inflation targeting regime were the most effective way of delivering price stability in the 2000's. By contrast, she cannot attribute a similar role to central bank independence or currency unions. Many of these analyses differ from ours by considering specific episodes or shorter periods. By contrast, our analysis correlates average behavior across available sample periods with factors that tend to be relatively invariant across those periods. By highlighting the importance of governance as well as the role of alternative monetary institutions, our results may have implications for the course of events following the 2007-2008 global crisis, which many have attributed to institutional features such as excessive credit market liberalization, as well as the euro area debt crisis, which has shown the shortcomings of the currency union regime in delivering business cycle synchronization.

5 Conclusion

In this paper, we have examined the business cycle characteristics of a large group of countries that includes industrial, emerging and transition economies from all continents and related them to a variety of institutional, macroeconomic and structural factors. Our study provides one of the few studies to examine the business cycle characteristics of such a large and heterogeneous set of countries. More importantly, it provides an original effort seeking to understand the role of institutional factors on such characteristics.

We have demonstrated significant differences in business cycle characteristics across broad country groupings as well as heterogeneity within such groups. Using cross sectional regressions that relate average business cycle characteristics to institutional, macroeconomic and structural factors, we have also demonstrated that business cycle characteristics during expansions show significant association with such factors as a broadly defined measure of governance and monetary institutions such as inflation targeting. We have also examined the determinants of business cycle synchronization for the countries in our sample. In common with other studies, we have found a strong role for distance between countries, as stipulated by gravity models, as well as the effect of bilateral trade intensity. However, we could not find a significant role for bilateral financial linkages using a subset of the countries. In terms of the institutional factors, we find that differences in governance or capital market institutions are robust determinants of business cycle synchronization. While we cannot attribute a significant role to membership in a currency or differences in the degree of central bank independence, we find that

countries that engage in inflation targeting also tend to have more synchronized business cycles.

References

Alesina, A. (1988). "Macroeconomics and Politics," *NBER Macroeconomics Annual* 3, 13-52.

Alesina, A. (1989). "Politics and Business Cycles in the Industrial Democracies," *Economic Policy* 8, 57-98.

Alesina, A. and L. Summers (1993). "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit and Banking* 25, 151-162.

Allen, F. and D. Gale (2007). "An Introduction to Financial Crises," Wharton Financial Institutions Center Working Paper No. 07-20.

Altug, S. (2009). *Business Cycles: Fact, Fallacy, and Fantasy.* New Jersey: World Scientific.

Altug, S. and M. Bildirici (2010). "Business Cycles around the Globe: A Regime-switching Approach," DP. No. 7968 CEPR/EABCN No. 53/2010.

Arnone, M., B. Laurens, J-F. Segalotto and M. Sommer (2007). "Central Bank Autonomy: Lessons From Global Trends," IMF Working Paper 07/88.

Backus, D., P. Kehoe and F. Kydland (1992). "International Real Business Cycles," *Journal of Political Economy* 100, 745-775.

Ball, L. (2010). "The Performance of Alternative Monetary Regimes," NBER Working Paper 16124.

Basel Committee on Banking Supervision (2010). "The Basel Committee's Response to the Financial Crisis: Report to the G20," October, hpp://www.bis.org/publ/bcbs179.pdf.

Baxter, M. and M. Kouparitsas (2005). "Determinants of Business Cycle Co-movement: A Robust Analysis," *Journal of Monetary Economics* 52, 113157.

Benczur, P. and A Ratfai (2010). "Business Cycles around the Globe," manuscript.

Bry, G. and C. Boschan (1971). *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*, New York: Columbia University Press for the NBER.

Burns, A. and W. Mitchell (1946). *Measuring Business Cycles*. New York: NBER.

Canova, F. (2010). "Business Cycles in the Mediterranean Basin: Similarities, Convergence, Spillovers," Paper presented at the 6'th Eurostat Colloquium on Modern Tools of Business Cycle Analysis, Luxembourg, September 26-29.

Canova, F., M. Ciccarelli, and E. Ortega (2007). "Similarities and Convergence in G-7 Cycles," *Journal of Monetary Economics* 54, 850-878.

Chauvet, M. and I. Morais (2010). "Predicting Recessions in Brazil," Paper presented at the 6'th Eurostat Colloquium on Modern Tools of Business Cycle Analysis, Luxembourg, September 26-29.

Corsetti, G., P.enti and N. Roubini (1999). "What Caused the Asian Currency and Financial Crisis? Part I: A Macroeconomic Overview," *Japan and the World Economy* 11, 305-373.

Cukierman, A., S. Webb, and B. Neyapti (1992). "Measuring the Independence of Central Banks and Its Effect on Policy Outcomes," *The World Bank Economic Review* 6, 353-0398.

Decressin, Jorg and Douglas Laxton (2009). "Gauging Risks for Deflation," IMF Staff Position Note, SPN/09/01.

Diamond, D. and R. Rajan (2009). "The Credit Crisis: Conjectures about Causes and Remedies," *American Economic Review* 99, 606-610.

Dincer, N. and B. Neyapti (2008). "Legal Quality of Bank Regulation and Supervision and Its Determinants: A Mixed Sample," *Contemporary Economic Policy* 26, 607-622.

Dincer, N. and B. Neyapti (2010). "Macroeconomic Impact of Bank Regulation and Supervision: A Cross-country Investigation," Bilkent University Discussion Paper.

Drees, B. and C. Pazarbaşıoğlu (1998). "The Nordic Banking Crisis: Pitfalls in Financial Liberalization," IMF Occasional Paper 161.

Eijffinger, S. and E. Schaling (1993). "Central Bank Independence in Twelve Industrial Countries," *Banca Nazionale del Lavoro Quarterly Review* 184, 64-68.

de Carvalho Filho, I. (2011). "28 Months Later: How Inflation Targeters Outperformed Their Peers in the Great Recession," *The B.E. Journal of Macroeconomics: Topics* Vol. 11, Issue 1, Article 22.

Frankel, J. and A. Rose (1998). "The Endogeneity of the Optimum Currency Area Criteria," *Economic Journal*, 108, 1009-1025.

Frankel, J. and G. Saravelos (2010). "Can Leading Indicators Assess Country Vulnerability? Evidence from the 2008-2009 Financial Crisis," NBER Working Paper 16047.

Fratzscher, M. (2011). "Capital Flows, Push versus Pull Factors and the Global Financial Crisis," CEPR DP No. 8496.

Giannone, G., M. Lenza and L. Reichlin (2010). "Market Freedom and the Global Recession," CEPR Discussion Paper 7884.

Girardin, E. (2005). "Growth-cycle Features of the East Asian Countries: Are They Similar?," *International Journal of Finance and Economics* 10, 143-156.

Glaeser, E., R. La Porta, F. Lopez-de-Silanes, and A. Schleifer (2004). "Do Institutions Cause Growth?" *Journal of Economic Growth*, 9, pp. 271–303.

Grilli, V., D. Masciandro and G. Tabellini (1991). "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries," *Economic Policy* 13, 341-392.

Hall, R., and C. Jones (1999). "Why Do Some Countries Produce So Much More Output per Worker than Others?" *Quarterly Journal of Economics*, 114, 83-116.

Hamilton, J. (1989). "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle," *Econometrica* 57, 357-384.

Harding, D. and A. Pagan (2002a). "A Comparison of Two Business Cycle Dating Methods," *Journal of Economic Dynamics and Control* 27, 1681-1690.

Harding, D. and A. Pagan (2002b). "Dissecting the Cycle: A Methodological Investigation," *Journal of Monetary Economics* 49, 365-381.

Harding, D. and A. Pagan (2005). "A Suggested Framework for Classifying the Modes of Cycle Research," *Journal of Applied Econometrics* 20, 151-159.

Imbs, J. (2004). "Trade, Finance, Specialization and Synchronization," *Review of Economics and Statistics*, 86, 723-734.

Imbs, J. (2006). "The Real Effects of Financial Integration," *Journal of International Economics*, 68(2).

Imbs, J. (2010). "The First Global Recession in Decades," CEPR Discussion Paper No. 7973.

Kaufmann, D., A. Kraay and M. Mastruzzi (2009). "Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996-2008," World Bank Policy Research Working Papers, No.4978.

Knack, S. and P. Keefer (1995). "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures," *Economics and Politics*, 7(3), 207-27.

Köse, A., C. Otrok and C. Whiteman (2003). "International Business Cycles: World, Region, and Country-specific Factors," *American Economic Review* 93, 1216-1239.

Krainer, R. (2000). "Corporate Governance and Business Cycles in the G-7 Countries: Do Institutions Really Matter?" Manuscript, University of Wisconsin.

Krolzig, H.-M. and J. Toro (2005). "Classical and Modern Business Cycle Measurement: The European Case," *Spanish Economic Review* 7, 1-21.

Kydland, F. and E. Prescott (1982). "Time-to-Build and Aggregate Fluctuations." *Econometrica* 50, pp. 1345-1370.

Levine, R. and D. Renelt (1992). "A Sensitivity Analysis of Cross-Country Regressions," *American Economic Review* 82, 942-963.

Neyapti, B. (2009). "Performance of Monetary Institutions: Comparative Evidence," Bilkent University Discussion Paper 09-02.

North, D. (1990). *Institutions, Institutional Change and Economic Performance*, Cambridge: Cambridge University Press.

Petursson, T.G. (2004). "Formulation of Inflation Targeting around the World," *Monetary Bulletin* 1, pp. 57-84.

Rand, J. and F. Tarp (2002) "Business Cycles in Developing Countries: Are They Different?" *World Development* 30, 2071-2088.

Rodrik, D., A. Subramanian, and F. Trebbi (2002). "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development," IMF Working Paper 02/189 (Washington: International Monetary Fund).

Roger, S. and M.Stone (2005). "On Target: The International Experience with Achieving Inflation Targets," IMF Working Paper, 05/163.

Rose, A. and C. Engel (2002). "Currency Unions and International Integration," *Journal of Money, Credit and Banking* 34, 1067-1089.

Rose, A. and M. Spiegel (2009). "Cross-country Causes and Consequences of the 2008 Crisis: Early Warning," NBER Working Paper 15357.

A Data

Table A.1 provides the list of countries used in our study as well as the sample period in question. We characterize national business cycles in these countries using quarterly GDP at constant prices measured in units of the national currency.[26] The GDP data are available from a variety of sources. For EU countries such as Austria, Belgium, Denmark, Finland, Greece, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, France, Germany, Italy, and the UK, the quarterly GDP data are from Eurostat. For Australia, Canada, Norway, Iceland, S. Korea, New Zealand, Switzerland, Mexico, and Cyprus, the quarterly GDP data are from the OECD. For a set of developing countries, the GDP data obtained from the International Financial Statistics (IFS) of the IMF. These include Kazakhstan, Kyrgyzstan, Botswana, and Morocco. The data for S. Africa, Thailand, Turkey, Brazil, Chile, Ecuador, Jamaica, Peru, and Uruguay are obtained from their central banks while the data for Indonesia, Malaysia, and Singapore are available from the Bank of International Settlements (BIS). The data for the remaining countries are obtained from the relevant statistical offices. The GDP data for Canada,

[26] These data have been derived from a dataset used by Benczur and Ratfai (2010).

France, Germany, Italy, Japan, the US, the Netherlands, Finland, Sweden, Taiwan, Colombia, Ecuador, Jamaica and Morocco are available in de-seasonalized form. The remainder of the data were de-seasonalized using the X11 linear de-seasonalization method.

The bilateral trade data are obtained from the IMF's Direction of Trade database, and show the exports of each country i to countries j for 61 countries. These countries are given by USA, UK, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Turkey, Australia, New Zealand, South Africa, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela, Jamaica, Israel, Sri Lanka, Hong Kong, Indonesia, S. Korea, Malaysia, Philippines, Singapore, Thailand, Morocco, Georgia, Kazakhstan, Krygyzstan, Bulgaria, Russia, Czech Republic, Slovakia, Estonia, Latvia, Hungary, Lithuania, Croatia, Slovenia, Romania. Data on bilateral trade linkages are provided on an annual basis between 1980 and 2009.

Data on bilateral financial linkages are obtained from the Bank of International Settlements Locational Banking Statistics, Table 9B. The countries for which such data exist are Australia, Austria, Belgium, Brazil, Canada, Chile, Chinese Taipei, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Panama, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. These variables are available at quarterly and semi-annual rates between December 1983 and September 2010.

B Institutional Indicators and BC Characteristics

In this section, we provide some preliminary evidence regarding the relationship between the institutional indicators and the business cycle characteristics. Figures 5-7 provide scatter plots of the average business cycle characteristics with the different institutional indicators. Here we consider the indicators Gov, CBI, the IPD indicators $ipdpc$, $ipdgs$,[27] $ipdlm$, and $ipdkm$ as well as the Freedom House indicator FH.

We observe that countries that score higher in terms of the overall governance indicator Gov tend to have longer expansions and less severe contractions. However, there appears to a weaker relationship between the index of central bank independence CBI and the average business cycle characteristics.

[27]The index $ipdpc$ is concerned with the nature of political institutions, security, and the functioning of public administrations, amongst others, while $ipdgs$ provides measures of the free functioning of markets.

Country	Sample Period	Country	Sample Period
Argentina	1980:1-2009:2	Korea	1980:1-2009:1
Australia	1960:1-2009:2	Kyrgyzstan	1995:1-2008:2
Austria	1988:1-2009:1	Latvia	1993:1-2009:1
Belgium	1980:1-2009:2	Lithuania	1995:1-2009:1
Bolivia	1990:1-2008:4	Luxembourg	1995:1-2008:4
Botswana	1996:1-2008:3	Malaysia	1991:1-2009:2
Brazil	1991:1-2009:1	Malta	1997:1-2009:1
Bulgaria	1994:1-2009:1	Mexico	1980:1-2009:2
Canada	1960:1-2009:2	Morocco	1990:1-2007:4
Chile	1981:1-2009:1	Netherlands	1960:1-2009:2
Colombia	1994:1-2008:4	New Zealand	1988:1-2009:2
Croatia	1994:1-2008:4	Norway	1978:1-2009:1
Czech Republic	1994:1-2009:2	Peru	1980:1-2010:2
Denmark	1990:1-2009:2	Philippines	1993:1-2009:1
Ecuador	1993:1-2008:4	Portugal	1995:1-2008:4
Estonia	1993:1-2009:1	Romania	1994:1-2009:1
Finland	1960:1-2009:2	Russia	1995:1-2008:4
France	1970:1-2009:2	Singapore	1985:1-2009:2
Georgia	1996:1-2008:4	Slovakia	1993:1-2009:1
Germany	1960:1-2009:2	Slovenia	1993:1-2009:1
Greece	1970:1-2009:1	South Africa	1970:1-2009:2
Hong Kong	1973:1-2009:1	Spain	1960:1-2009:2
Hungary	1995:1-2009:1	Sweden	1960:1-2009:2
Iceland	1997:1-2009:1	Switzerland	1980:1-2009:2
Indonesia	1996:1-2009:1	Taiwan	1982:1-2009:1
Ireland	1997:1-2008:4	Thailand	1993:1-2009:1
Israel	1980:2-2009:2	Turkey	1987:1-2009:2
Italy	1960:1-2009:2	UK	1960:1-2009:2
Jamaica	1996:1-2008:2	Uruguay	1988:1-2008:4
Japan	1960:1-2009:2	USA	1960:1-2009:2
Kazakhstan	1994:1-2009:1	Venezuela	1997:1-2009:1

Table A.1: Sample of Countries

From Figures 6 and 7, we tend to observe a similar pattern for the IPD indicators and for the Freedom House indicator FH as we do for the governance indicator Gov. Here, however, the sample sizes are either relatively smaller as is the case for the former variables or the patterns are more dispersed as is the case for the latter.

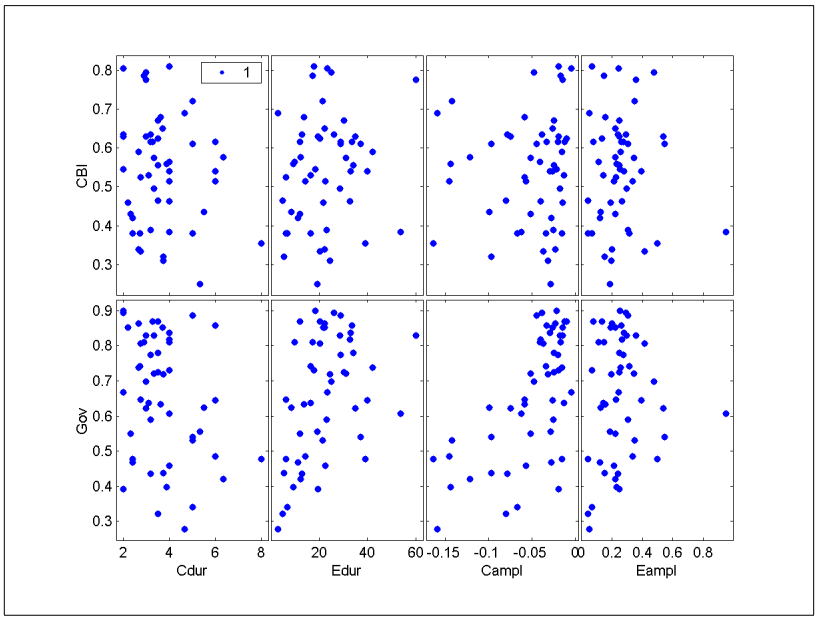

Figure 5: BC Characteristics and Governance Indicators

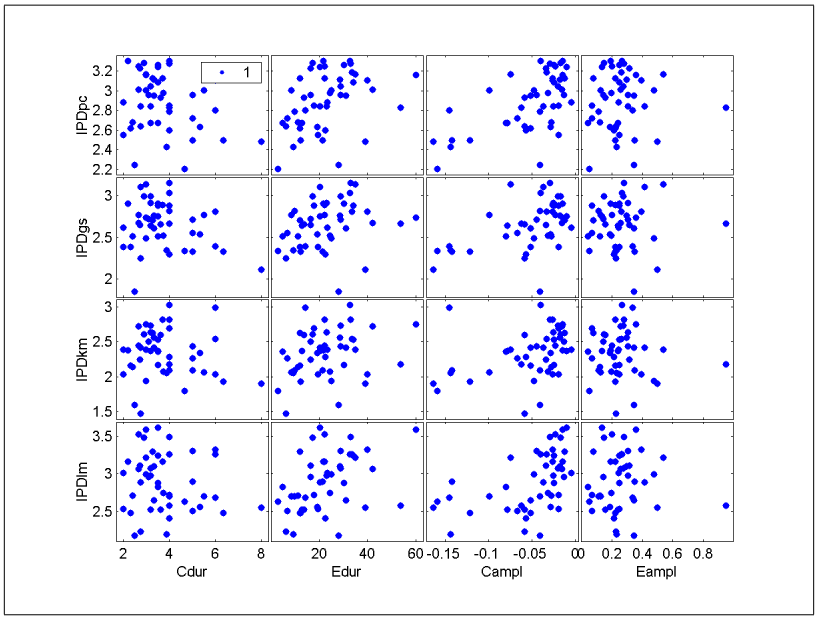

Figure 6: BC Characteristics and IPD Indicators

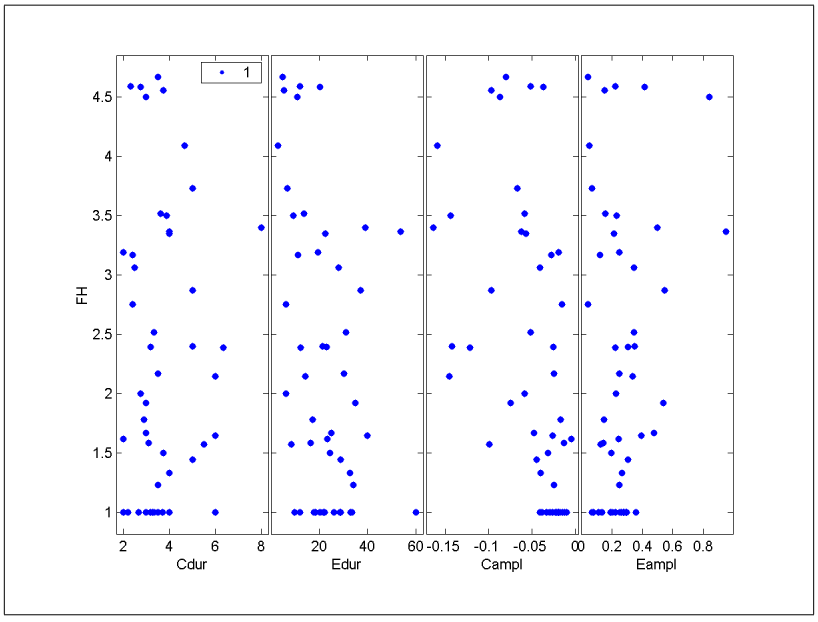

Figure 7: BC Characteristics and Freedom House Indicators

	Expansion		Contraction		Expansion		Contraction	
Dependent variable	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	3.75	0.25*	4.19***	-0.12***	15.45***	0.20***	4.05***	-0.06***
	(0.46)	(1.73)	(3.60)	(-3.78)	(3.69)	(3.68)	(10.03)	(-4.70)
Gov	29.45**	-0.04	-0.29	0.11***	-	-	-	-
	(2.64)	(-0.26)	(-0.19)	(2.88)				
IT	-	-	-	-	9.03***	0.03	-0.06	0.02**
					(2.98)	(0.74)	(-0.19)	(2.01)
open	-1.91	0.04*	-0.46**	-0.001	0.70	0.04	-0.48**	0.007
	(-1.32)	(1.93)	(-2.41)	(-0.45)	(0.44)	(1.67)	(-2.63)	(1.62)
*G*7	2.43	-0.009	-0.41	0.02**	5.64	-0.01	-0.44	0.03
	(0.53)	(-0.20)	(-1.13)	(2.04)	(1.18)	(-0.13)	(-1.19)	(1.24)
LA	-1.38	-0.06	0.31	-0.02	-5.98	-0.04	0.36	-0.04**
	(-0.27)	(-0.69)	(0.45)	(-0.95)	(-1.30)	(-0.69)	(0.73)	(-2.27)
CEE	6.09	0.15**	0.53	-0.02	4.36	0.17**	0.55	-0.03**
	(1.38)	(2.00)	(0.81)	(-1.10)	(1.09)	(2.26)	(1.00)	(-2.01)
d.f.	47	47	47	47	47	47	47	47
$\bar{R}^2$	0.13	0.11	0.02	0.37	0.13	0.11	0.02	0.28

	Expansion		Contraction		Expansion		Contraction	
Dependent variable	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	21.75***	0.23***	4.04***	-0.05***	17.25*	0.28**	5.06***	-0.07***
	(5.85)	(4.01)	(9.76)	(-4.40)	(1.93)	(2.04)	(5.51)	(-2.35)
CU	5.00	-0.04	-0.15	0.01	-	-	-	-
	(1.14)	(-0.90)	(-0.46)	(1.36)				
CBI	-	-	-	-	11.19	-0.11	-1.96	0.04
					(0.74)	(-0.62)	(-1.50)	(1.07)
open	-0.63	0.04*	-0.47***	0.004	-0.43	0.03	-0.51***	0.004*
	(-0.41)	(1.77)	(-2.72)	(1.00)	(-0.26)	(1.42)	(-3.10)	(1.09)
*G*7	4.22	-0.007	-0.41	0.02**	4.62	-0.01	-0.41	0.02**
	(0.96)	(-0.17)	(-1.20)	(2.15)	(0.86)	(-0.22)	(-1.18)	(2.13)
LA	-6.67	-0.06	0.33	-0.04**	-9.76**	-0.06	0.55	-0.05**
	(-1.42)	(-0.90)	(0.59)	(-2.20)	(-2.09)	(-1.10)	(1.01)	(-2.47)
CEE	2.00	0.15*	0.55	-0.04**	1.28	0.12*	0.94*	-0.04**
	(0.44)	(1.82)	(1.00)	(-2.18)	(0.23)	(1.73)	(1.78)	(-2.48)
d.f.	47	47	47	47	45	45	45	45
$\bar{R}^2$	0.03	0.11	0.03	0.23	0.05	0.07	0.10	0.25
	Expansion		**Contraction**		**Expansion**		**Contraction**	
Dependent variable	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	-6.58	0.37	4.51**	-0.17***	13.63	0.38*	4.14**	-0.10
	(-0.33)	(1.45)	(2.30)	(-3.66)	(0.78)	(1.96)	(2.51)	(-1.56)
ipdlm	10.91	-0.05	-0.14	0.04***	-	-	-	-
	(1.64)	(-0.65)	(-0.22)	(3.13)				
ipdkm	-	-	-	-	4.88	-0.06	-0.02	0.02
					(0.68)	(-0.91)	(-0.02)	(0.93)
open	-1.36	0.04*	-0.44**	0.003	-1.05	0.04	-0.44**	0.004
	(-0.85)	(1.72)	(-2.60)	(0.94)	(-0.61)	(1.46)	(-2.54)	(1.01)
*G*7	0.54	-0.01	-0.52	0.007	1.76	-0.007	-0.55	0.01
	(0.11)	(-0.27)	(-1.39)	(0.85)	(0.35)	(-0.16)	(-1.51)	(1.16)
LA	-5.27	-0.08	0.20	-0.03	-8.46	-0.08	0.25	-0.04**
	(-0.94)	(-0.93)	(0.30)	(-1.28)	(-1.63)	(-1.06)	(0.40)	(-1.96)
CEE	-1.07	0.07	0.47	-0.04**	-0.26	0.06	0.47	-0.04
	(-0.23)	(1.04)	(0.75)	(-2.05)	(-0.05)	(1.00)	(0.72)	(-1.55)
d.f.	41	41	41	41	44	41	41	41
$\bar{R}^2$	0.11	0.02	-0.02	0.32	0.03	0.02	-0.02	0.22
	Expansion		**Contraction**					
Dependent variable	Duration	Amplitude	Duration	Amplitude				
constant	29.29***	0.19**	3.94***	-0.02***				
	(6.82)	(2.82)	(9.50)	(-2.70)				
FH	-3.17*	0.02	-0.007	-0.01***				
	(-1.87)	(1.02)	(-0.04)	(-3.11)				
open	0.60	0.03	-0.44**	0.008				
	(0.31)	(0.60)	(-2.11)	(1.50)				
*G*7	0.27	-0.009	-0.26	0.009				
	(0.06)	(-0.12)	(-0.70)	(1.15)				
LA	-5.11	-0.08	0.45	-0.03				
	(-0.92)	(-1.00)	(0.70)	(-1.54)				
CEE	1.89	0.15**	0.62	-0.03**				
	(0.43)	(2.17)	(1.05)	(-1.91)				
d.f.	43	43	43	43				
$\bar{R}^2$	0.07	0.11	0.001	0.34				

t-statistics in parentheses

Table 2: Determinants of Business Cycle Characteristics

	Expansion		**Contraction**		**Expansion**		**Contraction**	
Dependent variable	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	2.92	0.18	5.38***	-0.13***	-7.68	-0.08	6.71**	-0.12
	(0.29)	(1.08)	(3.88)	(-3.45)	(-0.41)	(-0.36)	(2.70)	(-1.65)
Gov	23.93**	0.08	-0.09	0.11**	33.00*	0.35	-1.61	0.09
	(2.50)	(0.63)	(-0.06)	(2.47)	(1.85)	(1.44)	(-0.57)	(1.15)
IT	7.60**	0.07	-0.16	0.02	8.13**	0.08	-0.22	0.02
	(2.41)	(1.41)	(-0.36)	(1.36)	(2.29)	(1.39)	(-0.45)	(1.25)
CU	0.89	-0.04	0.31	-0.005	-0.79	-0.04	0.32	-0.008
	(0.19)	(-0.87)	(0.65)	(-0.45)	(-0.17)	(-0.77)	(0.57)	(-0.63)
CBI	-3.75	-0.11	-2.34	0.004	-0.02	-0.11	-2.16	0.02
	(-0.31)	(-0.63)	(-1.51)	(0.08)	(-0.001)	(-0.58)	(-1.21)	(0.40)
FH	-	-	-	-	1.83	0.05	0.25	-0.002
					(0.61)	(0.96)	(-0.92)	(-0.24)
$open$	-0.97	0.04*	-0.55**	0.01	-2.07	0.01	-0.35	0.02
	(-0.60)	(1.90)	(-2.66)	(0.13)	(-0.70)	(0.20)	(-1.18)	(0.20)
$G7$	3.32	-0.006	-0.45	0.01	1.07	-0.01	-0.30	0.01
	(0.69)	(-0.13)	(-1.20)	(1.14)	(0.23)	(-0.30)	(-0.71)	(0.93)
LA	-3.30	-0.05	0.58	-0.02 ‘	-4.28	-0.05	0.58	-0.03
	(-0.61)	(-0.70)	(0.83)	(-1.28)	(-0.88)	(-0.60)	(0.68)	(-1.15)
CEE	9.25**	0.14*	0.97	-0.02	9.27*	0.17**	0.78	-0.02
	(2.14)	(1.93)	(1.46)	(-1.00)	(1.80)	(1.97)	(0.96)	(-1.01)
$d.f.$	42	42	42	42	40	40	40	40
$\bar{R}^2$	0.20	0.06	0.04	0.40	0.18	0.06	-0.02	0.37

	Expansion		**Contraction**		**Expansion**		**Contraction**	
Dependent Variable	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	-2.35	0.07	5.11***	-0.12***	23.37***	0.22***	4.16***	-0.05***
	(-0.20)	(0.40)	(3.49)	(-3.10)	(6.26)	(3.60)	(10.26)	(-4.93)
Macro Factors†	-0.27	-0.03	-0.02	0.003	0.96	-0.02	0.01	0.007
	(-0.17)	(-1.16)	(-0.11)	(0.43)	(0.67)	(-0.89)	(0.08)	(1.16)
Inst. Factors†	-	-	-	-	3.26**	0.006	-0.13	0.009**
					(2.03)	(0.37)	(-1.10)	(2.23)
Gov	31.38**	0.23	0.39	0.10**	-	-	-	-
	(2.49)	(1.40)	(0.21)	(2.81)				
IT	8.42**	0.07	-0.12	0.02	-	-	-	-
	(2.53)	(1.37)	(-0.26)	(1.35)				
CU	-1.81	-0.07	0.18	-0.006	-	-	-	-
	(-0.42)	(-1.23)	(0.34)	(-0.50)				
CBI	0.07	-0.08	-2.26	0.005	-	-	-	-
	(0.005)	(-0.47)	(-1.38)	(0.10)				
$open$	-1.27	0.06	-0.26**	-0.003	-2.01	0.005	-0.5*	-0.003
	(-0.59)	(1.73)	(-2.17)	(-0.29)	(-0.84)	(1.47)	(-1.95)	(-0.56)
$G7$	1.83	0.001	-0.53	0.008	1.51	-0.003	-0.49	0.008
	(0.38)	(0.02)	(-1.21)	(0.73)	(0.28)	(-0.05)	(-1.16)	(0.84)
LA	-4.18	-0.07	0.55	-0.02 ‘	-5.76	-0.08	0.35	-0.03*
	(-0.98)	(-0.98)	(0.78)	(-1.19)	(-1.21)	(-1.14)	(0.59)	(-1.38)
CEE	8.11	0.12	0.93	-0.02	6.28	0.09	0.54	-0.02
	(1.66)	(1.50)	(1.36)	(-0.86)	(1.25)	(1.15)	(0.79)	(-1.03)
$d.f.$	39	39	39	39	42	42	42	42
$\bar{R}^2$	0.24	0.07	0.006	0.37	0.16	0.07	0.04	0.34

†: Using principal components
t-statistics in parentheses

Table 3: Determinants of Business Cycle Characteristics (Using Principal Components)

Dependent Variable	**Business Cycle Synchronization Index (I)**						
constant	0.74^{***}	0.60^{***}	0.72^{***}	0.70^{***}	0.72^{***}	0.75^{***}	0.70^{***}
	(21.32)	(16.40)	(22.84)	(21.42)	(17.92)	(18.77)	(19.05)
T_{ij}	0.40^{***}	0.52^{***}	0.50^{***}	0.46^{***}	0.52^{***}	0.52^{***}	0.45^{***}
	(4.81)	(5.13)	(5.87)	(5.43)	(5.22)	(4.91)	(4.59)
D_{ij}	-0.003^{***}	-0.003^{***}	-0.003^{***}	-0.003^{***}	-0.003^{***}	-0.003^{***}	-0.003^{***}
	(-5.95)	(-5.23)	(-6.05)	(-4.64)	(4.36)	(-4.74)	(-5.31)
$\ln(GDP_i + GDP_j)$	0.011^{**}	0.02^{***}	0.007	0.004^{***}	0.010^{**}	0.009	0.013^{**}
	(2.66)	(5.66)	(1.83)	(3.01)	(2.29)	(1.80)	(2.91)
ΔGov_{ij}	-0.11^{***}	-	-	-	-	-	-
	(-5.94)						
ΔCBI_{ij}	-	0.02	-	-	-	-	-
		(0.67)					
$BothIT_{ij}$	-	-	0.06^{***}	-	-	-	-
			(11.36)				
$BothCU_{ij}$	-	-	-	0.04^{***}	-	-	-
				(4.39)			
$\Delta ipdlm_{ij}$	-	-	-	-	-0.02	-	
					(-1.83)		
$\Delta ipdkm_{ij}$	-	-	-	-	-	-0.06^{***}	
						(-4.54)	
ΔFH_{ij}	-	-	-	-	-	-	-0.003
							(-1.25)
No. of obs.	1176	1128	1176	1176	946	946	990
$\bar{R}^2$	0.11	0.09	0.16	0.09	0.08	0.10	0.07
Dependent Variable	**Business Cycle Synchronization Index (I)**						
constant	1.11^{***}	0.92^{***}	0.90^{***}	0.87^{***}	0.98^{***}	0.93^{***}	1.16^{***}
	(17.87)	(14.03)	(11.39)	(12.54)	(12.55)	(12.14)	(17.31)
T_{ij}	0.09^{***}	0.25^{*}	0.24^{**}	0.18^{**}	0.24^{**}	0.26^{**}	0.09
	(2.70)	(1.93)	(2.26)	(2.00)	(2.29)	(2.29)	(1.47)
D_{ij}	-0.001^{***}	-0.002^{**}	-0.001^{**}	-0.001	-0.003^{**}	-0.001^{**}	-0.003^{***}
	(-2.68)	(-2.14)	(-2.03)	(-0.15)	-2.33)	(-2.07)	(-3.37)
$\ln(GDP_i + GDP_j)$	-0.03^{***}	-0.01	-0.10	-0.007	-0.02^{*}	-0.01	-0.04^{***}
	(-3.95)	(-1.34)	(-1.00)	(-0.88)	(-1.66)	(-1.24)	(-4.43)
ϕ_{ij}	-0.09	0.01	0.03	0.07	-0.03	0.02	0.009
	(-1.06)	(0.17)	(0.31)	(0.84)	(-0.30)	(0.19)	(0.16)
ΔGov_{ij}	-0.28^{***}	-	-	-	-	-	-
	(-9.64)						
ΔCBI_{ij}	-	-0.0004	-	-	-	-	-
		(-0.001)					
$BothIT_{ij}$	-	-	0.01	-	-	-	-
			(0.75)				
$BothCU_{ij}$	-	-	-	0.01^{***}	-	-	-
				(3.64)			
$\Delta ipdlm_{ij}$	-	-	-	-	-0.04^{***}	-	
					(-2.82)		
$\Delta ipdkm_{ij}$	-	-	-	-	-	-0.02	
						(-1.04)	
ΔFH_{ij}	-	-	-	-	-	-	-0.03^{***}
							(-5.57)
No. of obs.	210	210	210	210	210	210	171
$\bar{R}^2$	0.37	0.06	0.06	0.12	0.09	0.06	0.25

t-statistics in parentheses

Table 4: Business Cycle Synchronization: Baseline Models

Variable	Bound	β	t	Obs	$\bar{R}^2$	Z-variables	Robust/fragile
ΔGov_{ij}	Low	-0.19	-7.36	946	0.24	CBI, IT, FH	
	Base	-0.11	-5.95	1176	0.11		Robust
	High	-0.09	-4.03	946	0.17	$open$, $MPC1$, CBI, CU, $ipdkm$	
ΔCBI_{ij}	Low	-0.03	-1.04	946	0.14	$open, mpc1, Gov, FH$	
	Base	0.02	0.66	1128	0.10		Fragile
	High	0.05	2.12	946	0.19	IT, CU, $ipdlm$ or $ipdkm$	
$BOTHIT_{ij}$	Low	0.05	8.65	780	0.21	$mpc1, CBI, CU, ipdkm, FH$	
	Base	0.06	11.36	1176	0.16		Robust
	High	0.06	12.75	1128	0.25	$open, mpc1, CBI, Gov$	
$BOTHCU_{ij}$	Low	-0.01	-0.59	780	0.26	$open, mpc1, Gov, IT, ipdlm, FH$	
	Base	0.04	4.39	1176	0.09		Fragile
	High	0.05	4.45	1128	0.11	CBI	
$\Delta ipdlm_{ij}$	Low	-0.03	-3.20	946	0.18	IT, CU	
	Base	-0.02	-1.83	946	0.09		Fragile
	High	0.02	2.25	946	0.17	$open, mpc1, Gov, Ipdkm$	
$\Delta ipdkm_{ij}$	Low	-0.06	-4.52	946	0.10	CBI	
	Base	-0.06	-4.54	946	0.10		Robust
	High	-0.03	-2.12	780	0.25	$open, Gov, IT, ipdlmFH$	
ΔFH_{ij}	Low	-0.01	-2.31	946	0.10	$open, CBI$	
	Base	-0.003	-1.25	990	0.07		Fragile
	High	0.01	4.78	990	0.19	$Mpc1, Gov, ITCU$	

Table 5: Business Cycle Synchronization: Robust Analysis