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ABSTRACT

World Finance and the US 'New Economy': Risk Sharing and Risk Exposure*

The promising prospect of a ‘New Economy’ in the US attracted substantial equity inflows in the late 1990s, helping to finance the country’s burgeoning current account deficit. After peaking in 2000, however, US stocks fell by some 8 trillion dollars in value. To assess the welfare effects of international financial markets in this context, we use an analytically tractable (two-country, two-period, two-state) model of the global economy which allows the country experiencing the favourable supply side ‘shock’ to consume more against expected future output and to spread risk by selling shares. Since irrational exuberance and distorted corporate incentives can cause serious asset overvaluation, however, an asset price ‘bubble’ is also included, where market participants assign unwarranted likelihood to high pay offs. Relative to autarky, internationalizing financial markets does offer welfare gains. But these are small relative to the international wealth transfer that can arise from selling shares globally at inflated prices. Parameter variations suggest that this conclusion is quite robust.

A calibrated exercise shows how capital inflows to finance the ‘New Economy’ can be twice the consumption-smoothing deficit on current account; and how market losses – due to ‘misfortune’ or ‘excess upside probability’ – can have global effects on consumption when the bubble bursts. The analysis complements recent econometric studies of the transmission mechanism which find that financial factors are needed to explain why the European economy was so strongly affected by the US downturn starting in 2002.

JEL Classification: F32, F41 and G15
Keywords: capital flows, international transmission of shocks and moral hazard

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Submitted 20 December 2004

Non-technical Summary

In addressing the UK Treasury on "World Finance and Risk Management" in late 2002, Mr Alan Greenspan focussed on the way that financial assets can smooth consumption not just over time but also across different states of nature. To illustrate how efficiently financial markets can spread risks, the Chairman of the Federal Reserve cited the steadiness of the US economy in the face of "the draining impact of a loss of $8 trillion dollars of stock market wealth" since the US high-tech boom came to an end two years earlier. A stock market crash need not have severe knock-on effects on the economy, it seems, if losses of the New Economy are spread widely among those who hold shares and not concentrated in the corporate and financial sector as it would be with highly-leveraged financing. That equity financing is, in principle, appropriate for risky investment deserves emphasis: after all, the debt financing of much economic development in emerging-market economies is a recurrent source of financial crisis. But there other risks that shareholders must face besides the variability of project returns: without transparent accounting and good corporate governance, they may be cheated by CEOs and other corporate officials who mis-declare profits and mis-use income. Such 'moral hazard' may explain why equity finance is not so widely used in many emerging markets (including China, for example) - except in the form of Foreign Direct Investment where investors have direct managerial control. But is it relevant to the USA, generally taken as the global benchmark for transparent corporate accounting and good governance?

As regards the financing of the High Tech boom, the view that asset prices were far higher than could be justified by economic fundamentals was forcefully expressed before the market turned by Shiller (2000), who used history, sample surveys and psychology to identify 'irrational exuberance' on the part of investors. Others have argued that the conduct of monetary policy may have encouraged investors to believe they were insured against a market crash, Miller et al.(2002). Ex post, however, there is increasing evidence that -- after much financial deregulation under President Reagan -- truth-telling incentives were seriously weakened as "stock options distorted managerial incentives, and consulting distorted auditors incentives", Stiglitz (2003). Sufficient evidence has emerged in the US bankruptcy courts for corporate officials to be indicted for fraud and for the misappropriation of corporate funds; and this has led to deliberate financial

re-regulation under President Bush. The Sarbanes-Oxley Act, for example, now requires CEOs and CFOs to confirm the veracity of financial reports, with criminal penalties for mis-certification.

If prices were inflated by ´irrational exuberance´ and 'moral hazard' in the US high tech boom, how significant is this relative to the efficiency gains of risk-spreading emphasized by Mr. Greenspan? That is the issue addressed in this paper. To assess the welfare effects of global financial markets, where complete financial markets allow the country experiencing a New Economy 'shock' to consume more against expected future output and to spread the risk globally by selling shares, we use an analytically tractable (two-country, two-period and two-state) model of the global economy. To capture the effect of psychology and distorted incentives on the valuation of corporate assets, we exploit the fact that, in a General Equilibrium model of this sort, "the preference preordering reflects the tastes of the consumer for goods and services (including, in particular, their spatial and temporal specifications), his personal appraisal of the likelihoods of the various events, and his attitude towards risk" Debreu, *Theory of Value*, 1959 p.101.

Under the assumption of rational expectations, individual appraisal of likelihoods would, on average, correspond to the actual likelihood; but this is hardly appropriate in a context where incentives for trurth-telling by CEOs and CFOs were significantly distorted. We assume, instead, that consumers/shareholders systematically overestimated the likelihood of a high payoff from the New Economy; and we solve for asset prices and consumption plans under these beliefs.

Though this asset mis-pricing may be treated as incorporating a 'moral hazard bubble', the reader should be warned that we do not analyse precisely how corporate officials were able to exploit their inside information so as to mislead the public and to make extraordinary returns for themselves: our simple endowment economy does not even attempt to model the process of production itself. It would of course be preferable to model how the law tries to induce truth-telling in corporate America; and how incentives changed – temporarily – under deregulation: but this is a different exercise from measuring the welfare effects of the distorted perceptions. So the outputs of the New Economy, their objective probabilities, and the extent to which these are distorted are treated

exogenously given; and the effects of irrational exuberance and moral hazard are measured by seeing how the overestimate of the likelihood of high payoff affects consumer welfare.

With the development of the New Economy in prospect -- promising, say, a permanent step-up in output of some 5% with a variance of 2% -- the use of international financial markets for consumption-smoothing does provide welfare gains, but these are relatively modest. On the welfare measure we use, moving from autarky to complete financial markets offers gains worth 1/50th of one percent of consumption for the country developing the New Economy and for its trading partner. Why so small? For sure the country expecting the New Economy can run a deficit to increase current consumption and it can sell shares to spread risk, but the expected future increase in global output cannot be consumed today nor can aggregate risk be diversified, so consumption cannot be completely smoothed. In any case, Robert Lucas has argued that complete stabilisation of US consumption is worth only 1/100th of one percent of consumption for the case of log utility, an estimate that increases threefold when updated by Obstfeld and Rogoff (1996, p.330). Our estimates are in this ball-park.

Next consider the effects of distorted probabilities – due to irrational exuberance and/or to corporate moral hazard. Assume that, without any change in fundamentals, the mean return increases to 6%, i.e., the expected permanent step-up due to the New Economy rises by one percent of GDP. Without home bias, approximately half of the shares will be taken up by foreigners; so the associated rise in share prices will generate a transfer of almost half a percent of GDP to the US , a consumption gain many times the efficiency gains. Varying the rate of time preference and the coefficient of risk aversion over relevant ranges does little to alter these findings.

Qualifications and interpretation

Some qualifications need to be borne in mind when interpreting the figures. The size of the price distortion is exogenously specified, for example. But as the size of the international 'transfer' (relative to the efficiency gains) is proportionate to the distortion of probabilities, one can scale the transfers up or down as necessary to fit one's own priors as to the degree of distortion. Another qualification is that the holdings of securities in the model do not exhibit the 'home bias'

characteristic of actual portfolios: so the resource transfer induced by price distortions will be correspondingly exaggerated. Our results suggest a prudential basis for home bias: namely to limit exposure in foreign securities markets where the regulatory regime is unclear.

Perhaps the most important caveat is to explain why our results do not prove that the world would be better off without developed financial markets. As a first step, we note that Lucas's estimates of the gains from stabilisation have been criticised on the grounds that they effectively assume the economy is near its full-employment potential: the benefits calculated are those of smoothing minor fluctuations of consumption when the economy operates near this capacity level. But if it takes the promise and practice of stabilisation policy to put the economy close to capacity, then Lucas's procedure will underestimate the overall gains to stabilisation policy. Likewise, we must acknowledge that the calculations made in this paper assume that the development (and risk characteristics) of the New Economy are given regardless of what is assumed about the (international) provision of finance. But what if the supply side shock was endogenous to the operation of financial markets? Without the ready availability of equity finance and venture capital, the New Economy would surely have been much slower to develop -- and might have been still-born. So, broadly considered, the gains from developing financial markets, both domestically and across international frontiers, could include the New Economy itself – whose profits greatly exceed the fractions of a percentage point of GDP considered in this paper. The potential gains from financial markets – and the associated risk of market capture -- are discussed in much more general terms in *Saving Capitalism from the Capitalists*, Rajan and Zingales, 2003.

This paper does not show that financial development is bad for consumer welfare, nor is intended to do so. What it does indicate is that, in global capital markets with asymmetric shocks, asset price distortions can generate international 'transfers' which exceed the efficiency gains of consumption-smoothing and risk-spreading. Where asset prices reflect distorted incentives, it seems that ´saving capitalism from the capitalists´ may require legal enforcement for truth-telling.

1. Introduction

The role of risk-sharing in the financial system is a central element in Alan Greenspan's views of "World Finance and Risk Management". In addressing the UK Treasury in October 2002, the Chairman of the Federal Reserve highlighted the way financial assets can smooth consumption not just over time but also across different states of nature. To illustrate the importance of risk spreading, he cited the steadiness of the US economy in face of "the draining impact of a loss of 8 trillion dollars of stock market wealth", and of other adverse shocks throughout 2001-02. As the US productivity boom in the 1990s was to a large extent equity-financed, this meant that the decline in asset valuations was largely absorbed by shareholders, thus avoiding the concentration of risks in the corporate sector and banking associated with highly-leveraged financing. But the international dimensions of risk-sharing and the 'moral hazard' aspects of asset price fluctuations were not stressed by the Fed Chairman. They are the focus of this paper which examines the welfare benefits offered by international financial markets for consumption-smoothing and risk-spreading; and the transfers that may occur when a stock-price bubble finally bursts.

Ex ante support for the view that asset prices were far higher than could be justified by economic fundamentals was provided by Shiller (2000), who used history, sample surveys and psychology to identify 'irrational exuberance' on the part of investors. Others have argued that the conduct of monetary policy may have encouraged investors to believe they were insured against a market crash, Miller et al.(2002). Ex post, however, evidence emerging in US bankruptcy courts, where corporate officials have been indicted for misappropriation of funds and for fraud, suggests that corporate insiders had economic incentives to distort investor perceptions. According to one observer, "stock options distorted managerial incentives, [and] consulting distorted auditors incentives"; and the case of Enron, for example, showed that "shareholders didn't have the information with which to judge what was going on, and there were incentives not to provide that information but to provide distorted information" Stiglitz (2003, pp. 139 and 248). Much of the blame for these corporate excesses is attributed by Stiglitz to the zeal for deregulation that began with President Reagan[2]. While this might seem an argument of convenience by one who was Chairman of the CEA under Clinton (whose Presidency covered many of the boom years), there

[2] He also criticises the Chairman of the Fed for failing to follow up his ' irrational exuberance' speech in 1996 by acting on interest rates or margin requirements, Stiglitz (2003, chapter 3).

has in fact been a substantial shift to re-regulation under President Bush. The Sarbanes-Oxley Act, for example, seeks to reinforce truth-telling by CEOs and CFOs who are required to certify corporate financial reports subject to criminal penalties for miscertification.

Academic evidence of distorted incentives is summarised in a recent survey of theory and evidence relating to corporate 'excesses' and financial market dynamics circulated by the ECB. Stock options, while designed to align the interest of managers and shareholders, have, in the view of the authors, "turned out to have other effects: managers had an interest in driving up the stock price of their firm to realise their gains, exercising their options and cashing in upon leaving the company. Furthermore, particularly in the US, the use of stock options helped to distort published earnings" (Maddaloni and Pain, 2004, p13). As to whether the financial market bubble was, at least in part, inflated by biased investment advice given by stock market analysts and broker-dealers, the authors conclude: "although the more innocent explanation of 'irrational exuberance' […] cannot be ruled out, [the] history of biased earning forecasts is perhaps more consistent with the influence of the *conflict of interest* embedded in combining investment advice with securities underwriting and brokerage activities"[3] (Maddaloni and Pain, 2004, p 4-5).

What of the international implications? Spurred on by the "New Economy" productivity boom, the United States ran a significant current account deficit in the second half of the 1990s, see Table 1; and it also acted as a magnet for global capital flows. In an inter-temporal analysis, Bailey, Millard and Wells (henceforth BMW, 2001) argued that this current account deficit was driven by consumption rising in anticipation of future income gains (the anticipated productivity shock); and the capital inflows served to finance this consumption-smoothing exercise[4].

[3] They cite Chan et al (2003) who interpret the US evidence that the proportion of positive 'earnings surprises' persistently outweighs that of negative surprises as consistent with analysts massaging their forecasts to engineer good news.

[4] They also noted that, to the extent that productivity gains were concentrated on the tradable goods sector, the widening gap in relative income and consumption in favour of US consumers would also lead to a real appreciation of the US dollar via the Balassa-Samuelson effect.

Table 1: The US current account and its financing

US $ bn	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Current account	-118	-128	-204	-293	-410	-393	-503
Net flows in US securities*	221	171	45	158	281	337	414
Net direct investment	-5	1	36	101	130	3	-93
Total Capital inflows	216	172	81	259	411	340	321
Memo item							
'Risk capital' inflow from EU**	15	48	108	168	250	58	-24

**Including foreign official investment in US Government Securities.*
*** Bilateral net direct investment plus inflows into US equities from EU excl. UK (Source: Bureau of Economic Analysis and US Treasury).*

But the financing side of the US Balance of Payments shows interesting shifts of composition. In the late 1990s and early 2000s net inflows to the US in the form of foreign direct and equity portfolio investment sharply increased, while the inflows in fixed income bonds first declined and then turned to outflows for several years. Indeed, "the breakdown of the portfolio flows reveals that equity inflows to the United States increased strongly up to 2000, when the 'New Economy' boom was touted in the financial press as a historic shift in economic fundamentals[5]; but in 2001-02, amid a global economic slowdown and the bursting of the equity bubble, the composition of the US portfolio inflows changed, with the share of equity flows falling sharply relative to flows in bonds", Castrén et al (2003).

While the dynamic theory of the balance of payments under certainty focuses on the role of financial markets in smoothing consumption, risk-sharing provides an additional motive for capital flows in a stochastic environment, Obstfeld and Rogoff (1996). To capture both motives for US capital inflows analytically, we use a stylised two-country, two-period general equilibrium framework with an anticipated, stochastic productivity boom in one country (the US). In the simulations that follow the model specification, as in Debreu's original formulation[6], the stochastic

[5] The supply of risk capital from Europe given at the foot of Table 1 shows a cumulative inflow of just over half a trillion dollars over the years 1995 to 2000.
[6] In the "Theory of value", Debreu (1959, chapter 7.5, 7.7) solves for general equilibrium using subjective, not objective, probabilities.

distribution perceived by investors can differ from the true distribution: a discrepancy that may, for example, be attributed to "irrational exuberance" due to herding behaviour (Shiller, 2000); or to "corporate moral hazard", if distorted incentives leading to false accounting (Stiglitz,2003).

Note that efficient risk sharing implies that consumers in the faster-growing region sell equity and buy fixed income assets that provide the same consumption in all states of the world[7]; and this pattern of share-holding ex ante has clear implications for the ex post distribution of losses. Where the ending of the asset price boom involves a payoff below the mean -- and a fortiori below the expected value after distortions due to irrationality and moral hazard – there may be significant wealth transfers across the world very different from those associated with debt finance. Expected welfare calculations show that, in the absence of distortions, the gains from trade in global financial markets are positive, but very small: in terms of consumption flows, they are worth only about one fiftieth of one percent of GDP to each country -- a finding which is robust to parameter variations.

The implications of mis-pricing are more striking. Since overvaluation involves a transfer from investors worldwide to US producers, the US enjoys a gain which rises in proportion to the distortion in asset prices (with corresponding losses to foreign investors). In the case examined below, where – with no change in fundamentals – the mean value of the extra GDP added by the New Economy increases in expectation by one percent of GDP, the US enjoys an international transfer of almost half of that. Taking account of home bias in investors' portfolios would reduce the ratio of this unintended transfer to the efficiency gains; but even if the transfer were scaled down by a factor of three or four, transfer losses would still dominate efficiency gains for the rest of the world.

We suggest finally that this analysis complements recent econometric studies of the transmission mechanism which find that financial factors are needed to explain "why the European economy was strongly affected by the downturn in the US" (Artis et al, 2003).

The paper proceeds as follows. In section 2 we introduce the model for consumption and optimal portfolio choice between equity and debt. In section 3 we first derive the key welfare results setting σ and ρ to unity (i.e., for the log utility model in section 2); then we check on robustness. In

section 4 the model is numerically calibrated to fit the stylised facts of the US equity valuations over the 1990s and the early 2000s. Section 5 concludes.

2. Growth Expectations and International Financial Markets: a global model

To formalise the arguments we specify a two-period dynamic stochastic general equilibrium model, in the tradition of Weil (1990) and Obstfeld and Rogoff (1996). We assume representative consumers in both countries share identical preferences given by expected logarithmic utilities. In this setup, we obtain equilibrium consumption allocation, asset holding, and current account positions with and without the presence of ex ante mis-perception; we then compare the welfare under autarky, complete markets and misperception. To check the robustness, our results are extended (in the appendix) to more generalised preferences which allow for separate treatment of parameters for inter-temporal substitution (time preference) and cross-state substitution (risk aversion).

2.1 Consumption allocation in a two-country model

Consider an economy with two-countries (home and foreign) who exchange and consume one tradable good. The economy exists for two periods. There is no uncertainty in the first period, the endowments for both home and foreign countries are given by $Y_1 = Y_1^*$, where * denotes foreign variables. In the second period, both countries expect a (non-stochastic) trend growth in output at the same rate of g. The home country in addition anticipates the arrival of the "New Economy", a positive supply shock which increases period-to-period growth by a higher rate h or by a lower rate of l. The home country's date 2 endowments are given respectively by $Y_2(1) = Y_1(1+g+h)$ and $Y_2(2) = Y_1(1+g+l)$, with their ex ante probability of π and $1-\pi$. The date 2 endowments for the foreign country are given by $Y_2^*(1) = Y_2^*(2) = Y_1^*(1+g)$.

Representative consumers in both countries share identical preferences. Home country's lifetime utility is given by

[7] For efficient risk sharing, Debreu uses Arrow securities - each indexed to a particular time and state - instead.

$$U(C_1, C_2(\bullet)) = \ln(C_1) + \beta[\pi \ln(C_2(1)) + (1-\pi)\ln(C_2(2))] \qquad (2.1)$$

where β is the time preferences, C_1 and $C_2(\bullet)$ are date 1 and date 2 consumption respectively.

Assume complete asset markets with 2 Arrow-Debreu securities. Their prices are given by $p(s) > 0$ ($s = 1,2$) measured in date 2 sure consumption goods. No-arbitrage requires

$$\sum_s p(s) = 1 \qquad (2.2)$$

The budget constraint of the home country is given by

$$C_1 + \frac{p(1)C_2(1) + p(2)C_2(2)}{1+r} = Y_1 + \frac{p(1)Y_2(1) + p(2)Y_2(2)}{1+r} \qquad (2.3)$$

where $1+r$ is the gross real interest rate measuring date 1 consumption in units of date 2 sure consumption.

The partial equilibrium allocation is obtained when the home country is maximising (2.1) subject to budget constraint (2.3) given Arrow-Debreu prices and real interest rate. Specifically, substitution of C_1 from (2.3) into (2.1) and differentiating the expected utilities with respect to $C_2(1)$ and $C_2(2)$ yield the following two first order conditions:

$$\frac{\partial U(C_1, C_2(\bullet))}{\partial C_2(1)} = \frac{1}{C_1}\frac{\partial C_1}{\partial C_2(1)} + \frac{\beta\pi}{C_2(1)} = 0 \qquad (2.4)$$

$$\frac{\partial U(C_1, C_2(\bullet))}{\partial C_2(2)} = \frac{1}{C_1}\frac{\partial C_1}{\partial C_2(2)} + \frac{\beta(1-\pi)}{C_2(2)} = 0 \qquad (2.5)$$

where $\partial C_1 / \partial C_2(1) = -p(1)/(1+r)$ and $\partial C_1 / \partial C_2(2) = -p(2)/(1+r)$.

Simple rearrangement of (2.4) and (2.5) yield

$$C_2(1) = \frac{\beta\pi}{p(1)}(1+r)C_1 \qquad (2.6)$$

$$C_2(2) = \frac{\beta(1-\pi)}{p(2)}(1+r)C_1 \qquad (2.7)$$

After substitution of (2.6) and (2.7) into budget constraint (2.3), one can obtain date 1 consumption as

$$C_1 = \frac{1}{1+\beta}\left[Y_1 + \frac{p(1)Y_2(1) + p(2)Y_2(2)}{1+r}\right] \equiv \frac{W_1}{1+\beta} \qquad (2.8)$$

where W_1 is home country's wealth. So (2.6) – (2.8) characterise partial equilibrium consumption allocation for the home country, those for the foreign country follow the similar forms.

To obtain equilibrium prices and consumption allocation, we use the following market clearing conditions

$$C_1 + C_1^* = Y_1 + Y_1^* \tag{2.9}$$

$$C_2(s) + C_2^*(s) = Y_2(s) + Y_2^*(s), \quad s = 1,2. \tag{2.10}$$

Denote $Y_1^W = Y_1 + Y_1^*$, and $Y_2^W(s) = Y_2(s) + Y_2^*(s)$, (2.9) and (2.10) imply

$$p(1) = \pi\beta(1+r)Y_1^W / Y_2^W(1) \tag{2.11}$$

$$p(2) = (1-\pi)\beta(1+r)Y_1^W / Y_2^W(2) \tag{2.12}$$

Applying no-arbitrage condition (2.2) using (2.11) and (2.12) gives the equilibrium real interest rate

$$\beta(1+r) = \frac{1/Y_1^W}{\pi/Y_2^W(1) + (1-\pi)/Y_2^W(2)} = \frac{Y_2^W(1)Y_2^W(2)}{Y_1^W[\pi Y_2^W(2) + (1-\pi)Y_2^W(1)]} \tag{2.13}$$

Replacing $\beta(1+r)$ in (2.11) and (2.12) using (2.13) yields equilibrium Arrow-Debreu prices:

$$p(1) = \frac{\pi/Y_2^W(1)}{\pi/Y_2^W(1) + (1-\pi)/Y_2^W(2)} = \frac{\pi Y_2^W(2)}{\pi Y_2^W(2) + (1-\pi)Y_2^W(1)} \tag{2.14}$$

$$p(2) = \frac{(1-\pi)/Y_2^W(2)}{\pi/Y_2^W(1) + (1-\pi)/Y_2^W(2)} = \frac{(1-\pi)Y_2^W(1)}{\pi Y_2^W(2) + (1-\pi)Y_2^W(1)} \tag{2.15}$$

Although both home and foreign countries can smooth consumption and share risk with the aid of Arrow-Debreu securities, the degree of consumption smoothing and risk-sharing is affected by the aggregate uncertainty. The equilibrium real interest rate and Arrow-Debreu prices reflect such aggregate uncertainty. In particular, the real interest rate reflects the relative scarcity of aggregate intertemporal endowments (as it is the ratio of date 1 marginal utility of consumption of aggregate endowment to the expected present value of date 2 marginal utilities of aggregate state consumptions), and the Arrow-Debreu prices depend on the relative scarcity of aggregate state endowments. Since $Y_2(1) > Y_2(2)$ and $Y_2^*(1) = Y_2^*(2)$, (2.13) – (2.15) imply that an increase in π increases the real interest rate and the high state Arrow-Debreu price.

The general equilibrium consumption allocation can be derived by substituting (2.13) – (2.15) to (2.6) – (2.8). This yields

$$C_1 = \mu Y_1^W \tag{2.16}$$

$$C_2(s) = \mu Y_2^W(s), \quad s = 1, 2 \tag{2.17}$$

where

$$\mu = \frac{Y_1 / Y_1^W + \beta[\pi Y_2(1)/Y_2^W(1) + (1-\pi)Y_2(2)/Y_2^W(2)]}{1+\beta}. \tag{2.18}$$

From (2.17), one has

$C_2(1)/C_2(2) = Y_2^W(1)/Y_2^W(2)$.

So the ratio of date 2 state contingent consumption is independent of ex ante probability.

To see how a change in ex ante probability can affect equilibrium consumption allocation, we only need to look at how μ changes with π. It is straightforward to show that

$$\frac{\partial \mu}{\partial \pi} = \frac{\beta[Y_2(1) - Y_2(2)]Y_2^*(1)}{(1+\beta)Y_2^W(1)Y_2^W(2)} > 0 \tag{2.19}$$

as $Y_2^*(1) = Y_2^*(2)$ and $Y_2(1) - Y_2(2) > 0$. Given endowments, an increase in the probability of the higher growth state, π, increases home country's consumption in all state and time.

2.2 Asset allocation and the current account

In this part, we first derive the asset holdings for the home country in equilibrium, we then look at home country's current account position and how it is financed.

Let $S(s)$ denote Arrow-Debreu security for state s (which will deliver one unit of date two consumption good when s is realised). Assume there are two assets traded in the market: one is a stock on date 2 home country's "New Economy" (home country's date 2 excess output), the other is a riskless bond which has the return the same as the real interest rate. Specifically, the date 2 payoffs on one unit of stock are $\sum_s [Y_2(s) - Y_2^*(s)]S(s)$, and date 2 payoff of the bond is $(1+r)\sum_s S(s) = 1+r$. Given $Y_2(1) - Y_2^*(1) \neq Y_2(2) - Y_2^*(2)$, these two assets (each as a linear combination of the Arrow-Debreu securities) span the date 2 state space.

What would be the home country's demand for these assets to implement the equilibrium consumption allocation? Let home country's demand for stock and bond be given by ξ and ζ respectively. Date 2 budget constraints require

$$C_2(s) - Y_2(s) = \zeta(1+r) + \xi[Y_2(s) - Y_2^*(s)], \quad s = 1, 2. \tag{2.20}$$

Solving (2.19) for ξ and ζ, and incorporating (2.17) yields

$$\xi = \mu - 1 \tag{2.21}$$

$$\zeta(1+r) = (2\mu - 1)Y_2^*(1) \tag{2.22}$$

Foreign country's asset holdings are determined in a similar way as described in (2.20). Let foreign country's demand for stock and bond be given by ξ^* and ζ^*. Since the net demand for each class of assets has to be zero, then $\xi^* = -\xi$ and $\zeta^* = -\zeta$. For the parameter values chosen in this model, it is clear that $1/2 < \mu < 1$, so (2.21) and (2.22) imply that home country sells equity to and bus bonds from the foreign country to execute its optimal consumption plan. With an increase in π, (2.21) and (2.22) imply that both ξ and $\zeta(1+r)$ increase (as they vary positively with μ), i.e., the home country sells less of its equity in date 1 while the returns on bonds go up. Since (2.17) indicates that higher π leads to higher date 2 state-contingent consumption, (2.20) suggests that higher consumption is the result of both the higher interest on bonds in date 2 and of less equity sales in date 1.

Given the equilibrium consumption allocation outlined above, one can easily obtain the home country's current account position. Specifically, the home country's current account deficits are

$$CA = C_1 - Y_1 = \mu Y_1^w - Y_1 > 0.$$

Using budget constraint (2.3) and asset allocations (2.20) – (2.22), one can show how current account deficits are financed

$$CA = C_1 - Y_1 = -\zeta - \xi \frac{\sum_s p_s[Y_2(s) - Y_2^*(s)]}{1+r} \tag{2.23}$$

Equation (2.23) simply states that the home country sells equity to finance both current account deficits and the purchase of bonds in period 1.

How does an increase in ex ante probability affect (2.23)? As discussed above, an increase in π increases home country's current account deficits and reduces the amount of equity sold abroad in date 1. Using (2.22), one can show

$$\frac{\partial \zeta}{\partial \pi} = \frac{2\beta}{1+\beta} \frac{[Y_2^*(1)]^2 [Y_2(1) - Y_2(2)]}{Y_1^W [\pi Y_2^W(2) + (1-\pi) Y_2^W(1)]^2} [(2-\pi) Y_2(1) + \pi Y_2(2) + 2Y_2^*(1)] > 0 .$$

So a higher π means an increase in the number of bonds purchased by the home country in date 1. From the budget constraint (2.23), with an increase in π, home country issue less number of shares of equity to finance both higher current account deficits and the purchase of more bonds in date 1. This is only possible if the date 1 value of equity increases, i.e., the date 1 price of equity must increases more than compensating the reduced equity sale.

2.3 Welfare measures

For the equilibrium consumption given in section 2.2, what will be the utility gain for the home country when markets are complete? Under autarky, the home country simply consumes its endowments, so its lifetime utility is given by

$$U_A(Y_1, Y_2(\bullet)) = \ln(Y_1) + \beta[\pi \ln(Y_2(1)) + (1-\pi)\ln(Y_2(2))] \qquad (2.24)$$

Given autarky welfare above, we specify the gain from consumption-smoothing and risk-sharing as

$$\Delta U_T = U(C_1, C_2(\bullet)) - U_A(Y_1, Y_2(\bullet)), \qquad (2.25)$$

where $U(C_1, C_2(\bullet))$ is the home country's life time utility under complete markets.

To see how such utility gain can be translated into consumption, we provide the following two measures. First we assume that all the utility gain is accorded to an increase in the first period consumption (the so-called "Potlatch" in the next section), i.e.,

$$U(C_1, C_2(\bullet)) = U_A(Y_1 + \Delta C_P, Y_2(\bullet)). \qquad (2.26)$$

The second is to accord the utility gain to a "flow" of consumption in both periods:

$$U(C_1, C_2(\bullet)) = U_A(Y_1 + \Delta C_F, Y_2(\bullet) + \Delta C_F). \qquad (2.27)$$

These measures will be used in the numerical simulation in section 3.

Let moral hazard and/or "irrational exuberance" be characterised as misperception, i.e., where the distribution perceived by investors differ from the true distribution, in particular, where the perceived probability, π, of higher growth in period 2 is greater than its true probability, π_O. Denote the consumption allocation under perceived distribution by $C_t(s;\pi)$, the lifetime utility for such an allocation evaluated under the true distribution is

$$U_M(C_1(\pi), C_2(\bullet,\pi)) = \ln(C_1(\pi)) + \beta[\pi_O \ln(C_2(1,\pi)) + (1-\pi_O)\ln(C_2(2,\pi))]$$

The welfare change due to misperception (compare to complete markets case) is simply

$$\Delta U_M = U_M(C_1(\pi), C_2(\bullet,\pi)) - U(C_1, C_2(\bullet)), \qquad (2.28)$$

where $U(C_1, C_2(\bullet))$ is given by (2.3) with $\pi = \pi_O$. In the simulations in section 3, we also provide consumption measures of this utility change as outlined in (2.26).

3. Welfare Effects

Using this model, we consider the US "New Economy" boom of the late 1990s and the early 2000s and analyse its impact on expected welfare both at home (US) and elsewhere. For the baseline, expected welfare is calculated based on the assumption that there is a complete set of markets for smoothing consumption over time and for diversifying risk using key parameters from the Bank of England study, BMW (2001)[8] . This is followed by a scenario where investors are misled about the probability of high payoffs from the "New Economy".

Details of consumption-smoothing in the US and of global participation in the US market are reserved for the next section. Here we focus on questions of welfare: how much better off would US and foreign consumers be with the "New Economy" shock appropriately financed by the issue of Arrow-Debreu securities? What would the US gain (and foreigners lose) if these securities were sold at prices involving distorted probabilities? How robust are these calculations to parametric variations?

3.1 Three "New Economy" Scenarios

[8] So their results can be obtained as a special case of our stochastic framework.

Before presenting the numerical results, we specify the key assumptions involved in the various scenarios.

"Autarky"

In this case there is no international finance: in both periods and both states, each country consumes its endowment.

"Base-Line": Arrow-Debreu

As in BMW (2001), we assume that the expected boom in the US is a once-and-for-all 5.0% increase in the level of the US GDP, leaving trend growth unchanged at 2.4%. Given the stochastic nature of our model, we take this expected payoff to be the mean of two equi-probable outcomes, a low pay-off s^L which adds 3 percentage points to second period growth and a high pay-off s^H which adds 7 points. Note that if it is the low payoff that is observed *ex post*, the market will still fall -- even though the "New Economy" has succeeded in lifting the Home economy above its trend growth path. This downside risk will have been foreseen and balanced by the upside prospect of the market rising on observing the high payoff.

"Excess Upside Probability": a stock-market bubble

This scenario tries to capture the outcome when the probability weight attached to the high payoff is higher than warranted. This could be due to investor psychology, or to mis-information where accountants and Chief Executive Officers have private incentives to misreport actual and expected profits (because, perhaps, the normal checks on such misreporting are missing as result of rapid and extensive deregulation). It might seem tempting to model a "moral hazard equilibrium" where these incentives to misreport are checked, not by regulation but by the actions taken by suspicious investors. We do not do this in the paper on the grounds that the degree of misreporting was an unexpected surprise, whose true dimensions are only now apparent to investors, partly as a result of proceedings in the criminal courts. It is worth recalling that, in 1996/7 East Asian economies were being described as dens of "Crony Capitalism" in contrast to the US, whose Anglo-Saxon procedures for accounting and corporate governance were widely commended as a global benchmark. (Later, we assume, for simplicity, that such moral hazard has effectively disappeared with re-regulation e.g. the Oxley-Sarbanes Act.)

How is one to characterise the effects of an asset price bubble, including aspects of moral hazard, in a general equilibrium model? We do this by simply increasing the *perceived* probability of the high payoff of the "New Economy"; specifically it increases to 0.75, although the true probability still remains at 0.5; so the expected supply-side shock rises from 5 to 6 percent of GDP. In this case, if the low state payoff materialises, the market should fall substantially. In the meantime, decisions will have been distorted by excessively bullish expectations.

3.2. Welfare results

Welfare measures are shown in Table 2.In the top row are the lifetime welfare outcomes for the 'Old Economy', where there is no gain from trading financial assets and each country simply consumes its own endowment, which grows non-stochastically by 2.4% from one period to the next . Next are calibrations of three scenarios for the 'New Economy'. With Autarky, each country continues to consume its own endowment, despite the potential gains from trade in financial assets to spread the effects of the asymmetric shock. When these market opportunities are exploited, however, this yields the welfare outcomes for the Arrow-Debreu equilibrium shown next. Finally, labelled Excess Upside Probability, the utility of consumption plans made using distorted probabilities of the New Economy is assessed (but the welfare evaluation is made using the true probabilities).

Two measures are used to translate the welfare changes into consumption flows. The first, labelled "Potlatch[9]", indicates the percentage increase in consumption in the first period which would deliver an equivalent welfare change. The second, roughly half the size, labelled "Flow", indicates the extra consumption flow in both periods which would give the same welfare change. Although the Flow measure might seem the more relevant, the figures in the second row showing the consumption gains from the New Economy without international trade in financial assets suggest that the Potlatch measure may be more appropriate when 'permanent' changes are being considered in the context of a two period model. The figure of 4.72% representing the increase in current consumption corresponding to the gains from stochastic increases in second period output whose mean value is 5%, seems a better measure of what is in reality a permanent productivity change than the "flow" figure of 2.38%. Hence the focus on the Potlatch measure in what follows.

[9] An American word denoting an Indian winter festival,or the gift-giving at that time.

	HOME			FOREIGN		
	Lifetime Welfare	"Potlatch" % Cons'n	"Flow" % Cons'n	Lifetime Welfare	"Potlatch" % Cons'n	"Flow" % Cons'n
"Old Economy"	9.16462			9.16462		
ΔU0	**+0.04721**	**+4.72**	**+2.38**	**0**	**0**	**0**
Autarky Equilibrium	9.21141			9.16462		
ΔU1	**+0.00018**	**+0.02**	**0.01**	**+0.00019**	**+0.02**	**0.01**
Arrow-Debreu Equilibrium	9.21159			9.16481		
ΔU2	**+0.0045**	**+0.45**	**0.23**	**-0.0047**	**-0.47**	**-0.24**
Excess Upside Probability	9.21611			9.16017		
ΔU1+ΔU2	**+0.0047**	**+0.47**	**0.24**	**-0.0045**	**-0.45**	**-0.23**

Table 2. Expected lifetime welfare, by country

Clearly there are additional gains to be achieved by using *global financial markets* to smooth consumption over time and to spread risk of the asymmetric supply side shock internationally. How big are they? In terms of immediate consumption, the answer for both countries is a gain of only 1/50 of 1%, see ΔU1 in the table**.** So the gains from international trade in financial assets are clearly positive, but rather small.

This may be disappointing, but not too surprising if one recalls that Lucas (1987) calculated the welfare gain to the US from eliminating *all* consumption fluctuations to be less than one-hundredth of one percent of consumption when preferences are logarithmic, a figure that rises to around three-hundredths of a percent on updating[10]. Our general-equilibrium open-economy results are broadly consistent with these stylised calculations. If, in similar fashion, we consider the value of *completely stabilising home consumption* when the supply shock, *s*, occurs, the welfare benefit, to a first approximation, would be one-period gain of var(*s*)/2 = (0.0004)/2 = 0.00002[11].

[10] Updating his calculation to cover the period 1950-1990, Obstfeld and Rogoff (1996 p.330) report a figure of ρ.Var(ε)/2 = ρ 0.0007/2 = ρ 0.00035, where ε is the annual shock to consumption, and ρ is the measure of risk aversion: for log utility, this implies a flow gain 0.035 of 1 % of consumption. (The flow measure is obviously more relevant in this multi-period context.)

[11] While this may be a useful insight, the fact that it gives precisely the same as gains shown in the table is a coincidence. Presumably the additional benefit of smoothing the *anticipated* supply side shock just offsets the incompleteness of consumption stabilisation in period 2, when *global* risk must still be borne.

What are the welfare implications of asset price overvaluation stemming, perhaps, from distorted incentives in the corporate sector? Since these involve transfers from investors worldwide to producers in the US, there are winners and losers. On balance, US consumers enjoy a potlatch of almost half a percent of GDP --- i.e., more than twenty times the gains from completing financial markets: and the losses to foreign investors are of a similar magnitude, see ΔU2 in the table. It is not difficult to see why: if corporate moral hazard has lifted the expected size of the New Economy by one percentage point and foreigners acquire almost half of the shares on offer[12], then they will lose half on one percent in the final *denoument*.

Summing these changes gives the bottom line: relative to autarky, international financial markets trading with distorted probabilities deliver a gain of 0.47 percent of period 1 consumption in the Home country, but foreigners lose the equivalent of 0.45 percent of period 1 consumption, as the unanticipated transfer offsets their welfare gains from financial markets. [13]

Insight into these results is provided by Figure 1 which focuses on the risk- sharing in period two using a state-space diagram, with outcomes for the high payoff state on the vertical axis and for the low payoff state on the horizontal. From the results in section 2 for log utilities, it follows that -- whatever the perceived probabilities -- the consumption plans for each country lie on the ray OT, whose slope corresponds to the ratio of world endowments. (Thus OT passes through M, the average of the autarchy endowments, shown as A and A' for Foreign and Home respectively.)

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[12] See details in next section. Note there is no home bias in the model, and there is perfect symmetry between the two countries.

[13] The finding that international transfers can more than offset efficiency gains to opening markets was also a feature of the general equilibrium model of UK entry into the European Community of Miller and Spencer (1977). In practice, however, Mrs Thatcher renegotiated the transfers!

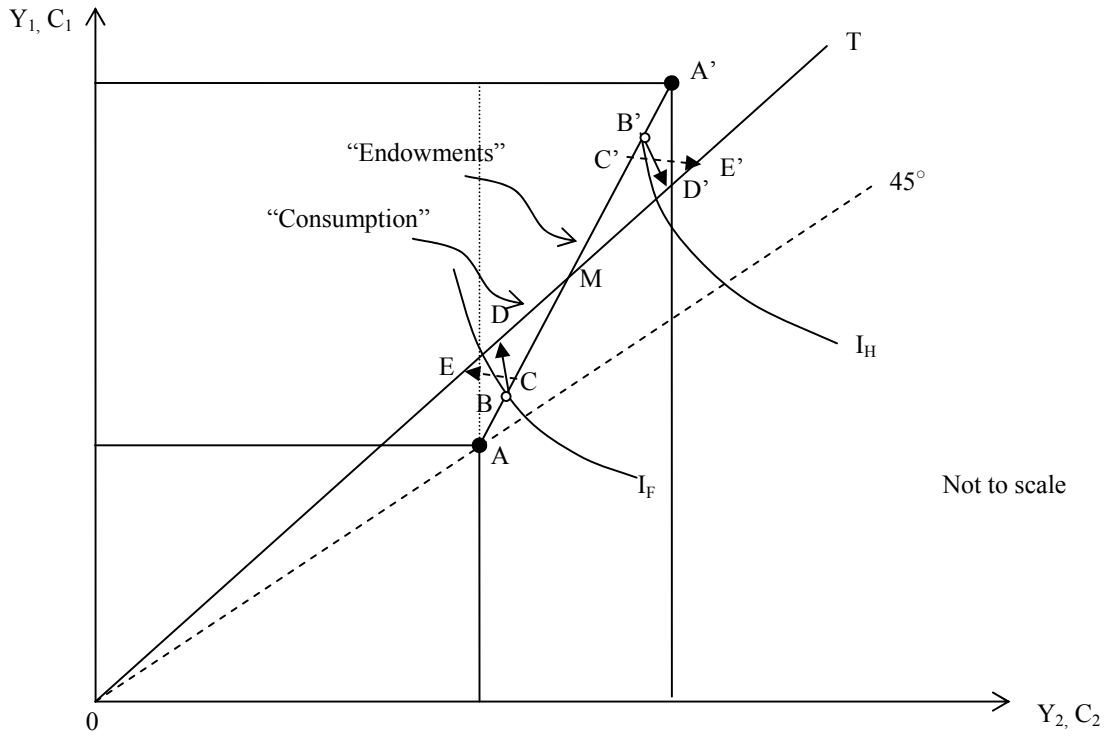

Figure 1. Equilibrium effects of distorted probabilities

How does the efficient Arrow-Debreu outcome differ from the consumption of these Autarchy endowments? Note first that the effect of the anticipated New Economy is to raise first period interest rates, as the Home country increases consumption and the Foreign country saves more. These current account imbalances in period one help to equalise entitlements in period two as is indicated by the revised 'endowment' points B and B' which lie between A and A'. In addition to this effect of intertemporal consumption-smoothing, the diagram shows the effects of efficient risk-spreading, where the Home country trades some of its high-state consumption for consumption in the low state as indicated by the vector B'D', whose slope reflects the ratio of state prices. Conversely the Foreign country chooses point D by trading along the vector BD. That these trades are Pareto-improving is obvious as the outturns on OT lie above the (homothetic) indifference curves passing through B and B' respectively.

What of the effect of distorted perceptions as to payoff probabilities? Could they make the Foreign country worse off than under Autarchy? First, we note that an increase in the perceived probability of the high outcome raises the interest rate in the first period, and so moves second period entitlements closer together, as shown by points C, and C'. Second, we note that the 'terms of trade' will move significantly against the Foreign country as the price of income in the high state rises in line with its increased likelihood. The effects of trading under distorted perceptions are indicated by the vectors CE and C'E' respectively whose flat slope reflects the shift in the "terms of trade". That these trades are not Pareto efficient, when evaluated using true probabilities, follows immediately from the fact that the Foreign country is trading at adverse 'terms of trade' which will lower its expected utility compared to no trade. (In the light of results from calibration, we have drawn point E as lying below the indifference curve through B.) What are the returns to the Foreign country which has boosted its saving in period one and bought assets to support the consumption plan at point E? In the low state it consumes less than its autarchy endowment which is not promising. The loss of welfare that this represents (no return on its saving) would be more than balanced by the fact that consumption will exceed the autarchy endowment in the high state, if the high state occurs with the distorted high probability. But if consumers have been significantly misled, this need not be true: the good times can occur so seldom that the Foreign country loses all the benefits of trade in assets, and is worse off than in Autarchy.

The state-space approach makes clear what asset holdings are needed to implement the chosen consumption plans; appropriate holdings of Arrow securities (each promising one unit of output in a given state of nature in a given period) are indicated by the coordinates of the consumption points in Figure 1. It may be more useful to work with combinations of Arrow securities which also span the space of consumption, namely bonds and shares, see Figure 2 where the non-contingent payouts of the former are represented by the 45 degree line and the state-contingent payouts of the latter by holdings along the vector AA' (assuming for convenience that all the value added in the New Economy accrues in the form of profits paid out to

shareholders).

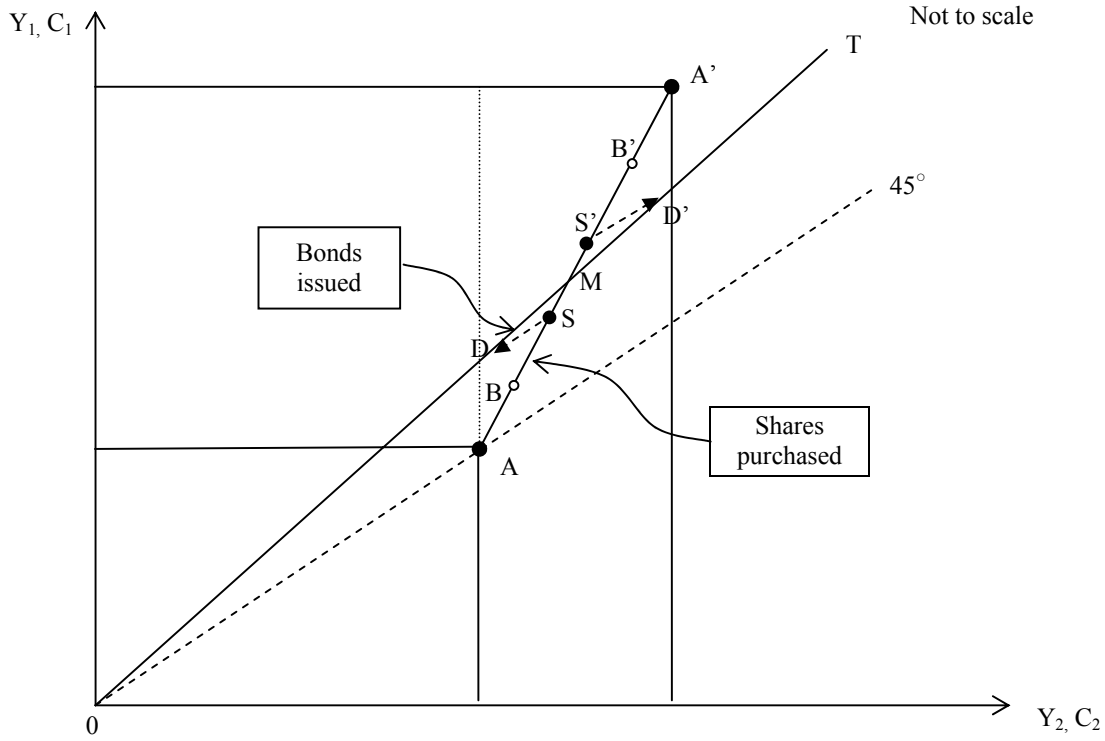

Figure 2: Asset holdings to implement consumption plans.

To support consumption at point E for example, Foreign consumers will need to hold shares in the New Economy as indicated by AS and issue debt as indicated by the vector SD. Absent the current account surplus in period one, foreigners who share the risk of the New Economy would have to be fully levered: with a current account surplus which effectively raises their second period endowment to point B, however, leverage is required to fund purchases from B to S[14]. In the calibrations which follow, leverage roughly doubles holdings attributable to the current account.

3.3 Checking the robustness of the welfare results

How robust are these welfare conclusions? As they depend crucially on the degree of asset mispricing, we check first to see how varying perceived π changes the size of the transfer. We also vary, in turn, ρ and σ.

Varying π, the "perceived" probability of the high outcome.

We observe that the ratio of Home country transfer gains (0.45) to its efficiency gains of consumption stabilisation (0.02) shown in Table 2 is 22.5; and this roughly matches the excess percentage probability attached to the high outcome, $100(0.75 - 0.25) = 25$. From the graph below it is clear that this proportionality holds for wide variations in expected π, so we can say that, for our global model with log utility, *the ratio of transfer gains to the Home country relative to the efficiency gains offered by complete markets approximately matches the excess probability of the high outcome*. If, for example, "meta moral hazard" was to add a quarter to the asset price overvaluation due to corporate moral hazard (lifting the perceived probability of the high outcome rises to 81.25% and the excess probability to 31.25), then the transfer gains would be about 30 times welfare gains of 1/50 of one percent of US consumption, i.e. almost 2/3 of a percent of GDP. As an important qualification, it should be emphasised that – aside from the New Economy shock -- this global model is one of perfect symmetry, with only one good and no "home bias" in portfolios: so foreigners are far more exposed to asset mispricing than one would expect in reality. This is discussed further below.

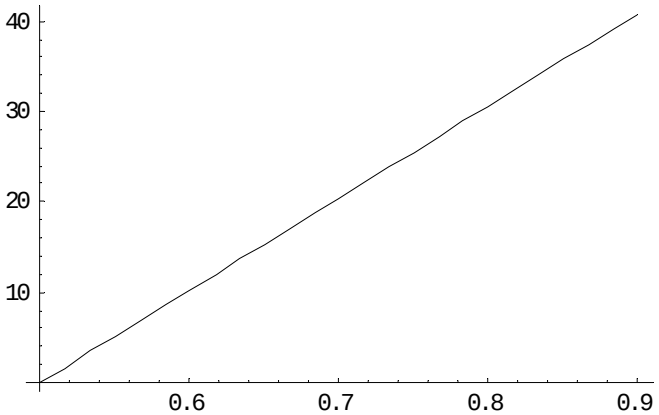

Figure 3. The ratio of transfer gains (potlatch, on vertical axis) and moral hazard distortion (π -0.5, on horizontal).

[14] Where the slope of the vector DB represents the terms of trade determined by state prices.

Varying ρ, the coefficient of risk aversion.

Econometric estimates suggest that risk aversion is greater than unity: Corsetti et al. (2003) set it at between 1.5 and 2. With ρ = 1.4, but all other parameters the same as for Table 2, there is a small decline in lifetime welfare in the US, see below: but the welfare of the foreign country and the effects of market integration and asset mis-pricing are unchanged.

		Home			Foreign	
	Lifetime Welfare	"Potlatch"	"Flow"	Lifetime Welfare	"Potlatch"	"Flow"
Autarky Equilibrium	9.21134			9.16462		
ΔU1	**+0.0002**	**+0.02**	**0.01**	**+0.0002**	**+0.02**	**0.01**
Arrow-Debreu Equilibrium	9.21154			9.16483		
ΔU2	**+0.0045**	**+0.45**	**0.23**	**-0.0047**	**-0.47**	**-0.24**
Excess Upside Probaility	9.21607			9.16018		
ΔU1+ΔU2	**+0.0047**	**+0.47**	**0.24**	**-0.0045**	**-0.45**	**-0.23**

Table 3. Welfare gains from trade and moral hazard effects (rho=1.4)

Varying σ sigma, the elasticity of intertemporal substitution

Other modellers typically assume a low degree of substitution over time, Bayoumi et al (2004) use a figure of 0.2 and Juillard et al (2004) a figure of 0.8. Reducing σ to a half -- and leaving all other parameters as for Table 2 -- increases the flow benefits of financial integration to each country, and reduces the consumption equivalent of the transfer (so the ratio of the two for the US falls below twenty). As a result net US gains are less, and the foreign country loses less than for log utility: but the differences are marginal.

We conclude that the results reported for the log utility case are robust to plausible variations in risk aversion and intertemporal substitution: and the 'transfer' effects vary proportionately with the difference between the subjective and the objective probability of the high outcome.

		Home			Foreign	
	Lifetime Welfare*100	"Potlatch"	"Flow"	Lifetime Welfare*100	"Potlatch"	"Annuity"
Autarchy Equilibrium	-1.91729			-1.96191		
ΔU1	**+0.0003**	**+0.03**	**0.01**	**+0.0003**	**+0.03**	**0.017**
Arrow-Debreu Equilibrium	-1.91699			-1.96159		
ΔU2	**+0.0042**	**+0.42**	**0.23**	**-0.0047**	**-0.44**	**-0.22**
Excess Upside Probability	-1.91279			-1.966		
ΔU1+ΔU2	**+0.0045**	**+0.45**	**0.24**	**-0.0041**	**-0.41**	**-0.21**

Table 4. Welfare gains from trade and moral hazard effects (sigma=0.5)

4. Economic outcomes (with log utility)

In this section we briefly examine the outcomes for international asset allocation, income, consumption in both states, but focussing mainly on the case that, ex post, nature chooses the low outcome. Leaving aside the Autarky case, where allocations simply match endowments, we consider three scenarios, the baseline and the two cases of moral hazard discussed above. Finally, we capitalise the flows in these scenarios to assess what these might imply in terms of losses as percentage of US GDP.

Baseline case

With a real interest rate of 6.5% and a US current account deficit of 1.2%, these outcomes closely match the results in BMW. What these simulations also provide are state-contingent consumption plans, and the asset positions taken to implement them. Instead of the US absorbing all the risk of the New Economy while the foreign economy enjoys consumption stability, both countries share the aggregate consumption risk. Details of the asset positions in the middle of the table reveal that, in addition to investing the current account surplus of 1.2% of GDP in risky US assets, the foreign country levers this position by borrowing 1.1% of its GDP and acquiring almost half of the value of shares in the US "New Economy".

4.1 State contingent plans and their financing.

	P^H	P^L	R	Shares issued	Debt issued	Home deficit	C_2^H	C_2^L
BASELINE π=0.5								
Global	0.465	0.474	6.5%	4.7	0		211.8	207.8
Home				2.4	1.1	+1.2	107.2	105.1
Foreign				**2.3**	**-1.1**	**-1.2**	104.7	102.7
EXUP π=0.75								
Global	0.698	0.237	7.0%	5.9	0		211.8	207.8
Home				3.0	1.5	+1.4	107.4	105.4
Foreign				**2.9**	**-1.5**	**-1.4**	104.4	102.4

Notes.
EXUP denotes Excess Upside Probability.
In this table Arrow-Debreu prices are discounted back to first period, so $P^H + P^L = 1/(1 + r)$.
Deficit denotes home current account deficit in period 1, as % of GDP.
Figures in bold show how the Foreign acquisition of shares is financed (approx. half by issuing debt).

With a high payoff, consumption grows by about 6% in both countries; but with the low payoff, home consumption is slightly less than its endowment (105.4), while the foreign consumption is slightly higher than its own endowment (102.4).

"Excess Upside Probability"

Encouraged by high subjective probabilities attached to high payoffs, foreign investors provide the funding for increased US consumption in period one in exchange of shares in the "New Economy" (whose present discounted value rises to almost 6% of GDP in this two period analysis) which they continue to leverage with borrowing that doubles their stock holding. Interest rates rise to seven percent. When leveraged bets go bad, foreign residents suffer strikingly from their exposure to US markets. As the results for the low payoff in the last two columns show, foreigners consume only their own endowment in period two: i.e., they get nothing on their savings in period one!

4.2 Losses in the US stock markets and their international transmission

It has been estimated that by late 2002, the losses on the US equity market from its peak two years earlier amounted to US dollar 8 trillion.[15] In this section we capitalise the flows discussed in the previous sections to see what they might imply about the size of the market fall and the relative contribution of normal market downturn (bad luck; in the baseline case) and excess upside probability.

Bad luck plays a key role in the Baseline scenario when the outturn lies below the (true) mean value incorporated in market expectations. We use the Arrow-Debreu prices to value the market *ex ante* as they take account of both the distribution of possible out-turns and of the delay before they occur; but these are applied to the flows after they have been capitalised. The first column of Table 5 shows the flow values in period two – a high of 7% or a low of 3 % – and the capitalisation factor used. The pure rate of time preference less trend growth from BMW augmented by the risk premium of estimated for the US market by Cechetti et al (2000) gives a price earnings ratio of almost 30 which is applied to half the New Economy GDP effects (to allow for a considerably higher share of profits in this sector than in GDP as a whole). The market valuation of 69% of GDP shown in the third row comes from summing these discounted capital values. Since US GDP in 2002 was approximately $10 trillion, this implies a perceived *ex ante* nominal valuation of the US New Economy at $6.9 trillion.

If 7 trillion dollars was the correct *ex ante* valuation of the supply side shock, how much would the market fall if nature selects the lower of the two possible out-turns (3% above the trend GDP growth)? Converting the capitalised value of this outcome (44.1% GDP) to dollars and subtracting it from the *ex ante* valuation gives a market fall of $2.5 trillion, i.e., losses due to "bad luck" costing about a quarter of US GDP.

[15] See Greenspan (2002).

Table 8: Stock Market Values and Estimated Losses
(Mean expected New Economy effect = 5.0% of US GDP)

		Flows in (period 2 %GDP)	Cap'n* (period 2 %GDP)	Arrow/ Debreu Prices	Valuation (period 1 %GDP)	Dollar Values $trillion	Non -US Losses $trillion
A	**BASE**						
1	High payoff	7.0	102.9	0.465	48		
2	Low payoff	3.0	44.1	0.474	21		
3	Expected payoff	5.0			69	$6.9	
4	Actual Payoff	3.0	44.1			$4.4	
5 = 3-4	**Losses ("Bad luck")**					**$2.5**	**$1.2**
B	**EXUP**						
1B	High payoff	7.0	102.9	0.698	72		
2B	Low payoff	3.0	44.1	0.237	10		
3B	Expected payoff	6.0			82	$8.2	
4B	Actual Payoff	3.0	44.1			$4.4	
5B = 3B-4B	**Losses**					**$3.8**	**$1.9**

Notes:
** The discount rate used for capitalisation, in percentage points, is 3.4 = 1.5 + 4.3--2.4 where 1.5% is the rate of pure time preference and 2.4 the trend growth rat – as for BMW – and 4.3% is the risk premium in US stock market estimated by Cechetti et al (2000).*
All numbers as % of US GDP, unless otherwise specified. US nominal GDP in 2000 was approx. US dollar 10 trillion. In this table Arrow-Debreu prices are discounted back to first period, so $P^H + P^L = 1/(1 + r)$

The fall gets bigger if excess probability has been assigned to the high outturn. If the perceived probability of the high payoff of the "New Economy" increases from 0.5 to 0.75, the *ex ante* stock valuation rises to 82% of the value of annual US GDP; and the corresponding fall when the low payoff is realised becomes $ 3.8 trillion, over a third of US GDP (see last line of Table 5). This loss is about half the figure given by Greenspan for the whole market (and corresponds broadly to the fall in the market capitalisation of the Nasdaq, as the index fell from its peak of 5000 in March 2000 to below 2000 in 2002). (To distinguish between 'bad luck' and distorted prices, note that about two thirds of the market fall of $3.8 trillion bad luck and would have occurred with correct expectations, leaving $1.3 trillion due to mispricing.)

The figure of $1.9 trillion appearing at the foot of the last column indicates that, in a one-good model of two symmetric blocs and no home bias, almost half of the total loss would be absorbed by shareholders outside the US. The results of an exercise to estimate losses on EU investments in the

US were reported in Castren et al (2003) amount to only about $0.5 trillion, however[16]. This is much less than the symmetric model suggests -- though it serves to illustrate the potential for international business cycle transmissions via the wealth channel. Perhaps, to take account of home bias and allow for non-EU foreign holders, one should take only a quarter or third of the transfer effects of stock market losses occurring in the model as realistic.

5. Conclusions

In intertemporal optimising models of the open economy, current account developments typically reflect consumption-smoothing of idiosyncratic shocks, with an expected supply-side shock of 5% leading to a deficit of over 1% of GDP for example, BMW (2001). When stochastic elements are added -- as in this 2 by 2 by 2 approach -- capital flows reflect global risk-spreading as well as the financing of inter-temporal trades. In our theoretical model, for example, it is optimal for foreigners to leverage their share-holdings to buy twice as much as is needed to finance the ´current account deficit -- and to absorb half the market losses[17]. Our calculations of the welfare gains to be obtained from such extensive cross border position-taking are, however, distinctly modest: a flow gain of only one fiftieth of one percent of consumption to each country, broadly in line with Lucas's well-known estimate of the benefits of consumption stabilisation. In comparison, the transfers attributable to asset mispricing bulk large. Artis et al (2003) find that financial factors play a role in their econometric account of why "despite some anticipations to the contrary … the European economy was strongly affected by the downturn in the US" -- a synchronisation which they note "may be temporary and a result of common shocks affecting these economies". Though highly stylised, our model of an asset bubble offers a theoretical rationale for these econometric results.

Some qualifications need to be borne in mind when interpreting the figures. The size of the price distortion is exogenously specified, for example. But as the size of the international 'transfer' (relative to the efficiency gains) is proportionate to the distortion of probabilities, one can scale the

[16] Note also that the supply of new risk capital to the US in the years 1995-2000 is estimated to be a little over half a trillion in Table 1.

[17] Had the US financed its widening current account deficit with fixed coupon debt US consumers would have had to absorb the full impact of the market fall when the bubble burst in 2000: with equity financing, the losses involved were globally distributed.

transfers up or down as necessary to fit one's own priors as to the degree of distortion. Another qualification is that the share holdings in the model do not exhibit the 'home bias' characteristic of actual portfolios: so, with New Economy risk distributed much more widely than one would expect in reality, the resource transfer induced by price distortions will be correspondingly exaggerated. But even if one reduces the transfers by a factor of four, they would still be many times larger than the welfare gains derived from these markets.

Can one conclude that, subject to the above qualifications, the overall gains offered by financial markets are small, so small that they can be swamped by transfer effects? The answer is no. To explain why, note that Lucas's estimates of the gains from stabilisation have been criticised on the grounds that they effectively assume the economy is near its full-employment potential: the benefits calculated are those of smoothing minor fluctuations of consumption when the economy operates near this capacity level. But what if it takes the promise and practise of stabilisation policy to put the economy close to capacity? Then Lucas's procedure will underestimate the overall gains to stabilisation policy.

In like fashion, we should acknowledge that the calculations made in this paper assume that the development (and risk characteristics) of the New Economy are given exogenously regardless of what is assumed about the (international) provision of finance. But what if the supply side shock was endogenous to the operation of financial markets? Without the ready availability of equity finance and venture capital, the New Economy would surely have been much slower to develop - and might have been still-born. So, broadly considered, the gains to providing adequate financial markets, both domestically and across international frontiers, could profits from the New Economy itself -- which bulk much larger than the fractions of a percentage point of GDP considered in the paper. An obvious extension of the analysis would be to make the New Economy endogenous.

The potential gains from financial markets – and the associated risk of market capture -- are discussed in much more general terms in Saving Capitalism from the Capitalists, Rajan and Zingales, 2003. This paper does not show that financial development is bad for consumer welfare, nor is intended to do so. What it does indicate is that, in global capital markets with asymmetric

shocks, asset price distortions can generate international 'transfers' which can exceed the efficiency gains of consumption-smoothing and risk-spreading. Where asset prices reflect distorted incentives, it seems that ´saving capitalism from the capitalists´ may require legal enforcement of truth-telling.

The real exchange rate implications of idiosyncratic shocks ideally require the inclusion of differentiated traded goods. Such an extension could show why the strength of the dollar in anticipation of the "New Economy" need not be followed by symmetric dollar weakness (because losses on leveraged investment in the US can wipe out the real transfer that foreign lenders would expect to receive for financing the US deficit): and it could lead to an endogenous rationale for 'home bias' in investor portfolios.

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Appendices

By request to authors.