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## **INSTITUTIONS AND BUSINESS CYCLES**

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# Institutions and Business Cycles

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## Abstract

This paper investigates the relationship between the main business cycles features and the institutional and structural characteristics of countries in which they are observed. Using the nonparametric Harding-Pagan approach, we derive the business cycle characteristics of a set of 63 countries that includes industrial, emerging and formerly centrally planned economies from all continents. Our analysis reveals that institutional factors have significant associations with the main business cycle characteristics. In addition, we examine the determinants of business cycle synchronization for the countries in our sample. In contrast to earlier studies which seek to account for such synchronization using gravity arguments as well as trade intensity and bilateral financial linkages only, we also consider the proximity of their institutional and policy environments.

**Keywords:** Institutions, business cycles, synchronization, nonparametric analysis

**JEL Codes:** C32, E32, E37

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# 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 institutional in determining macroeconomic outcomes has been discussed extensively in the literature. There are numerous studies that show that good governance has positive effects on economic performance (see, for example, Knack and Keefer, 1995), Hall and Jones, 1999, Easterly and Levine, 2003, and Rodrik et al., 2002). Sawyer (2010) provides an analysis that relates underlying determinants of economic growth such as total factor productivity for Latin America. There is also an extensive literature on the effect of central bank independence on inflation (see, for example, Bade and Parkin, 1988, Alesina, 1988 and 1989, Grilli *et al.*, 1991, Cukierman *et al.*, 1992 and 2002, and Eijffinger and Schaling, 1993). Neyapti and Dincer (2005) show that there is a significant relationship between the legal quality of bank regulation and supervision and GDP growth in transition economies. Allen and Gale (2007) and De Haan and Shehzad (2010) show that regulatory intensity reduces banking crises. Dincer and Neyapti (2010) also show that bank regulation is associated with better bank performance.

Yet there has been relatively little work that examines the institutional underpinnings of business cycle fluctuations. Krainer (2000) relates corporate governance structures to the financial business cycle characteristics of the G-7 countries. As a recent contribution in this regard, Giannone, Lenza and Reichlin (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. Imbs (2010) examines the joint dynamics of bilateral business cycle correlations and observed changes in goods and financial trade. He seeks to understand the factors influencing the distribution of business cycle correlations over time. He uses industrial production data for 39 countries and seeks to quantify the proportion of business cycle synchronization that can be explained by goods and asset trade. He finds that the degree of business cycle synchronization is unprecedented in three decades. He also finds that financial openness is correlated with this shift for the OECD countries while the weaker shift for the developing economies tends to occur for trade partners.

The business cycle literature has employed alternative approaches to determining business cycle characteristics. Hamilton (1989) proposed a simple nonlinear regime-switching framework for modeling postwar US GDP growth. In his framework, recessions and expansions are modeled in terms of a regime-switching variable that governs the permanent component of the series. The multivariate version of the Markov switching model is due to Krolzig (1997). Kim and Nelson (1999) proposed an alternative form of asymmetry that can generate recessions and expansions. This is known as the "plucking model" of business cycles where recessions occur as temporary deviations from the long-run level of GDP as occasional "plucks" whereas expansions reflect permanent shocks. 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 advocated a nonparametric approach to characterizing business cycles that has closer parallels with the Burns-Mitchell methodology. 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.

In this paper, we first extend Altug and Bildirici’s (2010) results to cover a mixed sample of countries that includes industrial, emerging and formerly centrally planned economies from all continents. We use the nonparametric Harding-Pagan approach to examine the business cycle characteristics of 63 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. The period ranges from the 1960’s until 2009, depending on data availability for each country. Second, we relate such business cycle characteristics to a set of institutional, structural and macroeconomic factors. We consider how the different factors affect business cycle characteristics in the expansionary and recessionary 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. An additional feature of our analysis is that we examine the determinants of business cycle synchronization across countries. The earlier work has concentrated on gravity arguments as well as the role of trade intensity and bilateral financial linkages. While we also control for such variables, we examine the impact of proximity in their institutional and policy environments. 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 describes the derivation of the business cycle characteristics used in our study. Section 3 describes the institutional, structural and macroeconomic variables used in our study while Section 4 describes the regression results used to correlate business cycle characteristics with the institutional, structural and macroeconomic variables. Section 5 provides evidence on the determinants of business cycle synchronization while Section 6 concludes.

## 2 Business cycle characteristics

The data used to derive the business cycle characteristics for our study is comprised of a representative set of developed and developing countries. Appendix 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. We used the nonparametric Bry-Boschan procedure to obtain the dates of business cycles and business cycle characteristics for the countries in our sample. As in the NBER approach, the nonparametric approach to characterizing business cycles is based on identifying the peaks and troughs of economic activity. Let  $y_{i,t} = \ln(Y_{i,t})$  where  $Y_{i,t}$  denotes real GDP of country  $i$  in quarter  $t$ .<sup>1</sup> The BBQ algorithm identifies a trough at time  $t$  if  $\{\Delta_2 y_t < 0, \Delta y_t < 0, \Delta y_{t+1} > 0, \Delta_2 y_{t+2} > 0\}$

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<sup>1</sup>Since the BBQ algorithm makes use of quarterly growth rates, we used the level data and removed seasonal effects by taking four-quarter rolling averages of the levels.

where  $\Delta_2 y_t = y_t - y_{t-2}$  and a peak if  $\{\Delta_2 y_t > 0, \Delta y_t > 0, \Delta y_{t+1} < 0, \Delta_2 y_{t+2} < 0\}$ . These conditions yield the turning points for classical cycles, as defined by the NBER methodology. A natural requirement that is imposed is that peaks and troughs alternate. In the event that this condition fails, the least pronounced of the adjacent turning points is deleted.

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, which is also used here. These include the *duration* and *amplitude* as well as a *concordance index*.<sup>2</sup> 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  $A_i = y_{t+d} - y_t = \Delta_d y_t$ .<sup>3</sup>

The results of implementing this algorithm are described in the Appendix. Table A.2 provides the business cycle dates for all the countries in our sample. As we discuss in the Appendix, some countries in our sample do not display multiple recessionary experiences. Hence, it does not make sense to calculate such measures as the average duration, amplitude, and excess cumulated movements across contractions and expansions for these countries. For the remaining countries, we examine the business cycle characteristics of the countries across several broad groupings. These are as follows:

- G7 consisting of the US, the UK, Japan, Canada, France, Germany and Italy;
- the EU countries comprising Austria, Belgium, Denmark, Finland, Greece, the Netherlands, Spain, and Sweden;;
- other industrialized countries such as Australia, Hong Kong, Israel, Malta, New Zealand, Singapore, S. Korea, Switzerland and Taiwan;
- the Central and Eastern European (CEE) countries of the Czech Republic, Estonia, Latvia, Lithuania, Romania, and Russia;
- the Latin American countries of Argentina, Brazil, Chile, Mexico, Peru, Uruguay and Venezuela;
- other emerging economies such as Botswana, Jamaica, Morocco, Malaysia, S. Africa, Thailand, and Turkey.

Figures 1 through 4 show the duration and amplitude of contractions and expansions for all of the countries that have multiple of recessions and expansions. Second, as a way of summarizing the individual county data, Table 1 also shows the average duration and amplitude of recessions and expansions for the six different country groupings described above. There are several ways of examining these results. If we compare the durations of contractions versus

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<sup>2</sup>We discuss the calculation of measures of business cycle synchronization in Section 5.

<sup>3</sup>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.

	<b>Recession</b>		<b>Expansion</b>	
	duration <sup>†</sup>	amplitude <sup>‡</sup>	duration <sup>†</sup>	amplitude <sup>‡</sup>
G7	3.53	-1.77	37.92	25.00
EU	4.07	-2.00	40.96	27.00
Industrialized	4.25	-3.00	30.05	29.00
CEE	5.05	-5.22	22.59	28.23
Latin American	6.02	-8.30	17.26	19.00
Emerging	4.47	-4.33	17.99	22.91

<sup>†</sup> in quarters; <sup>‡</sup> in percent

Table 1: Summary of Business Cycle Characteristics

expansions, we note that expansions tend to display more heterogeneous behavior relative to contractions. 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. These findings are consistent with the findings of Canova, Ciccarelli, and Ortega (2007), who show that expansions tend to have large idiosyncratic 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. These preliminary findings will have important ramifications for our subsequent analysis regarding the determinants of business cycle characteristics across the different phases.

Further viewing Figures 1 through 4 and Table 1, we can contrast the business cycle characteristics for the developed versus developing countries. A striking finding that emerges is the long duration of contractions for the developing countries. Likewise, we find that expansions tend to be longer for the developed countries. Examining the results according to the six country groupings described above, the G7 countries have the shortest and mildest recessions compared to the EU and other developed countries. However, as Figure 1 shows, part of the reason for our finding of more severe recessions for the EU countries is the experience of Finland and Sweden, which suffered sharp and prolonged declines in GDP during the Nordic banking crisis of the 1990's. (See, for example, Drees and Pazarbaşıoğlu, 1998.) Using quarterly GDP data to estimate univariate and multivariate Markov Switching models for Germany, UK, France, Italy, Austria, and Spain for the period 1970-1996, authors such as Krolzig and Toro (2005) find recessions tend to be milder in the "core" EU countries relative to the other developed countries such as the US. We also observe that the duration of expansions in the EU countries are longer than those for the G7 or other industrialized countries.<sup>4</sup> The amplitude of expansions tends to be similar across the G7, EU and other industrialized countries. However, 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 S. Korea and Taiwan, which have experienced strong growth in the postwar period.<sup>5</sup>

<sup>4</sup>This finding may be due to the experience of Finland and Sweden, which suffered sharp contractions but also enjoyed long expansions over the sample period.

<sup>5</sup>One could argue that countries such as S. Korea and Taiwan should be grouped with the emerging economies based on their initial per capita income over the sample period. However, their cyclical dynamics are more similar

Turning to the developing countries, we note that 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.<sup>6</sup> Likewise, Chile has long expansions characterized by large output gains. The highly heterogeneous group of emerging market economies tend 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. The Southeast Asian countries of Malaysia and Thailand tend to have longer and/or stronger expansions. Turkey tends to experience short recessions amid short expansions. Third, the CEE countries have longer and more severe recessions than the emerging economies but also experience longer and more robust expansions.

### 3 Determinants of business cycle characteristics

#### 3.1 The model

The literature on the determinants of business cycles is vast. In this section, we seek to understand the role of institutional factors in determining business cycle characteristics while allowing for the separate effects of structural and macroeconomic factors. As Reichlin *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, 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.

Our aim is to understand the association of institutional factors and business cycle characteristics. However, such factors may be correlated with many other variables, making it difficult to identify their separate effects. As an example, the new institutionalist literature has argued that institutions cause growth. However, there may exist reverse causality in that countries with higher income may have also developed better and more resilient institutions. Hence, we need to control for the effects of a variable such as per capita income. Likewise, the role of trade and financial integration has been extensively studied as determinants of business cycle characteristics. To control for such effects, we also include a set of macroeconomic and structural variables in our analysis.

To describe the model that we estimate, let  $bc_i = Edur_i, Eampl_i, Cdur_i, Campl_i$  denote average business cycle characteristics under study such as the average duration and amplitude of expansions and contractions, respectively, for country  $i$  over the relevant sample period. Then

$$bc_i = \alpha_1 + \alpha_2 macro_i + \alpha_3 struc_i + \alpha_4 inst_i + \alpha_5 reg_i + \epsilon_i, \quad (3.1)$$

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to the other industrialized countries when we consider the entire sample period.

<sup>6</sup>Our sample period reflects the end of the hyperinflationary experiences in Brazil. See Chauvet (2010) for a further discussion of the determinants of business cycles in Brazil.



where  $macro_i$ ,  $struc_i$ ,  $inst_i$  are vectors of macroeconomic, structural, and institutional variables and  $reg_i$  are regional dummies, and  $\alpha_i, i = 1, \dots, 5$  are coefficient vectors conformable to the vectors of variables.

## 3.2 Data

### 3.2.1 Institutional variables

We consider two sets of institutional variables. The first set of these variables correspond to a general notion of governance. Several indices of governance have been developed in the recent literature seeking to quantify the effect of institutional quality on economic outcomes.

- The Worldwide Governance Index (*Gov*) computed by the World Bank (see Kaufman, Kraay and Mastruzzi, 2009) provides a widely used aggregate measure of governance. This measures different dimensions of governance such 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.<sup>7</sup>
- The Institutional Profiles Database 2009 (*IPD*) developed by the French Development Agency<sup>8</sup> 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.

Of the *IPD* indicators, we particularly focus on the level of development of labor and capital markets (denoted *lm* and *km*, respectively). Briefly, the index of labor markets and labor relations examines such characteristics as freedom of association and trade union pluralism, flexibility in the labor market, re-training and re-skilling measures, adaptive education system, respect for workers' rights, weak employment contract rigidity, wage bargaining at the individual level, strikes, management of labor as well as characteristics pertaining to labor market segmentation and mobility.

The index of capital markets encompasses such 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.

- The Civil Liberties Index prepared by the Freedom House (*FH*).<sup>9</sup>

In their study pertaining to the factors that may account for the large drops in GDP during the recent global financial crisis, Reichlin *et al* focus on one of the subindicators of the Worldwide Governance Index, namely, regulatory quality. Since our aim is to understand average behavior of longer periods, the use of the aggregate measure of governance to overcome possible measurement errors seems more appropriate.

<sup>7</sup>This indicator is constructed for 212 countries and territories bi-annually for 1996, 1998, 2000 and annually for 2002-2008.

<sup>8</sup>See <http://www.cepii.fr/anglaisgraph/bdd/institutions.htm>

<sup>9</sup>Note that unlike the rest of the institutional indicators, greater values of the *FH* index indicate less freedom or lower quality of governance.

The recent macroeconomic literature has also emphasized the role of monetary and regulatory institutions in affecting economic stability. For this purpose, we include indicators of the quality of monetary policy institutions given by

- indices of central bank independence (*CBI*) provided by Cukierman *et al.* (1992 and 2002) and Arnone *et al.* (2007)
- dummies for inflation targeting (*IT*) or currency boards regimes (*CU*)<sup>10</sup>
- an indicator of bank regulation and supervision intensity (*RS*) constructed by Neyapti and Dincer (2005) and Dincer and Neyapti (2008)

### 3.2.2 Macroeconomic and structural variables

The remaining variables are intended to capture the role of macroeconomic policies and the underlying structural characteristics of the different economies. The source of data for the macroeconomic variables is the World Bank's World Economic Indicators. We include five macroeconomic variables given by

- inflation (*D*)<sup>11</sup>
- current account deficit as a ratio to GDP denoted (*ca/Y*)
- (log of) income per capita (*lnY*)
- the ratio of FDI to GDP (*fdi/Y*)
- credit extended to the private sector as a ratio to GDP (*cr/Y*).

The variables *D* and *ca/Y* are considered to capture the (lack of) soundness of economic policy in general and hence, its (lack of) ability to mitigate business cycles. The remaining three variables are income level, FDI exposure, and the level of development of the financial markets, respectively. However, the roles of FDI flows and financial market development in promoting growth have been extensively studied. It is generally assumed that the relationship between the level of financial market development and long-term economic growth is positive (see, for example, Levine, 2005). The impact of FDI flows has typically been assumed to depend on the recipient country's characteristics (see, for example, Balasubramanyam, Salisu and Sapford, 1996; Borenztein, De Gregorio and Lee, 1998). Reichlin *et al* (2010) argue that credit market liberalization which goes hand in hand with financial market development may actually amplify the effects of certain types of shocks. We conjecture that FDI may mitigate business cycles as it is usually observed to flow to countries with a good investment environment.

Finally, the structural variables included in the model are

- openness (*open*) measured as the sum of exports and imports as a percentage of GDP

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<sup>10</sup>See Neyapti (2009) for the list of countries under these regimes.

<sup>11</sup>Following Cukierman *et al.* (1992), we use a transformed version of inflation, defined as inflation rate/(1+inflation rate). This transformation is to eliminate the estimation problems that may arise from the large range of inflation values in the data set.

- income share of industrial value added (*Ind*)
- regional dummies

The sign of *open* may depend on whether the shocks are aggravated or mitigated through trade and financial linkages. It has been noted that greater openness may help reduce the severity of national business cycles by providing more risk sharing opportunities. On the other hand, economies that are more integrated may also be more affected by shocks that occur elsewhere.<sup>12</sup> The second variable is used to test whether the extent of industrialization helps to reduce cyclical fluctuations, which is a proposition that is based on the relatively greater shock proneness of the traditional sector compared to the industrial sector. 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 regions whose effects are controlled via dummies are the Group of Seven (*G7*), Central and Eastern European states (*CEE*), Latin American countries (*LA*), other industrialized countries (*DC*) and emerging market economies (*Emerg*).

Appendix Table A.3 shows the correlations between the main features of expansions (denoted by prefix *E*) and contractions (denoted by prefix *C*), namely duration and amplitude (denoted by *dur* and *ampl*, respectively) and the macroeconomic, structural and institutional variables. What stands out in the table is that governance (measured by both *Gov* and the *IPD* indices) is positively correlated with the duration of expansions and the amplitude of the contractions; inflation is negatively correlated with *Edur* (duration of expansions); and finally, while, *Eampl* is positively related with the duration of expansions (*Edur*), the case is reverse for contractions. It should be also noted that per capita GDP is positively correlated with many of the institutional indicators.

In what follows, we perform a regression analysis to investigate the significance of associations of business cycle characteristics with these variables. To determine the data range of the macroeconomic variables, we consider the period of coverage that leads to the measurement of business cycle features reported in Figures 1-4. Hence, all the macroeconomic variables, as well as *open* and *Ind* are in averages over the time period indicated for each country, where available.<sup>13</sup> The coverage of the institutional variables needs some compromising, however, 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* (and *RS*) is used when the date of the central bank (the banking law) covers the majority of the period considered; the data are coded as “non-available” otherwise. This leads to loss of many data points in the case of *RS*. The variable *Gov* is calculated in averages of the period from 1996 to 2007, whereas *IPD* data are only available for 2009. *FH*, on the other hand is available since 1972, and hence does not

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<sup>12</sup>In their study, Reichlin *et al* control for the effects of openness using both real and financial indicators. Specifically, they measure openness using four alternative indicators, (i) current account balance as a percent of GDP, (ii) the sum of exports and imports as a percentage of GDP in 2007, (iii) the sum of external assets and liabilities to GDP, and (iv) FDI as a percentage of GDP. As we show below, the correlation between our measure of openness and current account balance as a percent of GDP, namely, (i) and (ii), is only 0.46. Furthermore, the current account balance as a percent of GDP also provides additional information relative to (ii) in terms of the financing of the external balance. However, regardless of these issues, we consider below a measure that aggregates all of the macroeconomic variables using a principal components approach.

<sup>13</sup>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.

generate a problem in this regard but is nevertheless excluded from the analysis to gain a few more data points.<sup>14</sup>

One way of reconciling for these data deficiencies is that especially informal institutions, such as *Gov*, change very slowly over time. As a further means of reconciling for these deficiencies, we use the first principal component resulting from the factor analysis of the set of institutional variables (*IT*, *CBI*, *CU*, *lm*, *km* and *Gov*) in addition to the baseline regressions where we use all the available information. In addition, we report the estimation results both with and without *RS* since its inclusion restricts the degrees of freedom substantially (almost by half).

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.

## 4 Regression Results

Tables 2 and 3 report the estimation results. Since most of the macroeconomic variables reported in Table 2 are not individually significant, we also run alternative set of regressions that use the first principal component of these variables (reported as *MacroFactors*) and report those results in Table 3, gaining some degrees of freedom. The estimations with the inclusion of *RS* are performed using a more limited sample, which is nonetheless a balanced mixture of developed, developing and transition economies.<sup>15</sup> Those results are also reported in Table 3.

The estimations reported in Table 2 include all of the macroeconomic, structural and institutional factors, with the exception of *FH* as discussed above. They are based on 38 countries. The main findings can be summarized as follows.<sup>16</sup> Among the macroeconomic factors, inflation is the most significant variable and it is negatively related with the duration as well as amplitude of expansions. This can be interpreted as saying that if an expansion is associated with inflationary financing, it lasts shorter than the average expansion period and has a smaller amplitude. This observation also indicates that the lack of macroeconomic prudence hinders expansionary episodes.

Next, we find that the ratio of *FDI* flows to GDP is negatively associated with the average duration of contractions but it is positively associated with the amplitude of contractions, indicating that a healthy investment environment helps to mitigate contractions.<sup>17</sup> We find that both GDP per capita and FDI flows relative to GDP are negatively associated with the amplitude of expansions. The former finding may be explained by the convergence process, whereby

<sup>14</sup>Just to gain the data on France, South Africa and Turkey, *FH*, which is not available for these countries, is not included in the factor analysis for the institutional data. When included in the estimations, it is usually insignificant.

<sup>15</sup>Argentina, Belgium, Brazil, Czech Republic, Estonia, Finland, France, Germany, Greece, S.Korea, Latvia, Lithuania, Malaysia, Netherlands, Russia, Singapore, South Africa, Spain, Sri Lanka, Switzerland and Turkey.

<sup>16</sup>We also derived results that included the macroeconomic and structural variables and the institutional factors separately. However, the main findings did not change substantially relative to what is reported in Table 2.

<sup>17</sup>Since the amplitude of contractions is measured as the percentage decline in GDP over the contractionary phase, a positive effect of a variable suggests that a smaller percentage decline in GDP is associated with this variable.

countries with lower GDP per capita tend to display higher growth rates. The latter finding suggests that countries that are recipients of significant FDI flows experience less volatility during their expansionary phases. However, neither the current account nor the private credit to GDP ratios are significant after controlling for the effects of the other macroeconomic variables.

As for the structural factors, openness tends to increase the amplitude of expansions significantly. The impact of openness is also to magnify output fluctuations during recessions but this effect is not significant. By contrast, the income share of industrial value-added is not significant except for a borderline positive effect on the duration of recessions.

Even after controlling for the macroeconomic and structural factors, we find that the institutional variables have significant associations with business cycle characteristics. In particular, both the inflation targeting regime and better governance are associated with longer expansions. Likewise, the governance indicator is positively associated with the amplitude of expansions. Interestingly, we also find that central bank independence reduces the length of recessions significantly, indicating that CBI's impact on price stability also feeds into economic stability on the real side. Greater labor market development, on the other hand, tends to increase the duration of recessions. The last finding might be explained in terms of labor market institutions and social safety nets that tend to accompany more developed labor markets. Development of capital markets, on the other hand, does not show a significant association with any of the business cycle characteristics. In addition, we observe that G-7, other developed countries and CEE have recessions that last significantly shorter than average, whereas the emerging countries and CEE have higher recession amplitudes than average.

Table 3 reports the regressions after replacing the macroeconomic variables with their first principal component; to this list, we also add one of the structural variables: *Ind*, since it is not observed to have a significant effect individually. In addition, we omit the variable *km* from the rest of the explanatory variables, because it is found consistently insignificant in the regressions reported in Table 2. We also consider region dummies for broader groups by combining the G-7 and other industrialized countries into one group (*D1*), the Latin American and emerging economies into a second group (*D2*), and retaining the Central and Eastern European (CEE) countries as a third group. Hence, the goodness of fit slightly increases in these specifications. These estimations are performed in a sample of 38 and 19 countries respectively, where the latter set is determined mainly by the availability of *RS* data for the existing sample. In the regressions with the restricted sample, we also omit the variable denoting currency board regimes (*CU*) as there are no observations corresponding to this indicator.

Table 3 shows that macroeconomic factors as a whole (represented by their first principal component) do not appear to exhibit a significant association with business cycle characteristics, except for the negative effect on the amplitude of expansions when *RS* is included. By contrast, many of the institutional and structural attributes do. Not only does governance increase the duration and amplitude of expansions, *Edur* and *Eampl*, respectively, it also has the marginal effect of reducing the amplitude of contractions, *Campl*. The first two effects hold for both the unrestricted and restricted samples, suggesting that the positive association of better governance with stronger expansions is a robust finding. Openness also tends to amplify expansions and to reduce the duration and amplitude of contractions in the first and second (including *RS*) samples, respectively. In contrast, labor market development is observed to be negatively associated with the amplitude of expansions, *Eamp*.<sup>18</sup> The positive association

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<sup>18</sup>As we noted from the outset, our analysis does not permit a causal interpretation to the results of the

of *IT* with the duration of expansions is also confirmed, and so is the aggravation of business cycles in the CEE countries. CEE countries also exhibit longer than average duration of expansions.

The additional observation in the restricted sample is that *RS* has a mitigating effect on expansions, possibly via preventing above-normal credit expansions that prove to be destabilizing. In the restricted sample, the negative association of expansions with the macroeconomic set of variables is in accord with the formerly reported negative significance of inflation, *D*, and the ratio of FDI flows to GDP, *FDI*. Representing the set of institutional variables with their first principal component costs some explanatory power and the goodness of fit; hence they are not reported. Those regressions, however, also indicate that institutions especially exhibit positive associations with the duration of expansions as well as, interestingly, the amplitude of contractions. The significance of both openness and *CEE* is retained.

To summarize, our empirical analysis reveals that governance, monetary institutions such as *IT*, and openness are positively associated with expansions. By contrast, recessions appear more country- or region-specific, although they are also significantly correlated with variables such as openness and CBI.<sup>19</sup> Our approach of examining the determinants of expansions and contractions separately thus finds justification in the nature of the empirical results. It also lends credence to regime switching models which seek to describe business cycle dynamics in terms of the differing characteristics of the associated regimes. In this paper, we do not directly estimate the probability of such regimes switches. However, we go beyond the simple regime switching approach by trying to identify the determinants of business cycle dynamics in the different cyclical phases.

## 5 Business cycle synchronization

In this section, we turn to another characteristic of business cycles across countries, and that has to do with the synchronization of business cycles. In the earlier literature, Frankel and Rose (1998) show that international business cycle synchronization as measured by the Pearson correlation coefficient of growth rates is positively related to trade intensity across countries and over time. Imbs (2004, 2006) finds that measures of bilateral financial integration also correlate with such synchronization measures. Imbs (2010) shows that the recent global crisis has been accompanied by an unprecedented synchronization of business cycles across countries. He relates measures of business cycle synchronization across countries to trade and financial integration. In line with the approach in this paper, we examine the association between business cycle synchronization and a set of structural and institutional factors more broadly. In contrast to the earlier literature, however, we define business cycle synchronization following the approach in Harding and Pagan (2006), which dichotomizes the phases of economic activity according to recession and expansion.

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reported regressions. The finding regarding labor market development and the amplitude of expansions may be especially prone to this criticism, as developed countries will tend to display lower average growth rates and also have greater labor market development simultaneously.

<sup>19</sup>An alternative way of expressing this finding is that the impact of institutional and structural factors is more evident in the behavior of expansions whereas contractions or recessions typically arise from shocks that are not directly related to such factors.

Specifically define the random variable  $S_{it}$  as

$$S_{it} = \begin{cases} 0 & \text{if county } i \text{ is in a recessionary phase} \\ 1 & \text{otherwise.} \end{cases} \quad (5.2)$$

Thus,  $S_{it}$  is a binary random variable that is associated with the phases of the business cycle. Following Harding and Pagan (2006), we can say that the business cycle in countries  $i$  and  $j$  are perfectly positively synchronized if  $Pr(S_{it} = 1, S_{jt} = 0) = 0$  and  $Pr(S_{it} = 0, S_{jt} = 1) = 0$  for  $i \neq j$ . Likewise, they are perfectly negatively synchronized if  $Pr(S_{it} = 1, S_{jt} = 0) = 1$  and  $Pr(S_{it} = 0, S_{jt} = 1) = 1$  for  $i \neq j$ . More generally, we can examine the correlation coefficient between  $S_{it}$  and  $S_{jt}$  which, given the binary nature of  $S_{it}$  and  $S_{jt}$ , is defined as

$$\rho_{ij} = Corr(S_{it}, S_{jt}) = \frac{Pr(S_{it} = 1, S_{jt} = 1) - [Pr(S_{it} = 1)Pr(S_{jt} = 1)]}{\sqrt{Pr(S_{it} = 1)Pr(S_{it} = 0)}\sqrt{Pr(S_{jt} = 1)Pr(S_{jt} = 0)}}.^{20} \quad (5.3)$$

We hypothesize that the synchronization between the business cycles of countries  $i$  and  $j$  is associated with a set of structural and institutional variables. Following the literature on gravity models in international trade, we first consider the logarithm of the distance between country  $i$  and  $j$  or the distance between their capital cities,  $d_{ij}$  as the first determinant of business cycle synchronization. (See, for example, Baxter and Kouparitsas, 2005.) As Imbs (2010) emphasizes, many authors have found a strong role for trade intensity as a determinant of synchronization of international economic activity. Trade intensity between countries  $i$  and  $j$  is defined as

$$T_{ij} = \frac{X_{ij} + X_{ji}}{X_i + X_j}, \quad (5.4)$$

where  $X_{ij}$  denotes total merchandise exports from country  $i$  to  $j$  and  $X_i = \sum_j X_{ij}$ .<sup>21</sup> Data on bilateral trade linkages are provided on an annual basis between 1980 and 2009. 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. By contrast, Imbs (2010) uses time variation in the measure of bilateral trade linkages to examine the time variation in the correlation of economic activity between country  $i$  and  $j$ .

The literature on international business cycles has stressed that business cycle synchronization across countries may also derive from increased financial activity between them. Hence, we consider a third variable that has to do with bilateral financial linkages. We make use of the

<sup>20</sup>Notice that  $E(S_{it} = 1) \times Pr(S_{it} = 1) + 0 \times Pr(S_{it} = 0) = Pr(S_{it})$  and  $Var(S_{it}) = Pr(S_{it} = 1) \times (1 - Pr(S_{it} = 1))^2 + Pr(S_{it} = 0) \times (0 - Pr(S_{it} = 1))^2 = Pr(S_{it} = 1)[1 - Pr(S_{it} = 1) - Pr(S_{it} = 1(1 - Pr(S_{it} = 1)))] + Pr(S_{it} = 0)Pr(S_{it} = 1)^2 = Pr(S_{it} = 1)Pr(S_{it} = 0)$ .

<sup>21</sup>These 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.

bilateral locational banking statistics from the Bank of International Settlements to generate a measure of bilateral financial linkages as<sup>22</sup>

$$\phi_{ij} = \frac{F_{ij} + F_{ji}}{F_i + F_j}, \quad (5.5)$$

where  $F_{ij}$  denotes the consolidated foreign claims of reporting banks, reported on individual countries by nationality of the reporting banks, and  $F_i = \sum_j F_{ij}$ . These data are available quarterly and semi-annually between December, 1983 and September, 2010. We construct an exact measure of the bilateral financial linkage between county  $i$  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. However, they are only available for 25 countries.<sup>23</sup>

As the novel feature of our analysis, we also consider the differences between the institutional and macroeconomic/structural indicators as a measure of proximity between all the different country pairs for estimating their business cycle synchronization. Imbs (2010) analyzes the *changes* in the correlation coefficient of GDP growth across a large set of countries over time. To control for the impact of the size of the economies on the correlation coefficient, he includes the sum of their respective GDP's. While we do not analyze changes in business cycle synchronization, we conjecture that business cycle synchronization on average may also be related to the size of the respective economies. Hence, we include the logarithm of the sum of the GDP of county  $i$  and country  $j$ ,  $\ln(GDP_i + GDP_j)$ . The basic model that we estimate is given by:

$$\rho_{ij} = \alpha_1 + \alpha_1 d_{ij} + \alpha_2 T_{ij} + \alpha_3 \phi_{ij} + \alpha_4 \ln(GDP_i + GDP_j) + \delta' \Delta_{ij}^{macro} + \gamma' \Delta_{ij}^{inst} + \epsilon_{ij}, \quad (5.6)$$

where  $\Delta_{ij}^{macro}$  and  $\Delta_{ij}^{inst}$  are vectors of the differences of the macroeconomic/structural and institutional variables across countries  $i$  and  $j$ .

Table 4 reports our results regarding the determinants of business cycle synchronization. In columns (I), (II), and (III), we report the results by replacing the institutional and macroeconomic/structural variables with their principal components. The first three columns show that distance and trade intensity are significant and enter with correct signs. Specifically, we find that the distance between countries  $i$  and  $j$  reduces business cycle synchronization and trade intensity tends to increase it. Column (II) shows that our measure of financial linkages also tends to increase business cycle synchronization. However, the coefficient on this variable is not significantly estimated. Furthermore, the sample size is reduced since the variable that measures bilateral financial linkages is available for only a subset of the countries in our study.

In columns (I)-(III), we also include differences between the principal components of the macroeconomic/structural and institutional factors. Proximity of the institutional variables has the correct sign; that is, the larger the distance between the institutional variables of

<sup>22</sup>See BIS Locational Banking Statistics, Table 9B.

<sup>23</sup>These include 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. Imbs (2010) creates an approximate measure of bilateral financial linkages by using information on the gross (unconsolidated) assets and liabilities of banks for a larger set of countries. This measure is based on the notion that countries that are both open to capital flows will tend to be open to each other.



countries  $i$  and  $j$ , the lower the business cycle synchronization between them. However, the coefficients on the distance between the institutional variables and the distance between the macroeconomic/structural factors are not significantly estimated. By contrast, the size of the economies matters for business cycle synchronization. The coefficient on the sum of the GDP for countries  $i$  and  $j$  is positive and significant. This finding accords with the notion that synchronization of business cycle activity is driven by the behavior of the larger economies in a given region or the world.

In column (III), we add dummy variables to capture the interaction between such variables as trade intensity as well as institutional characteristics such as inflation targeting while in column (IV) we consider a specification where specific macroeconomic and institutional factors are used in place of their principal components.<sup>24</sup> Column (II) shows that proximity of the macroeconomic and institutional factors (on the aggregate) do not matter for business cycle synchronization. However, Columns (III) and (IV) reveal that certain macroeconomic and institutional factors matter more than others do. Besides the distance and the size of the economies involved in trade, what seem to especially matter are the size of the pairs of economies considered and their relative inflation performance. If the size of at least one of the countries in the considered pair of countries is large  $\ln(GDP_i + GDP_j)$ , or is developed ( $T_{ij} \times DC$ ), greater business cycle synchronization is observed. The difference in the inflation performance (DD) of the trade partners reduces their business cycle synchronization; similarity in the institutional arrangements to contain inflation, on the other hand, increases it (BOTHIT).

Combining with the results reported in Tables 2 and 3, inflation and inflation targeting seem to be the most important macroeconomic and institutional attributes of the countries that not only explain the duration of expansions, but they also appear as important determinants of the business cycle synchronization between them.

## 6 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 set of countries. It also provides an original effort that seeks 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,

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<sup>24</sup>We considered different specifications with the individual macroeconomic and institutional factors included separately. Aside from those factors reported in Table 4, these factors were either insignificantly estimated or their estimated coefficients switched signs.

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. Our results also suggest that the size of the respective economies and whether trade is conducted with a developed economy matters, confirming the notion that business cycle activity tends to be driven by the behavior of the larger, more developed economies. In terms of the institutional factors, we find that monetary institutions such as inflation targeting are important in determining business cycle characteristics during expansions as well as being a primary determinant of business cycle synchronization.

Several recent studies have tried to identify the determinants of output declines as well as changes in business cycle synchronization during the financial crisis of 2007-2008. Reichlin *et al.* (2010) claim that the measures of financial market liberalization correlate most strongly with countries' exposure to the financial crisis. Likewise, Imbs (2010) finds that increases in business cycle synchronization during the financial crisis can be attributed to financial linkages for the developed countries whereas developing countries were affected primarily through trade linkages and the decline in overall trade. In our study, we have not separated out this episode for specific study. However, many commentators have argued that one of the important lessons to be drawn from the recent financial crisis is the need to impose macro-prudential measures that have the effect of safeguarding the financial system as a whole (see Hanson, Kashyap, and Stein, 2010). The Basel Committee on Banking Supervision (2010) has also made significant recommendations – the so-called “Basel III” process – regarding new banking and financial regulation. Undoubtedly such recommendations have injected a new dimension into the policy debate that go beyond earlier policy discussions and reforms such as inflation targeting and central bank independence. However, to the extent that they point to further strengthening of the international monetary and financial architecture, they broadly accord with our findings regarding the importance of monetary institutions in affecting economic performance.

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## A Appendix

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.<sup>25</sup> 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, Morocco, and Sri Lanka. 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.

Table A.2 provides the recession dates or equivalently the dates of the peaks and troughs of business cycles for all 63 countries in our study. One finding that we observe from these tables is that a subset of the countries display a single recessionary experience. This is most likely due to the short sample for these countries. For countries such as Bolivia, Bulgaria, Croatia, Ecuador, Indonesia, Kyrgyzstan, Norway, the Philippines, and Sri Lanka, the single recession occurs in the mid-sample. For Southeast Asian countries such as Indonesia and the Philippines, the single recession occurs around the time of the 1997 East Asian crisis. Likewise, Bolivia and Ecuador experience recessions in the period surrounding the Brazilian crisis of 1999. For another subset of the countries, the only recession that registers is the one associated with the 2007-2008 financial crisis. These are typically European countries which were exposed to the financial shock through banks portfolios and credit market conditions such as Hungary, Iceland, Ireland, Luxembourg, and Slovenia, though a country such as Georgia is also adversely affected. The fact that some emerging economies such as Indonesia were able to avoid the worst effects of the 2007-2008 crisis is due to their relative lack of exposure as well as the lessons learned by emerging market economies in previous crises as noted by Diamond and Rajan (2009).

The remaining countries in our sample display multiple recessionary experiences. These experiences have been studied extensively in the literature. Altug and Bildirici (2010) provide a review and discussion of the business cycle responses of 27 developing and developing countries and describe the major recessions over time. These include the oil shocks of the 1973-1975 and 1980-1982, the global recession of 1990, the ERM crisis of 1992, the 2001 global crisis, and the 2007-2008 financial crisis. They also discuss the emerging market crises in the 1990's, including the impact of the 1997 East Asian crisis, the Russian crisis of 1998 and the various Latin American crises such as the Argentinian sovereign debt default. The additional countries which are not part of their study also display the effects of these global and more specific recessions and crises. Among the developed economies, Belgium and Switzerland display recessions during the early 1980's as well as during the ERM crisis of 1992. Likewise, Portugal and Switzerland are affected by the growth slowdown that occurred in the euro area in 2001-2002. In terms of the emerging or developing economies, Thailand experiences recessions during 1997 as well

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<sup>25</sup>These data have been derived from a dataset used by Benczur and Ratfai (2010).

as 2008. Indeed it is well known that the speculative attack on the Thai baht was one of the events that triggered the 1997 East Asian crisis. For a set of transition economies such as Croatia, the Czech Republic, Latvia, Lithuania, Romania, Slovakia, there are recessions during the years 1997-1999 which may reflect the effects of 1997 East Asian crisis as well as the Russian crisis of 1998 on smaller economies in the process of integrating financially with the rest of the world.

Country	Data Dates	No. of Data	Country	Data Dates	No. of Data
Argentina	1980:4-2009:2	115	Korea	1980:4-2009:1	114
Australia	1963:1-2009:2	186	Kyrgyzstan	1995:4-2008:2	51
Austria	1988:4-2009:1	82	Latvia	1993:4-2009:1	62
Belgium	1980:4-2009:2	114	Lithuania	1995:4-2009:1	54
Bolivia	1990:4-2008:4	73	Luxembourg	1995:4-2008:4	53
Botswana	1996:4-2008:3	48	Malaysia	1991:4-2009:2	71
Brazil	1991:4-2009:1	70	Malta	1997:4-2009:1	46
Bulgaria	1994:4-2009:1	58	Mexico	1980:4-2009:2	115
Canada	1963:1-2009:2	186	Morocco	1990:4-2007:4	69
Chile	1981:4-2009:1	110	Netherlands	1963:1-2009:2	186
Colombia	1994:4-2008:4	57	New Zealand	1988:1-2009:2	84
Croatia	1994:4-2008:4	57	Norway	1978:4-2009:1	122
Czech Republic	1994:4-2009:2	58	Peru	1980:4-2010:2	114
Denmark	1990:4-2009:2	73	Philippines	1993:3-2009:1	63
Ecuador	1993:4-2008:4	61	Portugal	1995:4-2008:4	53
Estonia	1993:4-2009:1	62	Romania	1994:4-2009:1	58
Finland	1963:1-2009:2	186	Russia	1995:4-2008:4	53
France	1970:4-2009:2	155	Singapore	1985:2-2009:2	97
Georgia	1996:4-2008:4	49	Slovakia	1993:4-2009:1	62
Germany	1963:1-2009:2	186	Slovenia	1993:4-2009:1	62
Greece	1970:4-2009:1	154	South Africa	1970:4-2009:2	155
Hong Kong	1973:4-2009:1	142	Spain	1963:1-2009:2	186
Hungary	1995:4-2009:1	54	Sri Lanka	1996:4-2005:4	37
Iceland	1997:4-2009:1	46	Sweden	1963:1-2009:2	186
Indonesia	1996:4-2009:1	50	Switzerland	1980:4-2009:2	114
Ireland	1997:4-2008:4	45	Taiwan	1982:1-2009:1	109
Israel	1980:2-2009:2	54	Thailand	1993:4-2009:1	62
Italy	1963:1-2009:2	186	Turkey	1987:4-2009:2	87
Jamaica	1996:4-2008:2	47	UK	1963:1-2009:2	186
Japan	1963:1-2009:2	186	Uruguay	1988:4-2008:4	81
Kazakhstan	1994:4-2009:1	58	USA	1963:1-2009:2	186
			Venezuela	1997:4-2009:1	46

Table A.1: Sample of Countries



Country	Recession Dates	Country	Recession Dates	Country	Recession Dates	Country	Recession Dates
Argentina	1980:4-1982:3	Greece	1974:1-1974:4	Mexico	2001:2-2002:1	Taiwan	2001:2-2002:1
Argentina	1984:4-1985:4	Greece	1980:3-1981:2	Mexico	2008:3 -	Taiwan	2008:3 -
Argentina	1988:1-1990:2	Greece	1982:2-1983:2				
Argentina	1995:1-1996:1	Greece	1986:2-1987:4	Morocco	1992:1-1993:4	Thailand	1997:1-1999:1
Argentina	1998:3-2002:4	Greece	1992:4-1993:4	Morocco	1994:4-1995:4	Thailand	2008:4 -
				Morocco	1997:1-1997:4		
Australia	1974:3-1975:1	Hong Kong	1974:3-1975:1	Morocco	1999:2-1999:4	Turkey	1988:3-1989:2
Australia	1982:2-1983:3	Hong Kong	1985:1-1985:3			Turkey	1990:4-1991:2
Australia	1990:3-1991:4	Hong Kong	1997:4-1999:1	Netherlands	1974:4-1975:3	Turkey	1994:1-1995:1
		Hong Kong	2001:2-2002:1	Netherlands	1980:2-1981:1	Turkey	1998:3-1999:4
Austria	1992:4-1993:2	Hong Kong	2008:3 -	Netherlands	1981:3-1983:1	Turkey	2000:4-2001:4
Austria	2001:2-2001:4			Netherlands	2008:3 -	Turkey	2008:4 -
		Hungary	2008:3 -				
Belgium	1982:3-1983:2			New Zealand	1989:2-1990:2	UK	1973:4-1974:2
Belgium	1992:3-1993:3	Iceland	2008:2 -	New Zealand	1990:4-1991:4	UK	1975:1-1975:4
Belgium	2008:3 -			New Zealand	1998:1-1998:3	UK	1980:1-1981:3
		Indonesia	1997:4-1999:1	New Zealand	2008:2-2008:4	UK	1990:3-1992:2
Bolivia	1999:1-1999:3						
Botswana	2001:4-2002:2	Ireland	2007:4 -	Norway	1988:1-1989:1	Uruguay	1995:2-1995:4
Botswana	2005:4-2006:2					Uruguay	1999:1-2003:2
		Israel	1982:1-1982:3	Peru	1982:1-1984:2		
Brazil	1991:4-1992:4	Israel	2001:2-2002:3	Peru	1985:2-1986:1	USA	1974:1-1975:2
Brazil	1995:3-1996:1	Israel	2008:4-2009:2	Peru	1987:4-1989:3	USA	1980:1-1980:4
Brazil	1998:3-1999:3			Peru	1990:2-1991:2	USA	1981:4-1982:4
Brazil	2001:3-2002:1	Italy	1964:3-1965:1	Peru	1992:1-1993:1	USA	1990:4-1991:3
		Italy	1974:3-1975:3	Peru	1998:1-1999:3	USA	2008:3 -
Bulgaria	1995:4-1997:2	Italy	1982:3-1983:2	Peru	2000:3-2001:2		
		Italy	1992:3-1993:3	Peru	2009:2-2009:4	Venezuela	1998:2-1999:4
Canada	1981:4-1983:1	Italy	2003:1-2003:3			Venezuela	2001:4-2003:3
Canada	1990:2-1991:4	Italy	2008:2 -	Philippines	1998:1-1998:4		
Canada	2008:3 -						
Chile	1982:3-1984:2	Jamaica	1996:4-1998:4	Portugal	2002:3-2003:3		
Chile	1998:3-1999:3	Jamaica	2001:4-2002:2	Portugal	2008:3 -		
Chile	2008:3 -	Jamaica	2004:3-2005:1	Romania	1996:4-1998:1		
Chile	2008:3 -	Jamaica	2007:3 -	Romania	1999:2-2000:4		
Colombia	1998:2-1999:4	Japan	1973:4-1974:4	Russia	1995:4-1997:2		
Colombia	2008:4 -	Japan	1979:4-1980:4	Russia	1998:1-1999:1		
		Japan	1993:1-1993:3				
Croatia	1998:3-1999:3	Japan	1997:3-1999:1	Singapore	1985:2-1986:1		
		Japan	2001:2-2002:2	Singapore	1998:2-1998:4		
Czech Rep.	1997:1-1998:4	Japan	2008:2 -	Singapore	2001:2-2002:1		
Czech Rep.	2008:3 -	Kazakhstan	1998:2-1998:4	Singapore	2008:3 -		
		Kazakhstan	2008:4 -				
Denmark	2003:1-2003:3	Korea	1997:4-1998:4	Slovakia	1999:2-2000:1		
Denmark	2008:2 -	Korea	2008:3 -	Slovakia	2008:4 -		
Ecuador	1998:4-2000:1	Kyrgyzstan	2001:4-2002:2	Slovenia	2008:3 -		
Estonia	1993:4-1995:1	Latvia	1996:3-1997:1	S. Africa	1982:1-1983:3		
Estonia	1998:4-1999:3	Latvia	2008:1 -	S. Africa	1984:4-1986:1		
Estonia	2008:1-2009:1			S. Africa	1990:1-1993:1		
				S. Africa	2009:1 -		
Finland	1975:2-1976:2	Lithuania	1999:2-1999:4				
Finland	1990:1-1993:1	Lithuania	2008:3-2009:1	Spain	1978:3-1979:1		
Finland	2008:3 -			Spain	1980:3-1981:1		
		Luxembourg	2008:2 -	Spain	1991:4-1993:4		
France	1974:4-1975:3			Spain	2008:3 -		
France	1992:4-1993:4	Malaysia	1997:4-1999:1				
France	2008:3 -	Malaysia	2001:2-2001:4	Sri Lanka	2001:1-2001:4		
		Malaysia	2008:4 -				
Georgia	2008:2 -			Sweden	1971:2-1971:4		
		Malta	2001:1-2001:4	Sweden	1976:3-1977:4		
Germany	1966:4-1967:3	Malta	2002:4-2003:3	Sweden	1990:4-1993:3		
Germany	1974:3-1975:3	Malta	2004:2-2004:4	Sweden	2008:3 -		
Germany	1982:1-1983:1	Malta	2008:3 -				
Germany	1992:4-1993:4			Switzerland	1981:4-1982:4		
Germany	2002:3-2003:3	Mexico	1982:2-1983:4	Switzerland	1990:4-1991:4		
Germany	2008:3 -	Mexico	1985:4-1987:1	Switzerland	1992:3-1993:2		
		Mexico	1994:4-1995:4	Switzerland	2002:3-2003:3		
				Switzerland	2008:3 -		

Table A.2: Business Cycle Dating

	Edur	Eamp	Cdur	Camp	cr/Y	open	Infl	lnY	Ind	ca/Y	fdi/Y	CBI	IT	CU	CB	RS	Gov	FH	lm	km
Edur	1.00																			
Eamp	0.67	1.00																		
Cdur	0.08	-0.24	1.00																	
Camp	0.17	0.13	-0.73	1.00																
cr/Y	0.12	-0.12	-0.22	0.32	1.00															
open	0.12	0.38	-0.34	0.29	0.37	1.00														
Infl	-0.51	-0.38	0.21	-0.31	-0.37	-0.35	1.00													
lnY	0.45	-0.08	0.04	0.29	0.58	0.23	-0.43	1.00												
Ind	-0.11	-0.08	0.33	-0.40	0.27	0.16	-0.08	-0.22	1.00											
ca/Y	-0.18	-0.36	0.06	-0.10	0.59	0.46	-0.10	0.44	0.36	1.00										
fdi/Y	0.23	0.31	-0.32	0.42	0.17	0.81	-0.22	0.25	-0.14	0.23	1.00									
CBI	0.23	0.12	-0.03	0.29	-0.17	-0.39	-0.24	0.15	-0.50	-0.61	-0.19	1.00								
IT	0.29	-0.28	0.20	0.14	0.18	-0.32	-0.02	0.54	-0.14	0.08	-0.23	0.01	1.00							
CU	0.39	-0.18	0.18	0.06	0.06	-0.17	-0.26	0.55	-0.25	0.06	-0.06	0.36	0.61	1.00						
CB	0.00	0.34	-0.33	0.21	-0.31	0.11	-0.12	-0.26	-0.19	-0.55	0.19	0.35	-0.39	-0.24	1.00					
RS	0.17	-0.16	0.07	0.16	0.34	0.16	-0.22	0.53	0.17	0.16	0.10	0.30	0.27	0.54	0.12	1.00				
Gov	0.70	0.28	-0.09	0.43	0.55	0.28	-0.56	0.87	-0.25	0.15	0.27	0.34	0.41	0.52	0.00	0.57	1.00			
FH	-0.60	-0.21	-0.13	-0.30	0.00	0.33	0.13	-0.44	0.47	0.43	0.01	-0.67	-0.37	-0.34	-0.22	-0.20	-0.58	1.00		
lm	0.55	0.11	0.07	0.48	0.20	0.03	-0.42	0.64	-0.15	0.05	0.19	0.42	0.42	0.41	0.06	0.43	0.69	-0.70	1.00	
km	0.29	0.01	-0.26	0.35	0.31	0.03	-0.42	0.58	-0.44	0.30	-0.01	0.26	0.39	0.62	-0.39	0.08	0.52	0.24	0.40	1.00

Table A.3: Correlations

Dependent variable	Expansion		Contraction	
	Duration	Amplitude	Duration	Amplitude
constant	82.90 (1.26)	1.68** (2.22)	3.70 (0.29)	-0.22 (-0.99)
<b>Macroeconomic factors</b>				
Private credit/GDP	0.02 (0.35)	0.000 (0.76)	-0.002 (0.22)	0.00 (0.20)
FDI/GDP	-0.53 (-1.00)	-0.01** (-2.16)	-0.17*** (-2.64)	0.003** (2.36)
Inflation (D)	-31.1*** (-2.60)	-0.24* (-1.67)	-1.09 (-0.31)	0.03 (0.42)
Current Account/GDP	-0.27 (-0.24)	0.00 (0.03)	-0.15 (-1.13)	0.002 (0.83)
ln(GDP)	-15.1 (-1.11)	-0.41** (-2.32)	-1.56 (-0.63)	0.06 (1.25)
<b>Institutional/Structural Factors</b>				
IT	9.13** (2.47)	0.03 (0.83)	-0.20 (-0.25)	0.02 (1.19)
CU	12.9 (1.64)	0.05 (0.81)	0.65 (0.82)	-0.006 (-0.50)
CBI	-3.66 (-0.17)	0.24 (1.09)	-6.61*** (-3.07)	0.01 (0.34)
Labor Markets	-1.02 (-0.08)	-0.08 (0.70)	2.82** (2.17)	-0.03 (-1.48)
Capital Markets	-5.8 (-1.06)	-0.04 (-0.58)	0.10 (0.12)	0.005 (0.31)
Governance (WB)	32.60* (1.68)	0.58** (2.46)	-1.32 (-0.30)	0.09 (1.22)
Openness	0.04 (1.00)	0.001** (2.43)	0.006 (1.09)	-0.0001 (-1.36)
Industrial Value Added	-0.05 (-0.10)	-0.003 (-0.50)	0.13 (1.56)	-0.002 (-1.04)
G-7	7.75 (1.04)	0.08 (1.34)	-1.79*** (-2.59)	0.02** (1.97)
LA	1.97 (0.16)	0.02 (0.19)	0.86 (0.53)	-0.006 (-0.20)
CEE	6.71 (0.46)	0.23* (1.58)	-2.42* (-1.86)	0.07** (2.29)
DC	-3.63 (-0.30)	0.12 (1.00)	-2.84*** (-3.23)	0.01 (0.80)
Emerg	-9.69 (-1.00)	-0.07 (-0.83)	-1.68 (-1.34)	0.04* (1.78)
<b>d.f.</b>	19	19	19	19
<b><math>\bar{R}^2</math></b>	0.23	0.33	-0.05	0.20

Table 2: Determinants of Business Cycle Characteristics

Dependent Variable	Expansion		Contraction		Expansion		Contraction	
	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude	Duration	Amplitude
constant	13.07 (0.41)	0.39 (0.86)	6.55** (2.13)	-0.16*** (-3.41)	-39.28 (-1.18)	-0.19 (-0.50)	1.51 (0.32)	-0.18*** (-2.63)
<b>Macro Factors</b>	5.16 (1.00)	-0.04 (-0.69)	-0.23 (-0.25)	0.02 (1.61)	-12.62 (-1.02)	-0.24*** (-2.58)	-1.74 (-1.16)	0.21 (0.94)
<b>Institutional/ Structural Factors</b>								
IT	8.79** (2.23)	0.07 (1.57)	0.10 (0.10)	0.008 (0.63)	1.20 (0.26)	-0.01 (-0.18)	-1.00 (-0.80)	0.02 (1.31)
CU	13.44 (1.88)	0.007 (0.12)	0.24 (0.29)	0.004 (0.34)	-	-	-	-
CBI	6.09 (0.28)	0.22 (0.87)	-5.64* (-1.74)	0.07 (1.34)	-17.56 (-0.67)	0.07 (0.16)	-8.73* (-1.72)	0.15** (2.01)
Labor Markets	-9.30 (-0.81)	-0.25** (-2.25)	1.18 (0.78)	-0.008 (-0.34)	1.54 (0.10)	-0.30* (1.82)	2.77 (1.24)	0.02 (0.70)
Governance (WB)	40.00* (1.86)	0.69** (2.66)	-2.45 (-0.70)	0.11* (1.87)	131.62*** (3.59)	2.10*** (5.36)	1.08 (0.17)	-0.03 (-0.35)
Openness	0.00005 (0.003)	0.0008*** (4.56)	-0.006** (-2.00)	0.0000 (0.25)	-0.04 (-0.67)	0.0003 (0.58)	-0.008 (-1.36)	0.0002** (2.09)
D1	3.20 (0.34)	0.04 (1.52)	0.12 (0.11)	0.02 (0.96)	5.45 (0.43)	0.23** (2.07)	-1.23 (-1.02)	0.02 (1.16)
D2	6.00 (0.83)	0.10* (1.76)	-1.36* (-1.85)	0.02* (1.92)	14.15 (1.54)	0.26*** (4.18)	-1.73** (2.53)	0.01 (0.99)
CEE	16.07** (2.30)	0.29*** (3.12)	-0.59 (-0.49)	0.05*** (2.95)	6.72 (0.44)	0.32** (2.34)	-1.74 (-0.72)	0.02 (0.59)
RS	-	-	-	-	-45.92* (-1.80)	-0.80* (-1.92)	4.95 (1.21)	-0.09 (-1.41)
d.f.	26	26	26	26	8	8	8	8
$\bar{R}^2$	0.29	0.28	-0.06	0.34	0.27	0.56	-0.51	-0.16

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

Dependent Variable	Business Cycle Synchronization Index ( $\rho_{ij}$ )			
	(I)	(II)	(III)	(IV)
constant	-0.151 (0.178)	-0.473 (0.346)	-0.064 (0.177)	0.103 (0.164)
Trade Intensity ( $T_{ij}$ )	0.005*** (0.0025)	0.006 (0.0036)	(0.004) (0.0027)	0.006** (0.002)
Financial Linkages ( $\phi_{ij}$ )	-	0.169 (0.357)	-	-
Distance ( $D_{ij}$ )	-0.055*** (0.009)	-0.026* (0.014)	-0.055*** (0.009)	-0.445*** (0.009)
Macro Factors <sup>†</sup>	0.003 (0.009)	-0.008 (0.016)	0.002 (0.009)	-
Institutional Factors <sup>†</sup>	-0.011 (0.008)	-0.028* (0.016)	-0.009 (0.008)	-
$\ln(GDP_i + GDP_j)$	0.171*** (0.032)	0.188*** (0.063)	0.145*** (0.032)	0.095*** (0.030)
$T_{ij} \times DC$	-	-	0.014** (0.006)	
BothIT	-	-	0.091*** (0.019)	
Inflation (DD)	-	-	-	-0.070*** (0.016)
Labor Markets	-	-	-	-0.016 (0.013)
d.f.	633	159	631	784
$\bar{R}^2$	0.12	0.15	0.15	0.19

<sup>†</sup> Using principal components

Table 4: Determinants of Business Cycle Synchronization

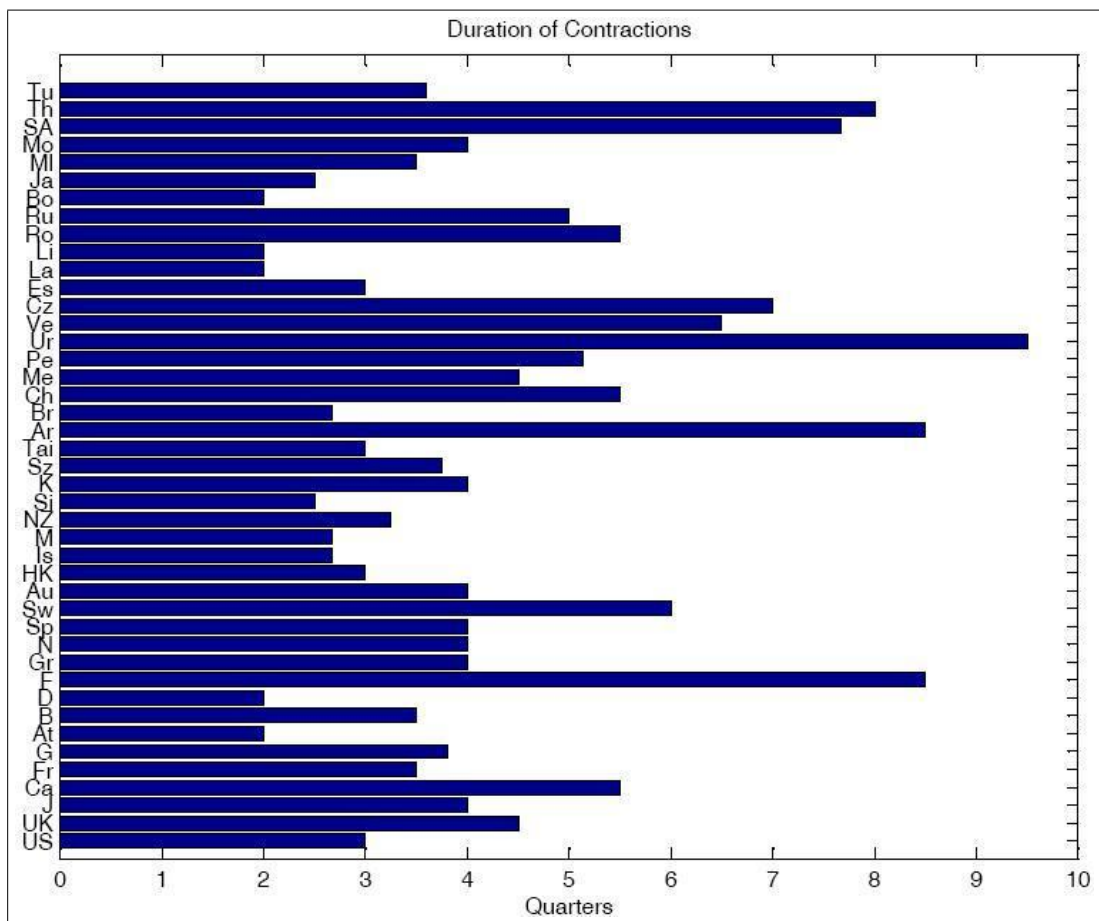


Figure 1: Duration of Contractions

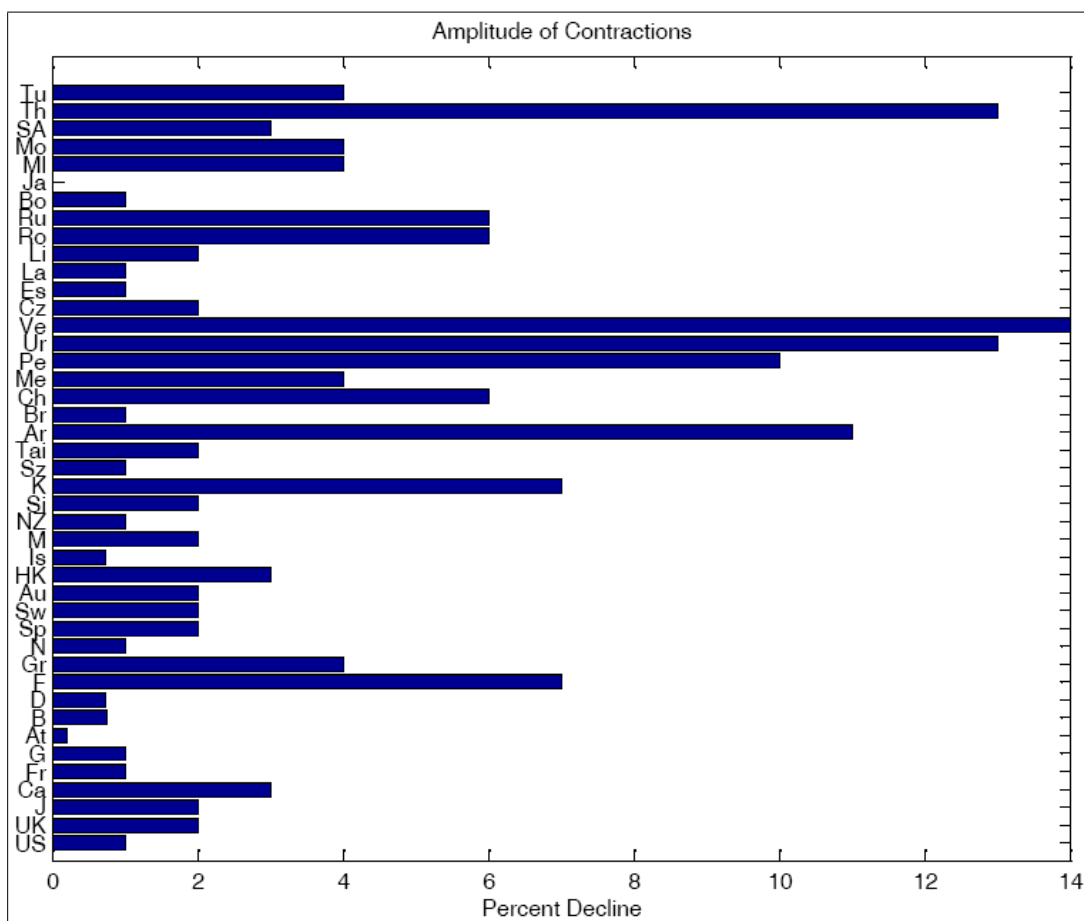


Figure 2: Amplitude of Contractions

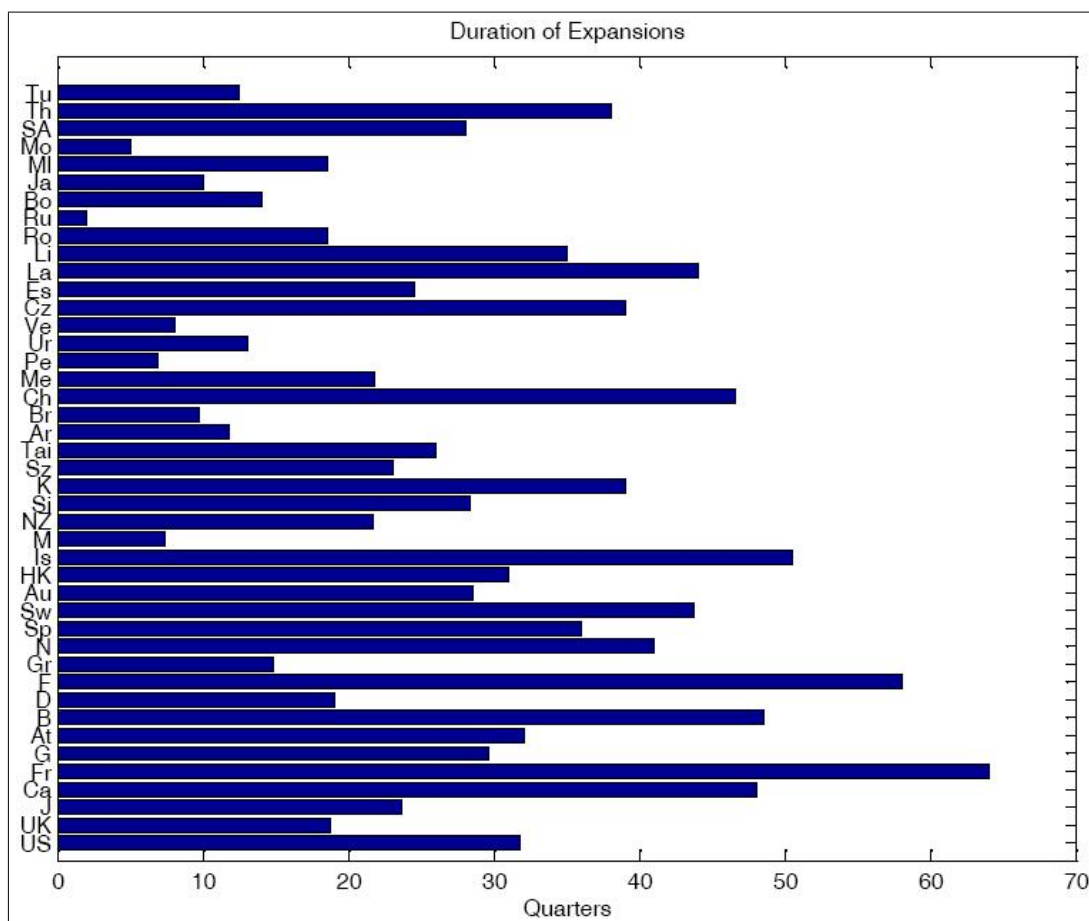


Figure 3: Duration of Expansions



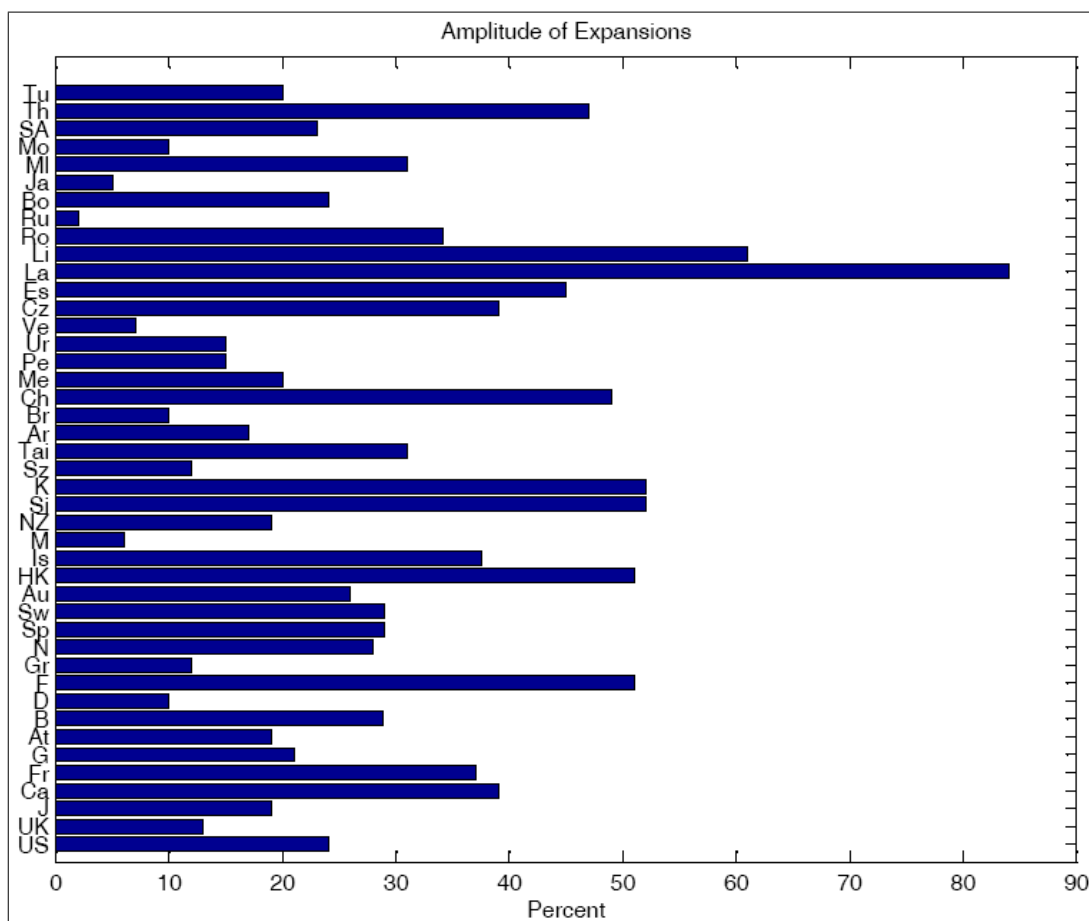


Figure 4: Amplitude of Expansions