How to Depart Earlier From a Recession?

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Abstract

Empirical studies of economic growth across countries are abundant and rich in conclusions, some of them widely accepted. This is not the case, however, with the empirics of business cycles. Particularly, there exists little evidence explaining why some countries take more time than others recovering from economic downturns or recessions.

This paper focuses on recessions. We are not interested, however, in the causes of recessions, but in the determinants of their length; thus, we study which economic variables accelerate/retard economic recovery. The results presented in this paper have direct policy implications, as they shed light on which variables can help shorten recessions.

From the estimation of count-data models (Poisson and Negative Binomial) and seemingly unrelated regressions, we find clear evidence that more open economies with diversified exports experience shorter recessions. At the same time, the evidence seems to confirm a generally better performance of floating exchange rate regimes as compared to both hard and soft pegs. In the final draft of the paper, we will include institutional explanatory variables.

Keywords: *recessions, business cycles, panel data, seemingly unrelated regressions, count-data models.*
JEL classification: C25, C33, E30, E32, F02.

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1. Introduction

Growth is one of the most studied and discussed topics in economics. A vast literature on the subject avails our knowledge and provides widely accepted conclusions. Since the first studies by Barro and Sala-i-Martin (1992), the empirical determinants of economic growth have been studied rigorously[1], providing a rich literature filled with explanations and policy options to foster it[2]. In recent years, estimations based on cross-section data have been substituted with newer and more sophisticated techniques, such as GMM for dynamic panel data and time-series econometrics, eliminating spurious correlations and making more efficient estimates.

Business cycles, in contrast, have been studied in much less detail. In particular, there seems to be virtually no empirical analyses based on international data comparisons. The lack of a standard procedure to follow -i.e. linear regression or another estimation technique- along the difficulties arising from recession identification and definition, may provide an answer on why recessions have not been studied using an empirical econometric approach. The subject, of course, has not been forgotten by economics. The seminal work by Kidland and Prescott (1982) and the breakthrough of new computational techniques other than econometrics, allowed serious study of business cycles based on micro-founded models and mathematical simulations. Nevertheless, a problem with real business cycle models is the increasing difficulty of modelling additional variables and effects.

This paper tries to fill a bit of this gap and studies the differences across countries in recovery times from a recession. This is, to our knowledge, a first formal empirical approach to the subject that incorporates information of a heterogeneous set of countries. Our analysis does not look for a reduced model containing the elements that explain and prevent recessions. Its scope is simpler and at the same time more pragmatic: given that new theoretical advances or strikingly novel economic policies will not eliminate economic fluctuations, identifying the variables that influence in a robust way the expected length of a recession can be of important value for policy making.

Our results point out that more open and export-diversified countries spend less time in recession. Also, we find important positive effects coming from the GDP growth of trading partners, thereby suggesting that market diversification is important. The evidence also supports the idea that countries with soft pegs (intermediate exchange regimes) fare worse than those with hard-pegs or floating exchange regimes. No indifference, however, among the latter two: floating rates seem to help overcome recessions more than hard pegs.

The structure of the paper is as follows: section 2 analyses relevant theories and related literature on the subject. Section 3 presents the methodology used in the paper, both in the description of the data and in the application of the econometric models. Section 4 presents the most relevant empirical results; the last section concludes.

[1] See Levine and Renelt (1992) and Sala-i-Martin (1997)
[2] See Sala-i-Martin (2002) and Sachs and Warner (1997)

2. Theoretical Aspects and Review of the Literature

The economic literature usually analyses business cycles and economic growth as two separate things, under the assumption that business cycles represent a transitory dynamic with no effects on long-term economic growth. Nevertheless, Fatás (2002) studies the link between business cycles and long-term growth rates, and reports evidence that cycles cannot be taken always as a temporal deviations from the trend. He also finds that more volatile countries, in terms of GDP growth volatility, tend to grow slower. This effect is far bigger for developing countries. All this evidence suggests that business cycles and growth volatility is a phenomena not totally independent of long-term growth.

2.1 What do recovery times depend on?

The question about cross country differences in recovery times from recessions is, in practice, a question of how countries manage the initial negative shocks that provoke an economic contraction.

Under real business cycles theories[3], economic volatility and the allocation of time between expansion and contraction depends mainly on supply factors; more specifically, on the way in which technological innovations occur, as they modify the inter-temporal relation of factor remunerations between the present and the future, as well as the equilibrium between time dedicated to work and leisure. Although this theoretical line of thought has been criticised[4], it has managed to emulate efficiently different economies around the world. Nevertheless, the procedures behind these methods cannot predict particular events, since they rely on highly simplified micro-founded models. Additionally, real business cycles models can hardly acknowledge any differences in recession recovery times across countries because they do not identify the movement of variables in terms of their mean; instead, they try to assess how well models emulate the real correlations between the variables of interest.

On the other hand, we can also argue that nominal as well as real market rigidities, jointly with volatility in aggregate demand, constitute the main factors behind economic volatility. Monetarists support the idea that monetary shocks, through their incidence on aggregate demand, affect the business cycle and the time that an economy spends in a recession.

Although the debate between different theories about the business cycle remains, it is possible to outline some preliminary ideas on why some countries recover faster than others from a recession. There seem to be three general conditions that explain a large of differences between countries' outcomes: the depth of structural economic reforms, overall economic openness (commercial and financial) and the level of factor market rigidities may explain different recovery times.

Bergoeing et al. (2002) present an example of the first idea when they try to explain why Chile recovered much faster than Mexico from the debt crisis of the 1980s. Earlier structural reforms in Chile --they argue-- can account for a large part of the difference in

[3] Kydland and Prescott (1982), Prescott (1986)
[4] See for example, Summers (1986).

recovery times between both countries. While Chile attempted deep reforms in trade liberalization, fiscal policy, privatization, financial markets and bankruptcy legislation throughout the 70s, Mexico only applied this sort of policies late in the 80s. Although the fall in investment and employment, the debt burden and the exchange rate depreciation were more severe in Chile, the structural reforms set the basis for faster recoveries and economic growth.

Certain elements of trade and financial openness can also explain differences in the length and severity of economic downturns. Given the increasing globalization and integration of world markets, international relationships (both commercial and financial) have an important role in explaining growth volatility. Since openness is positively correlated with economic growth[5] and international linkages to the world economy are responsible for smoother consumption and investment paths, more open economies should experience milder recessions and more stable macro aggregates.

In this line of investigation, Caballero and Krishnamurthy (2002) and Caballero (2003) argue that financial crises are followed by deeper contractions in investment and growth in those countries with limited access to international asset markets, i.e. less developed economies. Caballero (2003) addresses this idea more explicitly through a comparison of the Chilean and Australian experiences after the Asian-Russian crisis of 1997-98. Country selection was due to common characteristics shared by Chile and Australia: both countries are export-oriented and rely heavily on historically price-volatile commodities. Nevertheless, after the negative shock in terms of trade due to the crises, Australia recovered much faster than Chile. The Australian economy did not face a shortage of external capital inflows and the overall adjustment was absorbed by a higher current account deficit financed by international capital inflows; Chile, in contrast, had a severe contraction, both in consumption and output: expenditure fell 15% respect with respect to the pre-crises level and the economy suffered a recession in 1999. According to some calculations[6], the overall contraction experienced by the Chilean economy, was ten times larger than it would have been if the country had stronger linkages to international capital markets.

The degree of trade openness is the other side of the coin when we talk about the internationalization of an economy. Deeper trade relations during the second half of the twentieth century are related to the transmission and characteristics of the international business cycle. Additionally, a diversified export structure can partially substitute for the lack of access to financial markets, since it provides diversified fund sources and diminishes the vulnerability to external shocks.

During recessions, the economy performs adjustments between sectors, independently of whether the recession was due to external or idiosyncratic shocks. Trade openness and access to international capital markets allow the efficient reallocation of consumption and investment inter-temporally. On the other hand, market flexibility allows the efficient distribution of factors intra-temporally, given a negative shock, thus minimizing involuntary factor unemployment. For example, analyzing the response of the South Korean economy to the Asian crises of 1997, Koo and Kiser (2001) found that key

[5] Edwards (1998)
[6] Caballero, op. cit.

factors behind the short recovery period experienced by that country were the rapid labor market adjustment and the correct set of fiscal policies used.

Precise and objective data on the quality of economic structures and institutions is hard to obtain, or simply does not exist for long periods of time and heterogeneous sets of countries. A similar problem happens with labor markets. International data sets on labor market rigidities are scarce and do not extend too far into the past. Given these shortcomings, we focus on trade and openness statistics, which extend both across countries and through the years.

2.2 A Historical Review of Recessions

Several studies have claimed that the business cycle is getting milder and recessions are getting shorter for the US economy, among them Zarnowitz (1998), Blanchard and Simon (2001) and Ahmed, Levin and Wilson (2002). For example, Zarnowitz calculates that the average length of a US recession in the post-1945 period is 11 months (less than 4 quarters); between 1870 and 1945, on the other hand, that average was 21 months (7 quarters).

This trend seems to extend to the rest of the developed world. According to an IMF study[7] for a sample of 16 rich countries, the average decline of GDP in a recession (between peak and trough of the cycle) was 4.3% between 1881-1913; 8.1% between the world wars, and just 2.3% thereafter.

Many hypothesis have been given to account for this fact in the developed world[8]. Does this pattern apply to less developed countries? This question can be answered only partially, since long GDP series are usually unavailable for LDC's. A hint is provided by Easterly, Islam and Stiglitz (2000) where a heterogeneous group of countries is studied (both LDCs and OECD members). The paper concludes that crises have been getting worse in the last 25 years, specially for LDCs and that the cause of this increasing volatility lies in volatile financial markets. Accordingly, this IMF study also accounts for the difference in consumption, investment and output volatility between developed and less developed countries. This apparent asymmetry in the depth of recessions is confirmed by the following tables, in which information for 51 countries is summarized for the period 1970-2000.

Table 1: Recession statistics, OECD countries

Period	Number of recessions	Mean life of recession	Standard deviation	Country with longest recession (starting year, quarters in recession)
1971-1975	9	3.2	0.97	United States (1974, 5)
1976-1980	6	3.5	1.52	United Kingdom (1980, 6)
1981-1985	14	3.1	1.10	Canada (1982,5) – Portugal (1983,5)
1986-1990	6	5.5	3.62	Finland (1990,12)
1991-1995	9	4.7	2.55	Sweden (1991,11)
Total	***44***	***3.8***	***2.08***	

[7] IMF World Economic Outlook, May 2002.
[8] See Zarnowitz (1998) and Romer (1999).

As seen in Table 1, no clear trends relative to the mean life of a recession can be seen for the 1971-1995[9] sub-sample. The mean life of a recession for the entire sample is 3.8 quarters, very close to the 11 month average calculated by Zarnowitz for the US economy.

Additionally, Table 1 includes the most turbulent period faced by OECD countries (1981-1985, with 14 recessions) and the higher dispersion in the length of recessions experienced by developed economies in the late 80s and early 90s, as seen by the standard deviations.

Table 2: Recession statistics, developing countries

Period	Number of recessions	Mean life of recession	Standard deviation	Country with longest recession (starting year, quarters in recession)
1981-1985	5	6.2	2.59	Philippines (1983,10)
1986-1990	4	4.5	1.29	Peru (1988,6)
1991-1995	13	4.5	3.84	Latvia (1991,13) – Belarus (1993,13)
1996-2000	15	5.3	3.08	Argentina (1998,14)
Total	***37***	***4.95***	***3.05***	

Since quarterly GDP series for LDC's are shorter than those for developed countries, an important restriction was faced while performing these statistical comparisons. Hence, historical comparisons of GDP growth volatility and recessions could not be made, as Zarnowitz did for the US economy. Nevertheless, two interesting conclusions arise from the tables. First, the average length of a recession is higher for LDCs. Also, the duration of recessions is more volatile in LDC's, as noted by the higher standard deviation in Table 2.

It should be noted that the high number of detected recessions in LDC's in the 90s may be inflated by the fact that statistics for several transition economies became available only during the 90s; thus, the number of recessions between 1991 and 2000 may account both for an increasing number of countries with available statistics and for the occurrence of more recessions per country. Thus, we constructed a third table with Latin American countries only, for which longer GDP series were available.

Table 3: Recession statistics, Latin American countries

Period	Number of recessions	Mean life of recession	Standard deviation	Country with longest recession (starting year, quarters in recession)
1981-1985	4	5.3	1.71	Chile (1982, 7)
1986-1990	3	5.0	1.00	Peru (1988, 6)
1991-1995	5	3.0	1.00	Mexico (1994, 4) – Argentina (1995, 4)
1996-2000	5	6.0	4.90	Argentina (1998, 14)
Total	***17***	***4.7***	***2.75***	

The Latin American experience lies in between, since the mean life of a recession is 4.7, between the lower bound set by the OECD countries and the results of the exercise for the whole group of LDCs. Also, the dispersion of recessions –measured by the standard deviation of average recession length in the period- lays between the OECD and LDC's

[9] Sample period dependent on data availability.

statistics. Nevertheless, the results for Latin America are much closer to those of LDCs in general than to those of the OECD economies.

The statistics presented in the tables show a global perspective on the occurrence and trends of recessions over the last thirty years. Despite the unavailability of longer quarterly GDP series for LDCs, which would make for richer comparisons, several conclusions can be reached (given our limited sample): recessions seem to be shorter and less disperse for developed economies; developing countries –especially the so called transition economies- face longer and more severe recessions.

Thus, although empirical evidence supports the idea of a diminishing trend in the length of the US economy recessions, this stylized fact cannot be extended to the rest of the world.

3. Methodology

This section presents a general description of the data and methodologies used in the paper. We identified recessions across countries by studying quarterly GDP series, while the rest of the (explanatory) variables were used in annual frequency. Our dataset consists of information for 51 countries[10], between 1970:I and 2002:IV. A GDP index was used, with the same base year for all countries (1995) in order to make direct comparisons across series. We defined quarterly GDP growth as the percentage change of the series over a year ago. This procedure avoids the use of mechanical filters and ad-hoc seasonality adjustments for individual countries. All series were treated equally, maintaining objectivity and parsimony.

3.1 What is a recession?

The use of the IMF definition of a recession (two or more consecutive quarters of negative GDP growth) has the virtue of being simple, objective and easy to implement in an international dataset. Of course, this is not the only definition of a recession. There are other methods, with distinct requirements and characteristics.

For example, the recession definition of the National Bureau of Economic Research for the U.S. economy, takes into account a wide collection of series -namely employment, trade, income and output- and assesses the fact that there cannot be a complete economic recovery from a recession exclusively when the output is raising: without a correspondent surge in job creation and international trade, the NBER's criteria would leave the U.S. economy still in a recession. Although this approach provides quite a useful amount of information, its implementation for a wide set of countries lays beyond the scope of this paper. Moreover, specific country effects could bias the NBER's procedures, as well as incomplete and unreliable country data.

Another simple way of defining a recession is by estimating output gaps of long-term growth rates, calculated by means of mechanical filters such as Hodrick-Prescott, Beveridge-Nelson or Baxter-King. Once produced this estimates for the long-term or

[10] The complete list of countries is in the appendix.

"potential" GDP growth series, all negative deviations of the real data from this trend would represent negative business cycles, or in a capricious sense of the word, recessions. Since the seminal work by Kidland and Prescott (1982) and the ideas of Zarnowitz (1992), deviations of filtered series are seen as an accurate depiction of business cycles from peaks to troughs; Nevertheless, this mechanical algorithm can produce several problems and biases. For example, the distribution of quarters between recessions and expansions (under and above the trend) can be enormously biased by scalar factors. Also, mechanical methods have to accommodate to real observations, fictionally creating equal number of positive and negative deviations. Another frequently shortcoming addressed to mechanical filters for time series data, is that of miscalculation and low consistency of results when the sample length changes and when there are unitary roots in the series. Additionally, international comparisons would not be feasible nor credible if the length of the distinct GDP series are gruesomely dissimilar or if there are portions of missing values for different countries' datasets, as is the case with our own.

We decided to use the standard definition of a recession because of its simplicity; an even more important feature, is that this definition is the one used by the media and authorities in the majority of countries, thus producing economic policy reactions and movements in local markets.

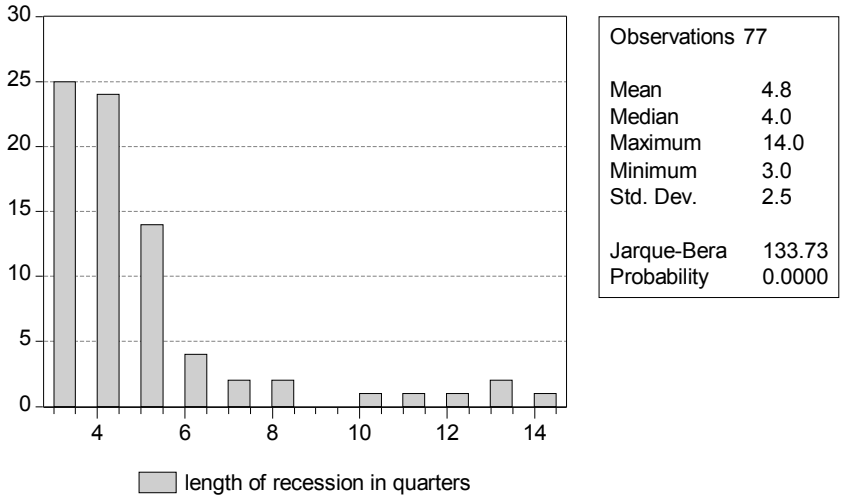
3.2 Estimation

After identification and calculation of the length of recessions across-countries and through time, we estimated the effect of a group of economic variables over the average length of a recession (in quarters). Therefore, once the length of a particular recession was attained, the year in which the recession started was assigned to it. Hence, an annual recession vector was constructed[11] which was attached to the annual frequency matrix of explanatory variables.

Given the way in which the dependent variable is constructed, it represents a strictly positive integer number that fits the characteristics of count-data models, used mainly in microeconomic analysis. The number of quarters an economy spends in a recession hardly resembles a "normal" distribution, as seen in figure 1.

Figure 1: Histogram and Statistics of Recession

[11] The annual series contain zeros (years without recessions), positive integer numbers (years with recessions), and non-available observations (years following a recession, since a recession can span consecutive years).



It is evidently from the graph that the large part of the observed outcomes present themselves in low frequencies. The majority of recessions (in our sample) lasts between 2 and 4 quarters –mean life of a recession is 4.8 quarters- and very few have durations exceeding 14 quarters. On the other hand, the Jarque-Bera normality test rejects the null hypothesis that the length of recessions follows a normal distribution at a confidence level of 99%.

According to this evidence, we applied count-data models to perform the empirical analysis[12]. Specifically, we use the Poisson distribution, since this is the standard distribution in this type of regressions and because the empirical distribution follows closely the theoretical one, as seen in figures 2 and 3.

Figure 2: Theoretical Poisson Distribution

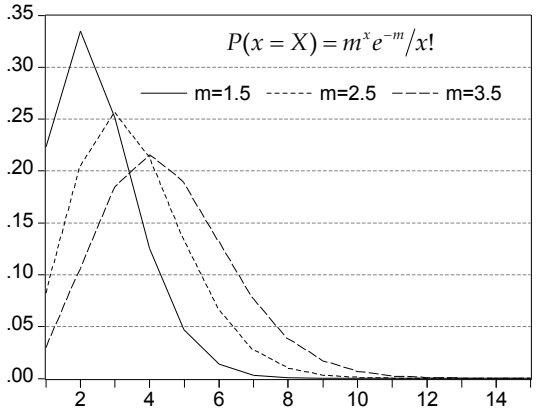


Figure 3: Length of Recessions' Empirical Distribution

[12] Specifics of this type of models can be seen in the appendix.

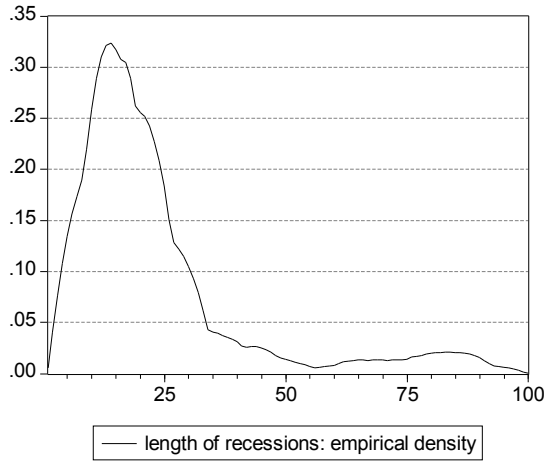


Figure 3 depicts the kernel density estimate of the distribution of the recession series, using an epanechnikov weight and a hundred grid points. As said before, it follows closely the theoretical distribution, like the one in figure 2, created with 15 observations and varying mean parameters. The comparison of both figures is straight forward: they show that a Poisson distribution fits well the data and that the estimation of a count-data model for this macro-phenomena is not far-fetched.

In order to assure weak exogeneity of regressors, special attention was put in introducing non-contemporary variables at the RHS of the equation. Endogeneity of explanatory variables invalidates the weak exogeneity assumption and produces non-robust and inconsistent estimators. Hence, most regressors were introduced in lagged terms: variables explaining the length of a recession which started at year *t*, are from year *t-1*, unless strong a-priori belief exists in order to treat them as exogenous and thus, introduce them contemporarily into the regression.

3.3 Explanatory Variables

This section presents a detailed discussion of the independent variables used in our study. All variables are in lagged form, except the contrary is explicitly stated. As explained before, the variables are focused in measuring overall economic openness due to availability and quality of international data.

- Trading partners' GDP per capita growth. Represents the annual percentage change of trading partners' GDP per capita growth, weighted by trade share. This variable was treated as exogenous (contemporary). Its expected sign is negative due to the fact that countries with more dynamic trading partners should experience milder recessions.

- Real exchange rate misalignment. It's the absolute value of the difference between the actual real exchange rate and its long-term trend, given by a Hodrick-Prescott's filter. The relationship between RER misalignment and length of recessions is supposed to be positive, because bigger misalignments represent deeper adjustments.

- Terms of trade shocks. It's the annual percentage change of the terms of trade series, the year before the start of a recession. Since worsening terms of trade represents a

situation of economic weakness, the expected sign of the coefficient is negative: growing (decreasing) terms of trade determine shorter (longer) recessions.

- Trade openness. As a standard procedure, this variable is measured as the sum of exports and imports, as a fraction of GDP. This particular definition of trade openness is superior to other alternatives in the sense that it captures efficiently the existence of non-tariff barriers to foreign trade. We expect a negative sign for this coefficient, since more open countries are able to smooth out negative shocks easily, thus experience milder recessions.

- Exports concentration index. The concentration of the exports structure in a country was constructed through a Herfindahl-Hirschmann index, in a scale ranging from 0 to 1 (maximum concentration, i.e. country with only one export). The expected sign of this variable is positive, since more concentrated countries are less flexible and cannot smooth efficiently any negative shock.

- Exchange rate regimes. We included dummy variables for the case of floating exchange rates and hard pegs. The effect of soft pegs (intermediate exchange rates) is captured by the constant of each regression. We used the de-facto classification by Levy-Yeyati and Sturzenegger (2002), since this classification stays true to what countries actually do rather than on what countries say they do ("Deeds versus Words"[13]). Although the expected sign of the coefficient is ambiguous, some international evidence tends to show that flexible exchange rates are related to better macroeconomic outcomes and more flexibility amidst negative shocks, in relation to soft/hard pegs[14].

4. Results

4.1 Poisson regression results

This section presents the most relevant empirical results. According to the discussion in section 3.2, we estimated a Poisson regression, in which the dependent variable was the length of a recession (in quarters) and the explanatory variables are the annual observations of the variables discussed in the previous section.

In general, our results are in line with the previous analysis of explanatory variables, in terms of expected signs of coefficients and overall statistical significance. Our results support the idea that more open and product-diversified countries suffer from shorter recessions, i.e. recover faster from negative output shocks. The benchmark regression is shown in table 4.

Table 4: Poisson Regression

	Dependent variable: number of quarters in recession
GDP pc growth of trading partners	-0.437341***
	(0.026947)
Real exchange rate misalignment	0.012098
	(0.572962)

[13] Eduardo Levy-Yeyati and Federico Sturzenegger, op. cit.
[14] See Larraín and Velasco (2001) and Larraín and Parro (2003).

Terms of trade shock	-1.525958*** *(0.557155)*
Openness (X+M as % of GDP)	-0.656922*** *(0.109994)*
HH index (export concentration)	1.614382*** *(0.351606)*
Exchange rate regime (d=1 if float)	-0.428537*** *(0.078480)*
Exchange rate regime (d=1 if fixed)	-0.341772*** *(0.075282)*
Considered recessions	62
LR index (pseudo R^2)	0.102
LR statistic p-value†	0.0000

Notes: Intercept not shown. Standard errors in parenthesis. Significance estimated through "z" statistics

† Null hypothesis: all coefficients equal zero.

*, ** and *** represent significance at 90, 95 and 99%.

As seen in the table, all variables present the expected sign and the overall regression shows high significance. According to the LR statistic, the null hypothesis of global insignificance is easily rejected at 99% confidence.

The most significant and consistent variables across estimations were the growth of trading partners and the exports concentration index, both with the correct expected sign. In other words, countries with dynamic trading partners and high export diversification are the ones that, according to our sample, tend to spend less quarters in recession. On the other hand, the only variable presenting mixed results was the RER misalignment, with a correct coefficient sign, but low statistical significance.

As discussed before, the expected sign of the exchange rate regime coefficients is ambiguous ex-ante. Although some empirical evidence on the macroeconomic performance of different regimes exists, there is no theoretical evidence supporting any particular exchange rate regime above the rest. Nevertheless, the results presented at table 4 are in line with previous literature relating the choice of exchange rate regimes with macroeconomic volatility. Both dummy variables (floating regimes and hard-pegs) show negative, significant coefficients; this results indicate that soft-pegs (or intermediate regimes) are the worse performing in our sample: those countries managing soft-pegs at the start of a recession, are more likely to spend more quarters in it, relative to an identical country managing a different exchange rate regime. On the other hand, our results tend to favour the floating exchange regime dummy, since its coefficient is more negative in relation to the hard-peg dummy. Thus, according to the evidence, countries with floating exchange rate regimes at the start of a recession are more likely to spend less time than the "competition".

4.2 Robustness

In order to test the robustness of our previous results, we estimated the same equation, under two alternative methods: a count-data regression model, under a different

distribution assumption (Negative-Binomial distribution) and a seemingly unrelated regressions approach[15]. The Negative-Binomial distribution case is of interest here, since it allows overdispersion in the dependent variable, something that can produce inconsistent estimators in Poisson regressions[16]. Seemingly unrelated regressions were also tested, because this method estimates the parameters of a system of equations, accounting for heteroskedasticity and contemporaneous correlation in the disturbances across equations. Results from both alternative regressions provide us from a reasonable robustness test, given the dissimilarity of estimation procedures/techniques. Close resembling coefficient estimates along similar goodness of fit across regressions, would indicate robustness of our results under different estimation procedures. Table 5 presents this results.

Table 5: Alternate Estimation Methods

	Dependent variable: number of quarters in recession	
	Neg-Bin	SUR
GDP pc growth of trading partners	-0.565298***	-0.406843***
	(0.059734)	*(0.025080)*
Real exchange rate misalignment	0.598525	0.229806
	(0.968143)	*(0.346654)*
Terms of trade shock	-1.113928	-0.557481
	(1.064983)	*(0.522711)*
Openness (X+M as % of GDP)	-0.715520***	-0.435976***
	(0.173738)	*(0.103183)*
HH index (export concentration)	2.015523***	0.748648**
	(0.635705)	*(0.296366)*
Exchange rate regime (d=1 if float)	-0.361044**	-0.279343***
	(0.142567)	*(0.056776)*
Exchange rate regime (d=1 if fixed)	-0.310987**	-0.240160***
	(0.140149)	*(0.049961)*
Considered recessions	62	62
Goodness of Fit‡	0.096	0.084
LR statistic p-value†	0.0000	--

Notes: Intercepts not shown. Standard errors in parenthesis. Significance estimated through z-statistics in the Negative-Binomial case and t-statistics in the SUR case.
* For Negative-Binomial: LR index. For SUR: Adjusted R^2
† Null hypothesis: all coefficients equal zero.
*, ** and *** represent significance at 90, 95 and 99%.

As seen in the table, the robustness of our earlier estimates is partially confirmed. On one hand, goodness-of-fit statistics (LR index for the Negative-Binomial regression and adjusted R-square for SUR) are quite close to those obtained under the Poisson regressions. Also, overall significance[17] of the Negative-Binomial estimation remained very high, in line with results from the Poisson methodology presented at table 4.

[15] See Zellner (1962)
[16] More details are presented in the appendix
[17] Not applicable to SUR.

In terms of particular coefficients, the robustness exercise presented here showed mixed results: GDP per capita growth of trading partners along trade openness and exports concentration maintained high statistical significance. Under both regressions, they also showed some resemblance to the point estimates from table 4. However, terms of trade shocks and RER misalignment suffered a loss of significance in table 5, as well as a meaningful change in the coefficient estimates.

Regarding the results for the exchange rate regimes dummy variables, conclusions remain from the last section. First, intermediate regimes or soft-pegs, present the worst performance among the three regime options, in terms of additional quarters in recession due to the choice of managing that type of regime. Second, the evidence ratifies a slight superiority of flexible exchange rates versus the other two regimes, given the more negative associated coefficient for that dummy. This result is maintained both in the Negative-Binomial regression and in the SUR approach.

It must be noted that the coefficients estimated by count-data models and those estimated under SUR are not directly comparable, in terms of the effect on the dependent variable, because of the non-linearity of count-data models[18]. Nevertheless, direct comparisons can be made through "mean marginal effects". This comparison is shown in table 6.

Table 6: Mean Marginal Effects Comparison

	$\partial F/\partial x_i$		
	Poisson	**Neg-Bin**	**SUR**
GDP pc growth of trading partners	***-0.1711***	***-0.1980***	***-0.4068***
RER misalignment	0.0473	0.2097	0.2298
Terms of trade shock	***-0.5971***	-0.3902	-0.5575
Openness (X+M as % of GDP)	***-0.2570***	***-0.2506***	***-0.0436***
HH index (export concentration)	***0.6317***	***0.7060***	***0.7486***
Exchange rate regime (d=1 if float)	***-0.1677***	***-0.1265***	***-0.2793***
Exchange rate regime (d=1 if fixed)	***-0.1337***	***-0.1089***	***-0.2402***

Significant effects at 90% or more in italics.

The table enables a direct comparison of the calculated effects of the different explanatory variables on the length of a recession, measured in quarters. Confirming the earlier discussion, results from the table show significant marginal effects of GDP per capita growth of trading partners, trade openness, exports concentration and exchange rate regime choice. Across methods, the two count-data models are closely related (Poisson and Neg-Bin columns) in terms of calculated marginal effects, while the SUR methodology seems to diverge somewhat. However, for specific coefficients the

[18] See appendix A2.3

differences under all methods are quite non-existent, which is the case of the HH export concentration index and the dummy variables for flexible and fixed exchange rate regimes. Implication of mean marginal effects presented at table 6 are direct. For example, a highly exports-concentrated country (HH index close to 1) will spend between 0.63 and 0.67 additional quarters in recession relative to a similar country –facing the same negative shocks- but with the exception that the latter country is very well diversified (HH index close to zero), ceteris paribus. Similar extrapolations can be performed for different variables and cases.

5. Concluding Remarks

This paper tried to answer the question of why do some countries take longer than others to get out from a recession. Although our analysis may lack several important variables (political, structural, among others), the results from a count-data model under a Poisson distribution show that more open and export-diversified economies spend less quarters in recession. Our conclusions remain under different specifications and procedures, sign of robustness of our estimates.

Specifically, we tested the role of the following variables in determining the expected length of a recession –measured in quarters, according to the IMF definition of a recession-: GDP per capita growth of a country's trading partners, real exchange rate misalignment, terms of trade shocks, exports concentration and dummy variables for hard-pegs and floats. In general, the correct expected coefficient signs were found, along overall statistical significance.

Direct and clear policy recipes are drawn from the results of this paper. High trade openness, a diversified basket of export products and dynamic trading partners are important preconditions to reduce the length of experienced recessions, thus they facilitate the faster recovery of an economy. The choice of the exchange rate regime is also important. Our econometric results imply that countries managing a flexible exchange rate regime at the start of a recession, spend less quarters in it than with other regime choices. The worst performing regime given our results are the soft-pegs or intermediate regimes, thus the evidence presented in this paper supports the "bipolar view" of exchange rate regimes.

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7. Appendices

Appendix 1: List of Countries

ARGENTINA, ARMENIA, AUSTRALIA, AUSTRIA, BELARUS, BELGIUM, BOTSWANA, BRAZIL, BULGARIA, CANADA, CHILE, COLOMBIA, CZECH REPUBLIC, DENMARK, ECUADOR, ESTONIA, FINLAND, FRANCE, GERMANY, GREECE, HONG KONG, HUNGARY, IRAN, IRELAND, ISRAEL, ITALY, JAPAN, KAZAKHSTAN, (SOUTH) KOREA, LATVIA, LITHUANIA, MALAYSIA, MALTA, MEXICO, NAMIBIA, NETHERLANDS, NEW ZEALAND, NORWAY, PERU,

PHILIPPINES, POLAND, PORTUGAL, SLOVAK REPUBLIC, SPAIN, SWEDEN, SWITZERLAND, THAILAND, TURKEY, UNITED KINGDOM, UNITED STATES, VENEZUELA.

Appendix 2: Count-Data models (Poisson, Negative Binomial)

If the dependent variable of a model has specific characteristics (strictly positive integer number), a count-data model can be estimated, under different theoretical distributions

A2.1 *Poisson Distribution*

Using standard notation for dependent and independent variables, Poisson-type regressions are based in the conditional density of y given x[†]:

$$f(y_i \mid x_i, \beta) = \frac{e^{-m(x_i,\beta)} m(x_i, \beta)^{y_i}}{y_i!}$$

Usually, a prior assumption regarding the conditional mean parameter (m) must be made. The standard formulation (used in this paper) is the log-lineal:

$$m(x_i, \beta) = E(y_i \mid x_i, \beta) = \exp(x'_i \beta)$$

The vector of coefficients β is calculated by maximizing the log-likelihood function

$$\ell(\beta) = \sum_{i=1}^{N} y_i Ln[m(x_i, \beta)] - m(x_i, \beta) - Ln(y_i!)$$

by means of an iterative numeric method (Newton-Raphson, Bernd-Hall-Hall-Hausman), given the non-linearity of the first order conditions set by objective function.

A2.2 *Negative-Binomial Distribution*

The Negative-Binomail distribution can be seen as a more general specification, from which the Poisson distribution is a particular case. Hence, it allows overdispersion in the dependent variable, as is usually the empirical case. Specifically, the log-likelihood function changes to

$$\ell(\beta, \eta) = \sum_{i=1}^{n} y_i Ln(\eta^2 m(x_i, \beta)) - (y_i + 1/\eta^2) Ln(1 + \eta^2 m(x_i, \beta)$$
$$+ Ln\Gamma(y_i + 1/\eta^2) - Ln(y_i!) - Ln\Gamma(1/\eta^2)$$

[†] Note that temporal indexes have been eliminated, in order to facilitate exposition and because in the different count-data models estimated throughout the paper, observations where pooled.

where η^2 it's the overdispersion parameter, estimated jointly with the coefficient vector β. As discussed above, the function is maximized through an iterative method, while the definition of conditional mean (m) remains.

A2.3 Marginal Effects

Given the expression used to estimate the dependent variable conditional mean, an expression for each observation can be found:

$$m(x_i, \hat{\beta}) = \exp(x'_i \hat{\beta}) = \hat{m}_i$$

then

$$Marginal\ Effect_k = \partial m(x_i, \hat{\beta}) \Big/ \partial \beta_k = \exp(x'_i \hat{\beta})\beta_k = \hat{m}_i \beta_k$$

In other words, the effect of each RHS variable over the conditional mean of y is sample variant, i.e. can be calculated for each observation "i". In order to simplify the discussion and the exposition of results, mean marginal effects were presented in the results section, calculated as follows:

$$Mean\ Marginal\ Effect_k = \exp(\bar{x}'_i \hat{\beta})\beta_k = constant$$

Appendix 4: Data sources

Variable	*Fuente*
Quarterly GDP index, 1995 =100.	International Financial Statistics (IFS) CD-ROM International Monetary Fund (IMF)
Trading Partners' GDP Per Capita growth (%, weighted average by trade share)	IMF: Directions of Trade Global Development Finance World Development Indicators
Real Effective Exchange Rate Index	Global Development Finance World Development Indicators
Terms of Trade index (goods and services), 1995=100	Global Development Finance World Development Indicators

Trade as percentage of GDP (sum of imports and exports of goods and services as fraction of total output)	Global Development Finance World Development Indicators
Export Concentration Index†	UNCTAD Handbook of Statistics. Available at: http://stats.unctad.org/restricted/eng/ReportFolders/Rfview/Explorerp.asp
De-facto classification of exchange rate regimes	Eduardo Levy-Yeyati's homepage, Universidad Torcuato di Tella: http://www.utdt.edu/~ely/base_2002.xls

† Index constructed a la Herfindahl-Hirschmann and normalized to obtain values between 0 and 1 (maximum concentration) according to the formula:

$$HH_i = \frac{\sqrt{\sum_{j=1}^{n}(x_j / X)^2} - \sqrt{(1/239)}}{1 - \sqrt{1/239}}$$

where

HH_i is the index for country i

x_j is the value of exports of product j

$$X = \sum_{j=1}^{239} x_i$$

and 239 is the number of exported products, at the three-digit SITC.