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The Business Cycle in a Financially Deregulated Context: Theory and Evidence

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ABSTRACT *This article proposes Minsky's financial instability hypothesis (FIH) as a theoretical underpinning for a three-regime business cycles model. Further, it is argued that the development of the FIH for open, developing economies (FIH-ODE) provides a better understanding of the performance of business cycles in these economies, particularly during the last two decades. In support of these claims, a three-regime autoregressive Markov switching model is estimated from 1980q1 to 2000q4 to Mexico's quarterly real GDP to investigate its business cycle behaviour. The estimated probabilities of the high and medium growth regimes suggest, for example, that after the financial liberalisation programme was fully launched, in the late 1980s, the economy shifted from the regime of medium to high growth (and vice versa) swiftly, reflecting its dependence on capital flows. Furthermore, the estimated parameters indicate that the average length of the business cycle has not changed.*

KEY WORDS: Autoregressive-Markov switching model, business cycles, Mexico, financial liberalisation, developing economies,

JEL CLASSIFICATION: E12, E32, F41, F32

Introduction

Most authors analysing and drawing inferences regarding business cycle movements implicitly assume that the economy is operating in one of two regimes, namely expansions and contractions (see, *inter alia*, Hamilton, 1989; Kim & Nelson, 1999; Mejia-Reyes, 2000). The hypothesis of a two state business cycle model is based on definitions of the business cycle à la Keynes (1936), Burns & Mitchell (1946) or Hicks (1950). However, other researchers (see, for example, Krolzig, 1997a,b; Clements & Krolzig, 1998; Öcal & Osborn, 2000 and Ferrara, 2003) have proposed and shown that a three-regime model better represents business cycle movements. But in this case, there is a shortcoming in terms of economic theory. In sum, the traditional theory has suggested two regimes, empirical work then has suggested three regimes, but without theoretical justification.

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Minsky's (1982, 1986) seminal financial instability hypothesis (FIH), however, can provide a good theoretical explanation for three-regime business cycle models. This framework proposes that the process from financial robustness to instability involves passing through regimes of increasing (optimistic) expectations associated with economic expansion, namely medium and high growth, and then to operate further in a regime of (financial) crisis. Importantly, the medium growth regime is followed by one of high growth. Furthermore, the FIH may be extended and applied to open, developing economies (FIH-ODE) as it allows the role of the financial liberalisation strategy as an element that influences the evolution of the business cycle asymmetries and its stability to be considered.

The aims of this paper are twofold. First, to show that the FIH can be used as theoretical framework to support three-regime business cycle models, allowing a better understanding of business cycle movements, filling the existing gap in the literature. Second, using the FIH version for financially liberalised developing economies explain how the financial liberalisation strategy affects the asymmetries and stability of the business cycle. To illustrate these two aims we apply the popular Markov switching autoregressive (MS-AR) model to Mexico's quarterly seasonally adjusted real GDP from 1980q1 to 2000q4. We choose the Mexican economy because it can be considered a representative case of the effects that the conventional liberalisation strategy has on the business cycle asymmetries and it, indeed, sparked the new era of financial crises in emerging economies.

This paper is set out as follows. The second section provides the theoretical base for a three-regime business cycle model and further explanations of its evolution in a financially deregulated environment. Following this, the third section describes the MS-AR model methodology while the penultimate section presents and discusses the estimated results of the three-regime MS-AR model applied to the Mexican economy. Finally, conclusions are presented in the last section.

The Three-regime Business Cycle Model

Vintage macroeconomic empirical studies searching for business cycle movements¹ have assumed the economy operates in two regimes, with the regimes associated with business cycle expansions and contractions. This general assumption basically follows the classical definition of the business cycle (see Burns & Mitchell, 1946, p. 3). The MS-AR model has been applied successfully in this regard, mainly in developed economies, spotting expansions and contractions that correspond fairly closely to traditionally dated turning points published by the NBER and/or the Center of International Business Cycle Research (CIBCR) (see for example Krolzig, 1997a). However, recent articles have shown that business cycles can exhibit more than two regimes. As Öcal & Osborn (2000, p. 27) point out 'there is growing evidence that at least three regimes are required to represent adequately business cycles movements'. These regimes have been associated, for example, with 'expansions typically consisting of a period of rapid recovery followed by one of slower growth'.² In fact, these sorts of models are able to date the shifts that an economy has undergone in a better fashion, though their forecast outcomes are not necessarily more accurate (see Clements & Krolzig, 1998). However, the lack of economic theory that considers more than two regimes is a constant shortcoming in these models. Their characterisation of a three (or more) regimes business cycle is based mainly on statistical evidence.

But Minsky's FIH (1982, 1986) aims to explain the endogenous process that drives an economy to a financial crisis in a three-regime business cycle context. It is based on an understanding of the debt-financing-investment process in a capitalist world, which is characterised by recurrent instability and uncertainty. Importantly, this instability is not due to the incompetence of policymakers, but is, in fact, the result of the fragile financial system that emerges from cumulative changes in financial relations and institutions. Hence, the main thrust of the FIH is the transition of the economy from a robust financial system to a fragile one due to the cumulative debt financing-investment process and the change in agents' expectations regarding current and future cash flows, which are the means of discharging debts. This endogenous transition is characterised by the economy operating in different regimes (crisis, medium growth and high growth), which reflect the evolution of the business cycle. That is, 'the FIH leads to an investment theory of the business cycle' (Minsky, 1982, p. 95).

More precisely, the FIH proposes that the process from financial robustness to fragility involves passing through regimes of increasing (optimistic) expectations associated with economic expansion, namely medium and high growth, to operate further in a regime of (financial) crisis. That is, the expansion phase is separated into two regimes, mild recovery (medium growth) followed by one of high growth, meanwhile the regime of contractions is related to (financial) crisis. During this transition, a structure of low financial fragility is usually a characteristic of an economy operating in a regime of medium growth. In this regime, firms, gradually, generate an environment to finance their investment projects, because the financial system (largely banks) is able to satisfy their credit requirements. That is, with favourable market conditions and optimistic expectations about the near future, firms and banks come to regard the margins of safety³ chosen in the past as over-cautious and their risks start to be underestimated, while at the same time, financing demand increases. Banks and other financial units do not have problems increasing the supply of money, either through common channels or through financial innovation. This increases firms' liabilities and the overall financial fragility increases, because their margins of safety fall.

Importantly, during the upswing, each regime is related to a firm's margin of safety. Large margins of safety prevailing will indicate the economy is in the medium growth regime with the majority of the firms classified as hedge units.⁴ As the economy evolves, with optimistic expectations dominating and the investing financing process increasing as well, the margins of safety will decrease, speculative and/or Ponzi units⁵ will predominate and the economy will be identified as being in the high growth regime. In Minsky's (1982, p. 99) words: 'The mix of hedge, speculative, and Ponzi finance in existence at any time reflects the history of the economy and the effect of historical developments upon the state of long term expectations'. As can be noted, the degree of financial fragility evolves in a parallel fashion and hence it is, in principle, possible to predict if the economy is close to moving into the crisis regime.⁶

Nevertheless, in a financially deregulated context, despite the existence of the above regimes, the classification of units is not so straightforward. A firm can resemble a hedge and a Ponzi unit at the same time. In this context, the FHI-ODE needs to be used because it is able to explain this phenomenon (see Arestis & Glickman, 2002, who extend the FIH to the context of financial openness in emerging economies). This is because the FIH-ODE considers the fact that units are propelled to embark on long term gestation projects issuing debts repayable in

foreign currency. If the firm expects to be able to meet adequately its financial commitments it can be considered, then, a hedge unit. However, the same firm can be classified as a speculative unit, with a tendency to resemble a Ponzi, since it is now more vulnerable to both domestic and external financial conditions. Furthermore, a unit that 'borrowed *short-term* in foreign currency to finance domestic long-term assets would also be speculatively financing itself under both of Minsky's criteria: as well as needing continually to roll debts over, it will also be vulnerable to changes in interest rates ... [and] to exchange-rate movements' (Arestis & Glickman, 2002, p. 242)⁷. The resultant *super-speculative* financing unit will be the sort of unit that will predominate and therefore the regime in which the economy is operating cannot be inferred from the firms' margins of safety in a direct fashion. Consequently, the degree of financial fragility is no longer so evident either.

A first contribution then of the FIH framework is a sound underpinning for a three-regime business cycle model. This three-regime model could either be able to characterise in a better way business cycle turning points or simply be a useful framework that allows an explanation of the manner in which the economy is likely to evolve until it reaches the regime associated with crisis.

However, the FIH-ODE framework also allows one to draw inferences regarding the business cycle asymmetries of these economies. In an emerging financially liberalised economy, assuming the absence of capital controls, asymmetries in the business cycle can be considerably altered due to the boost to domestic credit. If investors find adequate conditions in a specific emerging economy, they will likely *flood* the country with inflows of capital. The following surge of domestic credit, assuming optimistic expectations are gaining ground, will mean that agents will not face any obstacle to financing their projects, either in the domestic market or abroad. In the same fashion, banks will be able to increase both their loans and deposits, especially because they feel the same euphoria as businessmen. Investment and consumption, as a consequence, are likely to increase considerably. Hence a larger rise in output would be expected than otherwise. In sum, the quicker and larger the inflows arrive the higher the rate of growth would be expected to be. It is likely, hence, that the magnitude of the expansion phase can be increased considerably.

The duration of this phase, on the other hand, may also be modified. If the stream of flows remains constant or increases, optimistic expectations are likely to remain high as agents (and banks) will not foresee any impediment to continue with the debt-financing process. This optimistic euphoria might be further supported by the stability of some variables that affect units' margin of safety, such the rate of interest and the exchange rate. Both investment and consumption may continue at high levels and as a result the expansion will likely last longer. By the same logic, constant (and large) outflows of capital will negatively affect expectations and hence the expansion phase, leading the economy to move quickly to the crisis regime.

The magnitude of the crisis will depend essentially on the degree of existing macro imbalances. Large current account deficits coupled with high levels of banking, private and government leverage, accumulated during the expansion phase, will produce a sharp decrease in output if, on the one hand, the (domestic or external) supply of credit reduces or, on the other hand, as a result of the economic measures that the government takes in the event of capital flight or currency attack (or both). These measures will likely involve a further increase in

the domestic rate of interest and the floating of the exchange rate (see Grabel, 1996). The length of the crisis regime will depend on how quickly the authorities are able to regain investors' confidence, meaning they are able to stop the capital flight or attract inflows of capital again, or on the speed with which the international community is able to provide a financial bailout.

Finally, the FIH-ODE approach is able to provide us with the logic to explain the instability that the business cycle during the upswing can undergo, which is reflected in swift regime shifts (from the medium growth regime to the high one, and vice versa). As the economy becomes more financially liberalised, speculative activities become larger and larger because these transactions validate their profits through the increase in asset prices. If success breeds success, the economy will move to the high growth regime (and will continue operating there) as long as the foreign investments validate their profits. The pace and stability of the economy will indeed be dependent on these inflows, because agents' expectations will be based mainly on the returns from these activities and the stream of these flows may have the *power* to dictate the stability of key variables, such as the domestic rate of interest and the exchange parity. A sudden decrease in inflows of foreign capital, for example, would be expected to have a negative impact on the foreign exchange rate alongside a rise in the domestic rate of interest. As a result, in the very short term, even when the trend of foreign capital inflows returns to its former level or capital ceases to flee, a negative shift in agents' expectations might be expected to gain ground because their financial commitments might have been increased considerably, as well as current and future income flows which could also be affected negatively. As a consequence, the regime in which the economy is currently operating has the potential to change dramatically, i.e. from the high to the medium growth regime. In other words, the evolution of the business cycle would likely reflect the waves of flows, resulting in swift movements from one regime to another. Furthermore, it could operate for very short periods in one regime and then shift to another regime and again change to another, with the associated result that it may be difficult to identify in which regime the economy is operating.

In summary, the FIH-ODE framework provides a way of understanding business cycle asymmetries and instability, particularly in recent years, when the conventional liberalisation strategy has been fully applied in developing economies. As we noted, the FIH-ODE suggests a longer duration and magnitude of the medium and high growth regimes due to the inflows of capital. It also suggests that these inflows may provoke a higher instability of the business cycle. On the other hand, the FIH-ODE determines the magnitude of the crisis regime on the basis of macro imbalances accumulated during the upswing whereas its duration depends on policy makers' ability to regain investor confidence. Traditionally, the econometric tool that has been used to analyse and draw inferences regarding business cycles movements and asymmetries is the Markov switching autoregressive model. Before going into its application to the Mexican economy, in the next section we briefly describe how the MS-AR model works.

Markov Switching Models

MS-AR models are based in the following idea. Consider a stationary time series $\{y_t\}$ that is assumed to have been generated by an $AR(p)$ process and is influenced in its mean (μ) by an unobserved random variable s_t , which can be called the state

or regime (N) that the process was in at date t . To keep exposition as simple as possible consider an AR(1) process with only two states.⁸ Following Krolzig's (1997a) nomenclature, this process can be labelled an MSMean(2)-AR(1) process,

$$y_t - \mu_{s_t} = \phi (y_{t-1} - \mu_{s_{t-1}}) + \varepsilon_t, \text{ with } \varepsilon_t \sim NID(0, \sigma^2) \quad (1)$$

If the $s_t=1$, then the process is in regime one with associated mean μ_1 , while if $s_t=2$ the process is in regime 2 with associated mean μ_2 .

In the business cycle context, for example, if $\{y_t\}$ represents output growth of the economy, then we might have μ_1 corresponding to periods of recession and μ_2 corresponding to periods of expansion.

An alternative possibility to equation (1) is

$$y_t = \delta_{s_t} + \phi y_{t-1} + \varepsilon_t, \quad (2)$$

in which case the intercept shifts with the regime. The process can be labelled then an MSIntercept(2)-AR(1) model. In practice both equations give similar results. However, 'for a MSI model smoothing and filtering probabilities are less computationally demanding (and therefore much faster) than the statistical analysis with a MSM⁹ model. Hence, if there are not theoretical reasons which call for an MSM specification, an MSI specification is preferred' (Krolzig, 1997a, p. 126).

On the other hand, it is possible as well that for an MSM or MSI specification the variance changes with the regime. This allows the following specification

$$\begin{aligned} y_t &= \delta_1 + \phi y_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim NID(0, \sigma_1^2) \text{ when } s_t = 1 \\ y_t &= \delta_2 + \phi y_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim NID(0, \sigma_2^2) \text{ when } s_t = 2 \end{aligned}$$

In this case the process is labelled as an MSIH(2)-AR(1), where the H stands for the heteroskedastic term.

Markov chains are the mechanisms that govern the evolution of the stochastic and unobservable regimes on which the parameters of the autoregression depend (Clements and Krolzig, 1998, p. 55). For a first order Markov chain the probability the s_t equals some particular value j depends on the past only through the most recent value s_{t-1} :

$$P\{s_t = j | s_{t-1} = i\} = p_{ij}$$

Such a process is described as an N -state Markov chain with transition probabilities.

$$\{p_{ij}\}_{ij=1,2,\dots,N}$$

The transition probabilities p_{ij} give the probability that state i will be followed by state j . Note that

$$\sum_{j=1}^N p_{ij} = 1, \text{ for all } i$$

For a two-state Markov chain, the time-invariant transition probabilities matrix is:

$$\mathbf{P} = \begin{bmatrix} p_{11} & p_{21} \\ p_{12} & p_{22} \end{bmatrix}$$

Row one column two, for example, gives the probability that state 2 will be followed by state 1. The matrix \mathbf{P} is ergodic, irreducible and does not exhibit an absorbing state.¹⁰

To estimate the vector of parameters $\Phi = (\mu_s, \phi_1, \sigma^2, p_{11}, p_{22})$ the likelihood function of the MSM(2)–AR(1) model is maximized through an iterative estimation technique. The maximum likelihood (ML) estimation of the model is based on an implementation of the expectation maximization (EM) two-step algorithm proposed by Hamilton (1989).¹¹ The *expectation* step involves a pass through the filtering and smoothing algorithms, using the estimated parameter vector $\Phi^{(j-1)}$ of the last maximization step in place of the unknown true parameter vector. This delivers an estimate of the smoothed probabilities $P(S \mid Y, \Phi^{(j-1)})$ of the unobserved states. In the *maximization* step, an estimate of the parameter vector Φ is derived as a solution $\tilde{\Phi}$ of the first order conditions associated with the likelihood function, where the conditional regime probabilities $P(S \mid Y, \Phi)$ are replaced with the smoothed probabilities $P(S \mid Y, \Phi^{(j-1)})$ derived in the previous expectation step. Equipped with the new parameter vector Φ the filtered and smoothed probabilities are updated in the next expectation step, and so on, guaranteeing an increase in the value of the likelihood function at each step (Clements & Krolzig, 1998, p. 56).¹²

A Three-regime MS-AR Model for an Emerging Economy: The Mexican Experience

The Mexican economy has been the subject of development studies since the early 1990s. Initially, its brilliant macroeconomic performance was widely lauded. For example, Edwards (1998, p. 1) highlights that in the Second Wall Street Journal Conference, held in 1993, the audience was literally captivated by the Mexican Trade Minister's command of the stage and by his charm, and 'the unmistakable sense among the conference participants ... was that... Mexico was the brightest star in Latin America'. And he further notes 'The future looked brilliant, and virtually everyone expected that after the enactment of the NAFTA, Mexico would rapidly join to the ranks of the more advanced countries with solid growth, stability and prosperity'.

In the middle of that decade, however, the financial crisis of 1994–95, the so-called Peso crisis, was a puzzle to be solved. The conventional financial liberalisation strategy, fully applied since the late 1980s, played a key role during this performance. As agents' expectations turned optimistic with the implementation of this strategy the economy transited from a regime of medium growth to one of high growth and abruptly to a crisis regime. In this sense, the Mexican experience can be highlighted as the representative case of the effects that the conventional financial strategy has on the evolution and asymmetries of the business cycle of an emerging economy, and indeed it inaugurated the new era of financial crises in these economies. In this section, we apply the Markov switching methodology, hence drawing and making inferences regarding Mexico's business cycle performance and asymmetries to illustrate the hypotheses described in Section 2. In order to have a better understanding of the estimated results, we first present a brief overview of Mexico's economic evolution during the 1980s and 1990s, but particularly during the period from 1988 to the Peso crisis, 1994–95.

As we can see from Figure 1, economic growth prior to 1987 followed an unstable pattern with marked ups and downs, particularly from the debt crisis, in 1982, to 1986. From 1982 to 1986, it can be assumed that expectations were negative or even

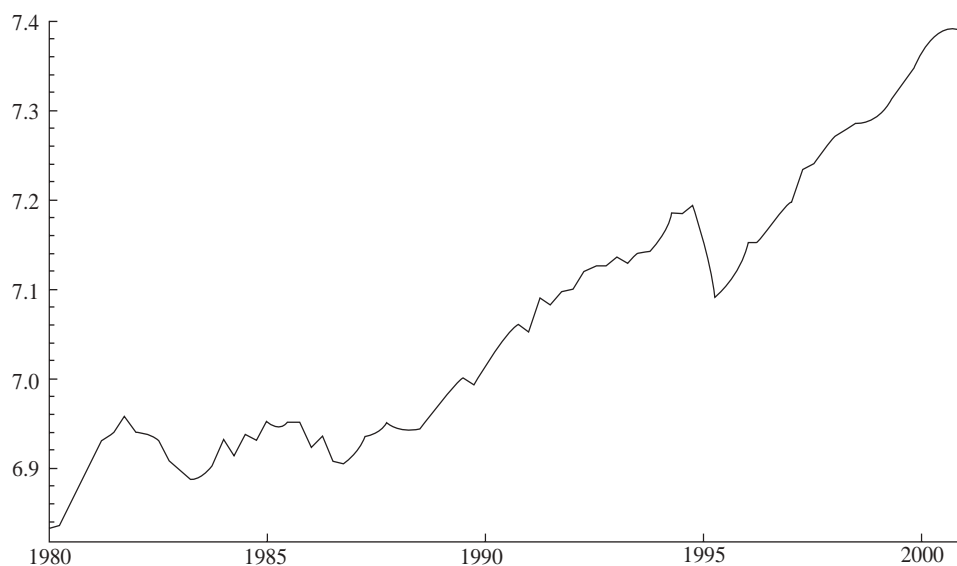


Figure 1. Mexico's real quarterly seasonally adjusted GDP, 1980q1–2000q.4, logs *Source:* IMF (2202)

pessimistic, keeping domestic aggregate demand at low levels due to poor investment (its average rate of growth was -6.5%) and a negative external context. Nevertheless, from 1987, despite the global stock market crash and the fall of oil prices of this year, to late 1994, GDP shows an increasing and stable trend. This trend is abruptly interrupted by the financial crisis of 1994–95, the Peso crisis. Finally, from early 1995 to 2000, economic growth exhibits again an upward and stable trend.

We argue that it is precisely the stabilisation plan officially launched by President De la Madrid in late 1987 that generated a shift in agents' negative expectations prevailing in previous years and hence the enhanced pattern of growth (see Cruz, 2004, section 4). The new strategy was based initially on an incomes policy, with the exchange rate as anchor¹³. Additionally, the government adopted fiscal and monetary retrenchment policies aimed exclusively at reaching a fiscal balance or surplus, contributing to stabilising prices.

The macroeconomic results of the plan were good and obtained rapidly. For example, inflation dropped from 51.6% in 1988 to 19.7% the next year to further reach one digit, 7%, in 1994. The fiscal imbalance followed the same direction as it passed from 8.8% of GDP in 1988 to 4.5% of GDP the next year and then reached a minimum of 0.03% of GDP in 1994. The nominal rate of interest also showed a decreasing trend, falling from 55.4% in 1988 to 48.7% in 1988 to around 20% in 1994. These results, which were accompanied by favourable external conditions, changed agents' expectations that in turn were reflected in the trend of investment, consumption and growth. During this period, the average rate of economic growth was relatively high, 3.4%, while investment increased 244% and private consumption 228%.

The stabilisation plan also included a privatisation programme, coupled with a conventional financial and trade liberalisation strategy. Mexico initiated financial deregulation strategy from 1977 and it was intensified in 1988, but it can be argued that in 1990 financial openness was fully launched. In March 1989 the Brady Plan to refinance the external debt was announced and in July it was signed; a succession

of measures relaxed bank's reserve requirements, credit quotas to high priority sectors and control in interest rates were implemented; the elimination of restrictions to foreign investment in domestic bonds, largely government bonds, and stock markets took place in 1989 and 1990. In order to give security to investors, the Financial Group Law was announced and passed in July 1990. The law allowed private-sector majority ownership of Mexican banks and initiated the privatisation process. Also, foreign investment was permitted up to 30% (Ros, 2001).¹⁴ The announcement of the Mexico–USA trade agreement took place in 1990.

The immediate consequence of these measures was a significant boost of external financing, particularly portfolio flows (during the period 1990 to 1993 aggregate flows to Mexico totalled US\$91 billion, an amount equal to one-fifth of all net inflows to developing countries in those years. Two-thirds of the net inflow was portfolio investment, most of it channelled into a hectic Mexican stock market (D'Arista, 2000)). With the economy flooded with external flows, agents' expectations rose even further and investment also registered unusually high rates of growth (the average rate of growth of investment was 8.1% during the period 1990–1994).

The Estimated Parameters and Probabilities

The sample period of Mexico's quarterly real seasonally adjusted GDP is 1980q1 to 2000q4.¹⁵ Using the rate of growth of this variable,¹⁶ we found that an adequate three-regime business cycle model (in the sense of generating an evolution consonant with the FIH-ODE framework)¹⁷ is an MSIH(3)–AR(4):

$$y_t = \delta_{s_t} + \sum_{k=1}^4 \phi_k y_{t-k} + \varepsilon_t$$

where $\varepsilon_t \sim NID(\sigma^2(s_t))$ and $s_t \in \{1,2,3\}$ is generated by a Markov chain. The specification has four lags.¹⁸

Figure 2 and Table 2 summarize the business cycle characteristics of this model.¹⁹ Figure 2 depicts the filtered and smoothed probabilities of the crisis 'C', the medium, 'M', and high growth, 'H', regimes, with the last two regimes associated with the expansion phase described in Section 2.

As we noted, immediately after a period of economic instability from the mid 1980s, there was a substantial recovery in the economy. Within an optimistic environment the economy was led from the medium growth to the high growth regime. Both smoothed and filtered probabilities confirm this fact. As we can see, from early 1987 the economy is already operating in regime M, and although decreasing, the probability of operating in this regime is high over the next two years. It is precisely in late 1988 that the economy starts to shift to the state H whilst it is in late 1989 that the probability of the economy operating in state H starts to get close to one. In fact, the negligible probability of operating in regime M in 1990 contrasts clearly with the almost unitary probability of regime H. It is important to note that the probability of both regimes is practically reversed between 1987 and 1990. In short, this empirical evidence suggests that after the economic slump of 1987 Mexico's business cycle initially evolved as the classical Minsky's FIH states (a mild recovery followed by high growth). Importantly, this evolution suggests that in the context of insignificant financial openness, the economy is likely to transit from one regime to another *smoothly*,

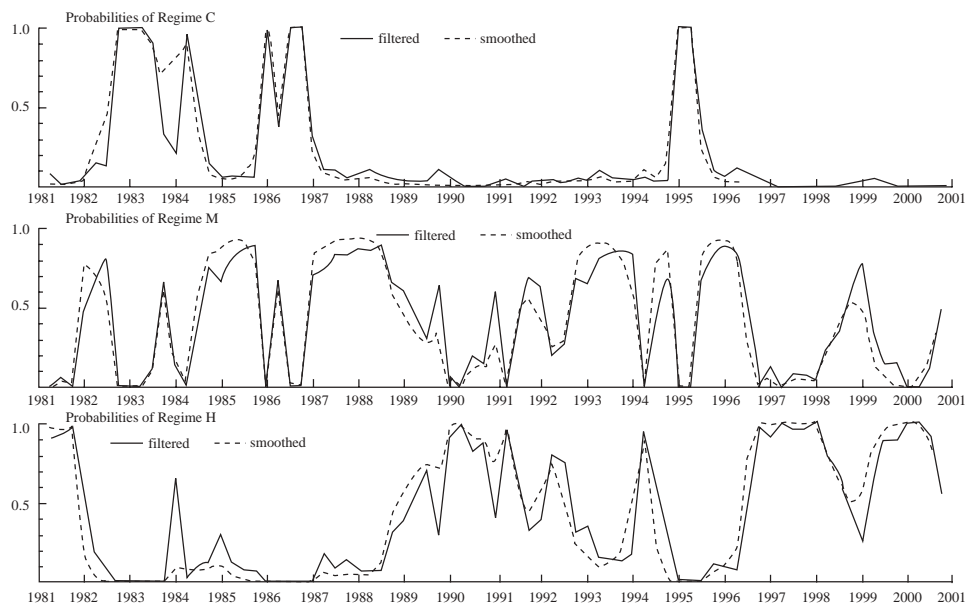


Figure 2. Smoothed and filtered probabilities of regimes C, M and H

along with a *normal* evolution of agents' expectations and their investment decisions.

On the other hand, the evolution of Mexico's business cycle regimes M and H during the period from early 1991 to late 1994 seems to be consistent with the FIH-ODE framework. Recall that it is expected that once the economy is totally open, the business cycle reflects the increased exposure to domestic and external market conditions, particularly due to capital flows. The estimated smoothed and filtered probabilities show that despite the probabilities of regime M and H maintaining an inverse evolution during early 1990s, it is difficult to categorize the regime in which the economy is operating in a straightforward fashion. In fact, from 1991q1 to 1991q4 the economy operates in regime M with an average probability of 0.5, but in 1991q3 it could be argued that it is operating in regime H as well. The next year exhibits a similar pattern. In this case, the probability of operating in regime H from 1992q1 to 1992q3 is around 0.6. However, from late 1992 to late 1993, the economy is already operating in the M state, then swiftly shifts to regime H, stays there for a very short period (only one quarter) and then shifts again dramatically to regime M. In other words, Mexico's expansion exhibits, as we can see, dramatic shifts of regime during the period from 1991 to 1994.

The fact that the economy operates indistinctly in either one of the regimes makes it difficult to identify in which regime the economy is operating as well as its degree of financial fragility. This evidence seems to be supported by the MSIH(3)-AR(4) model test for asymmetries (see Table 1) proposed by Clements and Krolzig (2003). The model does not reject the hypothesis of nonsharpness; that is, there is clear evidence of symmetric turning points (or sharpness).²⁰ Hence, the probability of moving from one regime to another is equal.

Importantly, although not surprisingly, when the Peso crisis is occurring, late 1994 until mid 1995, the probabilities of both regimes, M and H, are negligible. However,

Table 1. Test for asymmetries

Test	Sign	Test statistic value	<i>p</i> value
MS: sharpness		0.63	[0.88]
$p_{12} = p_{32}$		0.18	[0.66]
$p_{13} = p_{31}$		0.00	[0.99]
$p_{21} = p_{23}$		0.06	[0.80]
MS: deepness	–	0.37	[0.53]
MS: steepness	+	0.63	[0.42]
NP: deepness	–	17.2	[0.00]**
NP: steepness	–	1.8746	[0.17]

Notes: The nonparametric and MS(AR) test statistics are $\chi^2(1)$ under the null of symmetry. A positive (negative) value of 'sign' flags positive (negative) skewness.

**Significance at the 5% level.

and in contrast with previous experiences, the economy operates in regime C for very short time. This fact might be explained on the basis of the series of economic announcements and policy measures that the authorities took in the aftermath of the crisis (*inter alia*, but mainly, the reinforcement of mainstream economic policies aimed at continuing the openness strategy, the USA financial bailout package and the creation of a sort of federal insurance saving fund)²¹. In fact, the recovery of investors' confidence, coupled with the end of the financial panic seems to have started from May 1995. Investigating the *timing* of the crisis, following Coe's (2002) approach, we applied an MSIH(2)–VAR(9) model with the cost of credit intermediation and the growth rate of the currency–deposit ratio as variables to detect when the financial system was either in calm or panic. We found that the estimated probabilities suggest that the financial panic started in November of 1994 with the currency attack registered that month. This result supports the view that a financial crisis is usually signalled by a currency attack (cf. Schroeder, 2002). Furthermore, the probabilities also suggest that the crisis ended (or at least the return of confidence to the markets began) in May of 1995, when the exchange rate was stabilised and the domestic rate of interest, though high, started to show a decreasing tendency (the estimated probabilities can be obtained with the author upon request). After the 1994–95 collapse, as is to be expected, the economy starts to operate in regime M.

The estimated parameters given in Table 2 shed light on the asymmetries of the business cycle. First of all, the average duration of the business cycle (12.7 quarters) is in line with the average length of business cycles in emerging economies (generally between 7.7 and 12.0 quarters) reported by Rand & Tarp (2002, p. 2076). This evidence indicates that the Mexican business cycle length has not been altered by the implementation of the conventional financial strategy. It is important to stress that the sample of fifteen developing countries considered by Rand and Tarp includes only three recent financial crisis-affected economies: Mexico, Korea and Malaysia. This could be an argument to dismiss Rand and Tarp's results, as the possible effect of the financial liberalisation strategy on the business cycles could be insufficiently represented in the sample. In order to provide a more representative figure, the average length of the business cycle of these three countries (12.4 quarters) was then compared with the initial result. As we can see, it did not change the conclusion: the conventional liberalisation strategy has not altered Mexico's average business cycle length.

Table 2. Estimated parameters and transition probabilities of the MSIH(3)–AR(4) (standard errors in parenthesis)

Parameter	Estimate
δ_C	–1.2571 (0.8142)
δ_M	0.9007 (0.2246)
δ_H	2.1479 (0.4684)
ϕ_1	–0.2634 (0.0745)
ϕ_2	0.1246 (0.0645)
ϕ_3	–0.3099 (0.0693)
ϕ_4	–0.2007 (0.0670)
σ_C^2	5.0149
σ_M^2	0.40899
σ_H^2	1.1007
Trans. Prob. p_{CC}	0.7157
Trans. Prob. p_{CM}	0.2827
Trans. Prob. p_{CH}	0.0016
Trans. Prob. p_{MM}	0.6916
Trans. Prob. p_{MC}	0.1350
Trans. Prob. p_{MH}	0.1735
Trans. Prob. p_{HH}	0.8328
Trans. Prob. p_{HM}	0.1654
Trans. Prob. p_{HC}	0.0019
Duration C	3.52
Duration M	3.24
Duration H	5.98
Obs. in C	14.8
Obs. in M	30.9
Obs. in H	33.3
SIC	4.3383
Log likelihood	–136.4084

Furthermore, when comparing the average business cycle length for Mexico with the average business cycle length for the USA, five years (cf. Clements & Krolzig, 1998), the outcome presented here is also consistent with Rand and Tarp's main argument regarding the average business cycle length for transition economies. They argue that the average business cycle length for these economies is shorter than for developed economies (between 7.7 and 12 quarters *vs* 24 and 32 quarters).

These authors also found that, among regions, for Latin America 'the average length of the expansion periods is longer than the contraction period, whereas the opposite is characteristic for Asian and North Africa countries in the sample' (p. 2074). And in particular, for Mexico, Rand & Tarp (2002, p. 2075) point out that 'the expansion periods are longer ... during 1980–98 than the contraction periods.

But, the recessions clearly got shorter ... during the 1980s and 1990s, as compared with recessions in the 1960s and 1970s'.

As can be seen, this holds for Mexico's business cycle model as well. The duration of the expansion phase, the M and H regimes together, is higher than the duration of the C regime (9.6 quarters versus 3.5 quarters). Importantly, the expansion phase has an associated rate of growth of 3%. The rate associated with the regime C is -1.2%. This evidence suggest that, on the one hand, the length of time that the economy operates in the expansion regime has been altered, lasting longer, especially if it is compared with the length (4.8 quarters) that Rand & Tarp (2002, p. 2074) report for the period 1960–1999. This increase in the length of the expansion regime could be effectively associated with the large inflows of foreign capital of the 1990s. Moreover, the length of the C regime has become shorter (Rand and Tarp report an average contraction length of 4.7 quarters) and this may be the result, as we stated earlier, of the reinforcement of policies aimed at regaining investors' confidence rather than an improvement in economic policy, exogenous factors or some combination (see Buira, 1999). On the other hand, Mexico's business cycle magnitude has not become explosive, as it registers a moderate rate of growth associated with the expansion phase and, a relatively small rate associated with crises. In sum the economy registers high instability during the expansion phase coupled with moderate rates of growth, but it recaptures in shorter time the growth path.

Finally, it is noteworthy that the smoothed and filtered probabilities of regime C remain negligible during the period 1988–1994. This result further supports the hypothesis that the conditions for the crisis originated during this period in the sense that the economy was always operating in either one of the other two regimes associated with the expansions, but never in the state C.

Conclusions

This paper has proposed the Minsky financial instability hypothesis (FIH) as a theoretical basis for analysing and drawing inferences from a three-regime business cycle model, trying to fill the theoretical gap existing in this literature.

Its development into the FIH for open, developing economies (FIH-ODE) offers further insights about a number of issues relating to the business cycle in these economies. One issue concerns the role of the financial liberalisation strategy as an element that has influenced the asymmetries of the business cycle and its stability, via the surge of domestic credit supply and speculative activities, respectively. Another issue is the identification of the states in which the economy is operating and its degree of financial fragility.

To shed light on these issues, an autoregressive Markov switching (MS-AR) model was applied to Mexico's real quarterly seasonally adjusted GDP from 1980 to 2000. The results of the MSIH(3)–AR(4) model supported the view that the evolution of Mexico's business cycle is better analysed using a three-regime model. Furthermore, the estimated probabilities confirm the assumption that the Mexican economy in its transition from robustness to financial fragility during the period from 1988 to 1994–95 operated in the medium and high growth regimes. In this sense the probabilities during the period 1988–1994 are negligible for the C regime. Moreover, the analysis of the estimated probabilities of regime M and H also indicate that after the total implementation of the financial liberalisation strategy the economy during the upswing shifted quickly from one regime to another; further

asymmetric tests support the argument that the probability of shifting from one regime to another was equal. This fact suggested that in a financially liberalised context it is more difficult to accurately identify the regime in which the economy is operating as well as to detect its degree of financial fragility.

The estimated parameters indicate that the overall length of the business cycle has remained within the standards and that, comparing with the results of Rand & Tarp (2002), the expansion phase has become larger, though with an associated moderate rate of growth. The former result may be explained by the large inflows of capital that the economy received during the early 1990s whereas the latter is maybe the result of the absence of capital controls. Furthermore, the duration of the C regime has become shorter, probably as a result of the reinforcement of mainstream policies aimed at regaining investors' confidence, and it has, on average, contrary to the steep crises that the economy has undergone, an associated small rate.

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Notes

1. *Vintage* in the sense that the MS-AR model assumes time-invariant transition probabilities. That is the probability of switching from one regime to another is constant over the time. A step forward in the analysis of business cycles asymmetries are the *modern* time-varying transition probabilities MS-AR models. In this case the probabilities of switching may be dependent on some underlying economic fundamentals (see Diebold, Lee & Weinbach, 1994; Filardo, 1994).
2. In the same line is Sichel (1994). Other authors, however, propose that 'the contraction phase can be separated into a slowdown phase and a recession phase' (Ferrara, 2003, p. 375).
3. The margin of safety represents a cushion that absorbs any unforeseen changes in the cash inflows and outflows (Kregel, 2001, p. 196).
4. If current and expected income cash flows are enough to fulfil all the contractual commitments, the firm can be classified as a hedge unit. Moreover, this unit is not directly susceptible to adverse effects from changes in market conditions (Minsky, 1982).
5. A unit is speculative when for some periods, basically near term, the repayment of the principal has to be achieved through refinancing. A speculative unit can only hold the same margin of safety as a hedge unit if beliefs about expected income cash flows and the rate of interest are confirmed. A Ponzi unit can be considered a special case of a speculative financing unit for which in the immediate future the income cash flows are not sufficient to repay either the interest rate or the principal. This type of unit has to raise funds through additional debt inflows in order to pay its financial commitments. Its vulnerability to unexpected changes, mainly but not exclusively, in interest rates or the credit supply is greater than in the speculative unit case. In other words, there is no margin of safety for these types of units and they are extremely dependent on market conditions (Minsky, 1982).
6. In this setting, and contrary to conventional models that usually invoke as the main causes of crisis policy mismanagement, corruption or cronyism, the FIH is clear in respect of the evolutionary course leading the economy from stability to crisis. Moreover, it is clear from this framework that a crisis will necessarily arise after the economy has operated in the medium and high growth regimes.
7. An increase in the interest rate has two effects on firms' balance sheets. First, it reduces the present value of the cash flows expected to be earned from operating leveraged financial projects. Second, it increases the cash flow commitments for financing charges when lending is primarily

short term or set on an adjustable or roll over basis. For a firm with a large proportion of imported inputs, export sales or foreign borrowing, depreciation in the exchange rate has the same effect on cash flow commitments as an increase in interest rates (Kregel, 2001, p. 197). Furthermore, aggregate demand might decrease (and also current and expected cash flows) as a consequence of fiscal retrenchment and a tight monetary policy applied in order to regain investors' confidence.

8. However, an extension of the procedure to the general AR(k) case with N states would be straightforward.
9. For example, 'In the Hamilton (1989) model there is an immediate one-time jump in the process mean after a change in the regime. It may be plausible to assume that the expected growth rate smoothly approaches a new level after the transition from one state of the business cycle to another. For these situations, the MSI-AR model may be used' (Krolzig, 1997a, p. 232).
10. If the process enters state 1, but there is no possibility of ever returning to state 2, then it can be argued that the state 1 is an absorbing state, hence the chain is reducible. An irreducible chain is one in which all states intercommunicate. It is possible to speak of that chain as being recurrent, periodic, etc. (see Hamilton, 1994, ch. 22; Cox & Miller, 1965).
11. For a more detailed explanation of the EM-algorithm refer also to, *inter alia*, Hamilton (1990, 1994) and Krolzig (1997a, chs 6 and 9).
12. It is important to notice that a widespread use of the Markov switching models has been the analysis of a set of series that follow a common or contemporaneous regime (see Krolzig, 1997a,b; Coe, 2002). These Markov switching models, labelled as MS(N)-VAR(p), generalise the data generation process described in equations (1) and (2) to a multivariate context. Conditional on the state process, the N -dimensional vector of stationary time series $\{y_t\}$, is generated by a vector autoregression of order p . The MSM(2)-VAR(1), thus, would look like, $y_t - \mu_{s_t} = A_1(y_{t-1} - \mu_{s_{t-1}}) + \varepsilon_t$ with $\varepsilon_t \sim NID(0, \Sigma)$. We can also assume that the variance-covariance matrix Σ may be state dependent, namely $\varepsilon_t \sim NID(0, \Sigma_{s_t})$. Thus we have an MS(N)-VAR(p) process, where the mean (or the intercept) and the variance change when the regime of the process changes (Mejia-Reyes, 2000, p. 81). The mechanism to estimate the vector of parameters Φ is basically the same as for an MS-AR model.
13. The main goal of this kind of policy is to control and regulate wages and prices. The 'Pacto' (name given to the agreement made between the government, business and labour sector; the first one was the Pacto de Solidaridad Economica) was the instrument to reach that goal.
14. It is noteworthy that despite of these reforms the financial system remained underdeveloped. That is Mexico's financial system was kept as a (bank) credit-based system 'in which the capital market was weak and firms depended heavily on credit for rising finance beyond retained earnings' (Studart, 1993, p. 291). There is little doubt then why the indebtedness of firms increased rapidly with growth, boosting the vulnerability of the economy to domestic and external shocks with banks preferring to lend short (towards financing and speculation) rather than to longer term investments projects (see Studart, 1993, 1995).
15. The database source is the IMF (2002) *International Financial Statistics* Cd-Rom.
16. We modelled the rate of growth because Hamilton's (1989) methodology is specified for stationary series. The quarterly growth rate is calculated as $100 \cdot \ln(y_t/y_{t-1})$. The ADF statistic test for the test of the null hypothesis that a series is $I(1)$ against the alternative that it is stationary around a constant is -4.26 . This implies a rejection of the growth rate of the seasonally adjusted real GDP follows a random walk at the 1% level.
17. For a characterisation of Mexico's business cycle turning points using a three-regime model see Cruz (forthcoming).
18. We used the Schwartz Information Criteria (SIC) to select the lag order. Despite the AR with three lags giving a lower SIC, it does not exhibit business cycle features. For example, the estimated p_{11} and p_{33} are only 0.38 and 0.64, which directly translates into a very short duration (calculated as $(1-p_{ii})^{-1}$) of the crisis (C) and high growth (H) regimes, respectively. Thus for this period the MSIH(3)-AR(3) model attributes isolated observations to regimes C and H and is more a model of 'outliers' than a business cycle model. So, we chose the AR with four lags because it provides a more adequate characterization of the business cycle, and it still gives a lower SIC over the one with five lags.
19. The estimations reported herein were carried with the MSVAR class for Ox (see Krolzig, 1998).
20. Sharpness or turning points asymmetry indicates troughs are more 'sharp' and peaks are more 'rounded'. In a two state model, for example, the test is associated with the probability of jumping from the contraction to the high growth state exceeding the probability of jumping directly from high growth to contraction (see Clements and Krolzig, 2003).
21. This insurance was known as the FOBAPROA (Fondo Bancario de Proteccion al Ahorro).

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