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HETEROGENEOUS AGENTS AND THE COLLAPSE OF AN EXCHANGE RATE REGIME

by

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ABSTRACT

This paper argues that the form of speculative attacks on currencies is inextricably tied to the nature of heterogeneity of speculators. Heterogeneity of speculators, derived from differences in relative risk aversion, differences in information sets, and nonuniformity in liquidity or market power may lead to a spectrum of expectations and stimuli response patterns. Under such circumstances a balance of payments crisis can be characterized by a series of mini-speculative attacks on a currency. Attacks by groups of agents need not succeed at collapsing a fixed exchange rate as implied by the representative or homogeneous agent models. Speculative attacks on a currency are a function of the estimated mean and uncertainty surrounding expected post-collapse gains. The probability of collapsing an exchange rate regimes depends on the liquidity of attacking agents and on the responses and mutual perceptions of heterogeneous speculators. Balance of payments crises need not be self-fulfilling events.

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1. Introduction[1]

In existing models of collapsing exchange rate regimes, deficits in the balance of payments lead to a gradual erosion of central bank foreign currency holdings followed by a single sharp depletion of remaining reserves attributed to a speculative attack on the currency. By depleting reserves to the lowest level acceptable to the central bank, speculators eliminate the means by which the government can intervene in the foreign exchange market. Since the overvalued exchange rate can no longer be sustained through intervention, the exchange regime collapses.[2] The collapse can take the form of either a discrete devaluation of the fixed exchange rate or a switch to a floating exchange rate generally accompanied by a sharp currency depreciation. The experiences of Mexico, Argentina and Israel provide examples of such crises.

Theoretical models of exchange rate crises have modelled agents as homogeneous in their behavior, expectations and information sets. If speculators share the same forecasting model and behave rationally, balance of payments crises are characterized by a single successful speculative attack on reserves and an instantaneous abandonment of the controlled exchange rate. In this paper we relax the premise that all agents are identical. The form of speculative attacks and the probability of a regime collapse are reexamined.

It is important to study market behavior under heterogeneous agents since there is little empirical support for a homogeneity assumption. Indeed

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[2]Speculative attacks can be self-fulfilling since they can succeed at collapsing an exchange regime even when central bank reserve stocks are not at critically low levels. [See Obstfeld (1986).]

in financial markets considerably deeper than those in most crisis countries, agent heterogeneity is evident.[3] This paper argues that when agents are heterogeneous in their expectations or stimuli response patterns and nonuniform in their market power, a balance of payments crisis can be characterized by a series of mini-speculative attacks on a currency which do not necessarily produce a sharp collapse of a fixed exchange rate. The size of a speculative attack on a currency at any point in time is a function of the degree of agent heterogeneity, on agents' mutual perceptions about behavior and reactions, and uncertainty surrounding estimates of expected post-collapse gains.

The paper is organized as follows. Section 2 relates the direction of this paper to the literature on exchange rate crises and bank runs. Section 3 provides a reduced form model of the probability that an exchange regime will collapse which introduces heterogeneous agents. Section 4 presents hypothetical crises under various assumptions of speculative behavior and market fundmentals. Section 5 concludes.

2. Motivation

Krugman (1979) shows that when future government policy is known with certainty, a balance of payments crisis passes through three stages: a period of gradually declining reserves attributed to current account deficits, a sudden speculative attack which depletes all available central bank foreign exchange reserves, and a post-crisis period during which the currency depreciates under a new floating exchange regime. When future fundamental determinants of the exchange rate and the quantity of reserves that the

[3]See Ito's (1988) analysis of the Tokyo market.

government is willing to commit to maintain the existing exchange rate are not known, the timing and magnitude of the speculative attack are dependent upon the exchange rate estimates of individuals who have incomplete knowledge.

This intuition is expressed in the seminal Flood and Garber (1984) linear discrete-time collapse model. The timing and probability of a future exchange regime collapse are derived under assumed agent homogeneity and the premise that the probability of an exchange regime collapse equals the probability that an attack on central bank reserves will prove rewarding to speculating agents. Since all agents are assumed identical and cumulatively large enough to deplete central bank reserves at will, the probability that their will is exercised is identically equal to the probability that the exchange regime collapses. In the representative agent world, when this probability is 'high enough' a single sharp speculative attack will deplete central bank foreign exchange reserves and the exchange rate will collapse immediately. The critical or attack triggering probability is neither derived or explicitly discussed.

Consider more closely the derived probability of collapse. First, define the shadow exchange rate, $\tilde{S}_{t+1}$, as the exchange rate that would prevail in a post-collapse equilibrium. When the market fundamentals that determine the shadow exchange rate are subject to random disturbances, the market forms a period t expectation of the unknown t+1 rate.[4] In a homogeneous agent world, as soon as this one-period ahead shadow exchange rate is expected to exceed the known controlled rate, $\bar{S}_{t+1}$, as collapse will occur. If the exchange regime is abandonned, the speculating agents will profit by a minimum of $[\tilde{S}_{t+1} - \bar{S}_{t+1}]$ per unit of foreign currency held.

[4]See Flood and Garber (1984) and Goldberg (1988).

The collapse is certain because it is assumed that agents are powerful enough, and liquid enough, to deplete the reserves of the central bank. The central bank would be able to defend itself against such a speculative attack only if it had enough access to external capital to exhaust the resources of speculators. For most crisis countries, the scarcity of external capital makes prolonged defense of a currency unlikely unless international agencies provide emergency funds [Goldberg (1988a)]. Since the probable success of a speculative attack by agents with finite resources depends on the critical net floor of central bank reserves, private sector uncertainty regarding this level of central bank access to external credit influences the timing and magnitude of speculative attacks.

Existing studies of crises that apply the representative agent model to the experiences of Mexico and Argentina [Blanco and Garber (1986), Cumby and van Wijnbergen (1988), Goldberg (1988)] generate time series of the estimated probability that the exchange regime will collapse in the future and derive lower bounds for the post-collapse sustainable exchange rate.[5] The framework is also important for evaluating the potential success of exchange control and currency pegging strategies for containing hyper-inflations [van Wijnbergen (1987)].

Despite the impressive predictive performance of these recent empirical studies, the results suggest that the model is not capturing some of the important dynamics of crises. Numerical results suggest that a collapse

[5]See Blanco and Garber's (1986) application to Mexico, 1976 to 1983; Cumby and van Wijnbergen's (1988) application to Argentina, 1979 to 1981; and Goldberg's (1988b) application to Mexico, 1976 to 1987, and to Argentina, 1977 to 1986.

generally does not occur in the first period that the estimated "probability of collapse" equals one. Further, although in some periods the expected shadow rate exceeds the controlled rate, there is little or no significant alteration in the rate of decline in central bank reserves. This observation is surprising, particularly because if the economy were comprised of identical agents a single sharp attack on reserves would make the expectations underlying it self-fulfilling and would instantaneously lead to a collapse of the exchange rate regime.[6]

The gap between the observed course of events and the predictions of the model suggests directions for improving upon the available theoretical work. Conceptually, the forementioned definition of the probability that an exchange regime will collapse is generally invalid when agents are heterogeneous. When the homogeneity premise fails and some, but not all, agents attack central bank reserves, the probability of a collapse becomes the probability that these attacking agents will have enough aggregated market power and liquidity to deplete central bank reserve stocks to the critical floor. An agent attacks central bank reserves only when he expects this behavior to be profitable and characterized by appropriate levels of risk. The risk and expected profitability depend on perceived market fundamentals and on the extent and clarity of information available to different groups of agents. More importantly, each of the heterogeneous agents must form expectations over the willingness of the most powerful speculators among them to convert their domestic currency holdings into foreign exchange. If this is the first instance of a currency crisis there may be little a priori

[6]Obstfeld (1987) and Azariadis (1986).

information with which an agent can effectively guess the behavior of his peers.

In addition, each speculator must weigh the costs of liquidating his domestic currency holdings too soon, as measured by the time between conversion and actual collapse, and the costs of waiting too long, as measured by the decline in real value of his domestic currency brought about by the real devaluation.

Consequently, the form, timing and magnitude of the speculative attacks are linked to the diversity and distribution of agents in their wealth holdings, liquidity costs, information sets, and individual attitudes toward risk. This raises the possibility that there will be a series of mini-speculative attacks on a currency. Many of these mini-attacks may be unsuccessful both in significantly depleting reserves and in forcing the collapse of the exchange regime. The form of a currency run and the equilibrium path of the economy depend on the perceptions and behavior of the speculating agents and the speed with which new information diffuses through the crisis country.

The treatment of heterogeneous agents and information transmission also has been neglected in the related literature on bank runs. For example, in Diamond and Dybvig's (1983) static model of financial equilibrium, homogeneous agents allocate demand deposits based on either full believe or disbelieve in the solvency of the financial intermediaries. The equilibrium probabilities of runs are either zero, implying that complete market confidence in bank solvency is maintained, or one, in which a loss of confidence in the system leads to a self-fulfilling elimination of fragile bank solvency. A variation on the demand deposit contract that takes the form of suspension of allowing withdrawal of deposits is analogous to the suspension of currency convertibility by a central bank. Postlewaite and Vives (1987) reinterpret the equilibrium concept and show conditions for a unique equilibrium involving a bank run with positive probability. Depending on the nature of heterogeneity, a range of run probabilities can characterize bank run equilibrium. Analogous arguments apply to currency runs.

Given the liquid domestic currency assets and information available to a particular agent at some point in time, he decides on the timing of his actions based on the anticipated action of other players. Critical assumptions about the perceptions and behavior of speculating agents, specifically the problem of forecasting the forecasts of others [Townsend (1983)], affect the form of a crisis. "Schizophrenic" behavior, in which agents do not consider the effects on equilibrium prices of their own behavior, can be imposed. Such an assumption is acceptable only when agents are so small that they resemble perfect competitors or when agents commit to actions before observing the actions of others. Hellwig (1980) and Kyle (1986) criticize "schizophrenia". Kyle (1986) suggests dealing with the problem of agent schizophrenia by giving agents incentives to acquire costly information and modelling informed traders as imperfect competitors.

In Section 3 we discuss the form of speculative attacks on central bank foreign exchange holdings when two agent types are interacting and extend the discussion to capture the behavior of a range of different agent types. Although the strategic behavior is not fully modelled, the forms of speculative attacks are considered under various assumptions of "final" forms of behavior which already account for conjectural inter-relations among agents. By considering only the final form of the distribution of market reaction to information we avoid the important dynamics of agents learning about eachother. Implicit in the assumed distributions is the speed of diffusion of new information across individuals and the speed of learning about the perceptions and reactions of other sectors of the population.

3. The Probability of an Exchange Regime Collapse

This section presents a model of speculative attacks on a currency and the conditions under which the attacks will lead to a collapsed exchange rate. The path of either central bank reserve stocks under a fixed rate system or the exchange rate under a flexible exchange rate system are determined by fundamental variables. In Flood and Garber's (1984) seminal linear discrete time model of a collapse, and Goldberg's (1988) extension of the model, money market equilibrium conditions provide the fundamentals that drive the collapse model. The exposition which follows draws on those intuitions, but a more general form of fundamentals is specified later in the paper.

Since a country's money supply is largely fixed when its' exchange rate is pegged, when domestic credit expands without an offsetting increase in demand for money, central bank reserves decline to eliminate the excess supply of domestic credit. If reserves were not permitted to decline, the exchange rate would have to be devalued to restore money market equilibrium. As an alternative, the exchange regime could be abandonned at least temporarily so that market forces can drive the exchange rate to a new equilibrium level.

The exchange rate that would clear the money market if the currency were instantaneously allowed to float is interpreted as the shadow exchange rate, $\tilde{S}_t$. It provides a lower bound for the exchange rate that would be prevail if speculators attacked central bank reserves, depleted reserves to a critically low level, and forced the collapse of the exchange regime. This rate, along with the probability of a pending collapse, can be calculated using the crisis model.

Generally, the period t probability of a t+1 exchange regime collapse is equated to the probability that the expected shadow exchange rate one period ahead exceeds the controlled or announced rate one period ahead.[7] The rationale for this formulation is straight-forward. The government's commitment to a controlled rate gives speculators unrestricted access to the central bank's foreign exchange reserves. If speculators operating in period t expect the shadow rate to exceed the controlled rate in period t+1, they will purchase foreign exchange reserves at the start of period t+1. Since all agents are assumed identical, they will all demand conversion of domestic currency holdings at the same moment, thereby driving reserves down to the critical floor. With all resources available for the defense of the weak currency depleted, the collapse will occur instantly. As assessed in period t, under the collapse probability under agent homogeneity is:

1) $\pi^f_t = Pr_t \left\{ \tilde{S}_{t+1} - \bar{S}_{t+1} \geq 0 \right\}$

Where π^f_t is defined as the probability that the shadow rate, calculated on the basis of market fundamentals, will exceed the fixed rate next period. The definition implicitly assumes that speculative attacks will always succeed at depleting reserves to the critical floor. The distribution

[7] Flood and Garber (1984), Goldberg (1988b), Blanco and Garber (1986) and Cumby and van Wijnbergen (1988).

of the the one period ahead shadow exchange rate depends on the joint distribution of random components of market fundamentals. Flood and Garber (1984) allowed domestic credit creation to be random, while Goldberg (1988) allowed for uncertain fiscal deficits, uncertain access to external capital and relative price shocks.

For simplicity we express the reduced form for π^f_t as:

2) $\pi^f_t = \pi^f_t (\xi_t)$

where ξ_t is the information set about market fundamentals available to agents at time t. Calculating the probability that the shadow exchange rate will exceed the fixed rate serves as the first step toward modelling the collapse. In previous studies this also served as the last step because of the homogeneity assumption. Under agent or informational heterogeneity, the probability that the shadow rate will exceed the controlled rate, π^f_t, differs from the probability that the regime will collapse, π_t. Specifically, even if a group of agents attack central bank reserves, their cumulative efforts may not be large enough to force a collapse.

By distinguishing between agents and/or allowing specific agents to liquidate their domestic currency holdings gradually there arises the possibility of speculative attacks of varying magnitudes. The relationship between the respective probabilities, π^f_t and π_t, is conditioned on the timing and market power (or strength) of attacks by various categories of agents, or alternatively, of a series of conversions as agents with distinct information sets receive and process diffuse signals.

To link π^f_t with the probability of a successful attack on central bank reserves, the focus must shift to whether and when the cumulative discrete attacks are large enough to deplete central bank reserve stocks. On observing some π^f_t which is conditioned on his information set, each agent type decides upon the timing of his gradual or complete portfolio shift out of domestic currency. Aggregating over the population, when an increase in π^f triggers portfolio shifts out of domestic currency, they can be interpreted as either a complete currency conversion by each type of a spectrum of agents or as a gradual abandonment of the currency by all identical agents. Given the transaction costs of currency conversion, these actions are assumed irreversible during the crisis period.

A_{t+1} is the size of the attack on central bank reserves that will occur at the beginning of t+1, before t+1 values of market fundamentals are observed. It depends upon the perceived change in π^f_t and on the market power, χ_t, of the agents who will be triggered into action by that change. The market power of agents is represented as a proportion of convertible and liquid domestic credit, D_t.

3) $A_{t+1} = \chi_t D_t$

The distribution of χ_t is described by the probability density function $f_\pi(\pi^f)$ and the distribution function $F_\pi(\pi^f)$.

4) $\chi_t = \int_{\pi^f(t-1)}^{\pi^f(t)} f_{\pi,\tau}\, d\tau = F_\pi[\pi^f_t] - F_\pi[\pi^f_{t-1}]$

The cumulative density (or distribution function), $F_\pi(\pi^f)$, of speculative response to estimated π^f_t is a general form mapping from π^f to the scale of attack. It's interpretation depends on the equilibrium concept applicable to the crisis country. For example, we can generate $F_\pi(\pi^f)$ as: the outcome of Kyle's (1986) model of agents forcasting eachothers behavior; the outcome of a game between players with different information sets; the outcome of decisions by players with different wealth, liquidity or risk aversion levels; or of identical players with identical risk aversion, each of whom opts for gradual rather than complete conversion of his domestic currency holdings.

Suppose we considered a world of individuals characterized by individuals who react to information by one-shot conversion of domestic currency holdings. $F_{\pi}(\pi^f_t)$ represents the share of agents for whom trigger values for critical π^f_t have been exceeded, thereby prompting currency conversion. Suppose these agents differ from one another in their information sets ξ_i, in their aversion to risk, and/or in their wealth, liquidity or market power. When a critical value of $\pi^f_{t,A}$ is reached, $A_{t+1}=\chi_t \cdot D_t$ is the share of domestic currency that agents attempt to convert into foreign exchange. For any individual i, π^f_i derived from microfoundations depends on the individual's current exposure to risk, on his aversion to risk and on the alternative investment opportunities available to him.

If all agents commit themselves to particular actions before observing the actions of other agent types, the solution would be of Nash type and may reflect schizophrenic behavior. If all N of these agents are identical in wealth holdings, when π^f_A is reached proportion A of N will attempt to convert D_t/N into foreign exchange. If agents differ in individual wealth holdings, χ_t reflects that conversion of $A[D_t]$ of domestic currency holdings will be the outcome of the joint distribution over risk aversion and wealth holdings. The homogeneous agent case is a special case of this more general premise where all attack power or mass is concentrated at a single critical level of π^f_A.

Suppose we consider a world in which all agents are equally averse to risk, but gradually convert domestic currency into foreign exchange as π^s_t

increases. The distribution function describes the way that agents alter the weights of domestic and foreign currencies in their portfolios, as can be derived from a portfolio balance model of asset demand.[8] The specific trigger probabilities can be modelled as a function of the first and second moments of the expected mean shadow rate, instead of related exclusively to the mean. Portfolio arguments of the Tobin-Markowitz and Merton genre apply to the continuous reaction case.

Suppose we also present these agents with varied information sets so that, for example, some agents receive noisier signals than others. Then the hypothetical probability density summarizes the joint density over perceived responses to ${\pi^f}_i(t)$. The equilibrium concept and form of gaming and signal processing across agent types determines the density function. As one possibility we can adopt equilibria arising from a Stackelberg leader-follower game.

Forms of Speculative Attacks

Consider a simple example where there are two types of players in the foreign exchange market, each of whom completely converts his complete portfolio of liquid domestic assets when he decides to move. Each of the agent types control amount $D_{i,t}$ of the domestic credit in circulation, with $\Sigma_i D_{i,t} = D_t$, where i=1,2.

Suppose that there are large, powerful agents and smaller more atomistic agents, and that it is possible for the most powerful agents to succeed at collapsing the exchange rate without the low market power agents

[8]See Penati and Pennacchi (1987).

even entering the market. In this case, the low market power agents would not reap speculative gains unless they adopted a first move strategy. We might observe small unsuccessful attacks by the low power agents as they attempt to best guess the behavior of the large powerful agents. In this case the small agents will absorb costs of moving too early since any excessive hesititation means that they will take a large loss. They will calculate the optimal timing of conversion, in terms of π^f, based on their best guess distribution over the timing of moves by large agents. This may show up as a population comprised of low (π^f_L) and higher (π^f_h) probability agents. When π^f_1 is triggered type 1 agents will attempt to convert D_1 units of domestic currency into foreign exchange. If this speculative attack is not large enough to collapse the exchange regime, the economy continues along track until π^f_h triggers the next class of agents to convert their domestic currency holdings.

The distribution function describing the behavior of the spectrum of agents is, in a sense, the prior probabilities of the low π^f_i agents and the posterior probabilities of the high π^f_i agents, refers to their behavior after having observed the behavior of the low π^f_i agents. A beauty contest phenomenon or a concentration of the distribution of behavior as weaker agents anticipate the behavior of agents with greater market power may be encountered.

The distribution function over the discrete conversion of domestic currency and path of reserves in this two agent world might appear as in Figure 1. Two speculative attacks on the currency may occur.

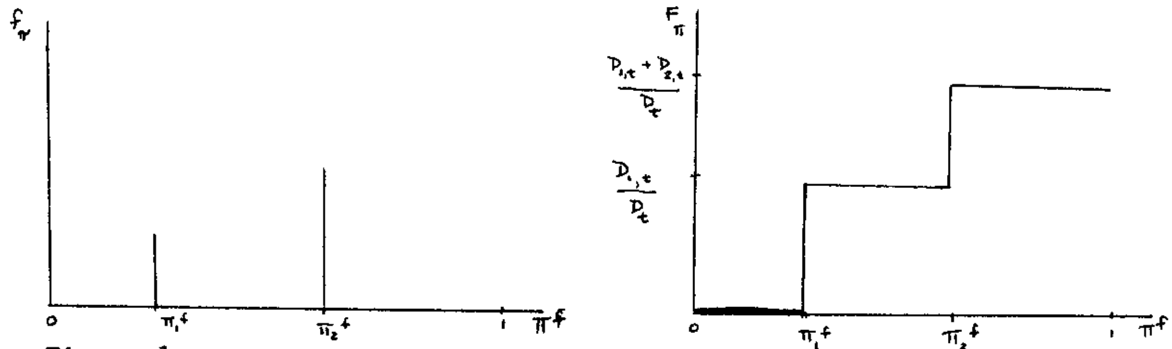

Figure 1:

For the N agent-type world, such discrete actions appear as an N-step probability distribution, with reserves declining as a step function.

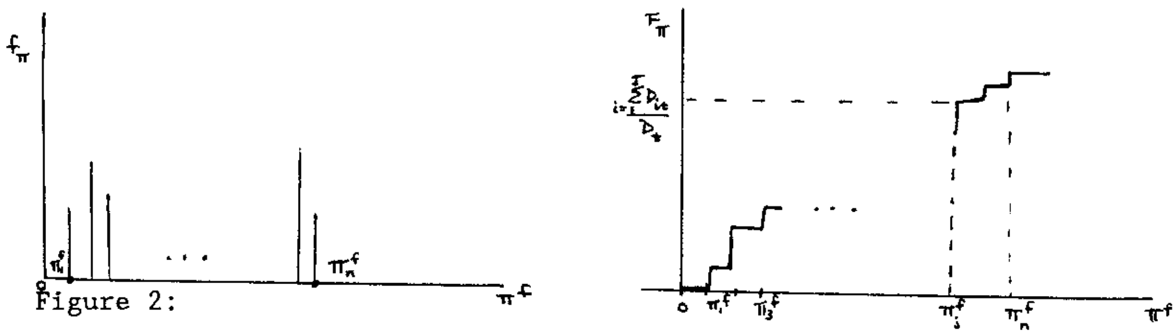

Figure 2:

In the limit, as $N \to \infty$ each with distinct π^f_i, we approach a continuous conversion of domestic currency into foreign exchange. This distribution more closely fits the interpretation that agents have identical aversion to risk with each agent converting his currency gradually. In that case, the share of wealth held in the risky asset (compared with the safe asset of foreign exchange) becomes a smooth function of π^f_i. Increasing levels of risk aversion increase the rate of currency conversion as π^f rises.

The probability of a collapsing exchange rate regime is the probability that the agents triggered into action by observed fundamentals, estimates of future fundamentals, and forecasts of the behavior of others, will be powerful enough to deplete central bank foreign exchange reserves to their minimum level.

The probability of a successful attack under heterogeneity is defined:

5) $\pi_t = \Pr\ [A_{t+1} \geq R_t - R_c]$

Using equations 3 and 4 to yield equation 6, the probability of collapse is a transformation of market fundamentals which critically depends on how the market reacts to this information,

6) $\pi_t = \Pr\ [\ F_\pi(\pi^f{}_t) \geq F_\pi(\pi^f{}_{t-1}) + (R_t - R_c)/D_t\ ]$.

where the probability of a collapse of a controlled exchange rate regime depends on the distribution of investor types and on the size of the attack needed to deplete central bank reserve holdings.[9] The ability of any group of agents to succeed in their currency attack depends both on their own market power and on how other agents react to signals from this group. This departs from the standard treatment which defines the probability of collapse as exactly equal to the probability that the expected shadow exchange rate exceed the controlled rate.

If F_π is known with certainty, the probability of collapse becomes a direct function of the incremental change in $\pi^f{}_t$. Expression (6) can be used to determine the expected timing of the collapse and the expected path of central bank foreign exchange reserves. However, problems arise with such applications. F_π is a theoretical construct since it is unrealistic to expect that policy-makers know the distribution of agent behavior with certainty. The true probability of collapse will depend on how agents perceive the reaction function of the population.

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[9]If we also introduce a government announcement parameter, the general form of the probability of collapse, π_t is:

$\pi_t = \Pr\{\ F_\pi[\pi^f{}_t, \lambda(g_t)] \geq F_\pi[\pi^f{}_{t-1}, \lambda(g_{t-1})] + [R_t - R_c]/D_t\ \}$

on the ability and attempts of the government to influence market behavior

Of course, in a world with 'peso problems' it is difficult to posit a specific distribution of speculative activity. Since speculative attacks are relatively rare events for most currencies, agents will have had little opportunity to learn the distribution of other agents reactions. As emphasized previously, this vital point is not easily modelled since it involves forecasting the forecasts of others and forecasting agents' reactions to forecasts.

Townsend (1983) studied this signalling problem in a dynamic linear equilibrium with rational but disparate information. Of interest to the current exposition may be the type of environment that Townsend characterizes as a hierarchical structure of filtered receipt of information. Consider the existence of a symmetric but disparate information structure in which individuals of each type observe economy-wide averages that are contaminated by measurement errors. The way in which individuals learn about eachother and act on the basis of this information (and how information is transmitted through the economy) is taken as given in the shape of the distribution function F_π. Also of interest are the types of decisions of speculators that are made in environments with noisy information that lead to signalling equilibria.

4. Simulated Speculative Attacks

Finally, in this section we look at hypothetical distribution of shadow probabilities for some point in time t and map this distribution to the reaction space of speculators in which we take into account the market power of various groups of speculating agents. Using this information we generate the shape of speculative attacks that would occur given market fundamentals and the types of shocks that affect the economy and expected currency value. Policy makers can perform such mappings to estimate the extent to which their fiscal and monetary activities jeopardize the sustainability of the currency value and their holdings of foreign exchange reserves.

Consider the following hypothetical forms for probability densities which can be parameterized to correspond to F_π:

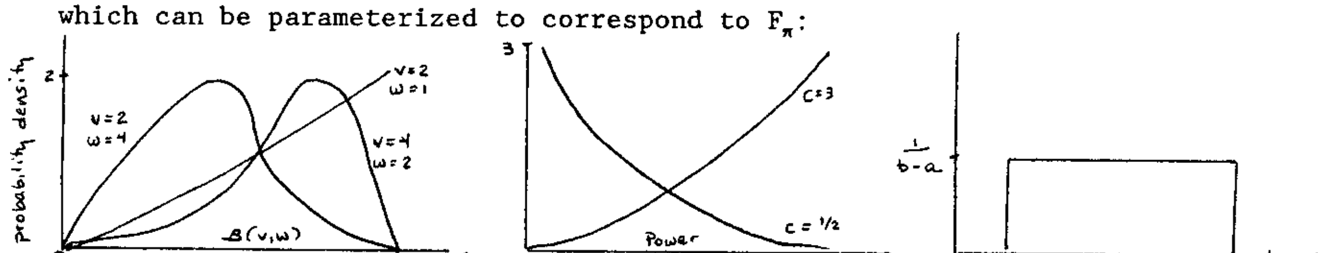

Figure 3: Forms of f'_π

<u>probability density functions</u>

Beta distribution $\beta(v,w)$: $(v+w-1)!x^{v-1}(1-x)^{w-1}/(v-1)!(w-1)!$ for integer v,w

Power function, c-scale: cx^{c-1}

Rectangular (continuous uniform): $1/(b-a)$

The form of speculative attacks on central bank reserves depend on the history of changes in π^s_t and on the sufficient statistics of the respective distributions.

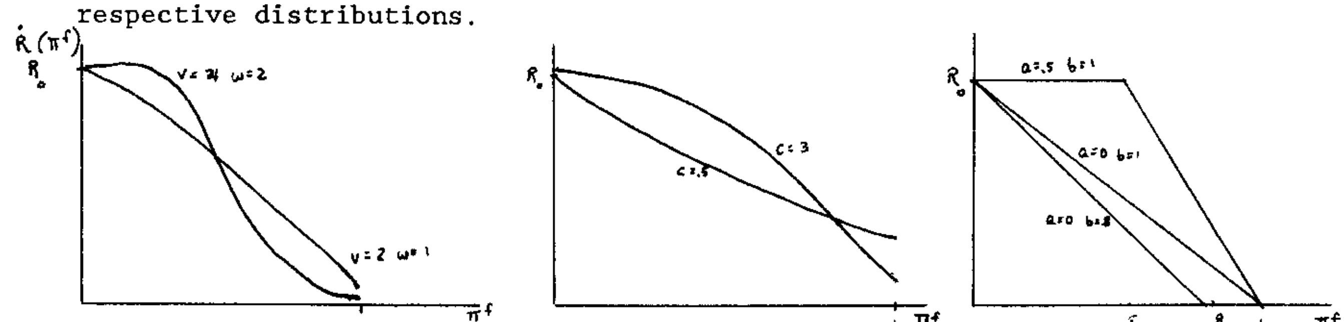

Figure 4: Forms of Speculative Attacks Under Different f_π

For example, when the population characteristics are best described by a rectangular distribution, the size of incremental speculative attacks each period are directly proportionate to the incremental change in π^f_t and to the degree of spread of agent types. At low levels of π^f there may be no speculative activity (a >0) while at some maximum level of π^f all agents may have completely rid themselves of the weak currency (b < 1). As the range of response (b-a) shrinks toward zero concentrate attack power about a single critical probability and generate the representative agent case. As the range approaches one we would observe a linear relation between reserve decline, changes in π^f_t and the domestic currency holdings of the population.

Given the probability density over reaction functions, it is straight forward to determine the size of attack on central bank foreign exchange reserves prompted by an incremental change in π^f_t. If the government had some power to influence (credibly or otherwise) the parameters of the distributions through its pronouncements or through altered restrictions on currency convertibility, it could alter the form and timing of speculative attacks on central bank foreign exchange reserves.

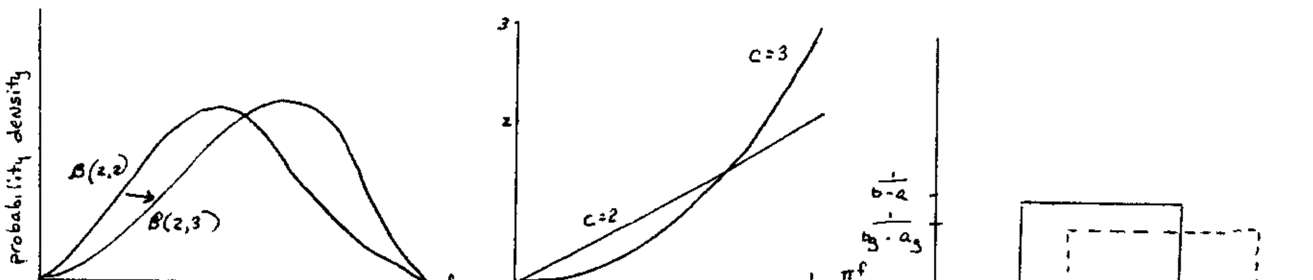

Figure 5: Forms of f_π with government intervention

probability density function

By correctly parameterizing any of these hypothetical distributions we can generate the special case of homogeneous agents and the single speculative attack on central bank reserves. Using the Beta distribution we can allow v or w to tend toward infinity to derive a point pdf, and specify a relation between v and w so that the critical collapse probability is pinned down [for example, if $w=kv$ then the full speculative attack occurs at $\pi^s=1/(k+1)$].

Homogeneity in the power function case requires the polar cases of either $c=0$ or $c=\infty$. Intuitively, the full force speculative attack can occur at a single point either when the probability first deviates from zero or when the probability reaches it's limit at one. The representative agent case is trivially solved in the case of a rectangular distribution over the reactions of the population. We simply collapse the range of the distribution (b-a) to a single point. At that point the critical mass provides the full force speculative attack that succeeds at collapsing the exchange regime is they can deplete remaining central bank foreign exchange reserves.

5. Concluding Remarks

Whereas the representative agent model is indispensible for understanding the mechanism by which an exchange regime can be forced to collapse, it is inappropriate for empirical application if the world is comprised of heterogeneous agents without concentrated power bases. The timing and potential success of an attack on central bank foreign exchange reserves is intricately tied to the characteristics of the population. The more concentrated is total attack power in a single group of agents, the better the predictive performance of the standard representative agent model. The less concentrated is total attack power the greater the potential for a government to pursue monetary and fiscal excesses that are inconsistent with exchange rate targets in the short run.

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