



# *In Katrina's Wake: On the Unforgiving Economics of Insurance and Climate Change*

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- Industry Overview: Profitability, Growth and Costs
- Insurance and Extreme Weather: Hurricanes
- Insurance, Economics and Climate Change
  - Properly Pricing Risk
  - Hurricanes and Coastal Populations
- The China/India Challenge for US Insurers



# Profitability, Growth and Costs

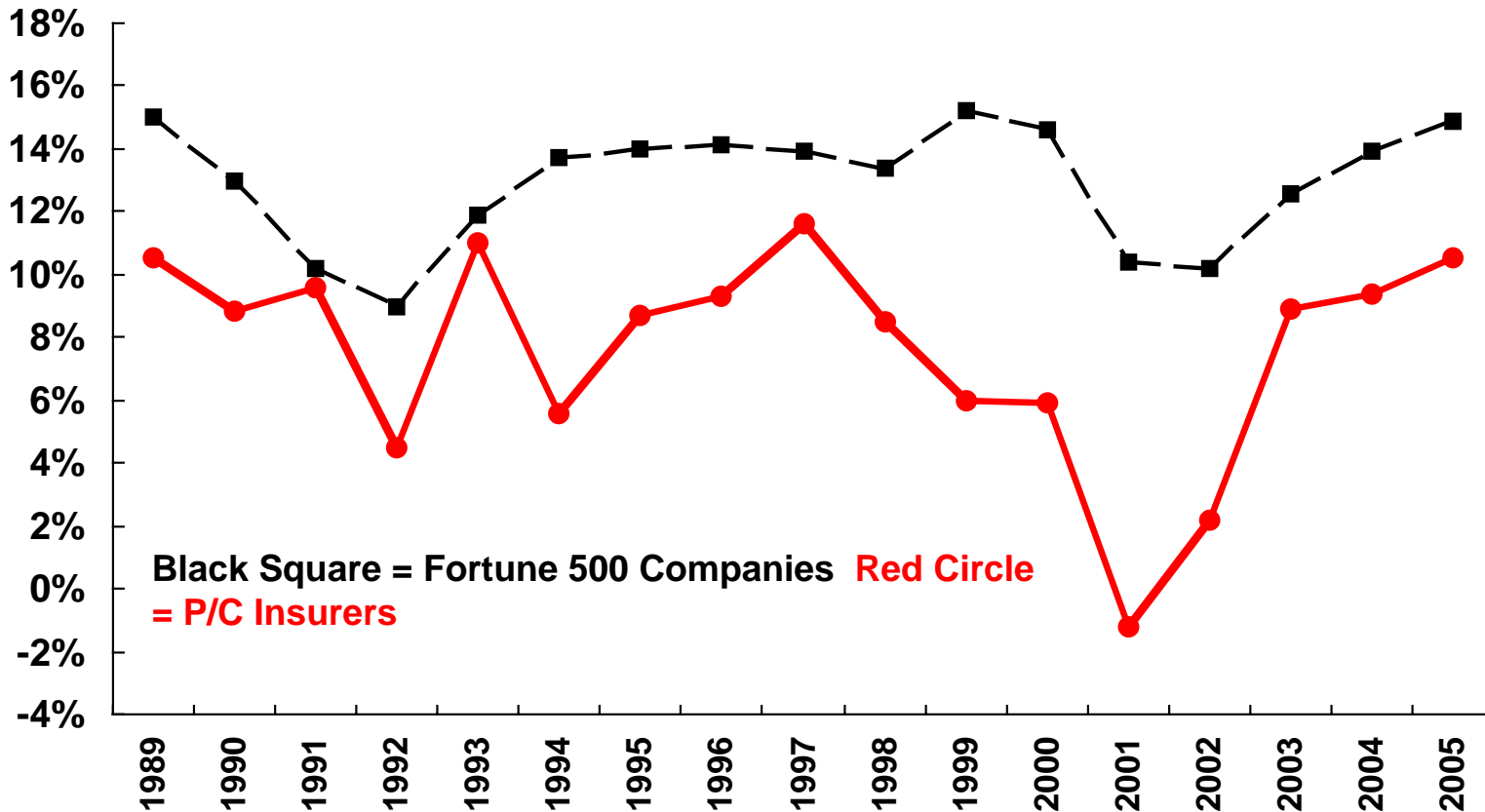


- Primary determinants of Insurer Profits:
  - Premiums,
  - Investment Income, and
  - Control of Operating Costs



# ROE of P/C Insurance Sector: 1989-2005

ROE of P/C insurance industry was down slightly in 2005 from 2004, but still above the 15 year average of 7.61% despite the hurricanes of 2004 and 2005.



\*GAAP ROE's = return on average surplus. 2005 figure is III full-year estimate. Source: Insurance Information Institute; Fortune for all industry figures

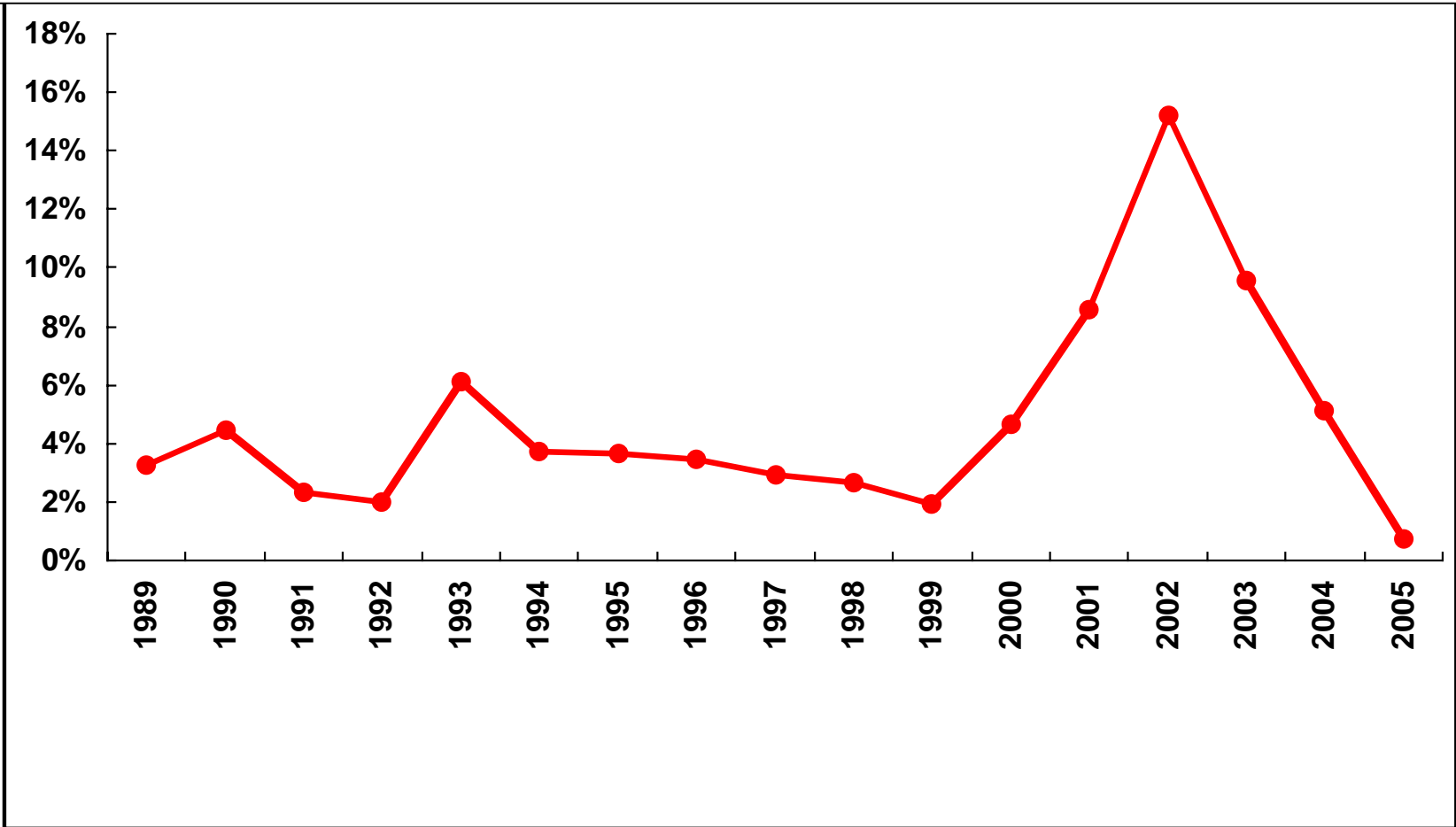


- Hurricanes are random negative shocks that drain industry earnings and policy holder surplus; no statistically significant impact of hurricanes on the aggregate financial performance of the insurance industry.
- Hurricanes losses in one year have a rapidly fading echo on industry return on equity in succeeding years; impact of hurricanes losses on ROE in each succeeding year diminishes by 50%.
- Hurricanes and terrorism have similar statistical effects on industry ROE at a point in time and over time.
- Statistical results suggest that insurance industry is resilient in the face of an increase in the frequency and severity of hurricanes so long as future storm losses conform to historic loss patterns.



# Growth of Net Written Premiums: 1989-2005

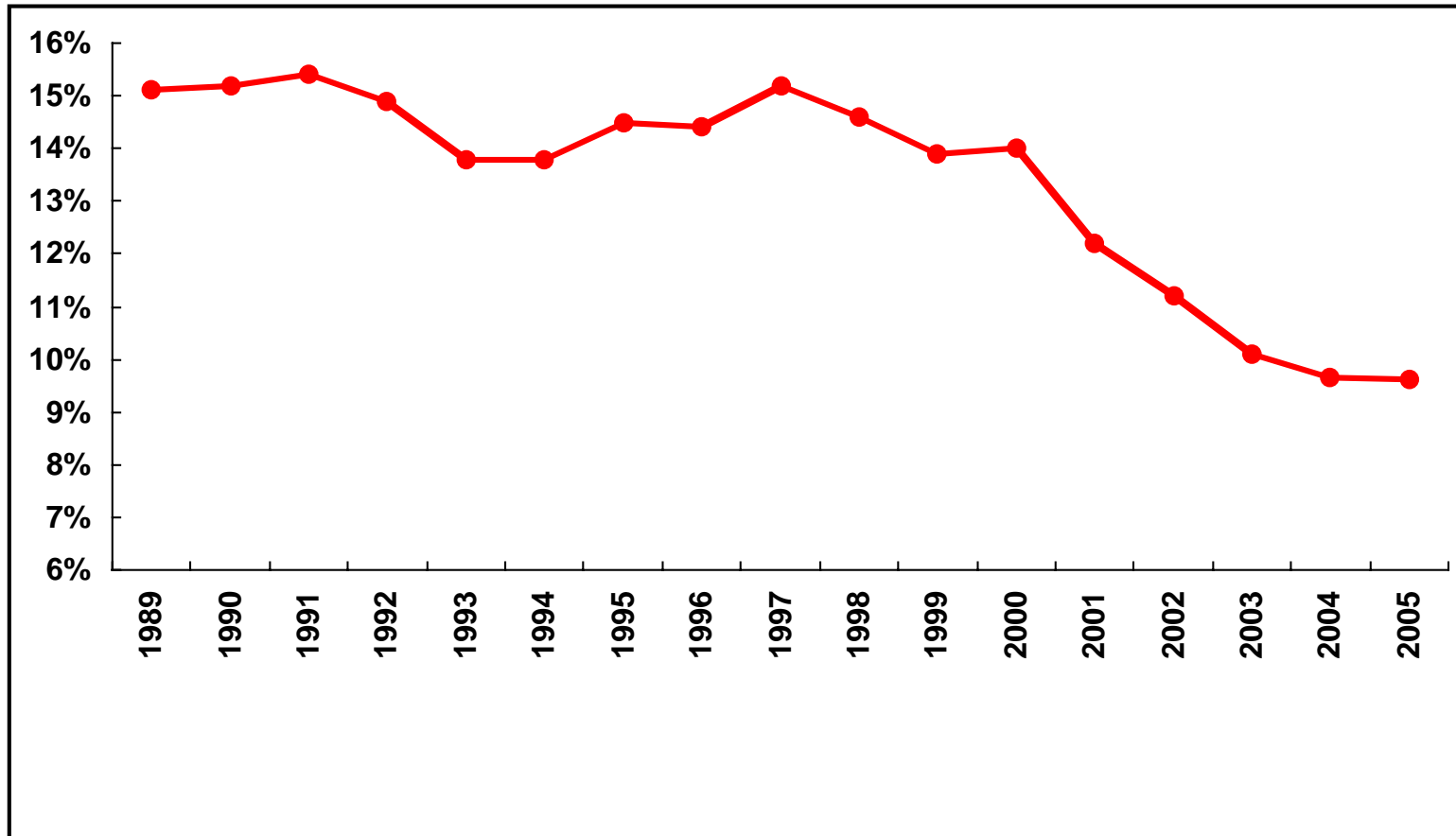
Premium growth has been falling since the peak in 2002 and was nearly zero in 2005. Yet, premiums grew an average of **4.72%** between 1989 and 2005, less than the growth rate from 2000-2005 of **7.67%**.





## Investment Income as Fraction of Net Written Premiums: 1989-2005

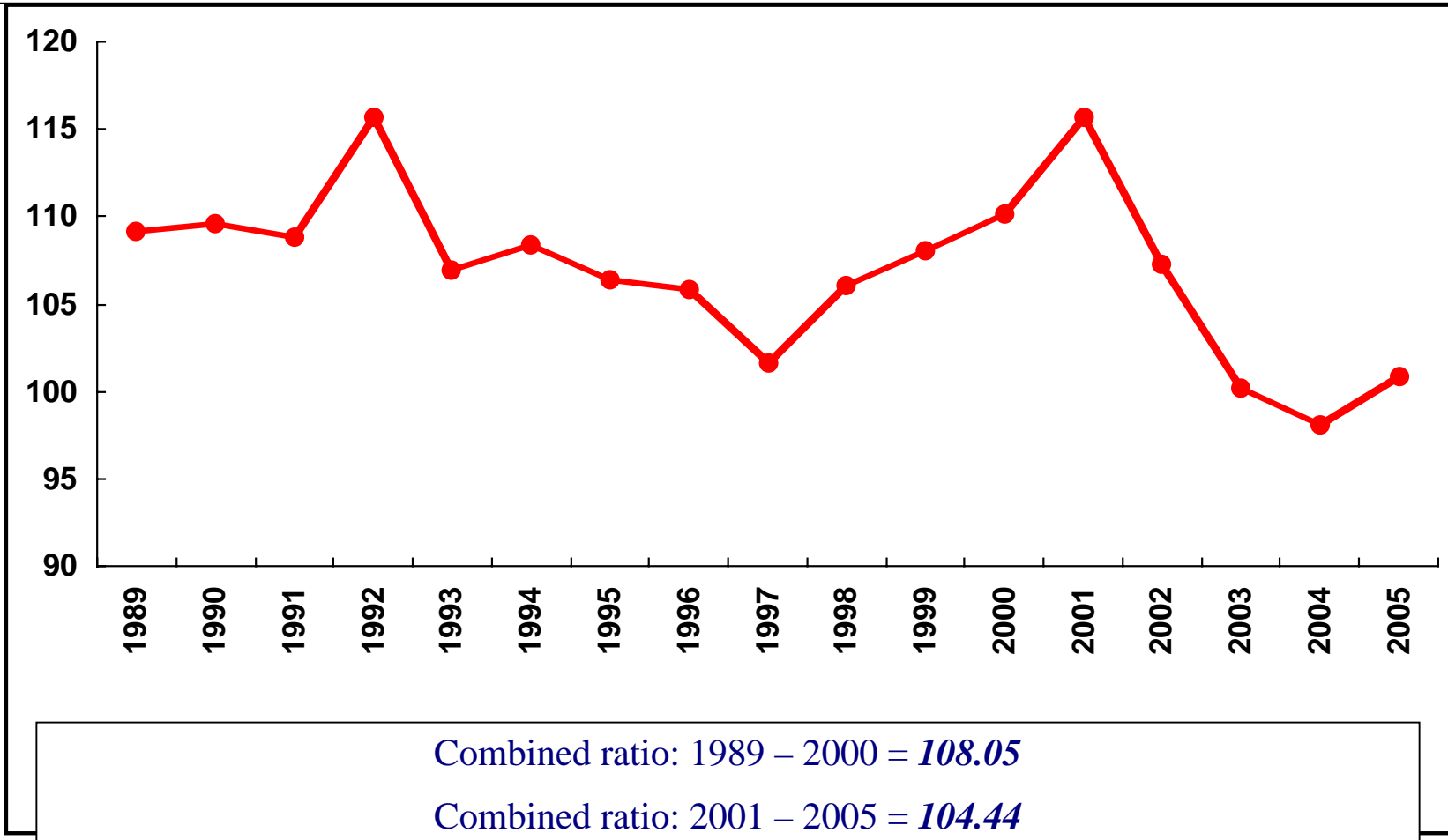
Investment income is falling compared to the level of net written premiums, despite the rise in interest rates over the past few years.





## Combined Ratio: 1989-2005

Combined ratio is low in 2004 and 2005 despite large storm losses; a sign that insurers are running their enterprises so efficiently that they can absorb large storm losses. Note the downward trend of the combined ratio with spikes in 1992 (Hurricane Andrew) and 2001 (9/11).

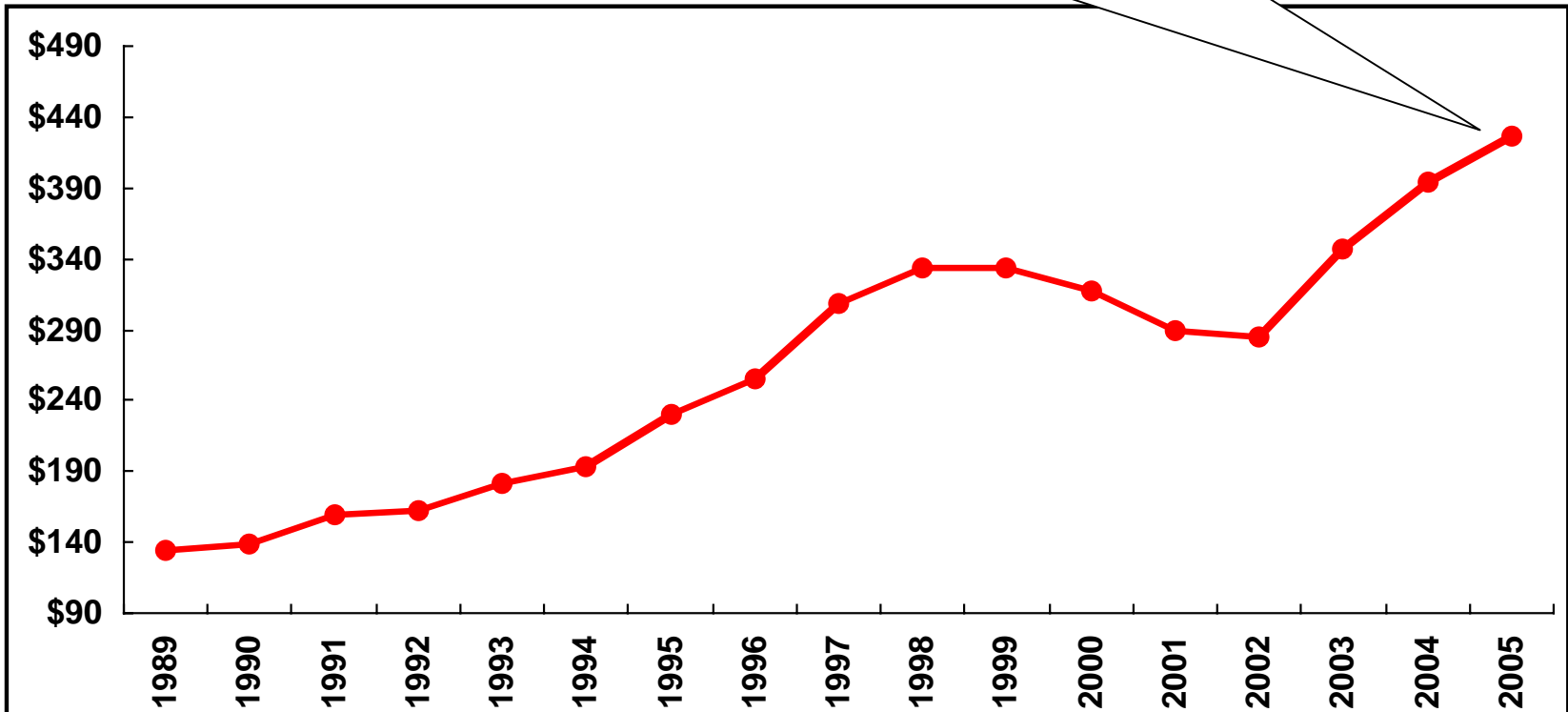




# Policyholders' Surplus: 1989-2005

Source: A.M. Best

Policyholder Surplus as of 2005 was \$427.1 billion

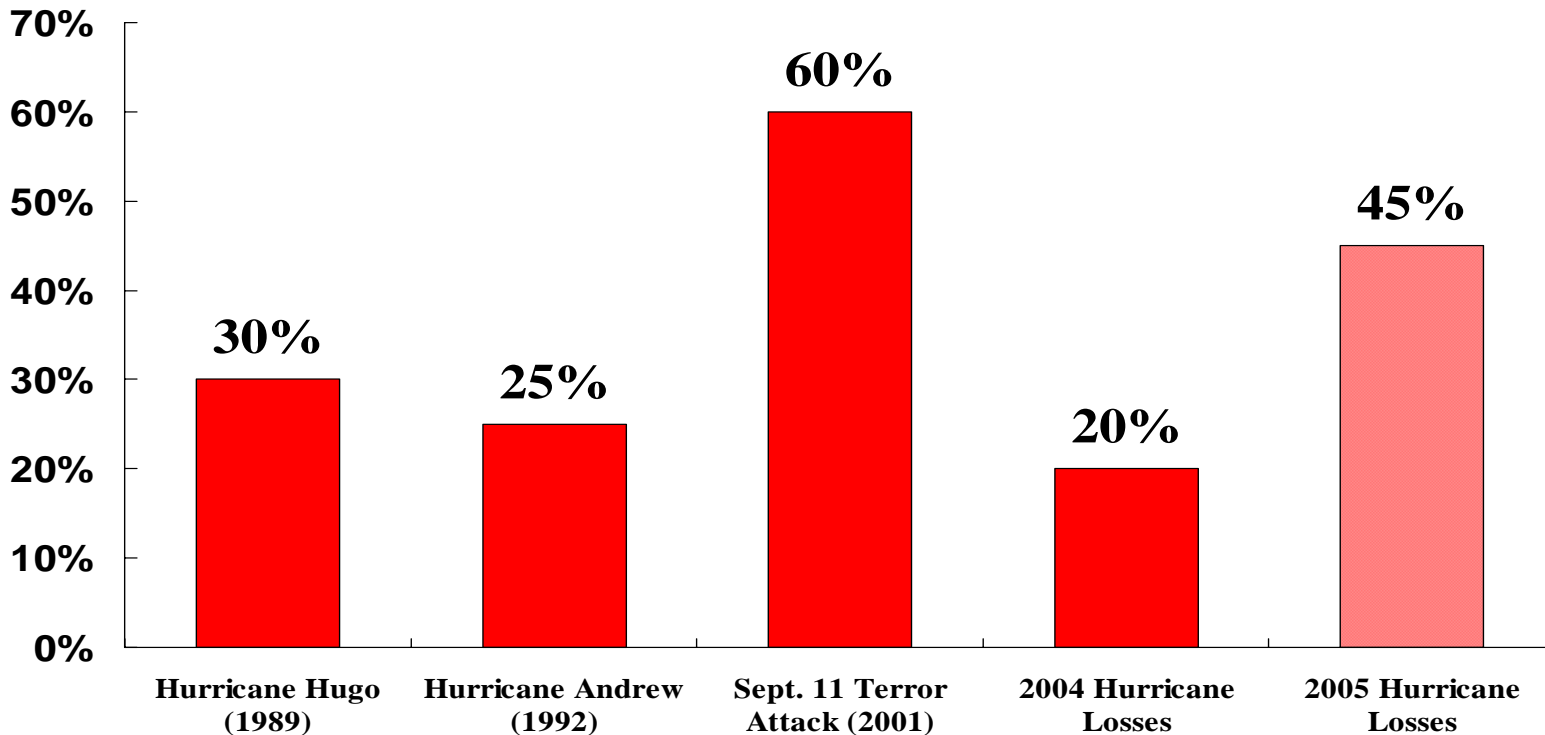


Policyholders' surplus has continued to grow in the face of the largest catastrophe losses in history, providing substantial capital for the industry to provide protection to its customers in all of its lines of business



# Share of Losses Paid by Reinsurers, by Disaster\*

**Reinsurance is playing an increasingly important role in the financing of mega-CATs; Reins. Costs are skyrocketing.**



\*Excludes losses paid by the Florida Hurricane Catastrophe Fund, a FL-only windstorm reinsurer, which was established in 1994 *after* Hurricane Andrew. FHCF payments to insurers are estimated at \$3.85 billion for 2004 and \$4.5 billion for 2005.

Sources: Wharton Risk Center, Disaster Insurance Project; Insurance Information Institute.



So, more efficient operations in the face of slow premium growth and modest investment income has allowed insurers to post decent profits despite high catastrophic losses, thereby permitting insurers to actually build up surplus in tough times.

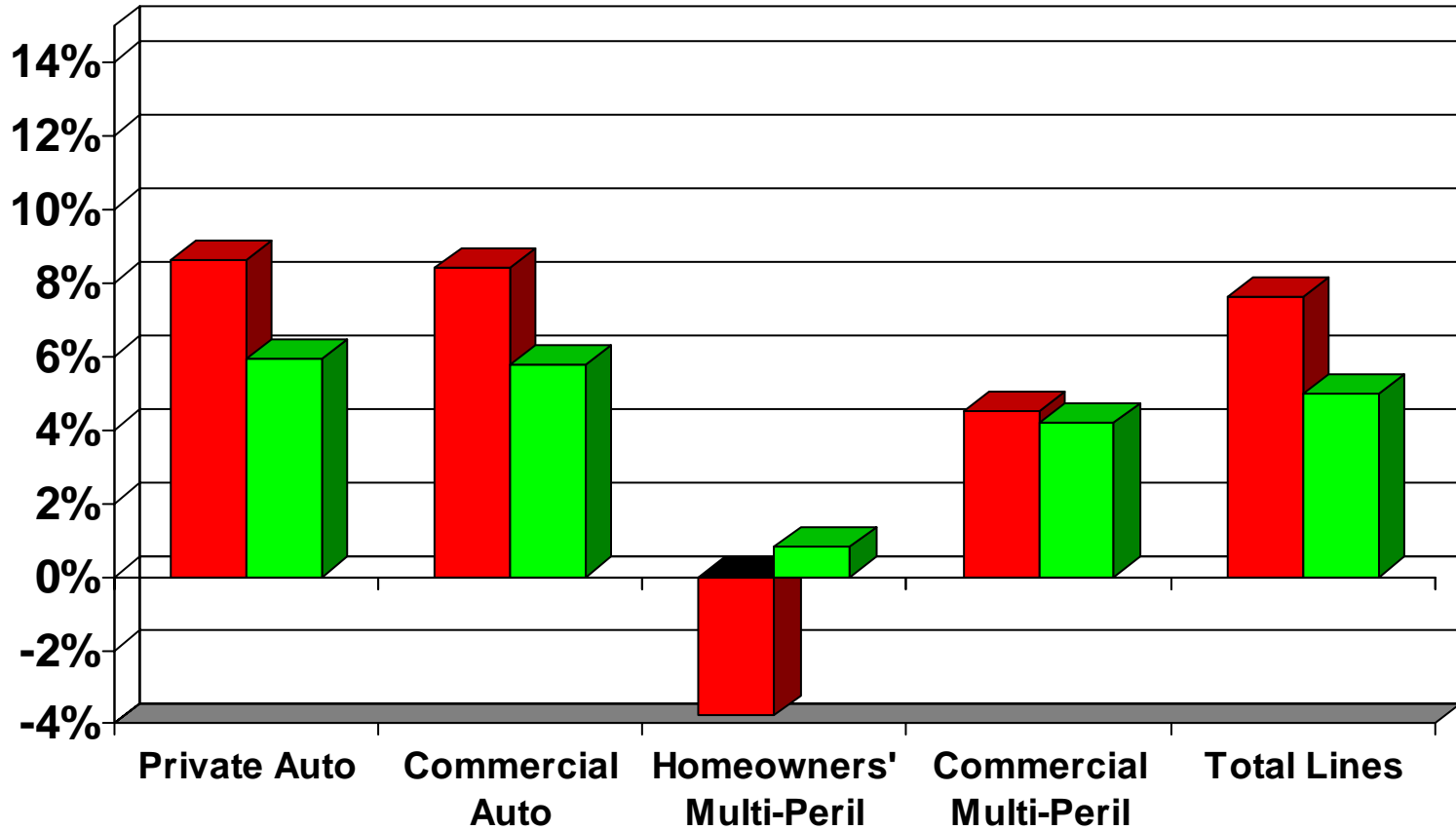
This is a portrait of a well-managed industry in challenging times.



## Return on Net Worth, Selected Lines and All Lines, 1989-2004

Returns of past 5 years lower for all lines except homeowners' insurance

Red Bars = 1989-2004, Green Bars = 2000-2004

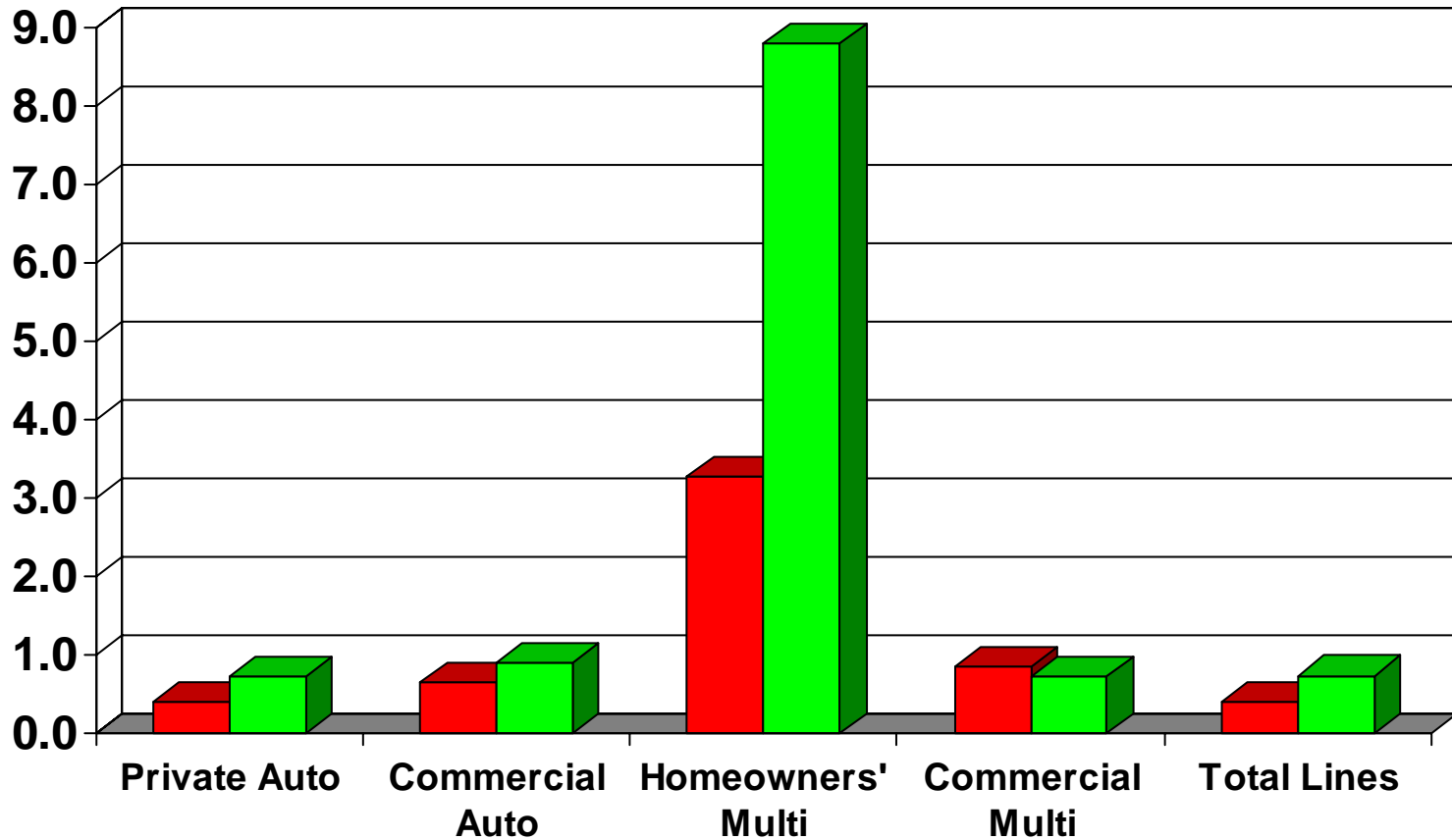




## Volatility of Returns by Selected Lines and All Lines, 1989-2004

Increased volatility of returns suggests a more difficult insurance environment over the past five years

Red Bars = 1989-2004, Green Bars = 2000-2004



*Volatility measured by the coefficient of variation – ratio of standard deviation of return to mean return*

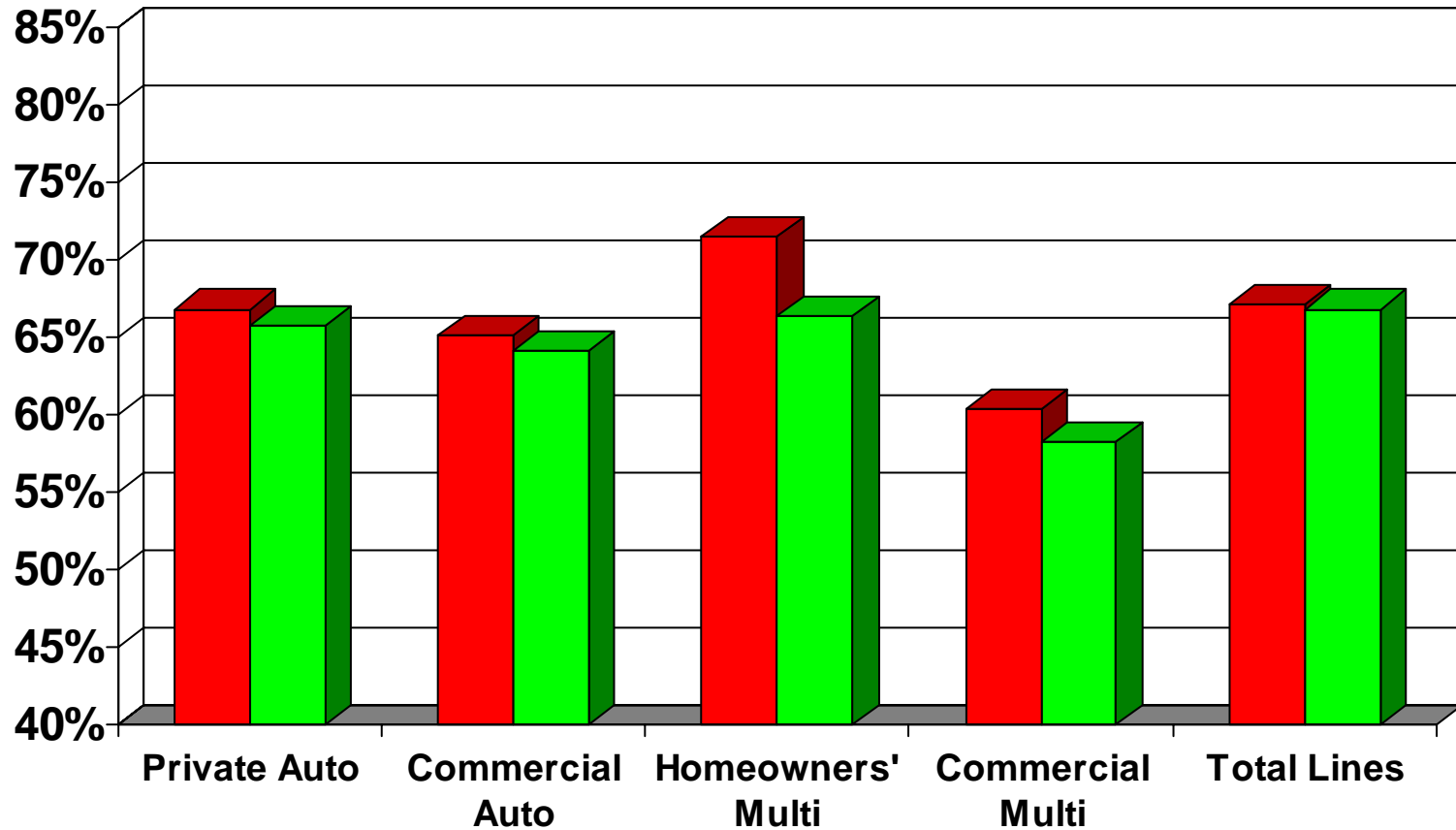
**Sources:** Insurance Information Institute, NAIC – Report on Profitability by State by Line and author's calculations.



## Loss Ratios Selected Lines and All Lines, 1989-2004

Loss ratios are down slightly, with more spectacular improvement in homeowners' insurance

Red Bars = 1989-2004, Green Bars = 2000-2004





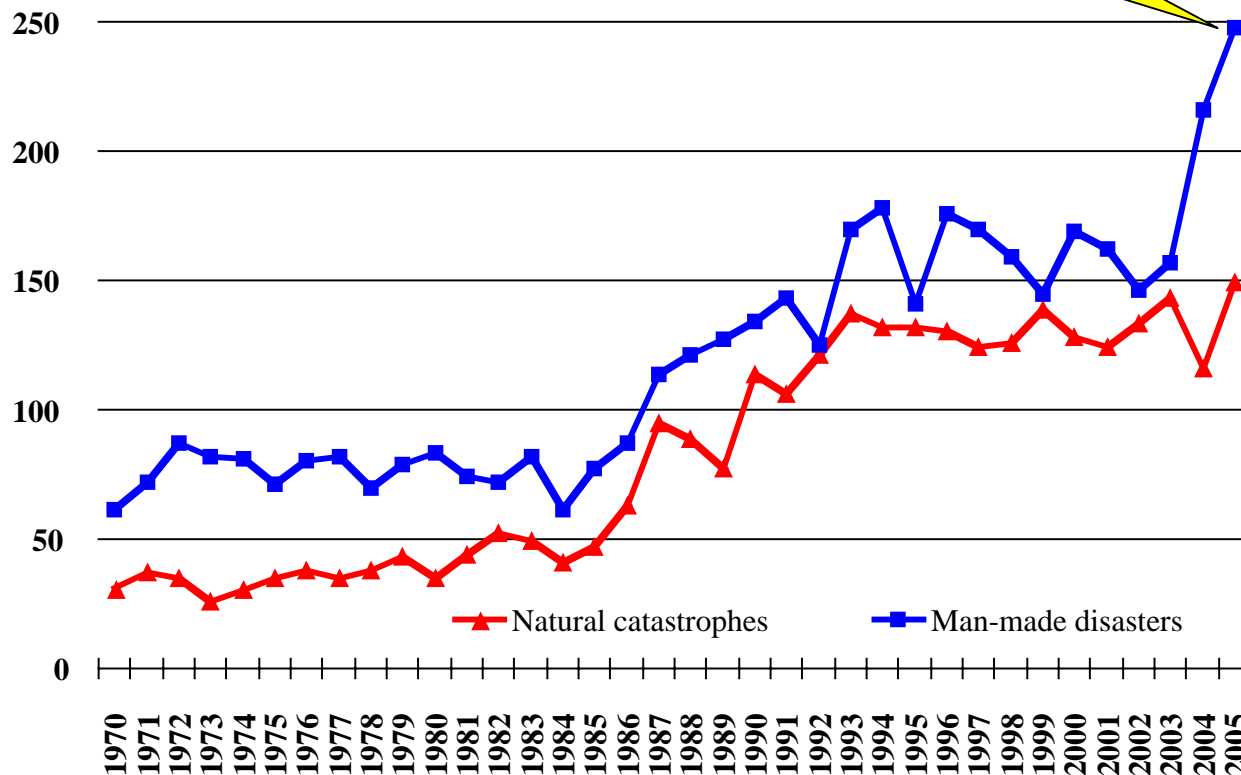
# The Profit Consequences of Extreme Weather: Hurricanes



# Global Number of Catastrophic Events, 1970–2005

The number of natural and man-made catastrophes has been increasing on a global scale for 20 years

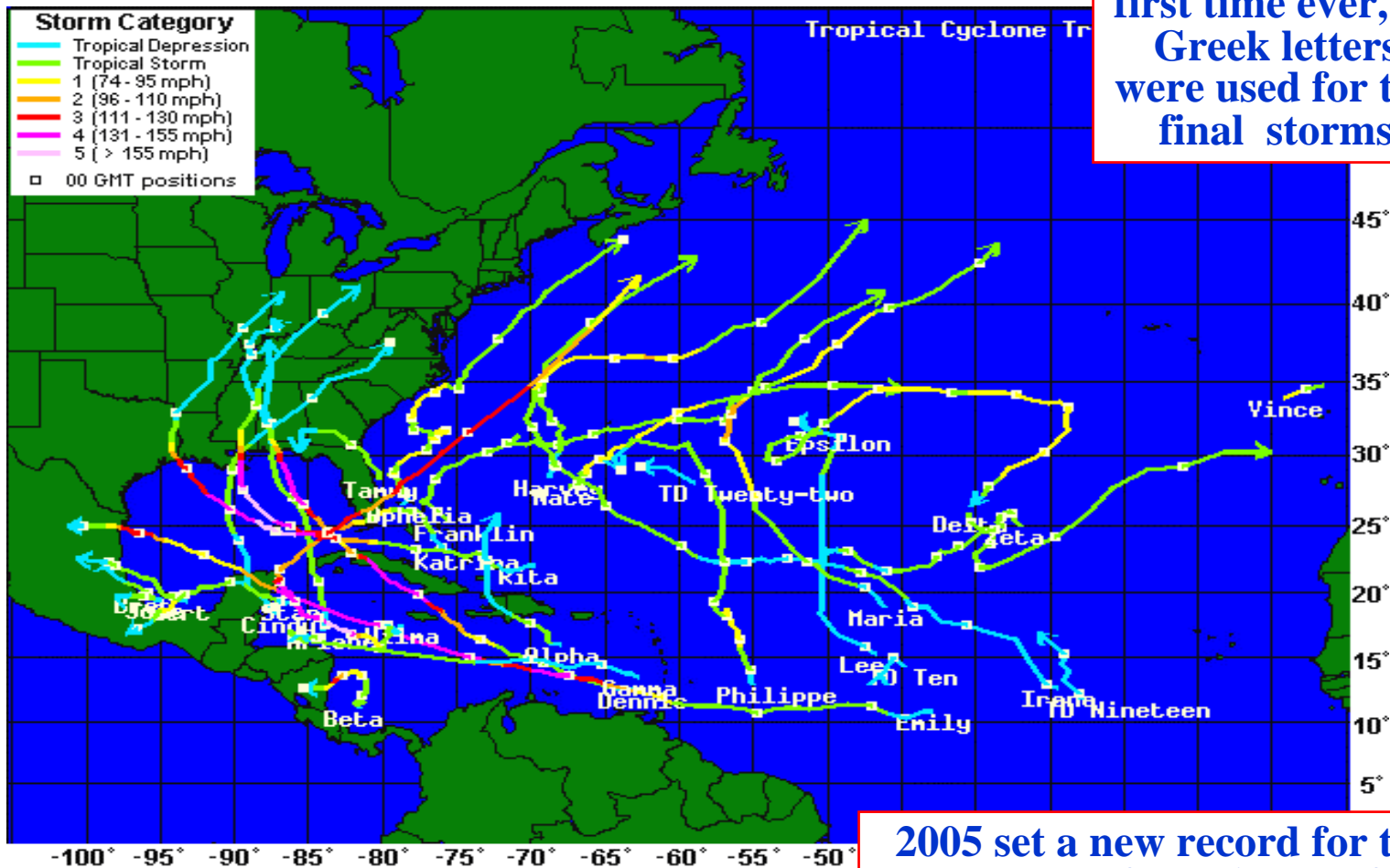
Record 248 man-made CATs & record 149 natural CATs in 2005





# 2005 Was a Busy, Destructive, Deadly & Expensive Hurricane Season

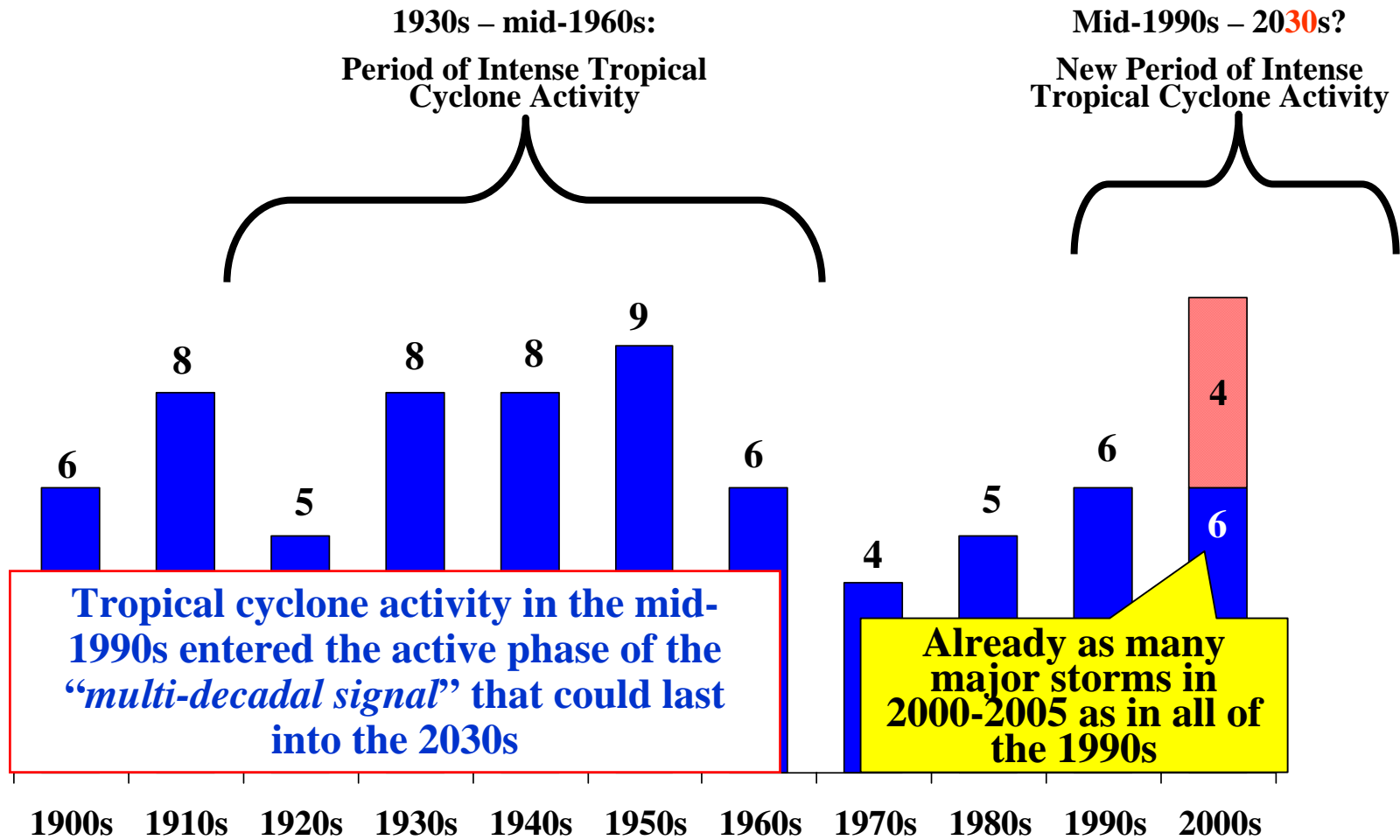
All 21 names were used for the first time ever, so Greek letters were used for the final storms



2005 set a new record for the number of hurricanes & tropical storms at 28, breaking the old record set in 1933.



# Number of Major (Category 3, 4, 5) Hurricanes Striking the US by Decade



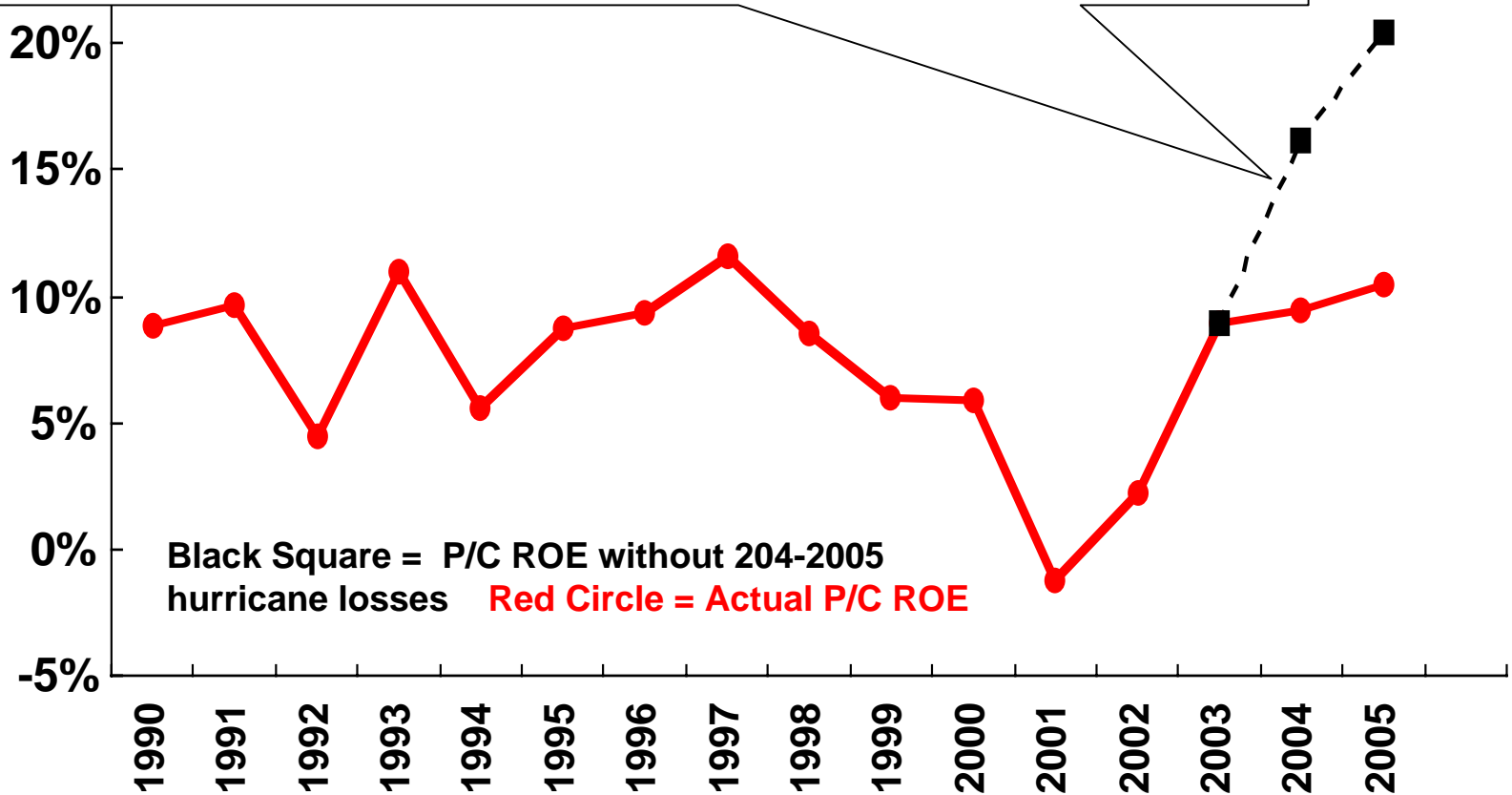
\*Figure for 2000s is extrapolated based on data for 2000-2005 (6 major storms: Charley, Ivan, Jeanne (2004) & Katrina, Rita, Wilma (2005)).

Source: Tillinghast from National Hurricane Center: <http://www.nhc.noaa.gov/pastint.shtm>.



# Impact of Hurricanes on ROE in 2004 and 2005

The Quartet reduced ROE by 5.66% in 2004 while Katrina, Rita and Wilma cut ROE by **10.42%** in 2005, and insurers' still earned healthy profits! ROE in 2005 could have been 20.47% but for the monster storms.



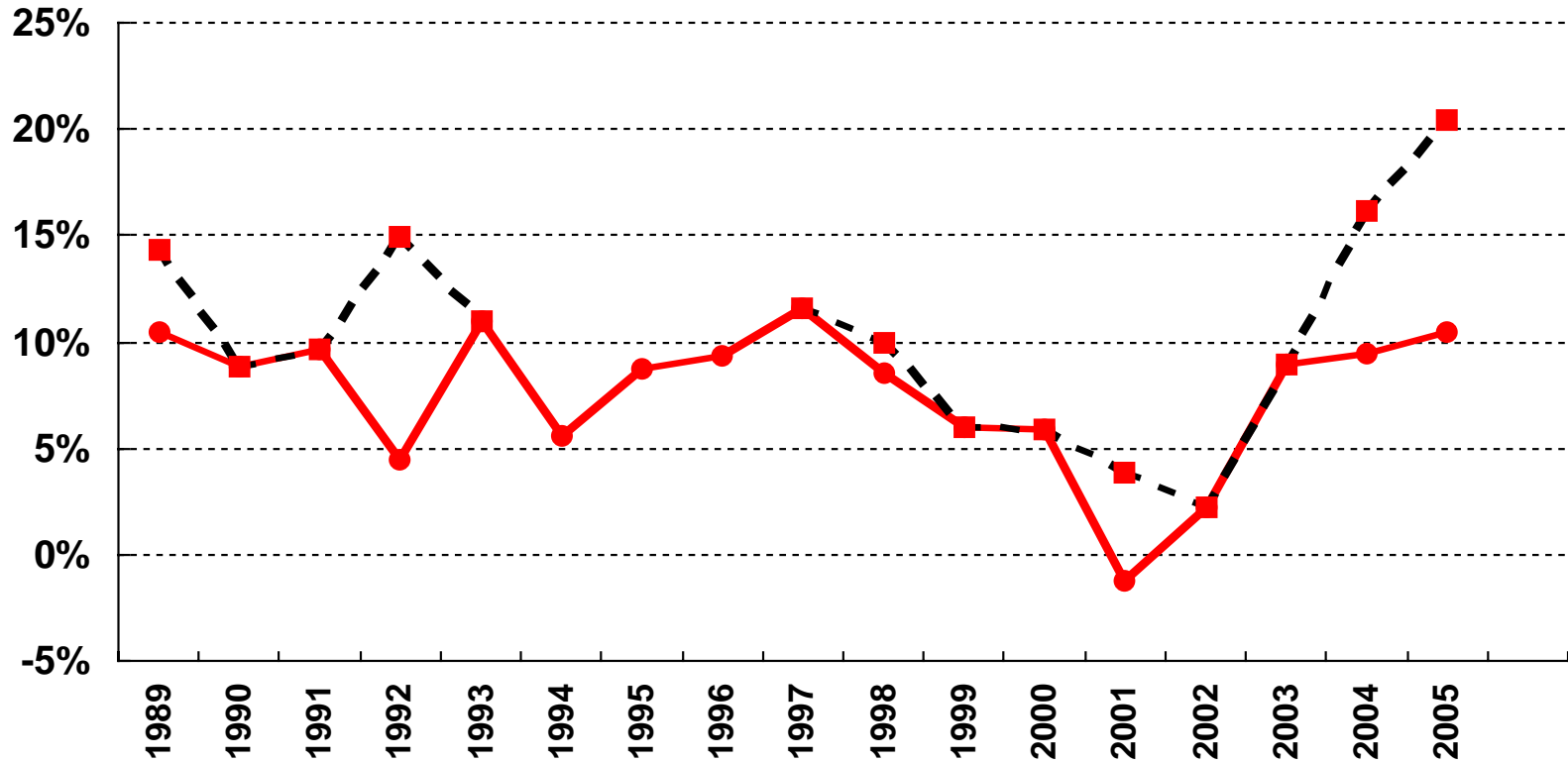
\*GAAP ROE's = return on average surplus. ROE in absence of storms estimated by adding storm losses to actual returns.  
Source: Insurance Information Institute; *Fortune* for all industry figures



# Impact of Hurricanes on Catastrophes on ROE: 1989-2005

Average actual ROE: **7.61%**  
ROE without catastrophe: **9.84%**

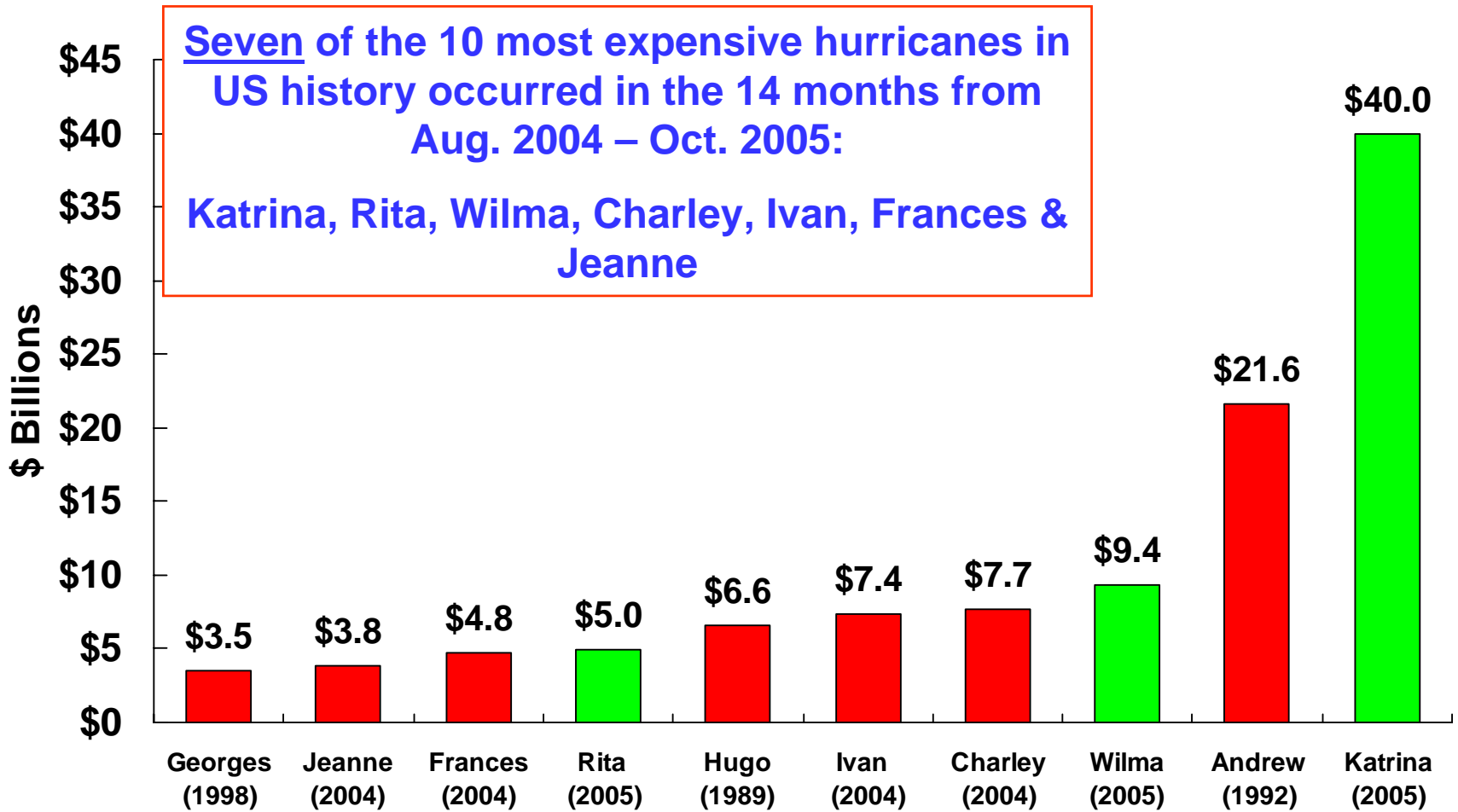
Catastrophes reduced average returns by nearly 30% between 1989 and 2005



\*GAAP ROEs except 2004/5 P/C figure = return on average surplus. 2005 figure is III full-year estimate. Estimated ROE in absence of storms estimated by adding storm losses to actual returns. Source: Insurance Information Institute; *Fortune* for all industry figures



# Top 10 Most Costly Hurricanes in US History, (Insured Losses, \$2005)





# Ten Largest Hurricane Losses as Fraction of Surplus

Event	Year	Losses* (billions)	Total Surplus* (billions)	Ratio
Katrina	2005	\$34.40	\$427.10	8.05%
Andrew	1992	\$20.88	\$200.54	10.41%
Charley	2004	\$7.47	\$402.26	1.85%
Ivan	2004	\$7.11	\$402.26	1.76%
Hugo	1989	\$6.39	\$166.44	3.83%
Wilma	2005	\$6.10	\$427.10	1.42%
Rita	2005	\$4.70	\$427.10	1.10%
Frances	2004	\$4.59	\$402.26	1.14%
Jeanne	2004	\$3.65	\$402.26	0.91%
Georges	1998	\$3.36	\$374.36	0.83%

The severity of hurricane losses must be assessed relative to the level of policyholders' surplus. Hurricane Katrina was the largest hurricane loss in absolute dollars but the second largest in terms of surplus. However, the losses from Katrina, Rita and Wilma combined were 10.47% of surplus.

**Source: Insurance Information Institute**



- Climate Change
- The Economics of Pricing Risk: Basic Concepts
- Coastal Populations in Hurricane Zones
- Insurance and the Emergence of China and India



# Insurance and Climate Change



### Climate Change and Extreme Weather Risk

1. Scientific consensus on the fact of global warming as well as on the fact of anthropogenic contributions to warming **but**,
2. No consensus on when, where or how global warming will effect weather patterns – including the frequency, severity, location or damage done by hurricanes, tornadoes, heat waves, torrential rains or rising sea levels – despite agreement that these outcomes are the inevitable result of warmer oceans and greater levels of humidity.



Climate change is an uncertain, *long term* source of property losses. Far more important and *immediate* problems include:

1. Increasing size and density of coastal populations;
2. Increasing accumulations of property in coastal regions;
3. Perverse pricing and regulatory mechanisms that actually encourage people to move into harm's way.



Climate change is chaotic process:

1. Very complex, multidimensional process that alters the way weather works, thereby threatening to undermine the capacity of insurers to use past loss experience to predict the future;
2. Chaos is a property of a complex system whereby small changes in one part of the system alter the operation of the entire mechanism in unpredictable ways precisely because the system has so many interacting parts.
3. The behavior of a chaotic system – like climate – can be radically different as a result of small changes that push it beyond a “tipping point”, thereby making past observations of a process irrelevant for predicting its future.



Abrupt climate change presents a major challenge to insurers because they cannot use history to predict the future.

Example: A sudden jump in ocean temperatures by 2 degrees Celsius over a thirty year period would have an unpredictable (but assuredly bad) impact on the number, severity and location of hurricanes, tornadoes, flooding episodes and other extreme weather events. This uncertainty means that insurers would not know how many perils to anticipate in any given place or time, thereby making it very hard to calculate the likely frequency and severity of claims.



Insurance *necessarily* assumes away chaos in favor of processes with stable distributions of losses thereby making it possible to calculate probabilities because specific patterns of loss recur.

Chaotic processes are systems for which history cannot be used to predict the future because the new system is radically different from what preceded it. ***The new relationships will only be known with the passage of time, perhaps a great deal of time.***



Insurance is well-suited to handle *gradual* climate change because:

1. Loss patterns change gradually, thereby allowing insurers to continue to use updated past information as a guide to the future;
2. Insurers can make good predictions about future losses based on information about new loss trends so long as there is no radical shift in the connection between perils, losses and behavior;
3. Evidence on climate change points to gradual climate change as the most likely scenario, though scientific uncertainty about the nature of the globe's climate requires caution.



The events of the past couple of years show that insurers can withstand a series of large losses and recover nicely through a combination of adroit risk management, financial management and cost control.

***The good news:*** gradual climate change that presents itself as a series of gradually escalating extreme weather events can be smoothly handled ***if insurance markets are permitted to price risks.***

***The bad news:*** population trends combined with questionable policy choices may present insurers will extremely tough choices ahead



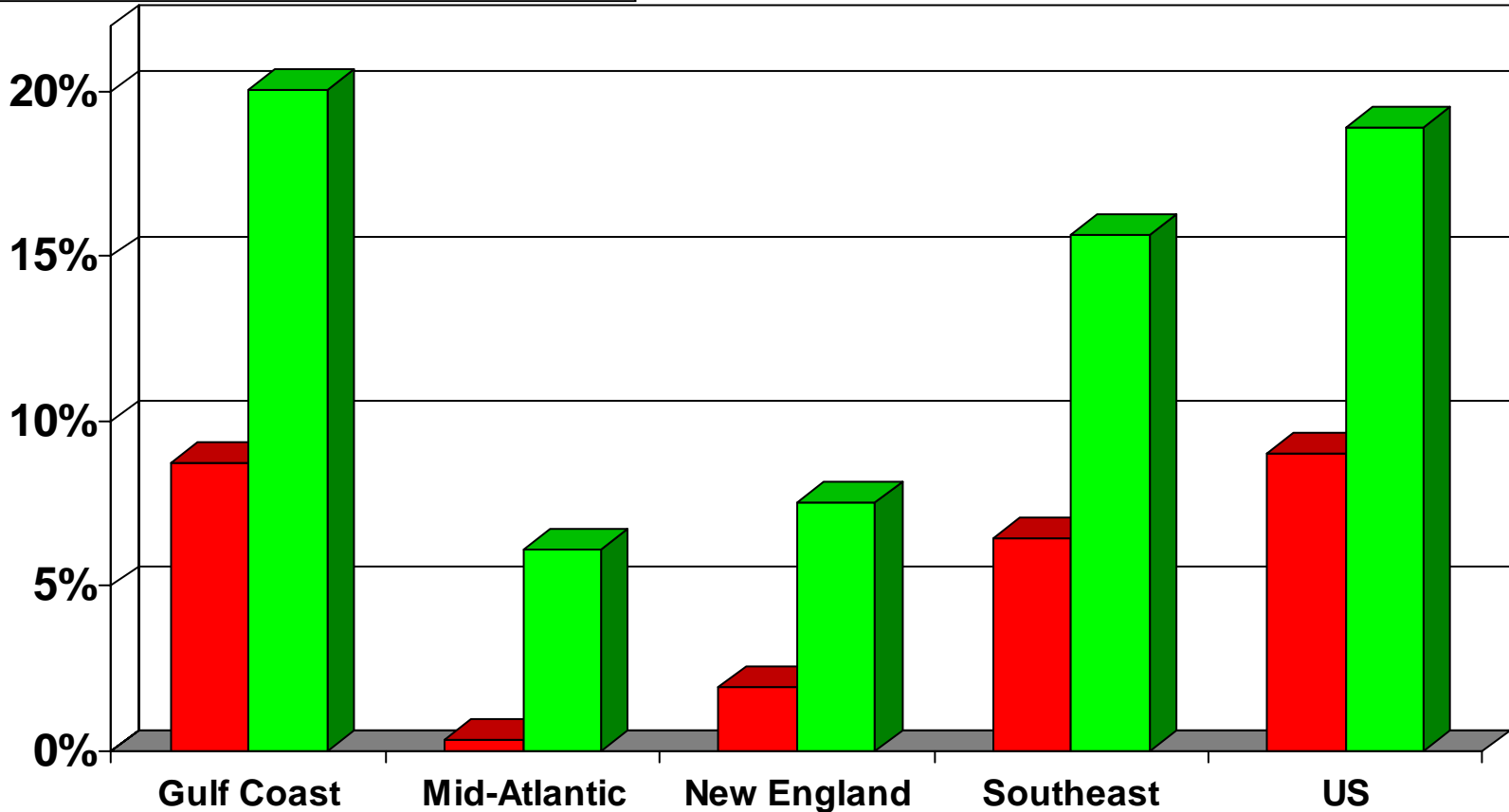
# The Harsh Economics of Coastal Populations



# Growth of Coastal Populations in US Hurricane Zones, 2005-2025

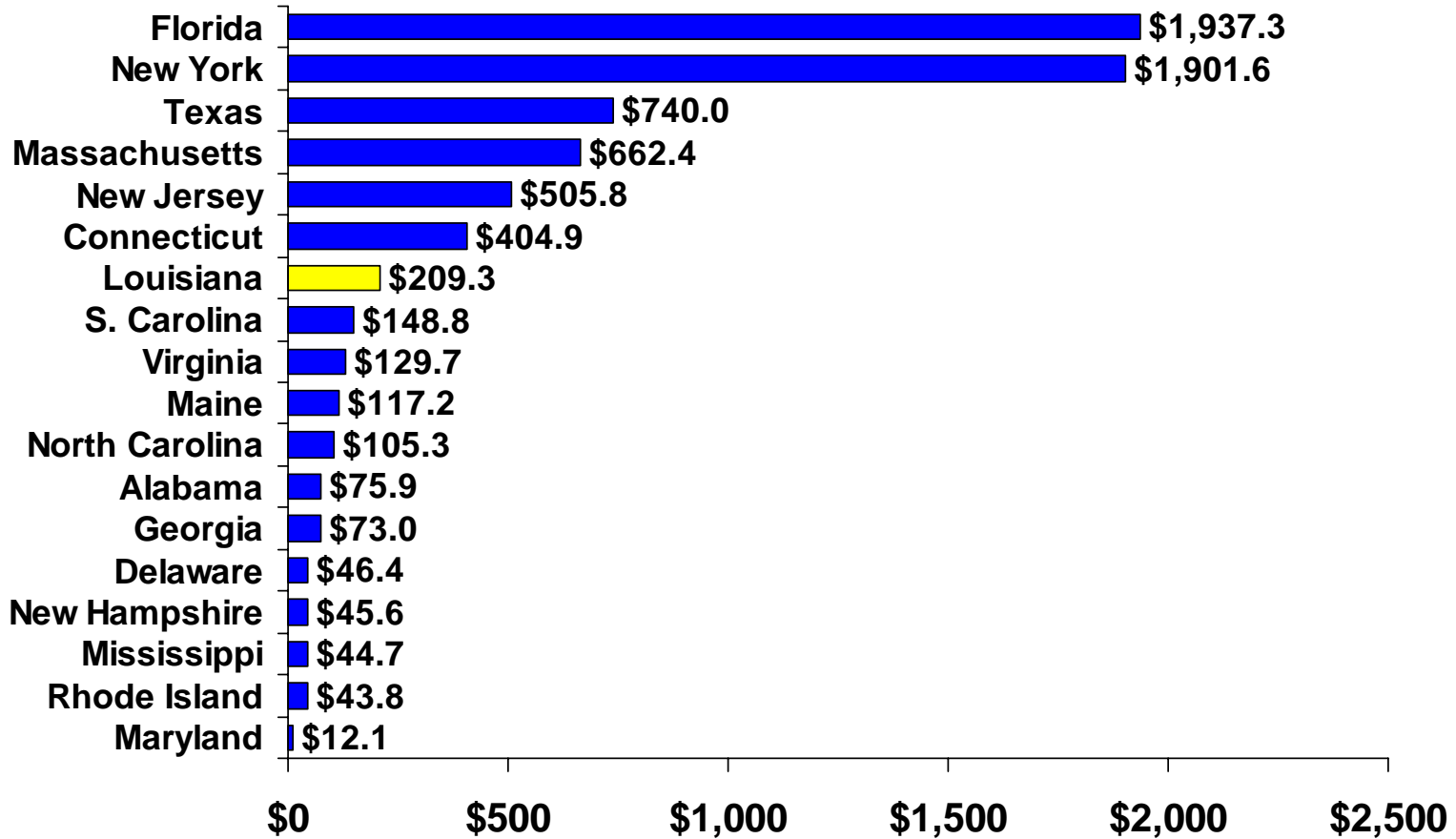
Rapid growth of populations on the Gulf and Southeast Atlantic coasts increases portion of US population exposed to hurricanes losses.

Red Bars = 2005-2015, Green Bars = 2000-2025



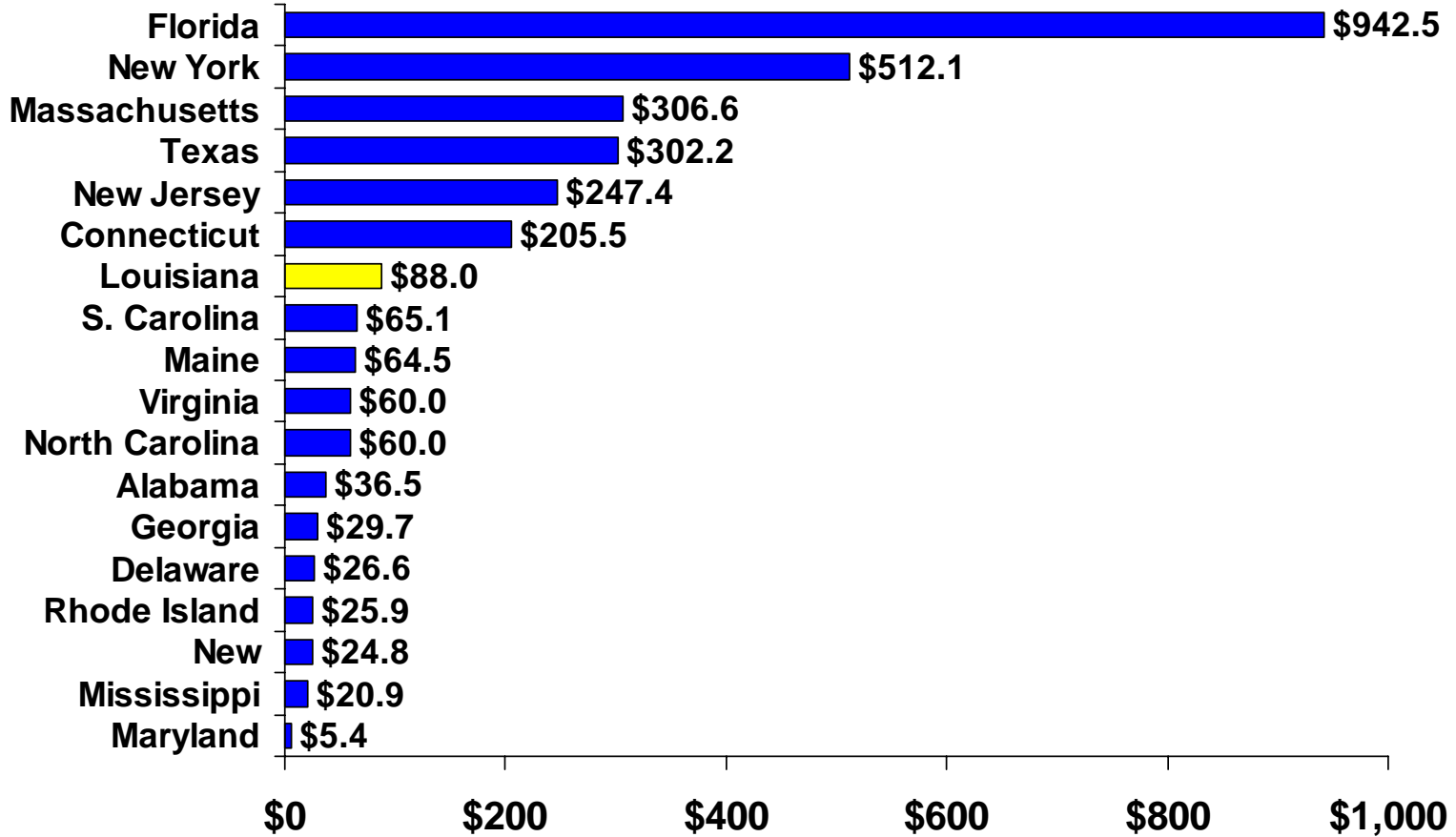


# Total Value of Insured Coastal Exposure (2004, \$ Billions)



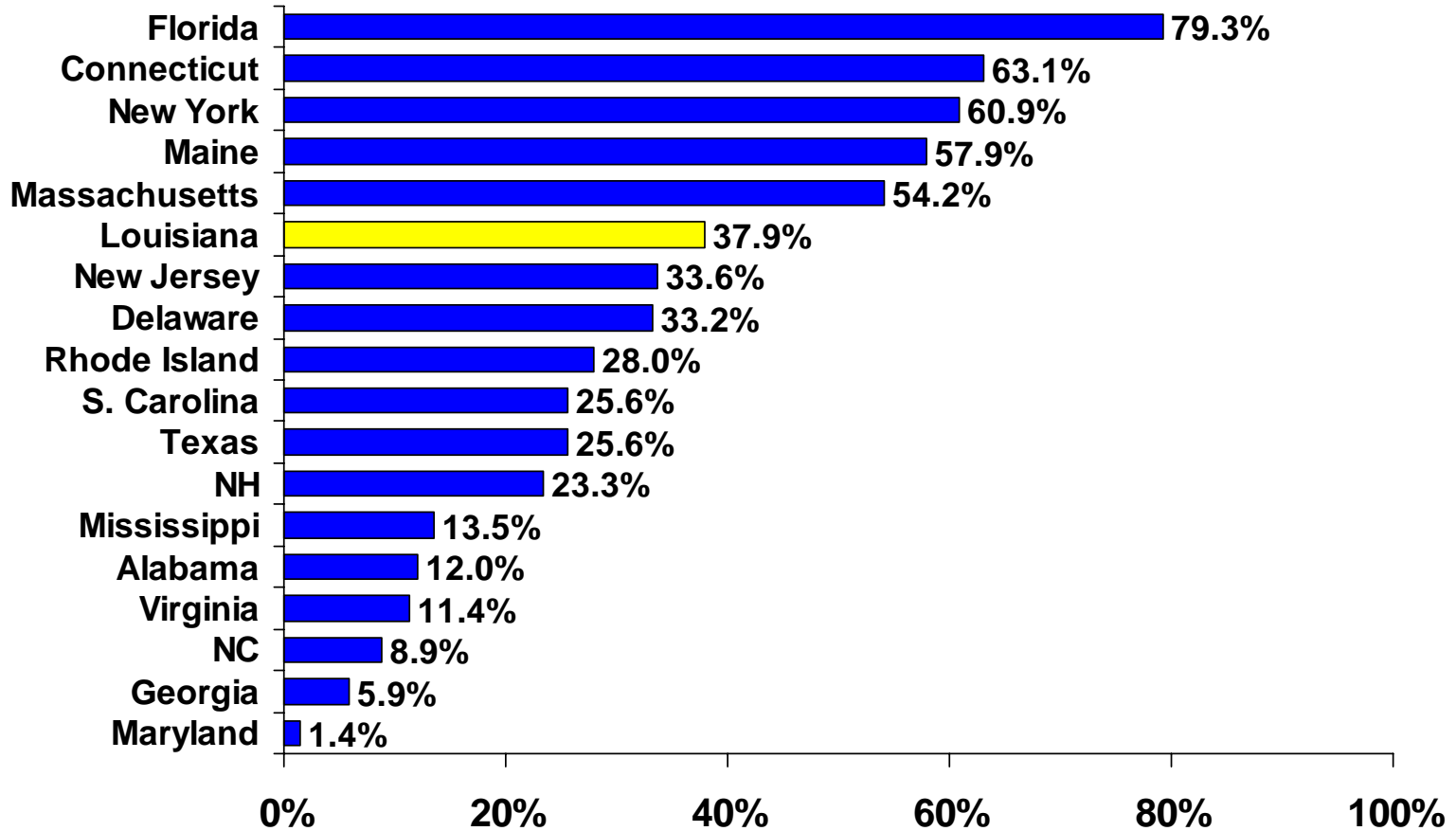


# Value of Insured Residential Coastal Exposure (2004, \$ Billions)





# Insured Coastal Exposure as a % of Statewide Insured Exposure (2004, \$ Billions)





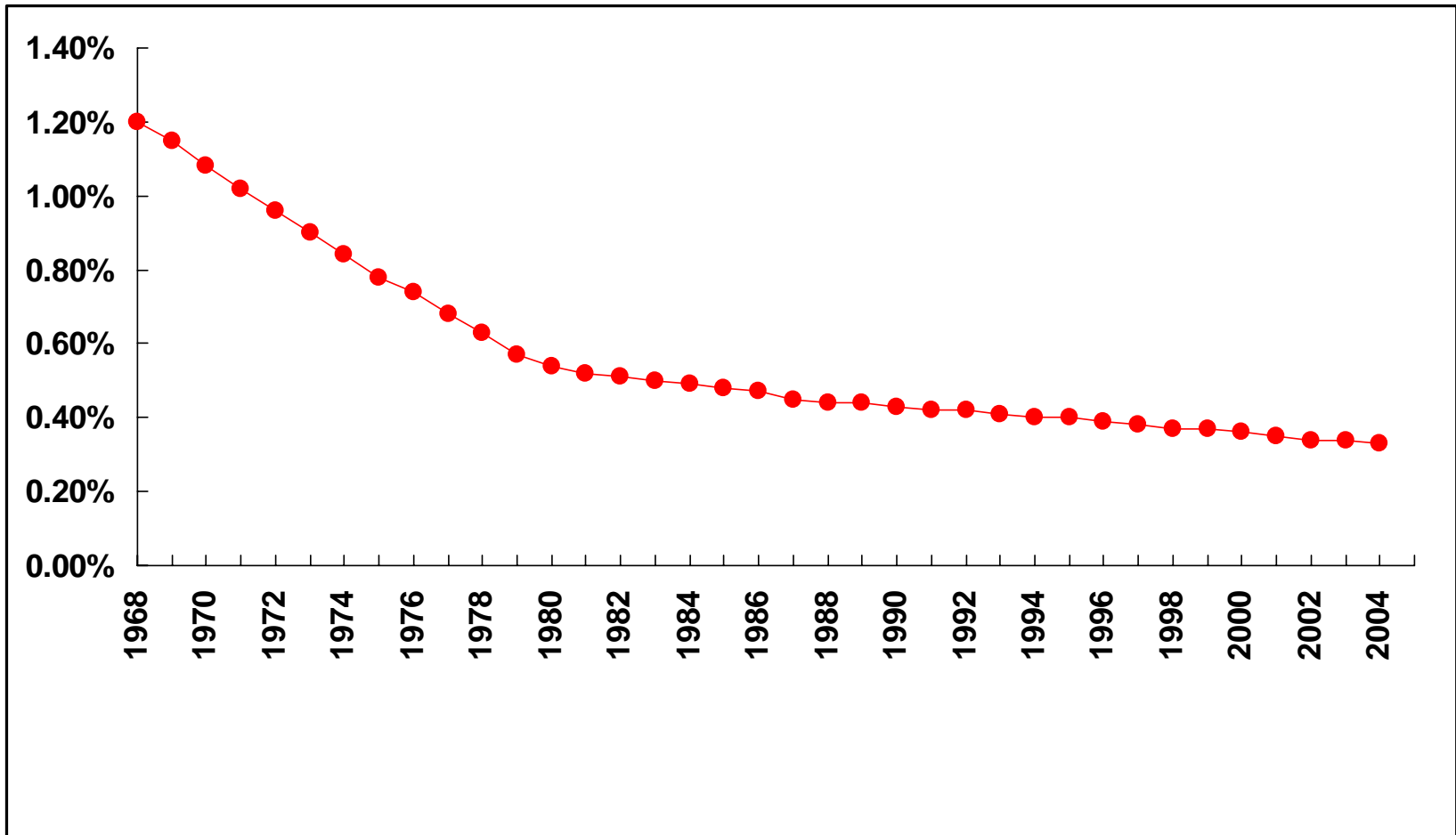
The crucial problem with US population growth patterns for insurers is that people are moving into harm's way: if people moved inland rather than to the coasts, then loss exposures would drop.

In turn, population movements are responding to economic incentives, including the low price of homeowner's insurance due to price controls by state regulators.



# Homeowners' Premiums Fail to Keep Pace with Housing Prices

The ratio of the average homeowners' premium to the median home price in the US has fallen steadily over the past 30 years, despite the impressive rise in home prices over the same period.





Insurance is a strange commodity since a supplier sells the service – protection – before knowing how much it will cost. Insurers must predict the likely cost of losses in order to know what price to charge.

The foregoing chart suggests that insurers are in the difficult position of selling protection for properties that are increasingly costly to reproduce if destroyed or damaged.

Regulation keeps premiums down, thereby reducing incentives to supply insurance and limiting the degree of financial security that can be provided.



# Properly Pricing Risk



1. Recent rate increases in Texas and Florida as well as Allstate's decision to pull out of the market for homeowner's insurance in Long Island, NY reflect the basic fact that insurers' need higher rates to cover perceived long term increases in loss costs.
2. Good public policy suggests that the current system of price controls in the market for homeowner's insurance is exactly the wrong policy given
  - a. Rising coastal populations
  - b. Rising property values due to housing boom
  - c. Need to alter incentives for living along coasts.



1. Residual markets for high risk properties provide a government to subsidy to high risk activities.
2. Two kinds of economic waste:
  - a. Excessive exposure of people and property to risk by cost sharing with low risk populations and
  - b. Excess use of disaster resources in the event of catastrophes – whether auto accidents or, in this case, hurricanes.



Price controls combined with residual markets for homeowners' insurance are, from an economic point of view, a sneaky subsidy to real estate interests and mortgage lenders via insurers, with low cost of homeowners taxed for the benefit of high cost homeowners.

**Winners:** mortgage banks see higher demand for loans; real estate experiences a higher demand for housing; current homeowners reap capital gains in markets for existing housing.

**Losers:** insurers face lower profit margins and therefore reduce their supply of capital; low cost homeowners face higher insurance rates due to (a) the capital shortage and (b) the tax imposed by government to provide insurance via the residual market.

1. Risk based pricing, especially in coastal states, will reduce incentives for locating along coastal areas;
2. Higher prices and profits will increase supply of capital by encouraging entry by more insurers, thereby increasing competition;
3. Result: insurance premiums will reflect risks; insurance will be more plentiful and affordable to smaller population capable of bearing risks.



Suppression of insurance prices and profits in favor of real estate driven development increases long run losses and human suffering due to excessive exposure to high risk outcomes.

Yet, risk-based pricing reduces the extent of economic development by forcing producers and consumers alike to take account of the full costs of activities, including the costs of prospective losses.

Basic economic insight: a public policy is sensible if, but only if, the benefits of that policy – in both financial and fairness terms – exceeds the costs.



1. Do the benefits of the price control regime in homeowners' insurance markets exceed the costs – both in terms of finances and fairness – particularly along coastal regions?
2. Will the benefits of price controls continue to exceed the costs if the frequency and severity of losses increases as a result of global climate change?



# Insurance and the China/India Opportunity – and Problem



The rise of China and India is among the most important economic events of the past fifty years, promising to improve the well-being of more than 2.3 billion people and their children, ***and some of our children***, over the next century.

***The good news:*** the growing prosperity of this multitude offers American workers and firms myriad economic opportunities in nearly every conceivable area of business activity – notably insurance companies.

***The bad news:*** the increased competitive pressure signaled by the emergence of China and India as global players will create winners and losers among the American people – including American insurers and their employees.



1. Emergence of China and India has direct impact of pace of global climate change and therefore the losses, prices and profits from insurance;
2. Anglophone India and Asia offer vast cheap labor supplies for insurance information services – accelerating the downward movement of underwriting expenses that plays such a role in buoying insurers' profits;
3. High levels of Chinese savings finance private and public ventures in the US – including US government deficits (thereby keeping interest rates down) – which, among other things, increases the supply of capital available for insurance and reinsurance purposes.



4. Millions of new customers for insurance products in personal and business lines as the Chinese and Indian middle class grows, along with access to substantial amounts of internal savings as financial liberalization proceeds.



1. Capital inflows from China are the mirror image of the US/China trade and budget deficits. The supply of insurance and reinsurance capital to the US will be linked to the resolution of long term trade imbalances between the US and China.
2. Both the "hard" and "soft" landing scenarios for the US trade deficit problem will affect the supply of capital in US insurance markets and have impact on the availability and affordability of insurance.
3. A "hard" landing will create enormous problems for insurers while a "soft" landing will leave the industry largely unaffected, though there may be some decline in the affordability and availability of insurance even in the best case scenario.



Any economic events that reduce US access to external sources of cheap capital – significant and ***swift*** dollar depreciation, redirection of Chinese savings to meet internal needs, reduction in lending from Middle East due to political disruptions – will reduce the supply of capital to the insurance industry, thereby reducing the availability and affordability of insurance.

***Macroeconomic risks*** are one more set of risk factors facing insurers – and are of far more immediate concern than the risk of global climate change.



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