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CAPITAL MARKET, FREQUENCY OF RECESSION, AND FRACTION OF TIME THE ECONOMY IN RECESSION

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Abstract

This paper investigates the relationships of capital markets, frequency of recession, and fraction of time the economy is in recession. The main finding is that frequency of recession is not robustly linked to measures of capital market development. However, the fraction of time the economy spends in recession is significantly related to capital market development, though the marginal effect is small. This implies that countries with more advanced capital markets would tend to spend lower proportion of time in recession. Results are generated using quarterly data of thirty-five countries from 1975 to 2004.

JEL: C33, C35, E32, E44, G00, G21

Keywords: business cycle, capital market, financial development, financial structure, panel data, market-based, bank-based

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1. Introduction

"Given the close link between the financial sector and household and firm balance sheets, a key question is how these differences in financial systems affect macroeconomic behaviour. ... Yet few empirical studies to date have analysed the effect of different financial structure on business cycle behaviour -attention has mostly focused on the role of overall financial development for growth performance."

World Economic Outlook, September 2006

In contrast to the large and growing literature on the impact of finance and growth [e.g. Demirguc-kunt and Levine (2001)], theoretical and empirical work on the relationship between finance and various aspects of business cycles has been relatively scarce, and even fewer papers on the effects of capital markets. This gap in the current research is quite surprising given the importance of business cycles in the study of macroeconomics. This paper extends previous research in this field by empirically investigating the effects of capital markets on certain aspects of business cycles, namely frequency of recession, and fraction of time the economy spends in recessionary periods.

Theoretically, capital market development would lower macroeconomic volatility. The effect works through several channels. First, corporate information is much more accessible in an economy with developed capital markets because investors would require both transparency and disclosure to have any confidence to invest directly in particular firms. In other words, capital market development helps reduce existing information asymmetry, and according to Greenwald and Stiglitz (1993), this would lead to lower volatility. Second, by allowing firms and investors easier access to saving, and investment opportunity respectively, capital market development would reduce market imperfection in the form of unequal access to investment across individuals. Since this imperfection would generate endogenous aggregate fluctuations [Aghion et al. (1999)], capital market development would reduce macroeconomic fluctuations. Third, according to Acemoglu and Zilibotti (1997), the inability to diversify idiosyncratic risk and the desire to avoid highly risky investment introduce large uncertainty in the growth process. Therefore, by providing better diversification for both entrepreneurs and investors, capital market development would dampen cyclical fluctuations. Lastly, capital market development would make lending decision relying less on long-term relationship, found more prominently in bank lending. Haan et al. (1999) suggest that this long-term relationship is vulnerable to break up in periods of low liquidity and the break-ups would lead to feedbacks between investment and financial intermediation that magnify the effect of shocks. Since lending decision is depending less on this relationship in the economy with more developed capital markets, the effect of shocks is dampened.

Capital market development affects business cycles not only in terms of volatility or severity [see Tharavanij (2007a) and Tharavanij (2007b)]but also in terms of frequency of an economy falling into recessions (fragility), and the amount of time for the economy to recover from those recessions. The reasons are the following. First, capital market development would make it easier for outside investors and other intermediaries to replace failing intermediaries in providing any further credit to their clients [Rajan and Zingales (2001)]. This fact would limit the extent of output loss from credit shortage to healthy debtors due to failing or under capitalized or unwilling to lend intermediaries. Moreover, outside investors have more ability to invest and restructure failing firms or intermediaries because of higher transparency and disclosure in well-developed capital markets. This ease of restructuring is a needed flexibility for the economy to recover quickly from any adverse shocks. Second, capital market development would allow an efficient alternative form of financing in extra to just bank lending. This would enable financial systems under stress to maintain an adequate degree of intermediation should any crisis happens in the banking sector [Greenspan (2000)]. This fact would also limit severe output contraction, and allow the economy to recover quickly from shocks.

The empirical results support a theoretical prediction that countries with more advanced capital markets would spend a lower fraction of time in recessions. However, the effect does not seem to work through the frequency of which those recessions happen.

This paper is organized as follows. Section 2 provides literature review. Section 3 discusses measurement issues. Section 4 provides discussions of data construction and data description. Section 5 is an explanation of methodology. Section 6 discusses estimation results from econometric analysis of capital market development and frequency of recession. Likewise, section 7 discusses results from econometric analysis of capital market development and fraction of time the economy in recession. Finally, section 8 contains policy implication and conclusion.

2. Related Literature

The standard neoclassical theory assumes that financial systems function efficiently, and as a result, financial factors are often abstracted from the analyses. However, more recent work has established relationships between the working of financial system and business cycles. Key functions of a financial system, according to Merton and Bodie (2004), are to facilitate capital formation and efficient allocation of risk bearing, and to allow agents to manage risks effectively. These functions are performed both through intermediated channel, such as financial intermediaries (e.g. banks), and non-intermediated channel or capital markets, such as bond, equity and derivative markets. As such, a whole financial system is composed of both financial intermediaries, and capital markets. Capital markets, as one of the key component in a financial system, play a crucial role in the relationship between the well functioning of the whole financial system and business cycles.

Before we go into a review of empirical work, it is beneficial to familiarize with one of the most popular terms in the finance and growth literature [e.g. Beck et al. (2000b)], namely "Financial Development". The term itself conveys the idea that it is a measure of overall development in a whole financial system in performing its functions. However, it is not. It is actually a quantitative measure of how well financial intermediaries perform its function in terms of financing real investment or spending of both firms and households. For instances, one of the most popular measure of financial development is private credit over GDP ratio. It measures only development in "indirect financing" channel or intermediated part of a whole financial system. It does not capture any development in the capital market part of the system. This paper uses both measures of financial development and capital market development in the empirical analysis.

There are only few empirical studies on the impact of financial development or capital markets on frequency of recession or fraction of time the economy spends in recession. Easterly et al. (2000) performed a probit analysis of an economic downturn, defined as negative GDP per capita growth. They found that financial development, measured by the ratio of credit to GDP, is marginally significant and the sign is positive. This implies that financial development increases the likelihood of a downturn. However, they also found that development of equity market, measured by stock market value traded over GDP, has the negative sign and is highly significant. They reason that stock market provides better risk diversification than do debt markets, and thus make the economy less vulnerable to an economic downturn.

Larrain and Choi (2004) analysed, not the causes of recessions, but the determinants of their length. They applied count-data models (Poisson and Negative Binomial) and seemingly unrelated regressions (SUR) to model duration of recession. They found that countries with higher financial development experience shorter recessions. Methodologically, Larrain and Choi (2004) used quarterly GDP series to identify recessionary periods across countries. All other variables were in annual frequency. They defined a recession as a period with two or more consecutive of negative quarterly GDP growth- defined as percentage change of the series over a year ago. This method avoids the use of mechanical filters and ad-hoc seasonality adjustments for individual countries and also has the advantage of being simple and objective.

3. Measurement Issues

Financial Development

Ideally, one would like measures of financial development, which indicate the degree to which the financial system ameliorates information asymmetry and facilitates the mobilization and efficient allocation of capital. Particularly, one would prefer indicators that capture the effectiveness with which financial systems research firms and identify profitable investment, exert corporate control, facilitate risk management, mobilize saving, and ease transaction [Merton and Bodie (2004)]. Unfortunately, no such measures are available. As a result, one must rely on several proxies of financial development that existing empirical work shows are robustly related to economic growth or other components of aggregate output.

The most commonly used measure of financial development [e.g. Levine and King (1993), Denizer, et al. (2000)] is "Private Credit", defined as the ratio of domestic credit extended to the private sector by financial intermediaries to GDP. More specifically, domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. This measure captures the amount of credit channelled through financial intermediaries to the private sector. Beck, et al. (2000b) show that Private Credit is a good predictor of economic growth and the positive correlation between the two is not due to reverse causality.

The alternative measure is the "Liquidity Ratio", defined as the ratio of liquid liabilities (usually M3) to GDP. Levine and King (1993) introduce this variable under the name "Financial Depth" to proxy for the overall size of the formal financial intermediary sector relative to economic activity. However, such monetary aggregates do not differentiate between the liabilities of various financial institutions, and may not be closely related to financial services such as risk management and information processing [Levine and King (1993)].

This study uses "Private Credit" as a primary measure of financial development. However, it also employs the "Liquidity Ratio" as an alternative measure for robustness check.

Capital Market

Measures of capital market development can be broadly classified into two categories: absolute and relative measures. An absolute measure identifies the level of capital market development itself without reference to other developments in the financial system. Alternatively, a relative measure attempts to measure the importance of direct financing via capital markets relative to indirect financing via financial intermediaries, particularly banks. These measures were first developed to classify financial systems as bank-based or market-based systems [Levine (2002)]. Given that these relative measures compare different components of the financial system, they can be used as measures of financial structure.

Absolute measures of capital market development usually involve the size and liquidity of stock markets and/or bond markets [Beck and Levine (2002)]. Most cross-country studies use only stock market data because bond market data are usually not available for emerging economies. The standard measure is the "Turnover Ratio", defined as the value of shares traded on domestic exchanges divided by the total value of listed shares. Basically, it indicates the trading volume of the stock market relative to its size. One advantage of this measure is that it is relatively immune to business cycle and asset price fluctuation because prices appear both in the numerator and the denominator. An alternative measure is "Value Traded", defined as the value of the trades of domestic shares on domestic exchanges divided by GDP. It measures trading relative to the size of the economy. Since value traded is the product of quantity and price, this indicator could rise just from favourable expectation of the future without any increase in transactions activity. Turnover ratio does not suffer from this shortcoming. The other alternative measure is "Capitalization Ratio", defined as the total stock market capitalization over GDP. This measure suffers the same weakness as "Value Traded". This paper uses "Turnover Ratio" as an absolute measure of capital market development and uses "Value Traded" and "Capitalization Ratio" as alternative measures for robustness checks.

Relative measures of capital market development gauge the development of capital markets relative to that of financial intermediaries, particularly the banking sector. In the literature they are known as measures of "Financial Structure", indicating whether the financial system is market-based or bank-based. Since there is no single accepted definition of financial structure, Beck et al. (2001) construct several indicators where higher values indicate that a financial system is more market-based. They aggregate these indicators into a single financial structure index. The first indicator is Structure-Activity, which measures stock market activity relative to that of banks. It is defined as the log of the ratio of Value Traded (defined as “value of total shares traded on the stock market divided by GDP”) over Bank Credit (defined as “the claims of the banking sector on the private sector as a share of GDP”).The second indicator is Structure-Size, which compares the sizes of the stock market and the banking sector. Specifically, it is defined as the log of the ratio of Market Capitalization and Bank Credit. Market Capitalization is defined as "the value of listed shares divided by GDP." Bank Credit represents the claims of the banking sector on the private sector as a share of GDP. Compared to Private Credit, this measure focuses on the commercial banking sector only, excluding the claims of non-bank financial intermediaries. Levine (2002) also proposed another indicator, Structure-Efficiency, defined as the log of the value traded ratio multiplied by overhead costs. Overhead costs equal the overhead costs of the banking system relative to banking system assets.

The aggregate measure of financial structure is the Structure-Aggregate index which combines the three previous measures. Specifically, it is the first principal component of Structure-Activity, Structure-Size and Structure-Efficiency. In previous studies [e.g. Levine (2002)], countries with a Structure-Aggregate index higher or equal to the sample mean are classified as having a market-based financial structure.

Conversely, countries with an index lower than the sample mean are classified as having a bank-based financial structure.

This study uses the "Structure-Aggregate index" as a relative measure of capital market development. However, the structure-aggregate index was constructed as the first principal component of structure-activity and structure-size indices only. The reason is that data required to construct the structure-efficiency index are not available for a number of countries and periods.

The "Financial Structure Aggregate Index" is used mainly for robustness check, and more importantly for a comparison purpose with an absolute measure of capital market development, turnover ratio. By using the index as a relative measure of capital market development, the applied methodology here related financial structure and growth literature with this study. The interpretation of results in this study should not be that a country should pursue any particular form of "financial structure" (bank-based or market-based), but rather whether a country also need well-developed capital markets, and not only financial intermediaries, to achieve more stable financial system and lower volatilities.

Recession

Stock and Watson (1998) point out two approaches in empirical analysis of business cycle. The classical technique of business cycle analysis was developed by researchers at the National Bureau of Economic Research (NBER) [Burns and Mitchell (1946)]. Conceptually, NBER researchers define a recession as a significant decline in the level of aggregate economic activity that lasts for more than a few months and define an expansion as a sustained increase in the level of activity. Practically, they determined business cycle turning points using a two-step process. First, cyclical peaks and troughs (respectively, local maxima and minima) were determined for individual relevant economic series (e.g. output, income, employment, and trade, both at the sectoral and aggregate levels). Second, common turning points were determined by comparing these series-specific turning points. If, in the judgement of the analysts, the cyclical movements associated with these common turning points are sufficiently persistent and widespread across sectors, then an aggregate business cycle is identified and its peaks and troughs are dated. The classical business cycle refers to absolute declines in output and other measures.

Though the classical cycle refers to the behaviour of the level of a variable, the analysis of its turning points could also be done with growth rates (first log-differenced series), Δyt, and sign of Δyt. An example of a heuristic "sequence rule" to locate a peak at t is {Δyt > 0, Δyt+1 < 0, Δyt+2 < 0} and a trough at t is {Δyt < 0, Δyt+1 > 0, Δyt+2 > 0}. This leads to the commonly quoted "two periods of negative growth in GDP" rule to define a recession. It is important to realize that the rule is not for locating a cycle in Δyt; rather Δyt is just an input into the dating process of the classical cycle [Harding and Pagan (2002)].

The classical cycle approach has the advantage that no trend modelling is needed, and that output loss from a contraction is well defined and easily measured as a loss relative to peak output.

An alternative approach to study economic cyclical fluctuations is to examine deviations from economic variable's long-run trends. The resulting cyclical fluctuations are referred to as growth cycles. Whereas classical cycles tend to have considerably shorter recessions than expansions because of underlying trend growth, growth recessions and expansions have approximately the same duration. Within "growth cycle" framework, a recession is defined in terms of output gap from long-term trend, calculated by means of mechanical filters such as Hodrik-Prescott, or

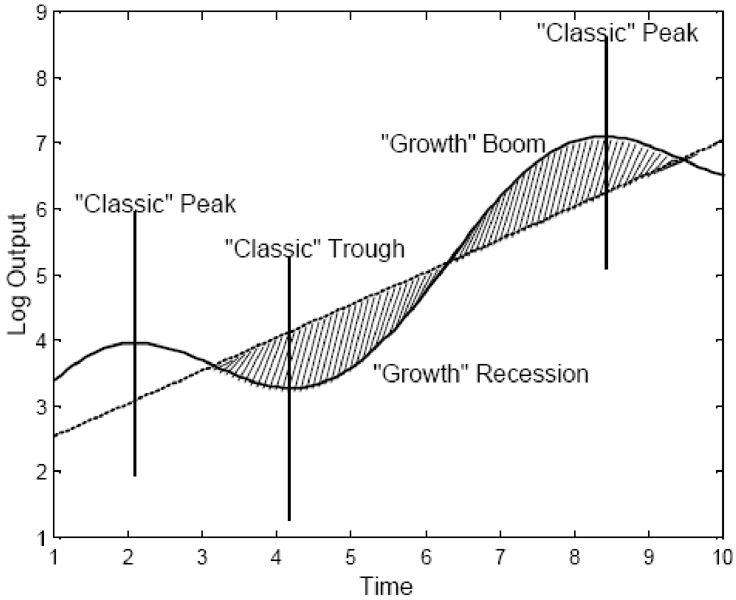
Baxter-King. Once produced, these estimates of potential GDP series are used as a benchmark. Negative deviations of the real data from this trend would represent negative business cycles, or in other words, recessions. However, the drawback of these mechanical methods is that they accommodate to real observations, fictionally creating equal number of positive and negative deviations. Furthermore, the result is also sensitive to the detrending method applied.

Figure 1 illustrates the difference between a growth cycle and a classical cycle in a stylized example assuming a log linear trend. It is noteworthy that the "growth boom" will start after the economy turn to an expansion phase, and last even after the economy faces a recession.

Figure 2 shows a stylized recession with A being the peak, and C the trough. The height of the triangle is the amplitude and the base is the duration.

One of the salient features of business cycle is its output loss due to recession. There are two standard measures for this loss: first, percentage loss of output at trough compared to peak, and second cumulative percentage loss. Figure 3 shows a graphical meaning of both peak-to-trough output loss and cumulative output loss due to recession.

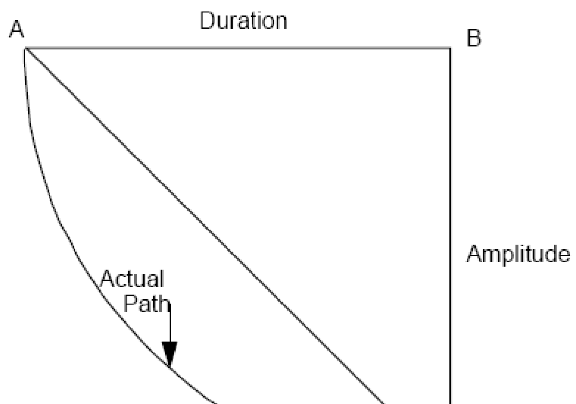
Figure 1: Classical versus Growth Cycle



Source: Christoffersen (2000)

Notes: The vertical lines show the "classical cycle" turning point dates. The period from peak to trough is "classical contraction phase", and the period between troughs to peak is "classical expansion phase". The shaded area below the trend line is "growth cycle recession" and the shaded area above the trend line is "growth cycle boom".

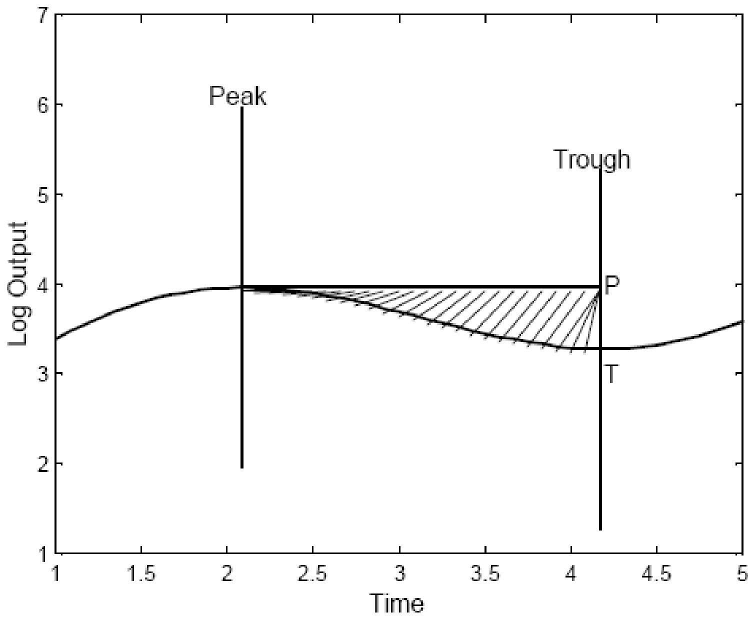
Figure 2: Stylized Recession Phase



Source: Harding and Pagan (1999)

Notes: The height of the triangle is the amplitude and the base is the duration. The area of the triangle approximates the cumulated losses in output from peak to trough, relative to the previous peak.

Figure 3: Cumulated versus Peak-to-Trough Loss Calculations



Source: Christoffersen (2000)

Notes: The distance from point P to point T indicates the peak-to-trough loss calculation, and the shaded area represents the cumulated loss calculation.

Recent studies have shown that NBER peaks and trough can be closely approximated by applying a business cycle dating algorithm to real GDP [Harding and Pagan (2002)]. Normally, the algorithm looks for peaks and troughs in overlapping five quarter periods and then picks those pairs that result in cycles (peak to peak) that are at least five quarters long and phases (peak to trough) that are at least two quarters long.

The best known algorithm for performing these tasks is the Bry and Boschan (1971) procedure (BB procedure). The general procedure is to look for turning points in some smoothed version of a seasonally adjusted series. The algorithm begins with finding initial estimates of the turning points in highly smoothed series (say, a 12-month moving average). Using these initial estimates, a somewhat less smooth curve is investigated (a Spencer curve, which is a 15-month centered moving average with the terms near the centre receiving the largest weight and the extreme terms receiving a negative weight) to refine the dates of the turning points. The final turning points are determined using the unsmoothed series and verifying that the turns satisfy a set of restrictions. The restrictions are usually that peaks and troughs alternate, that cycle duration is at least five quarters, and that expansion and contraction phases are at least two quarters long.

A variant of BB, called BBQ, was developed by Harding and Pagan (2002). It omitted the smoothing in the BB algorithm but retained other key principles of the BB algorithm. It also made the minimum phase and cycle lengths be two and five quarters respectively. Faster algorithms for located turning points have been later developed by Artis et al. (2004). Engel (2004) wrote the program to implement this algorithm, called MBBQ, in MATLAB code.

This paper uses classical business dating method in the analysis because it avoids arbitrariness of mechanical filters and also this method has the advantage of being simple, objective and easy to implement. Specifically, the algorithm applied to identify turning points was MBBQ. The MATLAB code was downloaded from www.ncer.edu.au/data/.

Frequency of Recession, and Fraction of Time in Recession

Frequency of recession is defined as the number of observed recessions during the observation period divided by the length of that period (in number of years). For example, the National Bureau of Economic Research (NBER) has analysed the US business cycle over a period of 152 years (1854 through 2005) and determined that in this time there were 32 recessions [Potter (2006)]. This implies that approximately two recessions occurred in every decade. More precisely, a recession occurred on average once every 4.75 years.

In the following analysis, frequency of recession is measured by the average number of recessions per ten year interval. The length of time period is important because it may not capture the business cycle and any associated recession if it is too short. However, extending the period too long runs the risk that the structural relationship of the cycle may change. The duration of ten years seems to constitute an appropriate time frame since the study of recession in the US has demonstrated that a recession occurred on average every 4.75 years, albeit in that particular country. Extending the time frame to approximately double that period should accommodate country-specific characteristics that may affect the average length while remaining within a time frame of sufficiently stable structure for proper measurement of the frequency of recession. Another argument of support for this time frame is that the entire business cycle is usually considered as the cyclical variation of aggregate output that lasts 2 to 8 years [Haug and Dewald (2004)]. Therefore, a period of 10 years would cover the entire cyclical variation usually associated with the business cycle.

The drawback of frequency as a measure is that it does not provide any reliable indication of the duration of a recession or an expansion [Potter (2006)]. For instance, if a recession occurs on average once every two years, it does this follow that the average length of expansion is two years. To illustrate, if a recession lasts for ten years on average, and if unconditionally recession is as likely as expansion, then the frequency of recession is also about one out of two, or once every two years. However if the economy just reached the trough, the next recession would be expected to happen in ten years, not in two years.

To overcome this ambiguity, the analysis investigates explicitly the fraction of time the economy in recession not only its frequency. Fraction of time in recession is defined as the number of quarters the economy is in recession divided by the total number of quarters in the observation period.

4. Data

Data cover 35 countries from 1975:q1-2004:q4. Every country in the analysis has at least 8 years (or 32 quarters) of quarterly real GDP data. Variable description and name list of countries in the sample classified by income level are in Appendix A and in Appendix B respectively.

For estimating the frequency of recession the business cycle dating algorithm is applied to determine turning points of quarterly GDP data obtained from International Financial Statistics (IFS). The number of recessions that occurred within each ten year interval (1975:q1-1984q4, 1985q1-1994q4, and 1995q1-2004q4) was counted. If there are fewer than 20 data points within a particular interval the corresponding observation in the panel for that interval is treated as missing. In this way, not too many data in the constructed panel are lost, and the transformed data are still representative of the corresponding years. The fraction of time the economy in recession is calculated as the ratio of the number of quarters the economy is in recession over the total number of quarter with available data within each decade.

Explanatory variables were of annual frequency. The annual variables are transformed into panel for each ten year period using the averages or the beginning values.

Characteristics of Business Cycles across countries

Table 1 shows business cycle turning points across countries. P stands for peak and T for trough. Note that the single recession in Korea lasted only one quarter. This is usually not the case because the business dating method imposes the condition that the expansion or recession phase lasts at least two quarters, except in a case of deep depression in which output drops more than a specified percentage point (in this case ten percent). This was what happened in Korea, of which the output dropped by more than ten percent in one quarter. Ireland did not have any turning points because of her continual economic expansion. Even though Ireland experienced growth recessions she never had a drop in absolute output.

Table 2 shows selected statistics of business cycles. On average, a country in the sample has a recession of 1.3 times in a period of ten years. Total amount of time in recession is 14.6% or approximately six quarters in ten years (40 quarters). On average, recession lasts for 3.3 quarters.

Frequency of Recession across countries

Table 3 shows histogram for frequency of recession. It also reveals that on average a country has 1.3 times of recession in ten years. The maximum number of recession in the sample is 4 times in a decade.

Table 4 shows one-way tabulation of frequency of recession. Frequency of once or twice in a decade amounted to more than half of the cases in the sample. There was about twenty percent of the case that no recession had occurred in a decade. There was only one case of four recessions within ten years.

Table 5 shows frequency of recession across countries. The full sample covered a period of thirty years from 1975:q1 to 2004:q4. Number of recession was counted within each ten year interval. Therefore, full sample would imply three observations. There were missing data in countries with less than three observations.

Fraction of Time the Economy in Recession

Figure 6 shows histogram for fraction of time in recession. It reveals that countries have approximately fifteen percent or six quarters in recession during the period of ten years. The distribution is inflated at zero. There was 22.1% of the sample that countries do not have any recessionary period in a decade.

Table 7 shows one-way tabulation of fraction of time in recession. There were two peaks in the distribution. The first peak was a fraction of zero and amounted to 22.1% of the case. The second peak was a fraction of fifteen percent and amounted to 12.8% of the case.

Table 8 shows fraction of time in recession across countries. The full sample covered a period of thirty years from 1975:q1 to 2004:q4. Number of recession was counted within each ten year interval. Therefore, full sample would imply three observations. There were missing data in countries with less than three observations.

5. Methodology

5.1 Estimation Strategy for Frequency of Recession

The main empirical questions are whether capital market or financial development has any effect on frequency of recession. The estimation methods are Quasi Maximum Likelihood Estimation (QMLE). This section is organized as follows. Section 5.1-1 would discuss pooled estimation. Section 5.1-2 and 5.1-3 would discuss random effects and fixed effects estimation respectively.

5.1-1: Poisson Regression

The empirical model is panel Poisson regression models, including pooled, random effects, and fixed effects. Fundamentally, the Poisson regression model specifies that the number of event occurred, y_i, is drawn from a Poisson distribution with a mean parameter λ_i, which is then related to the regressors, x_i. The equation of the model is

$$\text{Prob}(Y_i = y_i \mid x_i) = \frac{e^{-\lambda_i} . \lambda_i^{y_i}}{y_i\,!} \qquad , y_i = 0, 1, 2, ...$$

The mean equation is modelled as log-linear.

$$m(x_i, \beta) = \lambda_i = e^{x_i'\beta}$$

The expected number of events per period, and the variance of number of events occurred are the same, and given by

$$E[y_i \mid \mathbf{x_i}] = Var[y_i \mid \mathbf{x_i}] = \lambda_i = e^{x_i'\beta}$$

The Marginal Effect of x_i is

$$\partial\, E[y_i \mid \mathbf{x_i}] / \partial\, \mathbf{x_i} = \lambda_i . \beta$$

The Poisson model has been criticized because of its implicit assumption that the variance of y_i equals its mean. However, within panel regression framework, Poisson regression has a nice robustness quality in the sense that consistent estimation only requires correctly specified mean function. This point will be discussed further.

The above specification implicitly assumes that each observation was "at risk" of an event occurring for the same amount of time. This assumption could be relaxed easily. Different exposure time can be incorporated into the Poisson model. Let τ_i be the amount of time that observation i is at risk. If the expected number of event occurred per period is λ_i , then we would expect $\lambda_i.\tau_i$ to be the expected count over a period of length τ_i. So, the count model equation becomes

$$\begin{aligned} \lambda_i.\tau_i &= \exp(x_i'.\beta).\tau_i \\ &= \exp(x_i'.\beta + \ln \tau_i) \end{aligned}$$

This shows that the effect of different exposure times can be included as the log of the exposure time with a regression coefficient constrained to equal one.

The Poisson model can be estimated with maximum likelihood techniques. The log-likelihood function is

$$\text{Max}_{\text{wrt.}\beta} \ln L = \sum_{i=1}^{n} [-\lambda_i + y_i x_i'\beta - \ln y!]$$

Where, , $\lambda_i = e^{x_i'\beta}$

Note that the last factorial term is usually dropped in the maximization routine, since it does not contain the parameters that are being optimized.

At convergence, the asymptotic covariance matrix for the parameter is provided by

$$Var(\hat{\beta}) = [\sum_{i=1}^{n} \hat{\lambda}_i x_i x_i']^{-1}$$

Where, $\hat{\lambda}_i = e^{x'\hat{\beta}}$

The Poisson model has no natural counterpart to the R2, because the conditional mean is not linear and the regression is heteroscedastic. The pseudo-R2 (or likelihood ratio index) is calculated as

$$R^2_{LRI} = 1 - \frac{\ell(\hat{\lambda}_i, y_i)}{\ell(\bar{y}, y_i)}$$

This measure compares the estimated model's log likelihood (ℓ) with that of the constant only model. It is bounded by zero and one and increases as regressors are added to the model.

The mean equation is specified as the following.

$$\ln \lambda_{it} = \beta_0 + \beta_1.FD_{it} + \beta_2.FS_{it} + \beta_3.X_{it} + \ln \tau_{it}$$

λ_{it} is an expected number of recession occurred. FD is a measure of financial development, namely log of private credit ratio (credit). FS is a measure of capital market development. An absolute and a relative measure would be log of turnover ratio (turnover) and financial structure-aggregate index (struc), respectively. X is a vector of standard controlled variables[see e.g. Lopez and Spiegel (2002), Beck et al. (2003)]: log of GDP per capita, average growth rate of GDP per capita, standard deviation of changes in terms of trades, standard deviation of changes in real effective exchange rate, standard deviation of inflation, average log changes of terms of trade, average inflation rate, log of openness ratio, and government consumption over GDP. τ is an exposure or more specifically, number of quarters of country i during the time period t, of which data is available. If there is no missing, then exposure would be 40 quarters for 10 year period.

5.1-2: Random effects Poisson

Random effects Poisson regression takes into account random unobservable heterogeneity among cross-sectional units. A multiplicative random effects Poisson model maintains the following assumptions for a random draw i from the population. Let c_i be the unobserved, time-constant effect and $m(x_{it},\beta) = \lambda_{it} = \exp(x_{it}.\beta)$ be the mean equation.

1. $E(y_{it} \mid x_{i1}, \dots , x_{iT} , c_i) = c_i.m(x_{it},\beta) = c_i.\lambda_{it}$
2. $E(c_i \mid x_{i1}, \dots , x_{iT}) = E(c_i) = 1$
3. c_i is independent of x_i (i.e. uncorrelatedness of the regressors and the heterogeneity)
4. c_i distributed as Gamma distribution with $E(c_i)=1$ and $Var(c_i) = \eta^2$

If the above assumptions hold, the conditional maximum likelihood estimator (MLE) is efficient among all estimators that do not use information on the distribution of xi. Quasi-MLE random effects estimation produces consistent estimators under conditional mean and exogeneity assumptions (i.e., assumption 1, 2 and 3 above). However, we need to use robust variance estimator to get appropriate variances. Wooldridge (2002) provides further details.

The approach is to formulate the joint probability conditional upon the heterogeneity, then integrate it out of the joint distribution.

$$p(y_{i1}, y_{i2}, ..., y_{iT} \mid c_i) = \prod_{t=1}^{T_i} p(y_{it} \mid c_i)$$

Then the random effects is swept out by obtaining

$$\begin{aligned} p(y_{i1}, y_{i2}, ..., y_{iT}) &= \int c\; p(y_{i1}, y_{i2}, ..., y_{iT}, c_i)\, dc_i \\ &= \int c\; p(y_{i1}, y_{i2}, ..., y_{iT} \mid c_i).g(c_i)\, dc_i \\ &= Ec\,[p(y_{i1}, y_{i2}, ..., y_{iT} \mid c_i)] \end{aligned}$$

$p(y_{it} \mid c_i)$ has a Poisson distribution with mean, $\lambda_{it} = c_i.\exp(x'_{it}.\beta)$, in which ci is distributed as gamma distribution with mean 1 and variance η^2, then $E(y_{it} \mid x_{it}, c_i) = \lambda_{it}$, $Var(y_{it} \mid x_{it}, c_i) = \lambda_{it}[1 + \eta^2.\lambda_{it}]$ [Wooldridge (2002)].

5.1-3: Fixed effects Poisson

Fixed effects Poisson regression takes into account unobservable heterogeneity by estimating time-constant effects for each cross-sectional unit. The major difference from random effects is that fixed effects estimation does not require the assumption of independence between individual effect, c_i, and regressors, x_i, for the estimators to be consistent.

The fixed effects estimator is found by obtaining the joint distribution of $(y_{i1}, y_{i2}, ..., y_{iT})$ conditional on their sum.

Let $n_i = \sum_{i=1}^{T_i} y_{it}$ denote the sum across time of the count. Then,

$$y_i \mid n_i, \mathbf{x_i}, c_i \sim \text{Multinomial } \{n_i, p_1(\mathbf{x_i}, \beta), \ldots, p_T(\mathbf{x_i}, \beta)\}$$

Where the mean equation

$$m(x_{it}, \beta) = \lambda_{it} = e^{x_{it}\beta}$$

and

$$p_t(x_i, \beta) = \frac{m(x_{it}, \beta)}{\sum_{r=1}^{T} m(x_{ir}, \beta)}$$

Because the distribution does not depend on c_i, β can be estimated by standard conditional MLE techniques using multinomial log likelihood. The conditional log likelihood from observation, i , is

$$\ell_i(\beta) = \sum_{t=1}^{T} y_{it}.\log[p_t(x_i, \beta)]$$

The total log likelihood function is just the sum of individual i.

$$\ell(\beta) = \sum_{i=1}^{N} \ell_i(\beta)$$

The estimator of β that maximize the above log likelihood function is the "fixed effects Poisson estimator" (FEP). The FEP estimator is consistent for β under the conditional mean assumption [Wooldridge (1999)].

$$E(y_{it} \mid \mathbf{x_{i1}}, \ldots, \mathbf{x_{iT}}, c_i) = c_i.m(\mathbf{x_{it}}, \beta)$$

Other than that, the distribution of y_{it} given (x_{it} , c_i) is entirely unrestricted. Particularly, there can be over dispersion or under dispersion in the latent variable model. Also, there is no restriction on the dependence between y_{it} and y_{ir} , $t \neq r$. In particular, it allows for any deviations from the Poisson distribution and arbitrary time dependence.

Mathematically, the conditional distribution is given by

$$p(y_{i1}, y_{i2}, \ldots, y_{iT} \mid \sum_{i=1}^{T_i} y_{it}) = \frac{(\sum_{t=1}^{T_i} y_{it})!}{(\prod_{t=1}^{T_i} y_{it}!)} \cdot \prod_{t=1}^{T_i} p_{it}^{y_{it}}$$

where

$$p_{it} = \frac{e^{X_{it}^{'}.\beta+\alpha_i}}{\sum_{t=1}^{T_i} e^{X_{it}^{'}.\beta+\alpha_i}} = \frac{e^{X_{it}^{'}.\beta}}{\sum_{t=1}^{T_i} e^{X_{it}^{'}.\beta}}$$

The robust variance matrix can also be calculated. It is asymptotically valid, depending only on the assumption of correctly specified mean function. Wooldridge (2002) provides further details.

The virtue of dispensing the assumption of uncorrelatedness of the regressors and the group specific effects in fixed effects estimation is substantial. However, dropping this assumption comes at a cost, since it is necessary to estimate the constants, α_i , to compute the probabilities.

A popular alternative to the Poisson model is negative binomial model (NegBin). If the distributional assumption holds, then the NegBin maximum likelihood estimation is more efficient than the Poisson estimation. However, if the assumption fails, maximum likelihood estimators are generally inconsistent [Wooldridge (2002)]. Because of its robustness, the Poisson estimation is preferred in this analysis.

5.2 Estimation Strategy for Fraction of Time the Economy in Recession

Fraction of time the economy in recession is defined as number of quarters the economy in recession over total number of quarters during that period. Since the variable of interest, y, is restricted to the unit interval, the estimation model must take this into account.

A popular method is to assume that the log-odds transformation, log[y/(1-y)], has a conditional expectation of the form $x\beta$. The motivation is that log[y/(1-y)] ranges over all real values as y ranges between zero and one. This allows the estimation of β by OLS. However, the drawback is that it cannot be used if y takes on the boundary values, zero and one. The other weakness is that even if y is strictly between zero and one, it is not possible to recover an estimate of E(y|x), making β difficult to interpret [Papke and Wooldridge (1996)].

The approach to overcome these problems is Fractional Logit Regression [Wooldridge (2002)], which models E(y|x) directly as a logistic function:

$$E(y_i \mid x_i) = G(x_i\beta) = \frac{e^{x_i'.\beta}}{1+e^{x_i'.\beta}}$$

The model ensures that predicted values of y always lie in (0,1) and the effect of any x_j on E(y|x) diminishes as $x\beta$ approaches infinity. The marginal effect of x_j is $\beta_j.g(x.\beta)$, where $g(z) = \exp(z)/[1+\exp(z)]^2$. In application, the marginal effects are evaluated at the means of Xs. By specifying the mean equation above, we make no assumption about an underlying structure of y_i.

The quasi-maximum likelihood estimator (QMLE) of β is obtained from the maximization problem

$$\max_{\text{wrt } \beta} \sum_{i=1}^{N} l_i(\beta)$$

where the log-likelihood function is

$$l_i(b) = y_i.\log[G(x_i b)] + (1 - y_i).\log[1 - G(x_i b)]$$

$\hat{\beta}$ is a consistent estimator of β, provided that the mean equation is correctly specified. In other words, the QMLE estimator, $\hat{\beta}$, is consistent and √N-asymptotically normal regardless of the distribution of y_i conditional on x_i.

The robust standard errors are computed by the following.

$$g(z) = d\,G(z)/d\,z\ ,\ \hat{G}_i = G(x_i.b)\ ,\ \hat{g}_i = g(x_i.b)\ ,\ \hat{u}_i = y_i - G(x_i.b)$$

Define,

$$\hat{A} = \sum_{i=1}^{N} \frac{\hat{g}_i^2 .x'_i .x_i}{[\hat{G}_i(1-\hat{G}_i)]}\quad \text{, and } \hat{B} = \sum_{i=1}^{N} \frac{\hat{u}^2 \hat{g}_i^2 x'_i\, x_i}{[\hat{G}_i(1-\hat{G}_i)]^2}$$

A robust asymptotic variance of $\hat{\beta}$ is

$$\mathrm{Var}(b) = \hat{A}^{-1}\hat{B}\hat{A}^{-1}$$

Papke and Wooldridge (1996) provide further discussion.

The regressors (x_i) are the following.

$$E(y_i \mid x_i) = G(x_i\beta) = \frac{e^{z_i}}{1+e^{z_i}}$$

where, $Z_i = \beta_0 + \beta_1.FD_i + \beta_2.FS_i + \beta_3.X_i$

y is a number of quarters the economy in recession over total number of quarters during that period. FD is a measure of financial development, namely log of private credit ratio (credit). FS is a measure of capital market development. An absolute and a relative measure would be log of turnover ratio (turnover) and financial structure-aggregate index (struc), respectively. X is a vector of standard controlled variables[see e.g. Lopez and Spiegel (2002), Beck, et al. (2003)]: log of GDP per capita, average growth rate of GDP per capita, standard deviation of changes in terms of trades, standard deviation of changes in real effective exchange rate, standard deviation of inflation, average log changes of terms of trade, average inflation rate, log of openness ratio, and government consumption over GDP.

6. Econometric Analysis of Frequency of Recession

Table 9 reports results from poisson regression of frequency of recession. Turnover ratio (turnover), an absolute measure of capital market development, is not significant under any estimation method, though still has negative signs. On the contrary, financial structure index (struc), a relative measure of capital market development, is highly significant under pooled and random effects estimation. This is a surprise since both measures (turnover ratio, and financial structure index) have a reasonable high positive correlation of 0.45. Financial development, as measured by private credit ratio (credit), is not significant but consistently has negative sign. Among explanatory variables, average growth rate is consistently highly significant as expected. Other variables, including income level (gdp), are not significant.

In pooled estimation, LR test (not reported here) of the null hypothesis of equidispersion (basically E(x) = Var(x) as implied by poisson distribution) is also performed. The null hypothesis cannot be rejected even at ten percent in any specification. In addition, the mean frequency of recession of 1.34 is relatively close to the variance of 1.02.

In random effects poisson estimation, individual specific random effects are taken into account. Likelihood-ratio test of the hypothesis that $\eta 2$ (variance of random individual specific effects) = 0 is conducted. The statistic tests whether the random effects model is significantly different from the pool model. If we cannot reject the null, it implies that the random individual effects are not significantly different from zero. The results (omitted from the table) are that in every specification, we cannot reject the null even at ten percent. This implies that random individual specific effects are not statistically different from zero. Basically, we can just rely on pool estimation for any statistical inference. However, random effects estimation relies on the assumption that regressors and random individual heterogeneity are not correlated. If this assumption fails, the estimators would be inconsistent and we have to rely on fixed effects to obtain consistent estimates. Compared to random effects, fixed effects estimation is robust in the sense that it dose not require zero correlation between individual specific effects and other regressors. However, if this condition holds, fixed effects estimation would be inefficient (having larger variance) compared to random effects. The loss in efficiency partly explained why only variable "growth" is significant in fixed effects estimation.

Fortunately, the zero correlation hypothesis can be put to test using "Hausman test" [see Greene (2003), pp. 301-303]. From these statistics, we could not reject the null hypothesis of zero correlation between individual specific effects and other regressors at 10%. This would validate the results of random effects estimation. Furthermore, since in random effects estimation we cannot reject the null hypothesis of zero variance of random individual effects, this Hausman test then also indirectly validate the results of pooled estimation.

In summary, the result seems to indicate that countries with more market-based financial structure (as measured by struc), faster growth, and larger government size would tend to have less frequent recessions. However, this result is not robust with an alternative measure of capital market development or under different estimation method.

7. Econometric Analysis of Fraction of Time in Recession

Table 10 reports results of fractional logit regression. Both Turnover ratio (turnover), an absolute measure of capital market development, and financial structure index (struc), a relative measure of capital market development, are highly negatively significant. Financial development, as measured by private credit (credit), is not significant after control for average growth. Among explanatory variables, average growth rate is consistently highly significant as expected. Other variables except terms of trade volatility (sd-dtot) are not significant

The result indicates that countries with higher capital market development and faster growth would tend to spent shorter fraction of time in recessions.

To control for reverse causality and possible endogeneity of capital market development measures (credit, and struc), and financial development measure (credit), initial value of those variables in each time span in the panel are used instead of the average values. This method would mitigate the reverse causality problem, since it is hard to argue how severity depth in that particular period would affect the level of financial development at the beginning of the period. Moreover, this method also alleviates the problems of endogeniety because plausible endogenous variables are historical given at the first period in the time span.

The result confirms previous finding that countries with higher capital market development, and faster growth would tend to spent lower fraction of time in recessions.

8. Policy Implication and Conclusion

The econometric analysis supports the prediction that countries with more advanced capital markets would spend lower fraction of time in recession. However, the effect does not seem to work through the frequency that recession occurred. Coefficients of capital market development (turnover or struc) are highly negatively significant in fractional logit regression. However, this still leaves the question of whether the magnitude of this effect is economically meaningful.

To investigate the above question concerning the effect on fraction of time the economy spends in recession, the following calculation uses the marginal effect reported in Table 10. The marginal effect is -0.02 or -2%. The inter-quartile range of turnover ratio in the sample is 44.4 (or 1.2 in terms of log difference). Therefore, the effect of an inter-quartile improvement in turnover ratio on fraction of time in recession is 2.4 percentage point decrease. On average, a country in the sample spent 14.7% of time in a decade in recession, the above calculation would imply that an inter-quartile improvement in turnover ratio would decrease this amount to 12.3%.

In summary, this paper investigates the effect of capital market development on frequency of recession and fraction of time the economy spends in recession using quarterly data of thirty-five countries from 1975 to 2004. The main finding is that countries with more advanced capital markets would spend lower amount of time fraction in recession, though the marginal effect is small.

Table 1: Business Cycle Turning

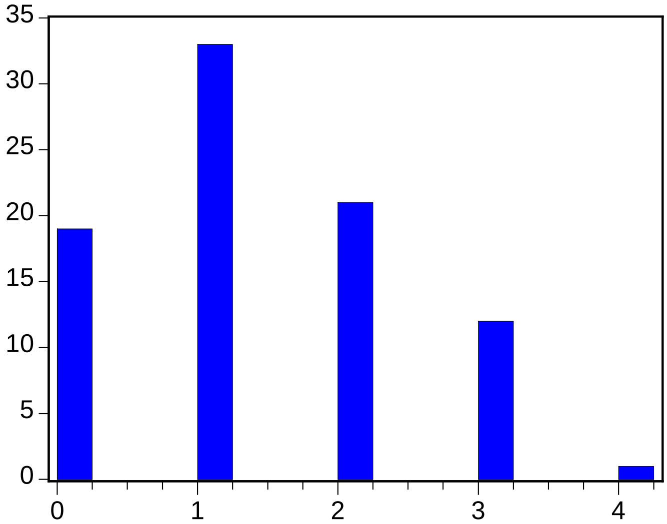
Country	First Data	Obs.	Business Cycles												
1 ARGENTINA	1990-1	60	T:1990-2	P:1994-4	T:1995-3	P:1998-2	T:2002-1								
2 AUSTRALIA	1975-1	120	P:1975-2	T:1975-4	P1977-2	T:1977-4	P:1981-3	T:1983-2	P:1990-2	T:1991-3					
3 BELGIUM	1980-1	100	T:1981-1	P:1982-2	T:1983-1	P:1992-1	T:1993-1	P:2000-4	T:2001-3						
4 CANADA	1975-1	120	P:1980-1	T:1980-3	P:1981-2	T:1982-4	P:1990-1	T:1991-1							
5 CHILE	1980-1	100	T:1982-4												
6 COLOMBIA	1994-1	44	P:1998-2	T:1999-2											
7 DENMARK	1977-1	112	P:1977-3	T:1978-1	P:1980-1	T:1981-2	P:1986-3	T:1987-1	P:1987-4	T:1988-3	P:1989-1	T:1990-4	P:1992-3	T:1993-2	
8 ECUADOR	1991-1	56	P:1996-1	T:1996-3	P:1998-2	T:1999-3									
9 FINLAND	1975-1	120	T:1975-4	P:1990-1	T:1993-2										
10 FRANCE	1975-1	120	P:1992-3	T:1993-2	P:1995-2	T:1995-4									
11 GERMANY	1975-1	120	T:1975-2	P:1980-1	T:1980-4	P1981-3	T:1982-3	P:1992-1	T:1993-1	P:1995-3	T:1996-1	P:2002-3	T:2003-2	P:2004-1	T:2004-3
12 ICELAND	1997-1	32	P:2000-3	T:2001-1	P:2004-1										
13 INDONESIA	1997-1	32	P:1997-4	T:1998-2											
14 IRELAND	1997-1	32													
15 ISRAEL	1975-1	120	P:1975-3	T:1976-1	P:1976-4	T:1977-4	P:1979-4	T:1981-1	P:1988-1	T:1989-1	P:1992-2	T:1992-4	P:2000-3	T:2002-1	
16 ITALY	1980-1	100	P:1980-4	T:1981-3	P:1982-1	T:1982-4	P:1992-1	T:1993-3	P:1996-1	T:1996-4	P:2001-1	T:2001-4	P:2002-4	T:2003-2	P:2004-3
17 JAPAN	1975-1	120	P:1993-1	T:1994-2	P:1997-1	T:1999-1	P:2001-1	T:2001-4	P:2004-1						
18 KOREA	1975-1	120	P:1997-4	T:1998-1											
19 MALAYSIA	1988-1	68	P:1997-4	T:1998-4	P:2000-4	T:2001-2									
20 MEXICO	1980-1	100	P:1981-4	T:1983-3	P:1985-4	T:1986-3	P:1994-4	T:1995-3	P:2000-4	T:2001-3	P:2004-2				
21 MOROCCO	1990-1	60	T:1990-4	P:1991-4	T:1993-2	P:1994-4	T:1995-2	P:1996-4	T:1997-2	P:1998-4	T:1999-3				
22 NETHERLANDS	1977-1	112	P:1980-1	T:1983-1											
23 NEW ZEALAND	1982-2	91	P:1982-3	T:1983-1	P:1985-1	T:1986-1	P:1990-4	T:1991-2	P:1997-3	T:1998-1					
24 NORWAY	1975-1	120	P:1976-3	T:1977-2	P:1981-4	T:1982-2	P:1998-2	T:1999-1	P:2002-2	T:2003-1	P:2004-2				
25 PHILIPPINES	1981-1	96	P:1983-2	T:1985-3	P:1990-3	T:1991-3	P:1992-1	T:1992-4	P:1997-4	T:1998-2					
26 PORTUGAL	1977-1	112	P:1982-4	T:1984-1	P:1992-1	T:1993-2	P:2002-1	T:2003-2	P:2004-2						
27 SINGAPORE	1984-3	82	P:1985-1	T:1985-4	P:1997-3	T:1998-2	P:2000-4	T:2001-3							
28 SOUTH AFRICA	1975-1	120	P:1976-3	T:1977-3	P:1981-4	T:1983-1	P:1984-2	T:1986-1	P:1989-3	T:1992-4					
29 SPAIN	1975-1	120	T:1975-2	P:1978-3	T:1979-1	P:1980-4	T:1981-2	P:1992-1	T:1993-2						
30 SWEDEN	1975-1	120	P:1976-4	T:1977-2	P:1980-1	T:1981-1	P:1990-1	T:1993-1	P:1996-1	T:1996-4					
31 SWITZERLAND	1975-1	120	T:1976-1	P:1981-3	T:1982-4	P:1990-2	T:1991-2	P:1992-2	T:1993-1	P:1996-1	T:1996-3	P:2001-1	T:2001-3	P:2002-3	T:2003-1
32 THAILAND	1993-1	48	P:1996-3	T:1998-3											
33 TURKEY	1987-1	72	P:1987-4	T:1988-4	P:1993-3	T:1994-2	P:1998-3	T:1999-3	P:2000-4	T:2001-2	P:2002-4	T:2003-2	P:2004-2		
34 UK	1975-1	120	T:1975-3	P:1979-2	T:1981-1	P:1990-2	T:1991-3								
35 US	1975-1	120	P:1981-3	T:1982-1	P:1990-3	T:1991-1									

Table 2: Characteristics of Business Cycles

	FREQ	R_FRACTION	DURATION
Mean	1.3	14.6	3.3
Median	1.0	12.5	3.0
Maximum	4.0	60.0	13.0
Std. Dev.	1.0	13.4	2.9
Observations	82	82	82

note:
freq = frequency of recession (event occurred within a particular decade)
r_fraction = fraction of time in recession (%)
duration = average length of recession (quarter)

Table 3: Histogram and Statistics of Frequency of Recession



Series: FREQ
Sample 1 3
Observations 86

Mean	1.337209
Median	1.000000
Maximum	4.000000
Minimum	0.000000
Std. Dev.	1.012980
Skewness	0.381012
Kurtosis	2.342760
Jarque-Bera	3.628642
Probability	0.162949

Table 4: One-Way Tabulation of Frequency of Recession

Value	Count	Percent	Count (cum.)	Percent (cum.)
0	19	22.1	19	22.1
1	33	38.4	52	60.5
2	21	24.4	73	84.9
3	12	14.0	85	98.8
4	1	1.2	86	100.0
Total	86	100.0	86	100.0

Table 5: Frequency of Recession across countries

COUNTRY	Mean	Obs.
ARGENTINA	1.5	2
AUSTRALIA	1.3	3
BELGIUM	1.3	3
CANADA	1.0	3
CHILE	0.3	3
COLOMBIA	1.0	1
DENMARK	2.0	3
ECUADOR	2.0	1
FINLAND	0.7	3
FRANCE	0.7	3
GERMANY	2.3	3
ICELAND	2.0	1
INDONESIA	1.0	1
IRELAND	0.0	1
ISRAEL	2.0	3
ITALY	2.0	3
JAPAN	1.3	3
KOREA	0.3	3
MALAYSIA	1.0	2
MEXICO	1.3	3
MOROCCO	2.5	2
NETHERLANDS	0.3	3
NEW ZEALAND	1.5	2
NORWAY	1.3	3
PHILIPPINES	2.0	2
PORTUGAL	1.0	3
SINGAPORE	1.5	2
SOUTH AFRICA	1.7	3
SPAIN	1.3	3
SWEDEN	1.3	3
SWITZERLAND	2.3	3
THAILAND	1.0	1
TURKEY	2.5	2
UNITED KINGDOM	1.0	3
UNITED STATES	0.7	3
All	1.3	86

Figure 6: Histogram and Statistics of Fraction of Time in Recession

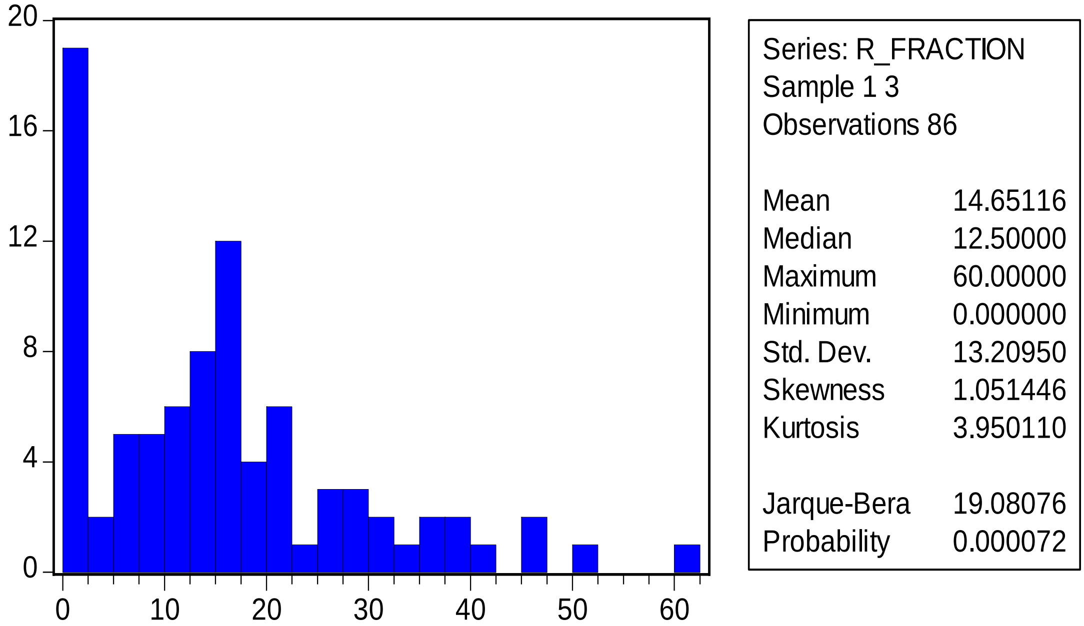


Table 7: One-Way Tabulation of Fraction of Time in Recession

Value	Count	Percent	Count (cum.)	Percent (cum.)
0	19	22.1	19	22.1
(0, 5)	2	2.3	21	24.4
[5, 10)	10	11.6	31	36.0
[10, 15)	14	16.3	45	52.3
15	11	12.8	56	65.1
(15, 20)	5	5.8	61	70.9
[20, 25)	7	8.1	68	79.1
[25, 30)	6	7.0	74	86.0
[30, 35)	3	3.5	77	89.5
[35, 40)	4	4.7	81	94.2
[40, 60]	5	5.8	86	100
Total	86	100.0	86	100.0

Table 8: Fraction of Time in Recession across countries

COUNTRY	Mean	Obs.
ARGENTINA	27.5	2
AUSTRALIA	13.3	3
BELGIUM	19.2	3
CANADA	10.0	3
CHILE	20.0	3
COLOMBIA	10.0	1
DENMARK	19.8	3
ECUADOR	17.5	1
FINLAND	14.2	3
FRANCE	4.2	3
GERMANY	16.7	3
ICELAND	12.5	1
INDONESIA	3.1	1
IRELAND	0.0	1
ISRAEL	19.2	3
ITALY	21.7	3
JAPAN	15.8	3
KOREA	0.8	3
MALAYSIA	7.5	2
MEXICO	19.2	3
MOROCCO	33.8	2
NETHERLANDS	12.5	3
NEW ZEALAND	10.0	2
NORWAY	9.2	3
PHILIPPINES	15.0	2
PORTUGAL	13.5	3
SINGAPORE	11.3	2
SOUTH AFRICA	24.2	3
SPAIN	9.2	3
SWEDEN	17.5	3
SWITZERLAND	19.2	3
THAILAND	20.0	1
TURKEY	20.9	2
UNITED KINGDOM	12.5	3
UNITED STATES	3.3	3
All	14.7	86

Table 9: Poisson Regression: $E(y_{it}|X_{it}) = \lambda_{it} = \exp(X_{it}.\beta)$ mean number of event

freq	Pooled		Random Effects		Fixed Effects	
Xs	poisson1	poisson2	poisson3	poisson4	poisson5	poisson6
turnover	-0.12		-0.12		-0.29	
	(0.08)		(0.14)		(0.36)	
struc		-0.36***		-0.36***		-0.37
		(0.05)		(0.14)		(0.47)
credit	-0.45*	-0.32	-0.45	-0.32	-1.27	-1.20
	(0.26)	(0.23)	(0.30)	(0.31)	(0.85)	(0.85)
gdp	0.20	0.32	0.20	0.32	2.14	2.45
	(0.26)	(0.22)	(0.30)	(0.29)	(2.55)	(2.50)
growth	-0.25***	-0.32***	-0.25**	-0.32***	-0.49*	-0.60**
	(0.06)	(0.04)	(0.11)	(0.11)	(0.26)	(0.30)
sd-dtot	-0.03	-0.05*	-0.03	-0.05	-0.01	0.04
	(0.03)	(0.03)	(0.05)	(0.05)	(0.16)	(0.14)
sd-dreer	-0.05*	-0.02	-0.05	-0.02	0.06	0.07
	(0.03)	(0.02)	(0.03)	(0.03)	(0.10)	(0.10)
sd-inf	0.01	0.00	0.01	0.00	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)	(0.07)
dtot	0.00	0.02	0.00	0.02	-0.02	-0.02
	(0.05)	(0.06)	(0.07)	(0.06)	(0.11)	(0.12)
inf	0.01	0.02	0.01	0.02	0.05	0.04
	(0.01)	(0.01)	(0.02)	(0.02)	(0.13)	(0.14)
openness	-0.09	0.24	-0.09	0.24	-0.07	0.67
	(0.25)	(0.24)	(0.27)	(0.31)	(1.68)	(2.16)
gcon	-0.05*	-0.06***	-0.05	-0.06*	-0.01	0.08
	(0.03)	(0.02)	(0.03)	(0.03)	(0.23)	(0.20)
N	66	66	66	66	53	53
# of countries	34	34	34	34	21	21
log-likelihood (ll)	-84.89	-81.74	-84.89	-81.74	-27.66	-27.67
Chi2	74.7***	184.65***	18.37*	23.58***	15.47	15.62
Chi2 gof	47.77	41.46	-	-	-	-
Hausman Chi2	-	-	8.05	5.38	-	-

note: standard error and two-sided p-value are in parenthesis respectively
* sig. at 10%, ** sig. at 5%, *** sig. at 1%
Chi2 = Chi2 for testing sig. of all Xs except constant
Chi2 gof = deviance goodness-of-fit Chi2 testing that data are Poisson distributed
Hausman Chi2= Hausman's test statistic for the null hypothesis of zero correlation between individual effects and other regressors

Table 10: Marginal Effects of Fractional Logit Regression: y= fraction of time

Variable	frac1	frac2	ifrac1	ifrac2
turnover	-0.02 ***		-0.03**	
	(0.01)		(0.01)	
struc		-0.06 ***		-0.04***
		(0.01)		(0.01)
credit	-0.05	-0.02	-0.03	-0.02
	(0.03)	(0.03)	(0.03)	(0.03)
gdp	0.02	0.04	0.00	0.02
	(0.03)	(0.02)	(0.04)	(0.03)
growth	-0.04 ***	-0.05 ***	-0.04***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
sd-dtot	-0.01 *	-0.01 ***	-0.01*	-0.01**
	(0.00)	(0.00)	(0.01)	(0.01)
sd-dreer	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
sd-inf	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
dtot	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
inf	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
openness	-0.02	0.04	-0.02	0.02
	(0.04)	(0.03)	(0.04)	(0.04)
gcon	0.00	0.00 *	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
predicted mean	0.12	0.11	0.12	0.11
N	66.00	66.00	66.00	66.00
# of countries	34.00	34.00	34.00	34.00
Chi2	106.18 ***	147.62 ***	79.17***	85.21***
aic	60.67	59.41	60.85	59.99
bic	86.95	85.68	87.13	86.26

note: standard error and two-sided p-value are in parenthesis respectively
* sig. at 10%, ** sig. at 5%, *** sig. at 1%
Chi2 = Chi2 for testing sig. of all Xs except constant
aic = Akaike Information Criteria
bic = Bayesian Information Criteria
ifrac1 and ifrac2 use the initial value data of turnover, struc, credit, and gdp

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Appendix A: Variables

Variables	Description	Sources
freq	frequency of recession (event occurred within a particular decade)	calculated from International Financial Statistics (IFS)
r_fraction	fraction of time in recession in a decade (%)	calculated from IFS
duration	average length of recession (quarters)	calculated from IFS
turnover	log (turnover ratio) = log (value of shares traded / GDP)	Beck et al. (2000a)
struc	financial structure- aggregate index	Beck, et al. (2000a)
credit	log (private credit ratio) = log (private credit / GDP)	World Development Indicator (WDI)
gdp	log (gdp per capita)	WDI
growth	average growth rate	calculated from WDI
sd-dtot	sd. of changes in terms of trade	calculated from IFS
sd-dreer	sd. of changes in real effective exchange rate	calculated from IFS
sd-inf	sd. of inflation rate (GDP deflator)	calculated from WDI
dtot	average change (%) in terms of trade	calculated from IFS
inf	average inflation rate (GDP deflator)	WDI
openness	log (openness ratio) = log ([export + import] / GDP)	WDI
gcon	government consumption over gdp ratio	WDI

Appendix B: Countries covered (35) classified by Income Level

High Income (23): Australia Belgium Canada Denmark Finland France Germany Iceland Ireland Israel Italy Japan Korea Netherlands New_Zealand Norway Portugal Singapore Spain Sweden Switzerland United_Kingdom United_States

Upper Middle Income (5): Argentina Chile Malaysia Mexico South_Africa

Lower Middle Income (7): Columbia Ecuador Indonesia Morocco Philippines Thailand Turkey