Rational Contagion and the Globalization of Securities Markets

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Outline

Overview

- Financial integration to some extent can promote contagion (herding) behaviour by reducing the incentives to gather information
- Constraints on short-selling can also exacerbate these behaviour
- Simulations show that these frictions have significant implications for capital flows in emerging markets

Model

The expected indirect utility of an investor is

$$E(\theta) = \mu(\theta) - \frac{\gamma}{2}\sigma(\theta)^2 - \kappa - \lambda(\mu(\Theta) - \mu(\theta)) \qquad (1)$$

where γ and κ are positive and

- $\mu(\theta)$ is mean of the portfolio return with θ wealth on J-1 countries
- $\sigma(\theta)$ is standard deviation of portfolio return
- γ is the coefficient of absolute risk aversion
- $\lambda(\mu(\Theta) - \mu(\theta))$ is the performance cost (benefits) for obtaining portfolio return below (above) market return

Model

Under fixed information costs, the model prediction is

- above a threshold, as the number of integrated countries (J) rises, the incentives to gather information is diminishing and the impact of unverified rumors assigned to a single country rises without bound.
- Global market volatility rises as J increases, resulting in a larger proportional effects on capital flows.

Model

The assumptions

- The initial condition is that country i is identical to the rest (returns and standard deviations are the same) and asset returns are uncorrelated. An investor has 1 unit of wealth, which is allocated to each of the J countries equally. Portfolio mean=ρ and portfolio variance=$\frac{\sigma^2}{J}$
- The rumor is that country I's return $r <= r^*$ and the true return $r^* = \rho$. Investor can pay κ to verify the rumor (informed) and he will believe the rumor (uninformed) if he does not pay the cost.
- If the investor is uninformed, he chooses to maximize

$$EU^U = \theta^U \rho + (1 - \theta^U) r - \frac{\gamma}{2}[\frac{(\theta^U)^2}{J-1} + (1 - \theta^U)^2]\sigma^2 \qquad (2)$$

Model

- Assuming internal solutions exist, the optimal portfolio is

$$\theta^U = (\frac{J-1}{J})[1 + \frac{\rho - r}{\gamma\theta^2}] \quad (3)$$

- Short-selling constraints: $-a <= \theta <= b$, where$a >= 0$ and $b >= 1$

Therefore, $\theta^U = b$ if $r <= r^{min}$ and $\theta^U = -a$ if $r >= r^{max}$, where $r^{min} = \rho - \frac{\gamma\sigma^2[J(b-1)+1]}{J-1}$ and $r^{max} = \rho + \frac{\gamma\sigma^2[J(a+1)-1]}{J-1}$ and as J goes to infinity, the interval that supports internal solutions shrinks

Model

- If the investor chooses to pay a cost and verify the rumor, so that the variance of return of country I is eliminated, the maximizes

$$EU^I = \theta^I \rho + (1 - \theta^I) r^I - \frac{\gamma}{2}[\frac{(\theta^I)^2}{J-1}]\theta^2 - \kappa \qquad (4)$$

- Internal solution $\theta^I(r^I) = (J-1)[\frac{\rho - r^I}{\gamma\sigma^2}]$
- Coner solution $\theta^I = a$ id $r^{I(max)}$ and $\theta^U = b$ if $r <= r^{I(min)}$ where $r^{I(max)} = \rho + \frac{a\gamma\sigma^2}{J-1}$ and $r^{I(min)} = \rho - \frac{b\gamma\sigma^2}{J-1}$
- The value of information is $S = EU^I - EU^U$

Model

Proposition 1 For any 'pessimistic' rumor such that 1) short-selling constraints are non-binding 2) $r <= \rho$; S is decreasing in J if the number of countries in the global market is $J > \frac{1}{1-[F(\rho)(b^2-a^2)+a^2]^{(1/2)}}$ (It is sufficient condition). It is notable that S decreases with J at a declining rate so that S converges to a constant level as J goes to infinity.

Model

Performance-based incentives Utility of a representative manager is

$$EU(\theta) = \theta\rho + (1-\theta)\rho - \lambda(\mu(\Theta) - \mu(\theta)) - \frac{\gamma}{2}[\frac{(\theta\sigma_J)^2}{J-1} + ((1-\theta)\sigma_i)^2 + 2\sigma_J\sigma_i\theta(1-\theta)\eta] \quad (5)$$

In this equation,

- $\lambda > 0$ if $\mu(\Theta) > \mu(\theta)$, which indicates a punishment
- $\lambda <= 0$ if $\mu(\Theta) < \mu(\theta)$, which indicates a reward

Model

Proposition 2: If in the neighborhood of the optimal portfolio θ^* corresponding to an investor free of performance incentives, the marginal cost (gain) of deviating from the mean return of the market portfolio $\mu(\Theta)$ is sufficiently large (small), then there exists a range of global, rational-expectations equilibria of individual portfolio allocations θ, such that $\theta = \Theta$

Model

Proposition 3: The range of contagion equilibria, defined by values of Θ in the interval $\theta^{low} < \Theta < \theta^{up}$, for which proposition 2 holds, widens as the global market grows (i.e. $\theta^{up} - \theta^{low}$ is increasing in J).

Numerical Simulations

Stylized facts and benchmark calibration

- Global portfolios and statistical moments of asset returns. Plugged various estimates of the mean and variance-covariance structure of asset returns and different sources of global portfolios in the resulting expression (Equation 17 in the paper to prove Proposition 2), γ ranges between 0 to 0.5 and 0.25 is chosen
- Indicators of information and their impacts on asset returns assessments. Use credit ratings of countries (CCR) constructed by international banks for lending operations (compiled and published every 6 months). Assuming normal distributions of variables involved, and standard homogeneity assumptions across country elements in the panel, the moments that describe these distributions are, Erb et. al (1996)

$E[r_h^I] = \alpha^{\mu} + \beta^{\mu} E[ln(CCR_h)]$ $E[\sigma_h^I] = \alpha^{sd} + \beta^{sd} E[ln(CCR_h)]$
$\sigma_{rh}^I = (\beta^{\mu})^2 VAR[ln(CCR_h)] + (\sigma_u^{\mu})^2$
$\sigma_{\sigma}^I = (\beta^{sd})^2 VAR[ln(CCR_h)] + (\sigma_u^{sd})^2$
The above are used to calculate mean and variances of countries' returns

Disincentive for information gathering Case 1: truth-revealing information (costly information reveals the true asset return of country i). Other assumptions: 1) asset returns are uncorrelated b) ex-ante all countries are identical. Values of variables: (units: percent) $\rho = 15.31$, $\sigma_J = 22.44$ and $\sigma_i^I = 6.46$ and J<=50. Plot $\hat{S}$ against J Finding: 1) when the rumor is that returns of country i is less or equal to ρ, $\hat{S}$ is a decreasing function of r (decrease at declining rate) and converge to a constant 2) when the rumor is that returns of country i is the r high, $\hat{S}$ is a increasing function of r; 3) gains from the costly information is lower for the rumor of $r = \rho$

Case 2: OECD information updates (cannot reveal true asset returns) So, in this case, investors only learn updates of mean and variance of returns when the pay ?. It is calibrate to 'stable' OECD markets $E(r^I) = 15.18$, $E(\sigma_i^I) = 21.81$, $\sigma_r^I = 6.46$ and $\sigma_\sigma^I = 1.84$ and ex-ante all countries are identical Finding: 1) Neutral rumor $r = r* = \rho$, $\hat{S}$ falls to 1Allow for correlations, $\eta = 0.35$ (the J-1 countries are uncorrelated), has smaller gains of information gathering: $\hat{S}$=22

Case 3: Segmented emerging markets. Most of the J-1 countries are also volatile emerging markets $E(r^I) = 33.12$, $E(\sigma_i^I) = 34.57$, $\sigma_r^I = 49.31$ and $\sigma_\sigma^I = 14.04$,$r^* = \rho = 31.21$, $\sigma_i = \sigma_J = 50.03$
Findings 1) $\hat{S}$ does not converge to a constant, actually, it increase slightly as J>=200; 2) When $r = r^{min}$ and $r = \rho$, $\hat{S}$ still drops sharply as J increases and reaches minimum when J=58 ($r = \rho$)
Capital flows: A rumor that reduces expected return on Mexico equity from equity market forecast of 22.4

Performance costs

- The lower and upper bound of contagion region is delimited by the intersections of $E\hat{U}'(1-\theta)$ and the marginal cost/gain lines
- As the number of countries increases, the contagion region widens; the contagion region is maximized when there is no marginal gain
- The contagion range is decreasing function of variances of returns of countries, but that effect dissipates as J>=10

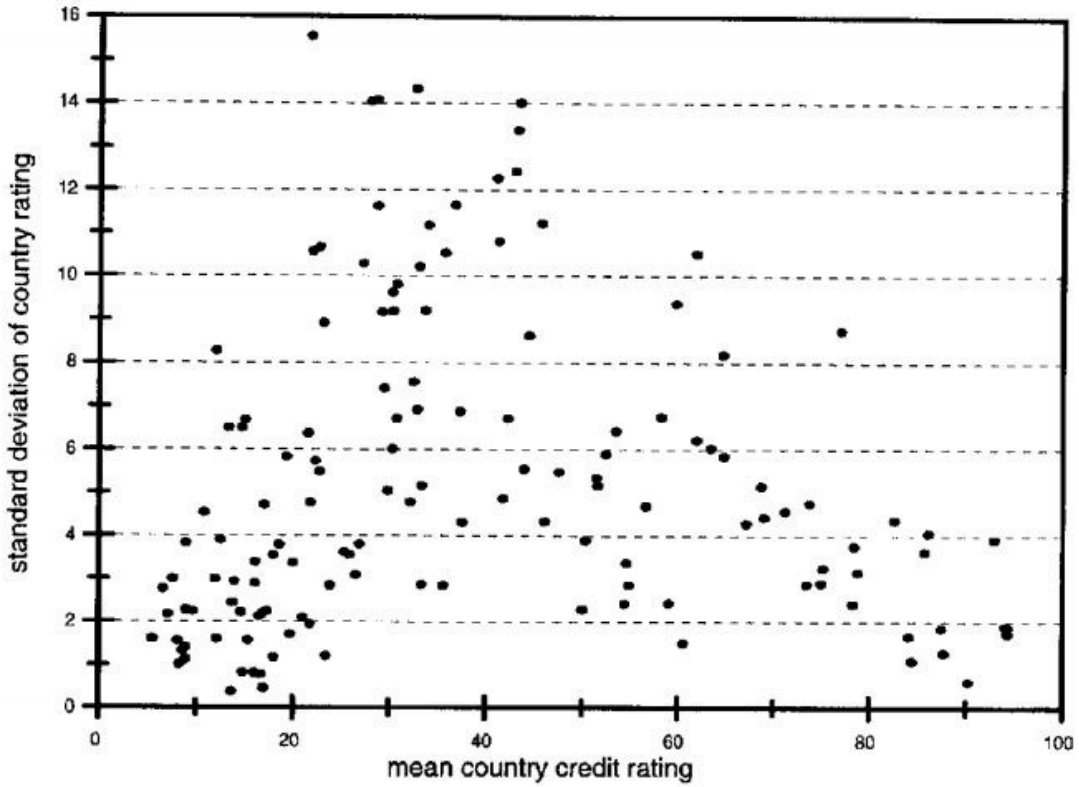

Fig. 1. Variability of country credit ratings.

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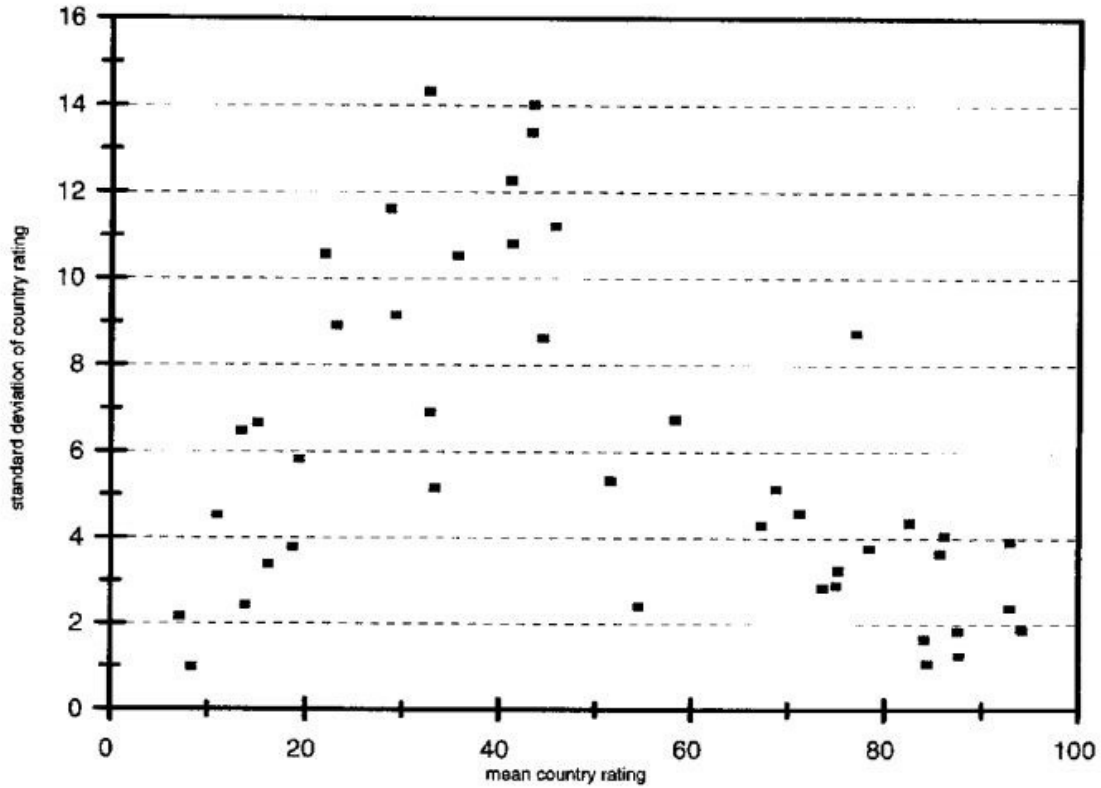
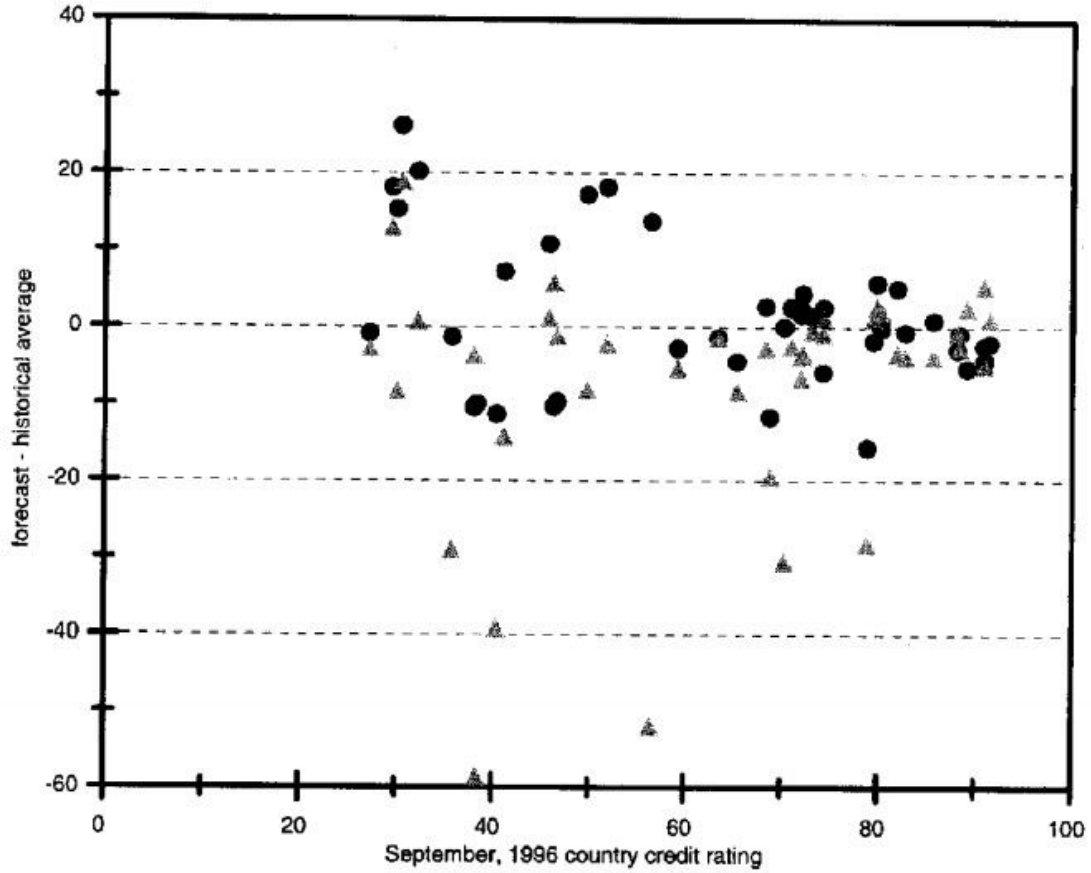


Fig. 2. Variability of OECD and Latin American country credit ratings.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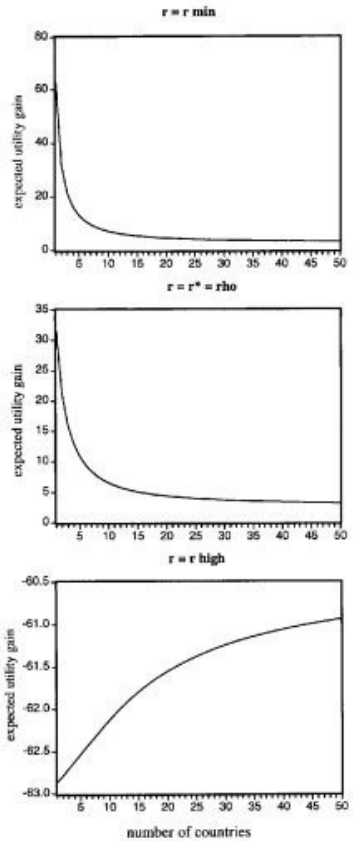
September, 1996 country credit rating



g. 4. Utility gain of costly information: Case 1 – the value of information.

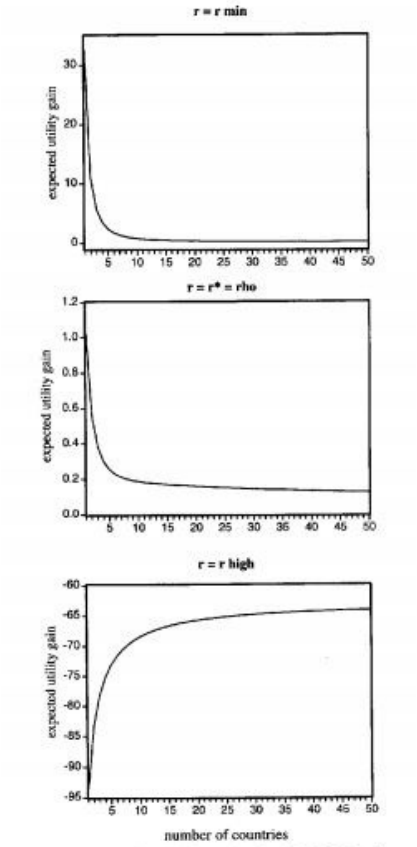
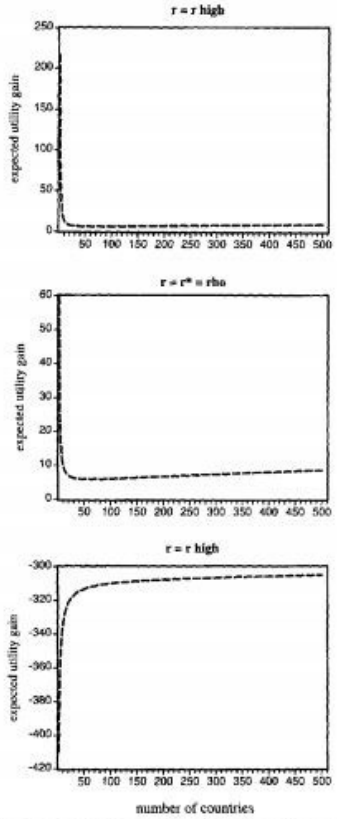


Fig. 5. Utility gain of costly information: Case II – OECD updates.



6. Utility gain of costly information: Case III – segmented emerging markets.

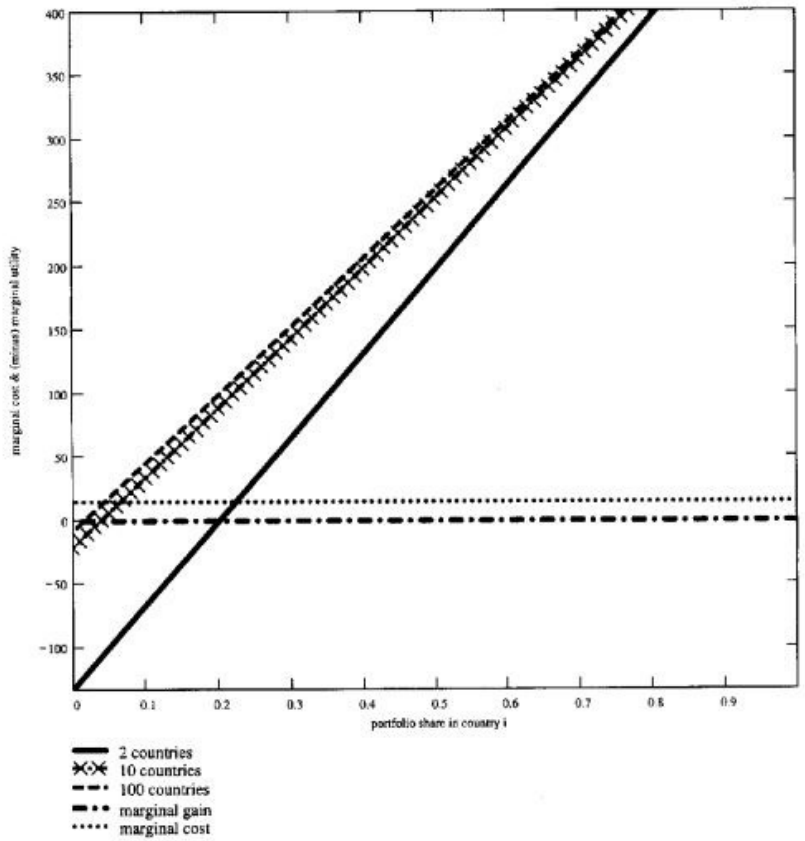


Fig. 7. The contagion range in the presence of performance costs.

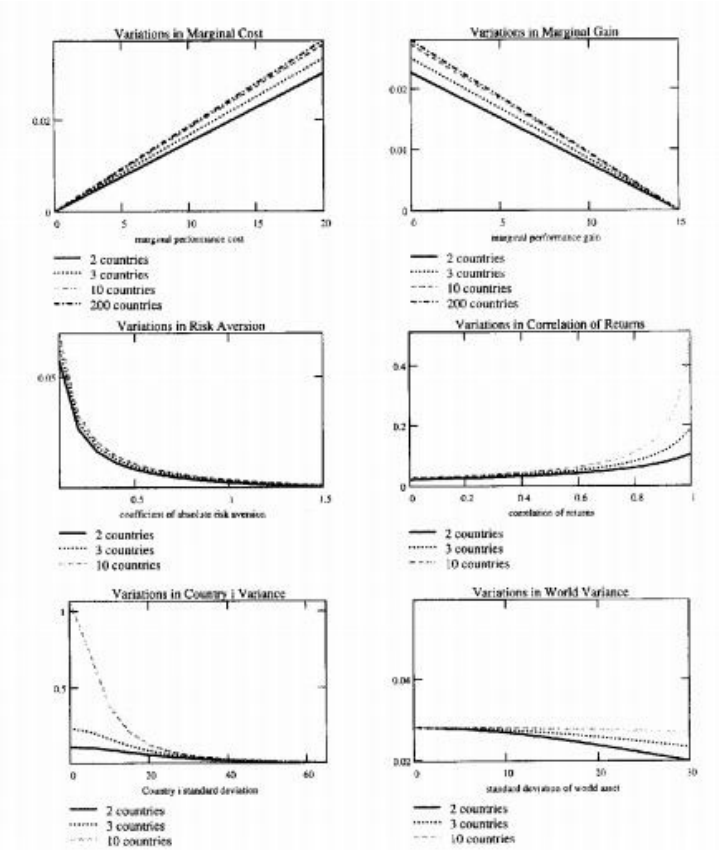


Fig. 8. Sensitivity analysis of the contagion range.