

The Revolution of Information Economics: The Past and the Future

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Central messages

- The economics of information has constituted a revolution in economics, upsetting longstanding presumptions, including the presumption of market efficiency
- The central models, elaborated on within the last forty years, have proven remarkably robust, at the same time that advances in the economics of information have shown the lack of robustness of the standard competitive paradigm
- The models have provided a deeper understanding of other market failures, including imperfections of competition and the absence of risk markets
 - Providing explanations of importance of corporate governance, financial market regulations, role of institutions
 - With significant policy implications—undermining, sometimes reversing, policy stances based on models with perfect information

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Central messages

- In markets with some, but imperfect competition (e.g. based on imperfections of information), firms strive to increase their market power and to increase the extraction of rents from existing market power
 - Giving rise to widespread distortions
 - Institutions, rules of the game matter
 - Public policy is critical in setting the rules of the game
 - Distributive effects of alternative rules may outweigh any efficiency gains
 - Undoing distributive effects may be very costly (partly because of information imperfections)
 - Many recent changes may have had both adverse efficiency and distributive effects
 - Distributive effects themselves may have efficiency consequences, especially in presence of macro-economic externalities

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Central messages

- Changes in structure of demand and in technology may lead to increased role of information, decreased competition, increasing inequality
- Many of key battles will be about information and knowledge (implicitly or explicitly)
 - Privacy/transparency (explicit rules of game about information)
 - Financial sector reform (including disclosure requirements)
 - IPR
 - Globalization
- How we handle these issues will affect inequality, economic performance, and the nature of our polity and society

I. Economists had long recognized importance of imperfect information

- Hope was that analyses with perfect information would be relevant so long as information was not *too* imperfect
- Thought that one could develop an “economics of information” – supply and demand analysis (much like “economics of agriculture,” focusing on particular characteristics)

Arrow-Debreu provided key benchmark model

- Provided conditions under which Smith’s “invisible hand” conjecture was correct (first and second fundamental theorems)
 - “The pursuit of self interest (maximizing profits, maximizing utility) would lead, as if by an invisible hand, to economic efficiency”
 - Technical conditions—convexity (making use of key economic assumption of diminishing returns)
 - Economic conditions—competition, full set of AD securities, absence of externalities (no public goods)

Sufficient conditions were “almost” necessary

- Arrow and Debreu had provided sufficient conditions for the efficiency of the economy: Question was would results still be true under more general conditions?
 - **Answer: essentially AD had discovered necessary and sufficient conditions**
 - Only other cases with “singular” and uninteresting
 - In economy with single individual, no need for risk markets
 - Remarkably, modern macroeconomics has focused on that singular case, implying that analyses about efficiency of policies questionable
 - Basis of many “neoliberal doctrines”
 - Part of explanation of why central banks did so badly crisis prevention and management
- **Key implication: There was no basis for reliance on markets**
 - Government had to play an important role for attaining *efficiency*
 - Government had to play an even greater role in attaining *equity*

Further key questions

- **How do we explain market failures (lack of complete set of securities markets, limited competition)**
 - With endogenous information and knowledge, competition will be imperfect, there will be pervasive externalities, and many key risk markets will be absent
 - Law of diminishing returns will not be satisfied—economic and technical conditions closely related
 - Knowledge is a quasi-public good
 - Many of externalities *diffuse*, not easily correctable with corrective taxation
 - Other explanations of missing markets, but with much the same implications

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Further key questions

- **How does society respond to “imperfections” (like absence of risk markets), and do these responses lead to some version of *constrained* efficiency (taking into account costs of information/creating markets)?**
 - Developed institutions and contracts
 - But no presumption of Pareto efficiency
 - Marginal inefficiencies
 - Structural inefficiencies—multiple equilibria, with economy in Pareto dominated equilibria
 - **Some institutions arising in response to information based market failures may actually lead to Pareto inferior outcome**
 - **Key implication: reliance on laissez faire policies won’t work—even going beyond markets**

Further key questions for economists: how robust was the standard model that they used?

- Hope was that model with perfect information would be good approximation for an economy with imperfect information, so long as information imperfections were not too large
- Not very: **even slight imperfections of information could lead to marked changes in results**
 - Non existence of equilibrium
 - Non pareto optimality
 - Many key characterization results changed
 - Markets may not clear in equilibrium
 - Law of single price repealed

Further questions: how robust were new models?

- Key information problems and modes of analysis that were identified early (adverse selection, moral hazard) have remained the central foci of research. **Insights and methodology has proven remarkably robust**
 - **Precise characterization of equilibrium dependent on details of markets/assumptions about information**
 - Complexity has proven a rich source of material for Ph. D. theses
 - If individuals/firms can decide whether to hide or disclose information, then neither Akerlof/price nor Rothschild-Stiglitz/quantity equilibrium can be sustained
 - Unique equilibrium is disclosed pooling contract (most favored by low risk individuals) supplemented by undisclosed price contract at high risk individuals odds purchased only by high risk individuals (Stiglitz-Yun, 2016)
 - In presence of adverse selection and moral hazard there may exist a pooling quantity equilibrium (Stiglitz-Yun, 2015)

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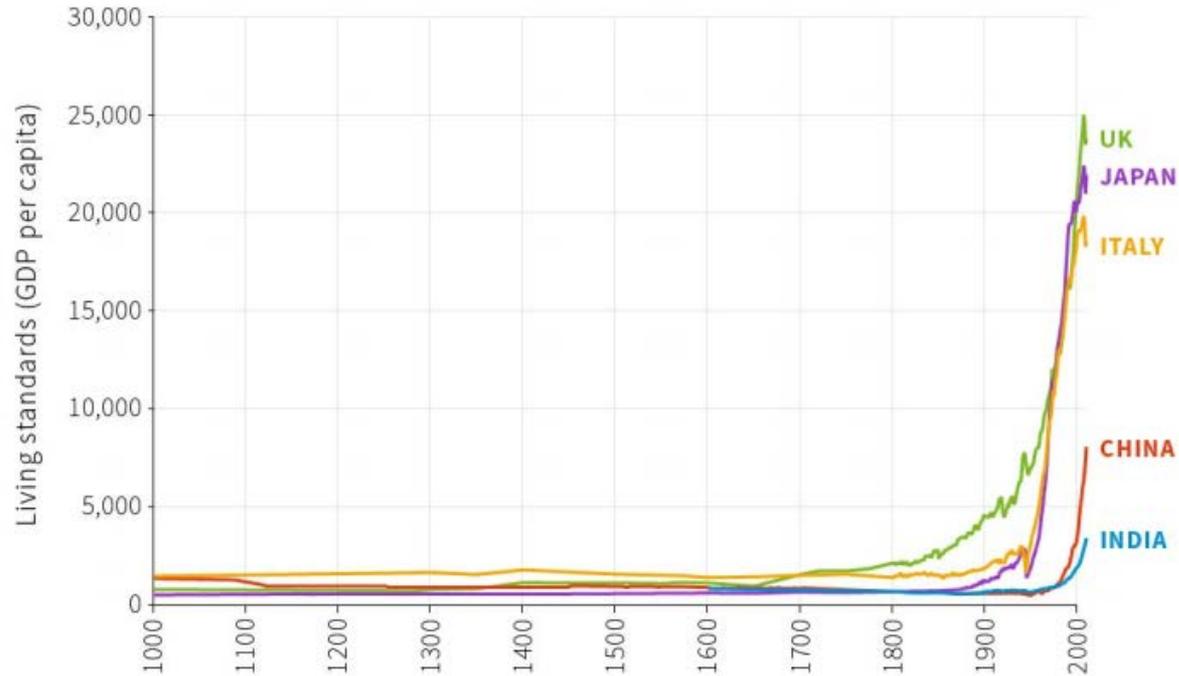
Richness of model led to development of new sub-fields

- **Important contribution included analyses of contracts and institutions, and focus on enforcement and commitment (time consistency)**
 - An alternative approach to law and economics to the Chicago school
 - In AD framework, not only was information structure exogenous and complete set of markets, but there were no problems with enforcement, no issues of commitment
 - Work on information economics helped develop understanding of these issues
 - A key issue in contract enforcement is verifiability, and thus relates to information
- **Results had greater applicability: economics of knowledge (a particular form of information, at the center of the theory of innovation)**

Knowledge as a form of information

- Information about technology
 - With many/most of key properties
 - Quasi-public good
- Difficulty of appropriation of returns
 - Large spillovers
- Other (related) market failures
 - Imperfect risk markets, imperfect capital markets, imperfect competition
- Increase in knowledge key to increase in standards of living
 - Far more important than accumulation of capital

Historical living standards



Source: INET

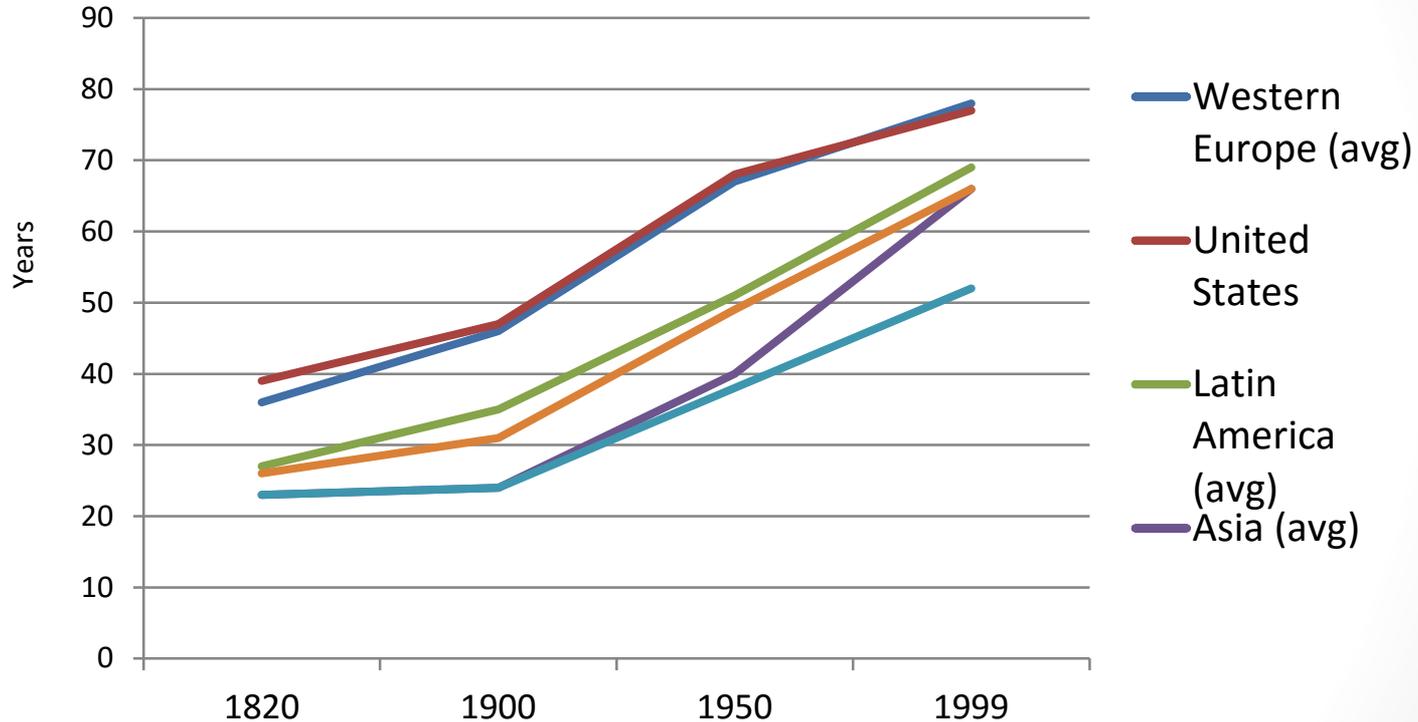
Real wages of London craftsmen, 1200-2000



Figure 3. Real wages over seven centuries: craftsman (skilled worker) in London (1264-2001).

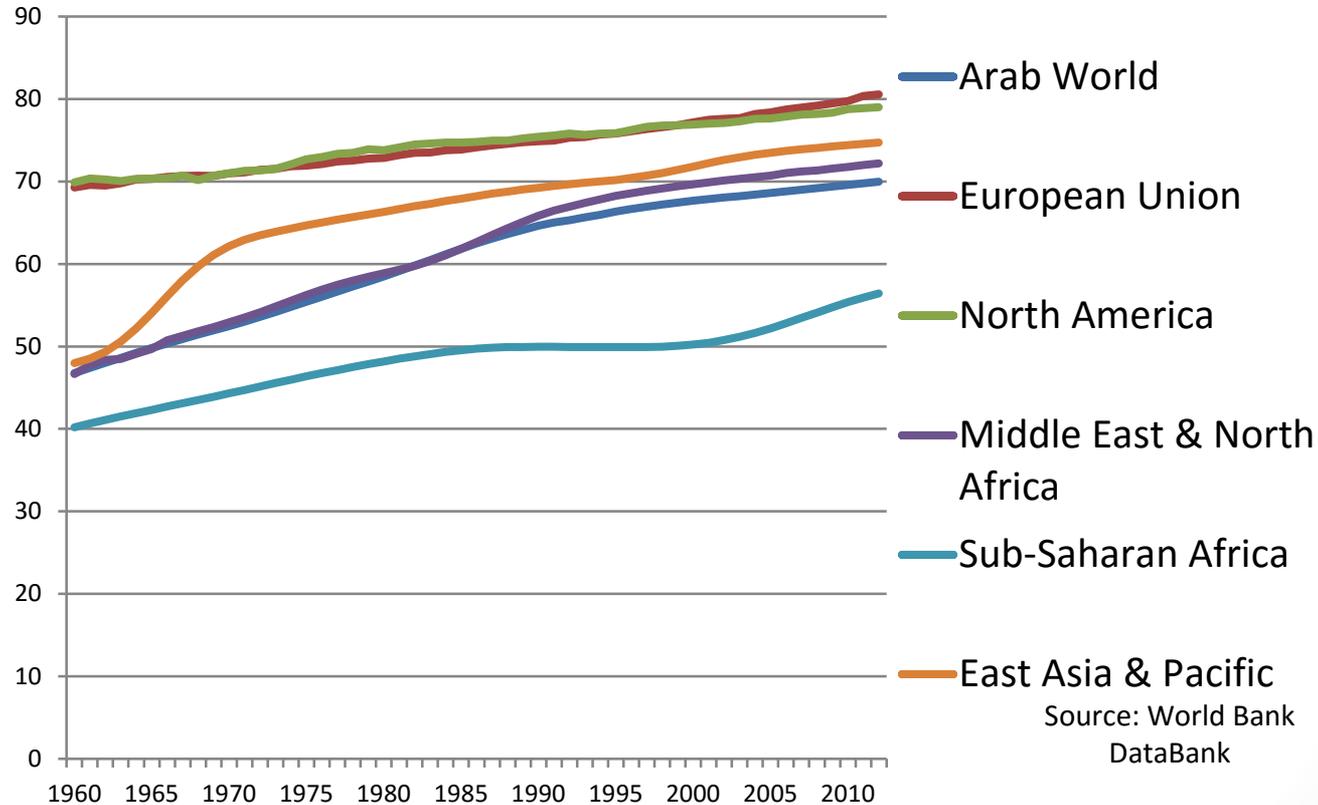
Source: INET

Improvements in life expectancy since 1820



Data are estimates from A. Maddison, 2001, "The World Economy: A Millennial Perspective," OECD.

Improvements in life expectancy since 1960



What caused this seemingly sudden change?

- The enlightenment—A CHANGE IN MINDSET
 - Questioning authority
 - Recognizing change was possible
- The scientific method provided systemic way of increasing knowledge
 - Trust with verification—building on the knowledge of others
 - Associated with creation of institutions of learning and science, and a common understanding of what we mean by knowledge, truth, and scientific uncertainties
 - With large economic implications—figuring out how to improve productivity; getting more outputs from given input

Knowledge and democracy

- THAT CHANGE IN MINDSET WAS ASSOCIATED WITH THE CREATION OF LIBERAL DEMOCRACIES
 - And typically associated with significant cross border flows, not just of ideas but of people
 - Undemocratic governments have succeeded in closing the knowledge gap in specific areas
 - But can they do this on a sustained basis? Can they be knowledge leaders?
- MORE GENERAL IMPLICATION: WE CANNOT SEPARATE ECONOMICS FROM POLITICS
 - MARKETS DON'T EXIST IN A VACCUM
 - HOW WE STRUCTURE MARKETS AFFECTS HOW THEY PERFORM
 - Efficiency, distribution, accumulation of knowledge

Reversing the Smithian presumption and fundamental theorems of welfare economics

- With adverse selection, moral hazard (endogenous information and knowledge) and incomplete risk markets, competitive markets are not in general (constrained) Pareto efficient (Greenwald-Stiglitz, 1986)
 - Smith's invisible hand is invisible because it's not there
- 2nd fundamental theorem also reversed
 - Robert Lucas: **“Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution.”**
 - Distribution of wealth (assets) *matters* and effects cannot be undone through (lump sum) redistributions

Production of knowledge/information intertwined with other activities

- **Presumption that market is not only inefficient in the production of information/knowledge, but also in the production of goods**
 - With imperfect competition, possibility of firms exploiting market power
 - And with imperfect and costly information, of creating and enhancing market power
 - Distortion of monopoly associated with trying to extract information
 - With perfect information, monopoly extracts all consumer surplus
- **Market failures associated with information/knowledge are pervasive and not so easily correct as other market failures, e.g. environmental externalities**

Other Key Insights

- **Social returns to information differ from private**
 - In some cases greater, in other cases less
- Privately profitable transactions may not be socially desirable
 - **Firms have incentives for creating information imperfections** (asymmetries)—lack of transparency
 - So do managers—to enhance their “market power”
 - **Complexity** is one way that they do so
 - Many financial transactions seem more designed to increase complexity and associated market power than to “solve” societal problems
 - Structured finance was not really about matching risk

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Further insights

- The micro-economic pecuniary externalities giving rise to Pareto inefficiency have their **macro-economic** manifestation
 - Center of much recent work in macro-economics
 - Excessive foreign denominated debt
- May (in general will be) optimal to treat things that are *observably* different differently
 - Taxes and regulations affecting foreign capital and financial institutions should differ from those affecting domestic
 - One of main points of contention in discussions of global finance in 1990s
 - IMF has now reversed position

Theory of second best

- **Theory of second best: eliminating one distortion in presence of other “failures” may lower welfare**
 - **Trade liberalization with imperfect risk markets and/or limited ability to redistribution may be welfare decreasing**
 - **Advocates of globalization failed to take this into account**
 - **One of key message of *Globalization and its Discontents***
 - **Differences in beliefs** gives rise to gambling (risk trading) opportunities
 - **Creation of pseudo wealth**
 - **Changes in pseudo wealth can give risk to macro-economic fluctuations**
 - **Creating new financial instruments/markets may reduce welfare—important contributor to 2008 crisis**

Host of other implications

- Helps explain pervasive problems in financial sector
- Helps explain imperfections in competition
- Helps explain importance of and failures in corporate governance

Other Key Insights: problems particularly acute in finance

- **Moral hazard associated with increased indebtedness**—market determined contractual **bankruptcy** provisions inefficient
 - One of reasons for necessity of bankruptcy laws
 - Advocates of contractual approach to sovereign debt restructuring don't seem to understand this
- Interlinkage of finance undermines the decentralizability of the economy
 - To know financial position of any firm requires knowing financial position of all creditors, which requires knowing financial position of all creditors of creditors....
 - Financial interlinkages may lead to an increase in *intrinsic uncertainty*—multiple equilibria
 - Derivatives may even result in the non-existence of equilibria

Financial architectures

- Different architectures affected extent of externalities, nature of information requirements
 - Efficiency of adequately capitalized clearing houses
 - No evidence that market driven architectures efficient
 - Because of disparity of private and social incentives one would not expect efficient outcomes
 - But an inefficient architecture could/would exacerbate disparity of private and social incentives
 - New financial products, greater complexity gives new opportunities for distorted architectures
 - Recent research on credit networks (Battiston *et al*) highlights inefficiencies, e.g. bankruptcy cascades, increased systemic risk with large/correlated shocks, following on earlier work by Allen and Gale (2001) and Greenwald and Stiglitz (2003).

Exploiting the political economy

- Too big to fail
- Too interconnected to fail
- Too correlated to fail
- Bankruptcies give rise to externalities which are not internalized
- With too big to fail, too interconnected to fail, too correlated to fail, success may not be based on relative efficiency but on relative size and linkages
- Depends, of course, on terms of government intervention
- Firms have incentives to become too big, too interlinked, too correlated to fail: there is a *systemic* problem

Information and competition

- Not only does imperfect information lead to imperfect competition
- But also, attempts to manage information imperfections reduce competition
 - Efficient management of adverse selection/moral hazard involves intertemporal linkages
 - Limiting the scope for usual competitive mechanisms/enhancing scope for monopolistic exploitation
 - And entailing *institutional* responses (like banks) internalizing some of the information externalities
- Small sunk costs can give rise to persistent monopoly rents with Bertrand competition
 - Information (knowledge) is a sunk cost
 - What matters is ex post (after entry) competition
 - Stronger ex post competition may enable persistence of larger profits
 - Little relationship between efficiency and distribution
 - Forbidding merger of two companies could have epsilon efficiency benefit but large distributive consequence (model assumes small fixed, sunk costs and constant marginal cost)

Information and delegation

- Information imperfections give rise to delegation; the separation of ownership and control undermines standard theory of the firm, and gives rise to problems of **corporate governance**
- Market failures associated with corporate governance
 - Managers do not necessarily do what is in interests of shareholders
 - Even greater difference between social returns and *managerial* returns
 - Evidence that these issues are particularly relevant in financial sector
- No presumption that market solution is efficient
 - Imperfections in all of control mechanisms (e.g. take-overs)
 - Rules of the game matter

II. Early attempts to broaden perspective—to recover earlier results on market efficiency—failed

- Efficiency of economy with stock market (risk classes) (Diamond)
 - With two commodities, or with bankruptcy costs, or with decisions which affected pattern of risk distribution, result was not true
- Contracts (payments dependent on observable state outcomes) (Stiglitz, Ross)
 - Huge literature exploring optimal contract design
 - Predicted *complexity* (except under special and easy to reject specifications of utility functions) far greater than observed patterns
 - Since among unobservable variables are common shocks, optimal contracts should make compensation dependent on others' outcomes: predicted *forms* of contracts typically different from that observed

Can institutions fill the gap?

- *New Institutional Economics*
- Explaining sharecropping as balancing out incentives and risk sharing
 - Many aspects of contract design consistent with what theory predicts
 - Many details of contract design (simplified form) differ from what theory predicts
- But hope that institutions would lead to Pareto efficiency failed
 - Could worsen equilibrium
- Key constraints (like incentive compatibility, selection, or collateral constraints) endogenous, affected by actions of all participants
 - Each fails to take into account impact on constraints

Schumpeterian competition

- Schumpeterian competition (Contestability doctrine) failed
 - No presumption that profits would be driven to zero or that market driven outcomes would be efficient (either in the level or direction of information/knowledge gathering/dissemination)
- Hope was that competition for the market would replace competition in the market
 - Only true if there was zero sunk costs
 - But expenditures on information/knowledge sunk costs
- Indeed, strong arguments for persistence of monopoly power
 - With incentives for research/investment directed to enhancing that persistence

III. Many policy corollaries

- W.C./neoliberal policies predicated on Smithian presumption + ignoring 2nd best economics
 - Presumption that moving the economy towards first best economy was welfare enhancing was wrong
 - Free trade could be welfare decreasing or even Pareto inferior
 - Distributive effects could outweigh over-gains and cost of undoing distributive effects could be large
 - Increase in risk could lead all individuals in all countries to be worse off
 - Tarrification may increase risk, and therefore be welfare decreasing
 - Capital market liberalization could increase risk, and be welfare decreasing

Policy battles over information

- HFT may be new form of front running—reducing the overall efficiency of the economy
 - Reducing ability of those providing “real research” to appropriate returns *ala* Grossman-Stiglitz
 - Justified by “Price discovery”—uncovering prices to enable the efficient allocation of resources (self-serving justification of financial sector: no evidence of importance)
 - Also justified by “liquidity” —enabling individuals to easily move into or out of assets, enhancing willingness to make real investments: evidence is that liquidity dries up when it’s needed
 - Creating additional risk instruments may actually increase risk

Policy battles over information

- Welfare may be increased by requiring disclosures—market equilibrium disclosures do not suffice
- Welfare may be increased by requiring trading in markets
 - So long as they are adequately capitalized (joint and several liability of market participants) improves decentralizability

IV. Reconciling two long-competing theories for describing market equilibrium and explaining inequalities

- Competitive equilibrium theory vs. market power (exploitation) theories (Smith and Ricardo vs. Marx)
- There is always *some* constraints on exercise of market power, *some* competition
- But standard (price taking) competitive model describes few markets
- Many of tests of competition are only tests of presence of some constraints, not tests of how close economy approximates perfect competition model

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Reconciling two long-competing theories for describing market equilibrium and explaining inequalities

- Imperfect information/imperfect competition model fundamentally different from either polar case
- Real world is this mixed model
- Key battle is over grabbing or limiting rents
 - Over structuring of markets, rules of game

The rules of the game matter— markets don't exist in a vacuum

- Restraining the set of contracts and actions and changing the rules to enrich one's interests at the expense of others (creating institutional frameworks for corporate and public governance)
 - This is why presumption that markets are basically competitive is poor starting point for policy analysis
- Governance is crucial—who makes the decisions, and the rules under which the decisions are made
 - In AD model, no real governance issue—simply maximize value
 - With imperfect information/risk markets matters whose judgments are decisive, how different judgments are “aggregated”
 - True in public and private sector
 - E.g. monetary policy

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The rules of the game matter— markets don't exist in a vacuum

- True of every aspect of economy—corporate governance, financial sector, monetary policy, bankruptcy, anti-trust, labor
 - Allowing unions, rules for union representation and collective bargaining
 - Presumptions in anti-trust policy
 - Priority in bankruptcy

Exploitation model provides better description of economy

- Cannot explain what has happened in advanced countries over past quarter of century with competitive model
 - Increasing role of rents: share of capital and labor down
 - Profits up, investment down, even with negative real interest rates
 - Wealth/income ratio up, capital/income ratio down
- Can explain it with model of economy with extensive market power
 - New technologies (including information technologies) create new barriers to entry and new methods for exploiting, extending, and amplifying market power

V. Broader theoretical impacts of information economics

- The information revolution helped push back other boundaries within economics
- **While it was able to explain many previously unexplained phenomena, models with rational behavior with imperfect information still could not explain some of what was going on, e.g. in financial markets**
- **Thus providing the basis of the move towards behavioral economics**
- Original work incorporated insights from psychology
 - More recent work, focusing on endogenous preferences, beliefs, “mental models” has incorporated insights from sociology
 - Both have helped provide insights into societal rigidities and social change
 - Providing new instruments for policy—WDR 2015

VI. A Look Forward

- Some of the changes in our economy—in technology, in demand structure, and in our regulatory framework—have exacerbated the disparity between private and social returns to information (knowledge) and enhanced rent seeking and capacity for rent extraction
 - Had thought that new technology would have increased competition, by lowering search costs
 - True in some areas—homogeneous or well-specified commodities and manufactured goods
 - **But new technology has also increased ability to exploit—increased asymmetries of information, and market power of those who have differential access to information**
 - **And move to innovation economy has led to increased importance of fixed costs—diminishing force of competition**
- Changes in underlying fundamentals will require changes in policy to prevent increasing market power, inequality
 - Will pose new questions

Further risks

- **Move to “information economy” may give market power to those who dominate in grabbing information**
 - **Information may be the really scarce commodity**
 - **Artificially created scarcity**
 - Google, Facebook, others
 - Distorts both the markets for goods and services (increased ability to price discriminate) and innovation (innovation in areas where there is high potential for grabbing rents based on information)
 - Extent to which this occurs will be determined by rules of the game
 - Privacy rights, who owns one’s data

New technology results in less competition

- Network effects and increasing role of knowledge may naturally lead to more scale economies, market imperfections
 - Understanding of behavioral economics, theory of discrimination, plus access to new data enhances ability to exploit market power
 - May have enhanced ability of incumbents to persist (Newbery-Stiglitz), in spite of some instances of disruptive technology
 - May help explain increased concentration and persistence

Changing structure of the economy may also lead to more market power

- To locally provided services
 - Where **information about quality** is key, reputation effects critical
 - Giving rise to local market power
- **Increased economic inequality arising from natural market forces leads to increased political inequality—which in turn leads to restructuring the rules of the game (e.g. rules governing privacy and transparency) to enhance market power and increase inequality**
 - **Weakening economic performance**

21st century fight against agglomeration of power

- Cannot separate agglomeration of market power from agglomeration of political power
 - Fight at end of 19th/beginning of 20th century realized that two were inextricably linked
 - Chicago school narrowed the fight to a narrowly defined view of economics—and then argued that because markets were naturally competitive, antitrust policy should be limited
 - Presumption was that markets were competitive
 - In 21st century, all of these presumptions have to be reversed
 - Expansive use of predation (Microsoft)
 - Pre-emptive acquisitions (Google)
 - Anti-competitive contract provisions (Visa, Mastercard, American Express, Sabre)

Need for new regulatory framework

- Europe is leading the way
 - Attacks on Google's anti-competitive practices not anti-American
 - But political influence of Google, Apple, finance make it difficult for US to take appropriate action
 - Australia's action on credit/debit cards
 - Concern about monopsony power as well as monopoly power
 - National interest in the long run rather than short run consumer interest should be guiding principle
 - Walmart might be able through monopsony power to lower consumer prices in SR: still bad for national welfare
- But stronger action is needed
 - Uncertain how much is needed to ensure competitive economy
 - Minimum: treating data has a "public good"
 - Alternative: treating platforms as a "public utility"

- Important lesson for SA: Not to adopt “Chicago school” narrow perspective but rather broader perspective, including impacts on development and politics
 - Especially important in areas like media
 - Concentration of power affects marketplace of ideas, not just market for advertising

Disinformation: new battlefield

- My work focused on naturally occurring limits on information
- New issue: deliberately created *misinformation*
 - For a variety of motives
- Combined with attacks on *epistemology*, how we know what we know
- Attack on scientific institutions and institutions of verification
 - “uncaptured” press
 - “alternative facts” “fake news”
 - Even in areas where truth seems obviously verifiable and has already been verified (climate change)
 - Defunding science
 - Threat to advances in science
 - And even functioning of democratic society
 - How do we ascertain what is meant by “due process” “equitable treatment”

1984 fictional dystopia is now becoming America's reality

- Battle is to prevent “normalization” of fake news
- Highlighting importance of science for the advancement of our standard of living
- Importance of independent media in ascertaining fake news
- Language is important: calling out President's lie for what they are, lies.

VII. Concluding comments

- Information economics has had a transformative effect on economics and economic policy
- Providing explanations of phenomena that previously had been unexplained
 - Its failures/limitations encouraging the development of behavioral economics
- Directly giving rise to new sub-branches of economics—contract theory, new institutional economics
 - Highlighting the importance of institutions, and explaining the existence and structure of some institutions

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Concluding comments

- Together with other work, suggesting that the economy best be viewed through models which highlight market power and exploitation (rather than through the lens of the competitive equilibrium model)
- Questioning—and in many cases reversing—longstanding presumptions of economic policy
 - The presumption is that market economies are *not* efficient
 - With pervasive market power (some associated with imperfections of information), interventions can typically increase efficiency and equity

A host of new economic problems requiring new solutions

- New technologies, rather than resulting in more competitive economy, as hoped, has led to more concentration of market power
 - Old regulatory mechanisms, including anti-trust inadequate in dealing with these new innovative ways of market exploitation
- New information problems—privacy, transparency, and disinformation (fake news)—posing an even greater threat to the functioning of our economy and our democratic society
 - Magnitude of the threat only slowly being realized
 - Uncertainties about best way to respond
 - At a minimum: recognize the threat it poses to basic values, Enlightenment, progress of science
 - We should not be relitigating the Enlightenment
- Much rests on our ability to find adequate if imperfect solutions: not only the future of our economy, but of our democratic institutions and society.