Insurance and Credit:
Micro Financial Underpinnings
for Entire Economies

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This presentation provides a unified conceptual framework for addressing household financial access, financial deepening, and poverty at the microeconomic level, on the one hand, simultaneously with macroeconomic growth and macro stability concerns, on the other. More generally, it provides an algorithm for how to think about policy.

Central Themes of the Talk

- **General Equilibrium**
  - Asking questions about insurance and credit means asking questions about two sides of a market, or more generally the efficiency of markets and institutions
- **Assumed micro financial underpinnings matter**
  - Actors/institutions/markets, as well as obstacles to trade, are the key inputs
- **Crucial: measure and test these micro financial underpinnings (both)**
  - Go beyond theories which make assumptions about markets, institutions, and even outcomes without measurement or testing
- **Success in doing this at the village level– and urban communities**
  - Follow the same path/method to macro and entire economies: Applied General Equilibrium Development Economics
- **Compare this approach with conventional macro aggregate approaches**
  - For contrast and clarification
  - In turn, this suggests new directions for both
  - Macro analysis of advanced industrialized countries is benefiting from innovations in development/micro measurement
- **New directions: Exploring the nexus of theory/data and micro/macro**
  - Formal vs. informal and their interaction, geography, hierarchy/layers, observed and unobserved heterogeneity, identification, testing mechanism design and incomplete markets, industrial organization and development, merging of subfields
- **Policy Evaluation and Policy Recommendations**
  - Welfare theorems are overall guide to policy, in whether to try to fix something, in the design of markets and institutions, and where systematic regulation or policy intervention might be needed
  - Specific examples are provided
  - The agenda is operational

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GENERAL EQUILIBRIUM: The title "Insurance and Credit" may conjure up the wrong inference about what the talk is about, especially so as this is in a development session and one may be thinking about improved financial access. This is not about impact on the demand side only, i.e. the impact of increased availability of financial products for households and firms, while ignoring the supply side. Why does it matter? Because there is no presumption that governments or NGOs should be providing these products. Rather, we need to determine what the market and other institutions are doing and identify potential constraints in order to know if and how to take action. Put another way, the other side of credit is saving, so if credit is inefficient, this is a reflection of poor financial intermediation. We can then start thinking about why that might be the case. Likewise, if there is limited insurance, this is a statement, for example, that the community is not engaging in reciprocal risk sharing - i.e., in order for someone to receive an identity in return for paying a premium, someone else must be on the other side providing the insurance for that fee, and everyone could gain if they were. In sum, the general equilibrium framework gives us a way to think about policy.

MICRO FINANCIAL UNDERPINNINGS MATTER: We know from theory even before getting to data issues that what we assume about micro financial underpinnings has consequences for the phenomena a researcher may be trying to model, whether it be micro or macro. An incorrect starting point may lead to incorrect conclusions. Examples are provided throughout this talk. The point here is not to be realistic always, in all circumstances, regardless of the goal. For example, aggregation may work in certain instances, so in those cases assumptions about micro underpinnings do not matter and larger aggregates can be used. Or, in other instances, micro financial underpinnings might be a side show. However, in the applications emphasized in this talk, variation in obstacles to trade (hidden states, moral hazard, adverse selection, transactions costs, and limited commitment) or variation in the assumptions about the players of the economy and the stage on which they interact, are associated with variation in observed outcomes and welfare. This talk is neither the perspective of development economists unwilling to think about macro issues nor that of macro economists reluctantly drawing in micro considerations. It is about research embracing an integrated perspective. The data are both micro and macro, just as Friedman's work on the consumption function was trying to reconcile cross-sectional and time series data. He wanted to explain both.

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NOTES, CONTINUED…

CRUCIAL TO MEASURE AND TEST MICRO UNDERPINNINGS: If underpinnings can be crucial, then we need some guidance about what to include in a sub-modules of a model, so to speak. How do we do this? We need both adequate measurement and analytic tests. Are these insurmountable barriers to research progress? No, as the data and measurement are often already available from micro surveys and standard national income and product accounts, including flow of funds accounts. Others may have done the requisite quantification and tests, and it is only the integration into macro models that is lacking. In any event, many of the tests are not hard to do, methods have been standardized, and there is a literature which researchers can draw on.

SUCCESS IN DOING THIS: Work on risk sharing and micro financial underpinnings of institutions and markets have created a well-defined literature known as "village economies." From a policy standpoint, this is a natural starting point to address concerns about financial access. From a methodological standpoint, this is also a good place to begin. Work on villages provides dramatic examples of success in combining micro and macro data in a general equilibrium approach. This also offers guidance for constructing models of "larger" economies, and often, one can build from these premises: villages interacting with each other within the larger open economy, interactions of regions in a country, and the co-movement of macro aggregation across countries. In some efforts, financial service providers are explicitly modeled, interacting with each other and linking households to the larger economy. All of these frameworks together are referred to in a shorthand way as "**general equilibrium development economics**." There are notable, early successes in this field and much momentum. But in another way, the term "development" economics may be misleading. In reality, this new field is a productive way of approaching standard macroeconomic concerns, applicable to low income countries and emerging market countries but also equally relevant for the modeling of advanced countries. In this sense, this talk is not about micro development or emerging market economies alone; it also proposes ways to think about the U.S., Europe, and other OECD countries.

COMPARISON WITH OTHER APPROACHES: This talk outlines a comparison with other standard macro modeling approaches. This can be taken, at first blush, incorrectly as a criticism of these approaches. That is not the message. Rather, the goal is to clarify when these more standard approaches can be used; to present alternative, complementary approaches that are a halfway point; to provide some unity among the various approaches; and to point to directions for future efforts and integration, featuring research which is already under way.

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NEW DIRECTIONS: Early work featured a dual economy distinction, namely interactions across financially intermediated and non-intermediated sectors in a given economy, both in savings and credit and in risk sharing. More recent work features new elements as we work from below and toward the aggregate: formal vs. informal sectors and their interaction; geography and the zooming in and out with varying assumptions at distinct levels (i.e., complete markets within a village and incomplete markets in the larger economy); hierarchies (i.e., connections with a joint liability group or family business group and how these entities deal with each other and with financial institutions and markets in the larger economy); observed heterogeneity (e.g. wealth) and unobserved heterogeneity (e.g. talent); identification and what is needed to estimate parameters reliably, to reject a model, and the illusive chase for theory-free tests; testing mechanism design against incomplete markets through a structural model but with measured auxiliary assumptions so we know what financial information regimes to use in the larger macro models; industrial organization and development as we think about the supply side of financial services; and the merging of subfields more generally, i.e., macro and finance.

POLICY EVALUATIONS & POLICY RECOMMENDATIONS: The general equilibrium approach gives us the power of the welfare theorems in a variety of ways. This includes classic cases:

- Assumptions, to be measured and tested, which are sufficient for competitive equilibria to be Pareto optimal and assumptions which are sufficient for any Pareto optimum to be supported in a competitive equilibrium with suitable taxes and transfers (some obstacles such as moral hazard and non-convexities, as well as other seemingly non-standard assumptions, need not cause a problem). In this case one should not intervene, and there is no role for policy other than lump sum redistribution.
- Assumptions where these theorems fail, but nevertheless the welfare theorems give us a way to (re) design markets and institutions to avoid problems and regain efficiency (though this may require some proactive intervention in deciding what kinds of trades are desirable ex ante, with fees or subsidies for market participation). Here the role of government and policy are restricted to ex ante design.
- Assumptions under which there are chronic failures and the need for systematic government interventions. Otherwise, equilibrium outcomes will be Pareto inefficient. This is true for some environments, for example, where there is a need for continuing monetary liquidity policy.

All other alternative motivations for regulation and policy have, in the framework of this talk, a burden of proof, so to speak, including so-called "international best practices" as in the regulation of financial institutions and markets.

Outlined

1. Understanding the unit of analysis and the data
2. What Applied General Equilibrium Development Economics is (and what it is not)
3. Micro Underpinnings
   1. Insurance
   2. Credit
   3. Obstacles to Trade
4. Putting together micro and macro
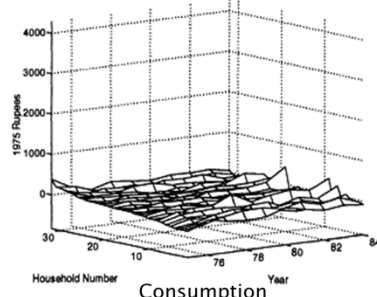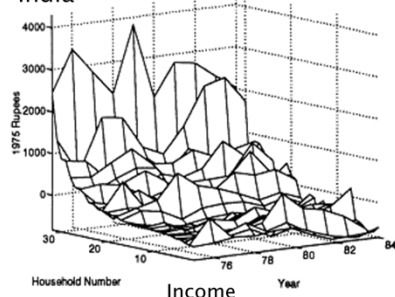5. Conclusion

This slide provides an outline of the talk. It does not follow the themes on the first slide per se, but rather addresses the overall themes through the above organization.

Outline

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These graphs show incomes and consumption of a village economy in India, both in the cross section and over time, as compared to the overall economy-wide average, which is normalized to zero. The income graph shows the "starting point," the "Rocky Mountain" peaks and valleys, as the peak of one household in front conceals the valley of another behind it, illustrating that incomes do not co-move. In contrast the flat "Kansas" consumption graphs plotting the consumption outcome, on the same scale as income, shows little movement, at most some slow undulating waves over time common across households. The comparison is dramatic and begs the question, what is going on?

A THEORY WITH TESTS: This outcome seems to be as the optimal allocation of risk bearing would predict (Wilson, 1968): that idiosyncratic income shocks are pooled away and what is left are aggregate economy-wide income shocks which are shared. Panel data regressions confirm this is a surprisingly good approximation, though there is a small but positive coefficient on idiosyncratic income in most instances, larger for the class of landless labor (both are not evident in the graph).

HOW MUCH DATA IS NEEDED: The strength of the test of the benchmark standards, in employing only income and consumption data, is that it can be accomplished with relatively little data.

INSTITUTION- AND MARKET-FREE OUTOMES: Another strength is that one can ignore the question of exactly how this is accomplished: it does not matter which markets, institutions, and other mechanisms are at play. For the curious, this successful outcome certainly begs that question, however, and subsequent work with Lim (1998) has followed up on this.

POLICY FIRESTORM: This paper created a firestorm among Washington policymakers as it suggested that, albeit with exceptions, a community of poor households in India could do quite well as a group against local shocks and that policies should be targeted at most to aggregate shocks. Targeting individuals in a community might be futile.

A GORMAN REPRESENTATIVE HOUSEHOLD EMERGES: Under the additional assumption of Gorman aggregate risk preferences, the village as a whole could be represented as a representative consumer in its dealings with the outside world. As Wilson (1968) has shown, a risk syndicate would be unanimous in its choice of action. This helps in aggregation and is an implicit underpinning, typically untested in standard representative consumer macro models.

OTHER BENCHMARKS ARE ALSO TESTED: Subsequent work in other contexts has taken such benchmark standards to other variables: labor, investment, assets, and occupation choice. There is now an enormous literature, partially surveyed in the slides that follow, testing these various benchmarks in a variety of economies.

Another Village Economy, and a Contrast

- Going back in history is another way to get variation
  - Focus here is on institutions
    - land holdings, fragmented into long narrow strips!
    - In contrast to village India, doing much more ex ante, for some reason, e.g., private information, do less ex post
- But keep general equilibrium perspective
  - How it all fits together
  - Do not look at landholdings alone
  - Do not look at one market or institution in isolation

The Medieval Village Economy

ROBERT M. TOWNSEND
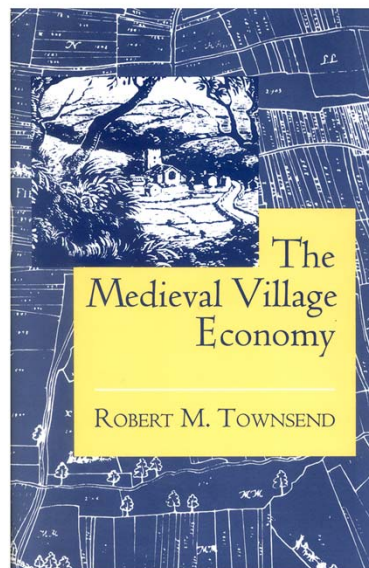
In contrast, this slide displays a stylized map of the open fields of Laxon, Nottinghamshire, England. Salient are the long narrow strips of a single plot; a typical household held 60 or so of these about the village.

A THEORY TO TEST: The theory here is one of costly diversification of a portfolio of assets, with each plot responding differently to hail, insects, and other shocks as a function of slope and location. Unlike village India, there seems to have been pressure for ex ante diversification and some obstacles against ex post smoothing. Households in India were more specialized in their activities by soil, crop, location, and occupation. A model of moral hazard for the medieval village economy is postulated, with costs of division and prevalence of shocks drawn from McCloskey (1976) and historical data. There is nothing automatic about the goodness of fit of the model and, indeed, there is even more fragmentation in reality than the theory can support.

EVEN WITH A FOCUS ON INSTITUTIONS, IT IS STILL GENERAL EQUILIBRIUM MODELING: General equilibrium theory provides the discipline, as ex ante division of land and landholding as an institution cannot be considered in isolation of other markets and institutions. (Mechanisms for ex post smoothing, or consumption transfers in this instance, are impeded by the disincentives of private information.)

MODEL CALIBRATION – AN EARLY EXAMPLE: A second point is that this is a modern day macro calibration exercise. (Other chapters in *The Medieval Village Economy* deal with commodity storage as buffer stocks and labor market/sharecropping.) Village economies and macro models share the same approach in these applications.

AGRARIAN METAPHORS ARE A BIG PART OF THE WAY WE THINK IN OTHER CONTEXTS, INCLUDING ADVANCED INDUSTRIALIZED COUNTRIES: In modeling, economists write down primitives in terms of Lucas trees and other metaphors as if in an agrarian context. So this is a good starting point, a gateway to macro.

BUILDING BLOCKS / MODULES FOR USE IN SUBSEQUENT, LARGER MODELS: A third point is that model economies with imperfections (such as private information) can be solved and used as building blocks in subsequent analysis. This is true in contemporary contexts, as well.

Method/Approach: How Do We Describe These Village Economies?
Use Language of GE Theory

Townsend (1995) "Financial Systems in Northern Thai Villages"

- Preferences/Endowments/Technology (production, storage)
  - Includes measured obstacles to trade
  - A PET Economy
- But these are intended to be REAL, this is why started in villages in first place!
- Assumptions about underpinnings, micro structures do matter
  - Part of the empirical work!
- Controversies remain, to be resolved
  - Part of structure is inferred, not measured directly
  - Limited by analytic capability of getting closed-form solutions
  - Limited by computational feasibility
  - Identification, how much or how little structure do we need
- Counter to "anything goes" (Sonnenschein-Mantel-Debreu 1973-1974), general equilibrium does impose testable restrictions (Brown and Matzkin 1996)
- Models as Economies, Townsend (1988)
- It is the variation across villages, regions, entire economies, that can attract interest in development economics

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METHOD/GENERAL EQUILIBRIUM ENVIRONMENT: In the previously described approach to village India and the Medieval village economy, and in work on the financial systems of northern Thai villages featured in this slide, there is a common method from Arrow Debreu general equilibrium theory. That is, to describe each economy in the language of endowments and technologies.

VARIOUS METHODS OF OBSERVABILITY: These endowments and technologies are relatively easily observed in Thai villages; the picture above shows land, labor, and capital. Thus, underpinnings are not assumed but drawn from the existing data in this case, from questionnaires in early field research done about the same time as Udry and before this became common in contemporary development economics (but well in the tradition of agricultural economics, as in T.W. Schultz).

TAKING THE ENVIRONMENT SERIOUSLY: The economy is described in realistic, if simplistic, terms as a Preference-Endowment-Technology (PET) economy. One point of clarification: some describe models as "toy models," but that language may suggest that modeling is only taken as illustrative or in a light-hearted way. Here, with this approach, the opposite is the case. Models are taken seriously. They offer surprises and we learn from them.

THE "SOCIAL PLANNER" APPROACH: PREMISE OF A PARETO OPTIMUM: Again, the environment is taken seriously. The presumption is then that, somehow, pressures to achieve a socially optimal allocation will prevail. Townsend (1995) chronicles the success of this exercise in some villages, taking one village at a time, but does not shy from reporting puzzles or anomalies in others. A common benchmark standard is being used to interpret data.
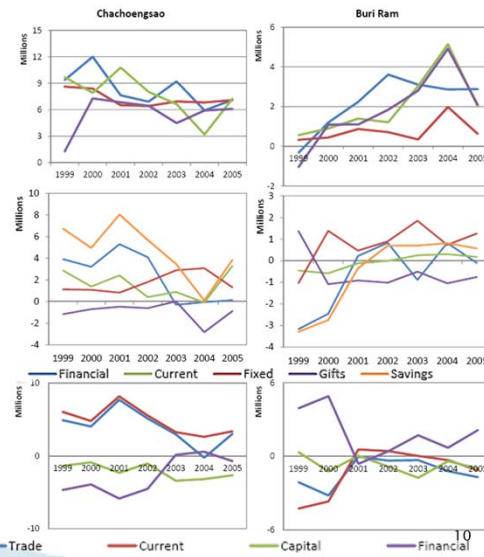
GENERAL EQUILIBRIUM THEORY HAS CONTENT, TESTABLE RESTRICTIONS: The more general point is that the theory has content in that data can reject the class of models under consideration, with and without private information (also measured), as in Brown and Matzkin (1996) and in contrast to the "anything goes" work on excess demand function of Sonnenschein-Mantel-Debreu (1973). It is not true that any observation can be made consistent with the model. The theory has content.

VILLAGES AS SMALL OPEN ECONOMIES: One seeks to explain differences as the outcome of variation in environment (if not other factors). A key ingredient in doing this in village economy models is an economy-wide budget constraint and varying connections to the national economy. Puzzles led to a much larger data collection, the Townsend Thai Project, described later. One caveat would be to avoid the trap of trying to explain what happens in every village (this is never the goal).

Building Toward the Larger Macro Picture: Placing Villages in Context as Small Open Economies– with Paweenawat

VILLAGES AS A KEY UNIT OF ANALYSIS: Villages can be analyzed as entities in the same way that international economics analyzes entire countries. We can use data with the framework of national accounts to create GDP, savings, and its allocation into various types of investment. We can create the trade, current account, balance of payments, and the balancing flows (capital and financial accounts).

THE BEHAVIOR OF THE AGGREGATED UNIT DEPENDS ON MICRO FINANCIAL UNDERPINNINGS: The behavior of an economy depends on its financial underpinnings. If there is full risk sharing and as-if complete markets, and if preferences are Gorman aggregate, then the village has a representative consumer. If private information is present and poses a constraint, as reflected in internal outcomes and institutions, then the economy behaves differently.

THE WHOLE IS A SUM OF INTERACTING PARTS: A collections of villages (and regions) and their interaction constitute a larger economy. These are the building blocks, actors.

LARGER AGGREGATION AND THE DISAPPEARANCE OF SUB PARTICLES: There is a caveat: sometimes, it is a collection of villages that constitute the unit and there is nothing special about a village per se. For example, just as households may be aggregated and represented by a village, villages may be aggregated and represented by a region. However, this is testable with sufficient data, e.g. within- versus across- village risk sharing, and within-region and across-region risk sharing. Passing cross-unit tests allows for aggregation and useful simplifications (based on the tested assumptions). Building models based on inaccurate premises can lead to bad, misleading predictions, limited understanding, and incorrect policies.

Townsend Thai Project: Data From Regions, villages/cities, 15 Year Panel
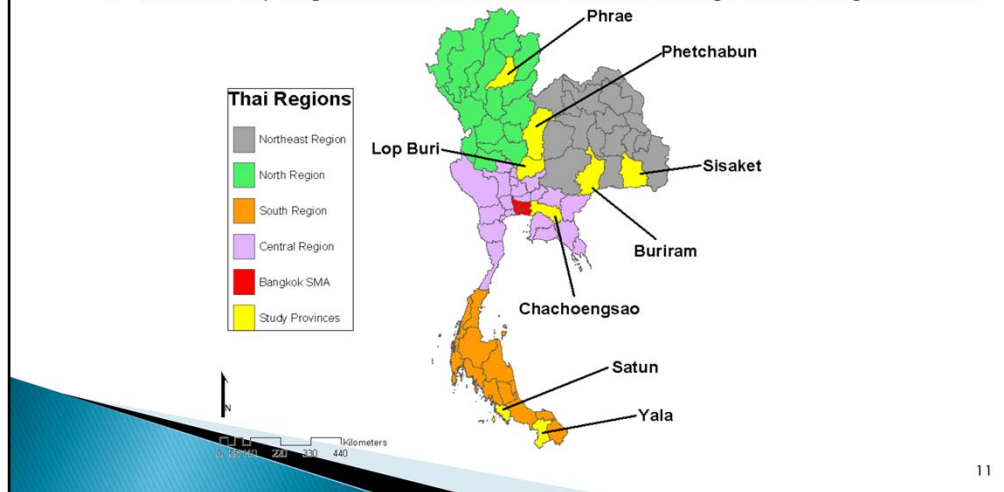
TOWNSEND THAI PROJECT: This is an effort to gather data to measure micro underpinnings and allow tests of models at various levels. Its uniqueness gives us insights which are reported in this lecture.

NOT JUST VILLAGES ANYMORE: Data includes neighborhoods in towns and cities, though earlier comments apply.
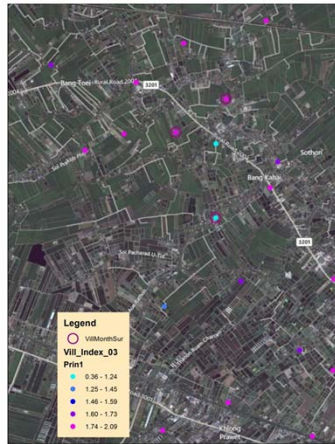
INDUSTRIALIZED, HIGH WEALTH AREAS: This is also about the developed and higher wealth part of an existing economy, not about rural poverty per se, though the interconnectedness and financial integration or its absence are key.

HOW TO DO IT: Forthcoming book, *Chronicles from the Field,* (MIT Press, 2013), describes data collection in greater detail.
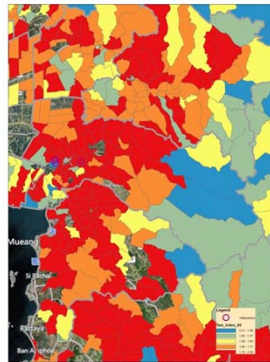
OTHER OPTIONS: Shorter panels, cross-sectional data, and intermittent surveys also provide huge insights. Drawing on the Townsend Thai Project, these methods have been used in Mexico and Chile, for example, without the necessity of embarking on a long-lasting, intensive project. Scale is not a barrier to this method of analysis. Other notable datasets include the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) surveys from 1975 - 1984, India's NCAER ARIS-REDS from 1968 - 2006, and the Bangladesh Nutrition Survey in 1982 and 2002. Yale's Growth Center has also embarked on long term surveys.

DATA COLLECTION IN OTHER COUNTRIES UNDERWAY: Yale's Growth Center has implemented two large-scale panel surveys in India and Ghana. Each survey has three components: a survey of households and their enterprises; an inventory of the village infrastructure; and a complete listing of the village population and their socioeconomic characteristics.
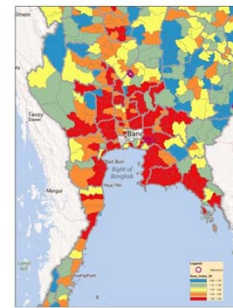
Measurement: From Local to Global

(High wealth in red)

(High wealth in red)

Villages surveyed monthly, (and others) with roads

o Featuring other secondary data on GIS database archive with auto search
  o Here wealth from CDD, archive includes SES, Labor Force Survey, Population Survey, bank location, surveys of industry

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EXISTING SECONDARY DATA CAN BE ENOUGH: Secondary data is useful in and of itself; it is not necessary to collect your own data in order to use the recommended method of analysis.

COMBINATIONS AND CONTEXT ARE POWERFUL: Putting existing specialty data in the larger context of secondary data gives more power than any data set individually.

DATABASE ARCHIVES ARE STRONGLY RECOMMENDED: In Thailand, we feature and utilize an extensive collection of primary and secondary data. This can and is being done in other countries, such as Mexico.

GIS IS A USEFUL TOOL: Maps provide great visuals (as in this slide), but more is possible with geo spatial and temporal analysis.

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Review: Hallmarks of This Approach

- Not simple individual maximization in partial equilibrium (as in some versions of permanent income)
  - It is general equilibrium, including endogenous prices such as interest rates
- Not financial products narrowly, i.e., impact on individuals
  - It is efficiency for the entire system
  - It is about improvements using Pareto criterion
  - As distinct from distribution of wealth
- Not fixated on complete markets, nor on incomplete markets
  - It is about empirical tests to determine which, or something in between
- Not Washington Consensus of 1990's liberalization, or intervention/regulation now
  - But rather using theory and data as guide to policy
- Modeling local and national economies with general equilibrium perspective using measured underpinnings (more on this below)
  - Thailand
    - Townsend (2011) *Financial Systems in Developing Economies*
  - Mexico
    - Harriman, Moreno, Townsend and Zhorin (2012)
  - European history
    - Townsend (1990) *Financial Structure and Economic Organization: Key Elements and Patterns in Theory and History*

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What this approach is _not_ is discussed on this slide.

FINANCIAL SYSTEMS IN DEVELOPING ECONOMIES (2011): This book begins with the large, macro facts of growth, inequality, and financial deepening in Thailand and moves to a more disaggregated spatial view and summaries of salient patterns. It then reports on Kuznets and TFP micro and macro decompositions, respectively, to highlight the key drivers of change in per capita income, movements in inequality, and the reduction of poverty. In Thailand, this is found to be financial access, occupation/sectoral shifts, and education. Sectoral TFP numbers demand the distinction between intermediated and non-intermediated populations. These driving forces are dealt with one at a time in both historical and contemporary data. Finally, first generation models with exogenous and endogenous financial deepening draw on micro facts, with parameters estimated from these to micro data, to compare simulation and actual macro paths. A parallel book is underway for Mexico.

FINANCIAL STRUCTURE AND ECONOMIC ORGANIZATION (1990): This book examines these topics in both theory and in early European History. Key features in environments of the theories are matched with actual historical environments. The drivers of organizational and financial arrangements in theory and in historical regimes are emphasized, along with the matching of models, to reality. This provides conceptual frameworks to help us think about what is going on in contemporary emerging market countries.

Review How To Do Policy with General Equilibrium: Research Policy Algorithm

▸ Positive: To explain, understand
  ◦ Why are some individuals (villages, regions, countries) poor?
  ◦ And what happens when there is growth?
▸ Normative: To prescribe, intervene
  ◦ Workable solutions to alleviate poverty
  ◦ Not just as in targeting individuals, but also more inclusive financial systems
  ◦ Market design, optimal regulation and if/when/how to intervene
  ◦ Example: work towards reconciling financial access (micro, development) with financial stability (macro)
▸ Algorithm
  ◦ Tests of benchmark standards (full or constrained-efficient)
  ◦ If do not reject ⇒ leave it alone or build on this base
    · e.g., build formal/national on informal/village
  ◦ If with obstacles to trade (constrained-efficient) ⇒ reject full efficient
    · but accept constrained-efficient and leave it alone
    ⇒ or, alleviate constraints
    · collateral constraints ⇒ legal reforms might help
    · moral hazard constraint ⇒ possibility of more monitoring
▸ If distortion comes from ill-designed regulation ⇒ Fix the policy
▸ Not as unlikely as it might seem
  ◦ "International best practice" typically lacks theoretical/empirical underpinnings
    · A patchwork to fix perceived problems or symptoms when things go wrong
    · Not based on fundamentals

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POSITIVE ECONOMICS AND NORMATIVE ECONOMICS ARE NATURALLY LINKED IN GENERAL EQUILIBRIUM: This slide on policy, or normative economics, is a natural follow-up to positive economics, that is, attempts to fit the data of an economy with a model. The models are built on micro underpinnings and, as the resulting benchmark standards can be tested, it leads to the research policy algorithm outlined in the current slide.

SPECIFIC POLICIES: These are considered in the slides which follow, where they emerge in the context of models and data under consideration.

What Is Applied General Equilibrium Development Economics?

- Contrast with "standard" macro general equilibrium models
- First with implicit micro financial underpinnings
- AGE: Applied General Equilibrium
  - To compute Walrasian outcome: Scarf (1967)
  - U.S. taxes on capital gains: Shoven & Wally (1972, 1973)
- CGE: Computable General Equilibrium
  - Predecessor: Johansen (1960) (Monash, Australia and Cambridge, U.K.)
  - Reviews: Kehoe and Kehoe (1994); Dawkin, Srinivasan and Walley (2001)
  - Applications: World Bank policy assessments, climate modeling
  - Measurement
    - Drawing on, integrated with, NIPA (HH, Firms, etc.), input/output matrix
  - Key underpinning: Complete markets or equivalent
    - What if not true ⇒ Separation of households/firms fail
- DSGE: Dynamic Stochastic General Equilibrium
  - RBC, Real Business Cycle: Kydland Prescott (1982)
    - Review: Cooley (1995)
    - Measurement (drawing on NIPA)
- Key Underpinning: Gorman aggregation with complete markets
  - Method does generalize
    - With Pareto weights: Negishi (1960)
  - But what if as-if-complete-markets fail, then separation fails
  - Where is the financial modeling?

Advantage	Disadvantage
Lots of realistic sectors	Static
	No uncertainty

Advantage	Disadvantage
Dynamics	Assumes representative consumer
Shocks	No redistributive wealth effects

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APPLIED COMPUTABLE GENERAL EQUILIBRIUM CAN BE UNDERSTOOD, IN PART, BY A CONTRAST TO OTHER EXISTING APPROACHES. This is the first of several slides.

APPLIED COMPUTABLE GENERAL EQUILIBRIUM: This line emerged from Scarf's (1967) work on finding Walrasian market clearing prices for a general equilibrium model. His students, Shoven & Wally (1972, 1973), were the first to apply the general equilibrium approach to public finance and questions of welfare gains and losses (from taxation). Thus, general equilibrium and policy have been linked from the beginning.

COMPUTABLE GENERAL EQUILIBRIUM: The reviews of Kehoe & Kehoe (1994) and Dawkins, Srinivasan & Walley (2001) are very useful descriptions. This approach is essentially a model based on the standard national income and product accounts (NIPA), including the input and output matrix. This linking of the model to standard measurement is a huge advantage. Indeed, it was recognized that certain parametric specifications for utility and production functions allow key elasticities to come from those NIPA accounts, without any testing at all, if the model were true, an early form of calibration. This approach remains tractable and allows much realism within many sectors. It is used in policy, typically in analysis of trade agreements and climate change. A drawback is the static and nonstochastic modeling. In featuring the firms sector as separate from households, though consistent with the general equilibrium modeling of Arrow and Debreu, this line implicitly assumes complete markets. This is what is meant by the assumed financial underpinnings being implicit. In developing countries a good deal of production is in the household sector, and the separation (treating firms as separate units) is, if anything, even more difficult to rationalize, except again with complete markets.

What Is Applied General Equilibrium Development Economics?

- Contrast with "standard" macro general equilibrium models
- First with implicit micro financial underpinnings
- AGE: Applied General Equilibrium
  - To compute Walrasian outcome: Scarf (1967)
  - U.S. taxes on capital gains: Shoven & Wally (1972, 1973)
- CGE: Computable General Equilibrium
  - Predecessor: Johansen (1960) (Monash, Australia and Cambridge, U.K.)
  - Reviews: Kehoe and Kehoe (1994); Dawkin, Srinivasan and Walley (2001)
  - Applications: World Bank policy assessments, climate modeling
  - Measurement
    - Drawing on, integrated with, NIPA (HH, Firms, etc.), input/output matrix
  - Key underpinning: Complete markets or equivalent
    - What if not true ⇒ Separation of households/firms fail
- DSGE: Dynamic Stochastic General Equilibrium
  - RBC, Real Business Cycle: Kydland Prescott (1982)
    - Review: Cooley (1995)
    - Measurement (drawing on NIPA)
- Key Underpinning: Gorman aggregation with complete markets
  - Method does generalize
    - With Pareto weights: Negishi (1960)
  - But what if as–if–complete–markets fail, then separation fails
  - Where is the financial modeling?

Advantage	Disadvantage
Lots of realistic sectors	Static
	No uncertainty

Advantage	Disadvantage
Dynamics	Assumes representative consumer
Shocks	No redistributive wealth effects

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NOTES, CONTINUED…

DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM: This line is closely associated with Kydland & Prescott's (1982) early work on modeling business cycles. It overcomes the limitations of CGE in allowing dynamic and stochastic aspects. It also draws heavily on the NIPA and recommends calibration. But most tractable versions start with a representative consumer maximizing utility, and again, that can typically be rationalized only with complete markets and Gorman aggregable preferences. By assumption, then, there can be no redistributive wealth effects. Contemporary versions assume a representative household with many (or an infinite number of) individual members, clearly driven by the concern of losing tractability if doing otherwise. Yet it is difficult to map that construction -- and assumptions about actors and trading -- onto reality. However, Gorman aggregation and the representative consumer are not really a necessary part of DSGE models; heterogeneity in preferences and wealth can be handled computationally with the methods of Negishi (1960), as in the spirit of his proof of existence, using the welfare theorems. Namely, as a competitive equilibrium is a particular Pareto optimum and all Pareto optimal allocations can be supported as competitive equilibria with transfers and subsidies, one moves along the Pareto frontier until the value of endowments equals the value of consumption, with shadow prices as Lagrange multipliers on constraints (Prescott & Townsend, 2006). Still, this approach with heterogeneity is less common.
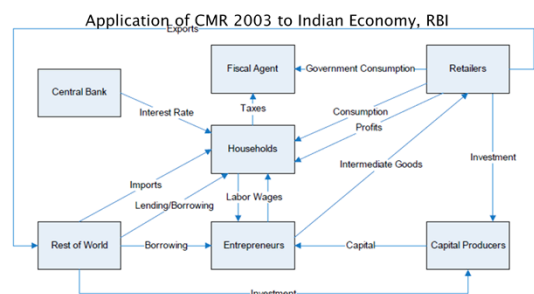
APPLIED GENERAL EQUILIBRIUM DEVELOPMENT ECONOMICS: This draws on the strengths of the above approaches and can equate in some circumstances (when micro underpinnings are equivalent with complete markets and heterogeneity is limited in certain ways). It also shares a reliance on measurement as in the NIPA, though it constructs these from household-level financial accounts (see the following slide).

Persistence, Amplification, Monetary Phenomena, Credit Channel, Bank Lending Channel

‣ Bernanke and Gertler (1989, 1990); Bernanke, Gertler and Gilcrist (1998); Kiyotaki and Moore (1997); Christiano, Motto and Rostagno (2003)
‣ Surveys: Brunnermeier, Eisenbach and Sannikov (2012)
‣ Sweden: Jacobson, Linde and Roszbach (2005)

Advantages	Limitations
Built on micro underpinning	Initially addressing only aggregate micro data
Costly State Verification (Townsend 1978)	Retains and adds actors
Key is credit, financial accelerator	Micro assumptions not tested

Application of CMR 2003 to Indian Economy, RBI

[Diagram: Central Bank, Fiscal Agent, Retailers, Households, Rest of World, Entrepreneurs, Capital Producers with flows labeled Exports, Government Consumption, Interest Rate, Taxes, Consumption, Profits, Investment, Imports, Lending/Borrowing, Labor Wages, Intermediate Goods, Borrowing, Capital, Investment]

‣ Recent directions: Moving toward incorporating micro development
  ◦ Christiano, Motto, Rostagno (2012)

Advantages	Disadvantages
Using more micro data	Still creating economic actors not intending to match to data
Firm size data: Influence of development (Hsieh and Klenow 2009)	Implicitly assuming separation
Financial variables	Households, separate from firms, even with financial imperfections
Bankruptcy	

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FINANCIAL FRICTIONS "AUGMENTED" DSGE MODELS: This is perhaps more accurate terminology than Dynamic New Keynesian models, as many of the issues can be addressed without notions of sticky prices and money. This literature is an attempt to explain business cycles, as measured in the national accounts. Bernanke & Gertler (1989, 1990) uses as a key financial underpinning the contracts which emerge under costly state verification (Townsend, 1978), generating investment that co-moves with borrower net worth, persistence over time, and debt contracts with default. Simpler versions impose incomplete contracts that do not allow default and simply scale loans by a collateralizable capital, as in Kiyotaki & Moore (1997). Empirical versions, as in Bernanke, Gertler & Gilcrist (1998), feature this financial accelerator. Brunnermeier et al. (2012) provides a summary of this amplifier literature, and Jacobson et al. (2005) is an application to Seeden and its micro data. One caution: the reader could easily get the impression that a common reduced form comes from a variety of models, so that reduced form is the place to start. This is not the case, however, as the quantitative mapping of net worth into observables depends on the underlying imperfection and, in some cases, assumptions about market structure.

THE ECONOMY AS A PLATFORM FOR FINANCIAL AND OTHER INTERACTIONS, IMPOSED AND NOT MEASURED: Christiano, Motto, & Rostagno (2003) represents an even more ambitious version of quantitative models explaining aggregated variables, trying to get at monetary phenomena such as inflation and bank lending channels. The original motivation was to explain through a model the U.S. Great Depression and the role of monetary policy. The assumed micro underpinnings make distinctions among firms (retail, capital goods, producers vs. entrepreneurs) and are motivated by the need for tractability. Households are, as in CGE and RBC, a separate sector. There are central banks and in some cases, bankers. The actors in these models (firms, households, and banks) cannot choose the sector they are in. Again, none of the assumptions about these actors and their interconnections are tested in micro data or descriptions of institutions/markets, though the latter surely vary across countries. The goal is to explain macro aggregates. These models are used to explain advanced industrialized economies such as the U.S., and now, emerging market economies such as India (the schematic in the slide) and Brazil.

MOVING TOWARDS CONVERGENCE ACROSS MODELS: More recent contributions have moved in the direction of applied general equilibrium development economics in incorporating measures of financial variables such as bankruptcy and the size distribution of firms. These contribution are also "inspired" by the U.S. financial crisis. Plausibly, there were shocks to dispersion in production. In short, there are both micro and macro facts which these models try to fit as endogenous outcomes, not simply aggregate variables alone. Likewise, applied general equilibrium development models are moving toward operational macro models. So the issue is not one approach versus another but more nuanced distinctions. The tension here is to try to respect a stylized version of actual market/institutional structures, using the micro data in estimation and calibration, and yet end up with a tractable model. We return to this later in this talk.

Applied General Equilibrium Development Economics
Embrace and Measure Micro Financial, with Implications for Macro

- Households run enterprises and make high contribution to GDP
  - Not just small is beautiful, small is important quantitatively
- More than any other sector in Thailand up to the 1990's and to TFP, productivity change: Jeong and Townsend (2004)
- Measurement
  - Use corporate financial accounting but apply to households: Samphantharak and Townsend (2010)
  - Can be applied to surveys more generally
- Some key measured micro underpinnings, examples:
  - Occupational choice/wealth/credit: Paulson, Townsend, Karaivanov (2006)
    - Amplifier depends on limited commitment vs. moral hazard
  - Firm financing: Albuquerque and Hopenhayn (2002); Clementi and Hopenhayn (2006); Meisenzahl (2011)
    - Distinguish limited commitments, moral hazard, costly state verification
- Underpinnings do matter
  - Things are rarely monotonic: Matsuyama (2007)
    - Same theory with application to a wide variety of sub-fields
  - Perverse steady states with costly state verification: Boyd and Smith (1994)
  - Endogenous credit constraint can attenuate North/South flows: Gertler and Rogoff (1990)
- Applied General Equilibrium Development Economics
  - Exemplars of micro and macro coming together: details to follow
    - Gine and Townsend (2004); Banerjee and Duflo (2005); Ueda and Townsend (2006)—more literature described below
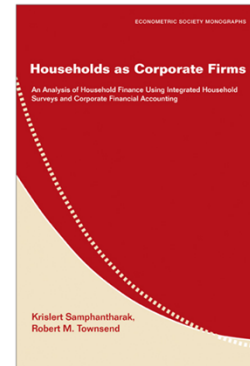
"The only way to obtain measures [of income and consumption] is by imposing an accounting framework on the data, and painstakingly constructing estimates from myriad responses to questions about the specific components that contribute to the total." Angus Deaton (1997)

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APPLIED GENERAL EQUILIBRIUM DEVELOPMENT MODELS BUILT ON THE FOUNDATION OF DISCRETE CHOICE MODELS, ESTIMATED WITH MICRO DATA: These models, in contrast, typically do not dis-aggregate from the macro, top down, but rather aggregate from the micro, bottom up. The key underpinning is household and firm discrete choice, or selection problems among observed sectors.
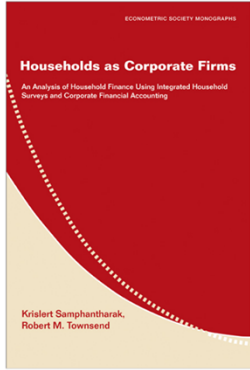
For example, a household decides between either wage work or running a firm, as in Gine & Townsend (2004). There is a mapping from observed wealth and unobserved talent to this choice so that underlying parameters of preference and technology can be estimated from the micro data. Likewise, these models feature measures of the size of the sector e.g., the number of entrepreneurs. The other key driver is a credit/saving financial intermediation sector. However, in these first-round models of occupation choice, this sector is imposed as exogenous. That is, its size and reach are calibrated to match the data. Jeong & Townsend (2004) show that Thai TFP at the macro aggregate level, taken as a primitive in RBG models, is consistent with a transitional, expanding financial sector, which allows better allocation of existing resources. This is so even without exogenous TFP shocks. Gine & Townsend (2004) also show the model fit to GDP and inequality. The point of these papers is that self-selection and small scale household enterprises are drivers of observed growth at the macro level. These are micro-founded models of entire economies.

In some models there is a decision of whether or not to join the formal financial system, with the alternative being in financial autarky. These are models of endogenous financial deepening as in Ueda & Townsend (2006). The data tell us which sector a household is in and the observed choice is used to estimate and deliver key parameters. Banerjee & Duflo (2005) emphasize firm size, that is, imperfect financial intermediation and fixed costs. In a highly styled model, lumpy firm size can explain differences in TFP between the U.S. and India.

NOTES, CONTINUED…

OBSERVED CHOICE AND DISTINGUISHING OBSTACLES TO TRADE: This takes us back to the earlier part of this presentation.

- Paulson, Townsend & Karaivanov (2006) focuses on enterprise and wealth. Both a moral hazard and limited commitment model predict that the frequency of enterprise increases in wealth as it does in the data. But overall in the central region, the quantitative mapping is closer to that predicted by the moral hazard model at estimated parameters. There is another distinguishing feature. Net worth and credit are monotonically increasing under limited commitment, as is assumed in reduced form models, but decreasing in the moral hazard model. And again the latter is closer to much of the data. Clearly this would impact debt dynamics over a business cycle.
- Clementi & Hopenhayn (2006), as compared with Albuquerque & Hopenhayn (2002), derives diverse implications for firm finance and growth, depending on information vs. limited collateral, respectively.
- Meisenzahl (2011) uses data from the U.S. Survey of Consumer Finances to empirically test and distinguish moral hazard versus costly state verification.
- Matsuyama (2007) reverts to the financial friction associated with collateral/limited commitment and yet still establishes that many mappings can be non-monotonic with respect to parameter changes.

MICRO UNDERPINNINGS (ASSUMED & INFERRED) DO MATTER FOR MACRO OUTCOMES AND OBSERVATIONS: Tractability of the limited commitment collateral constraint, also referred to as liquidity constraints, makes it a common ingredient in many applied general equilibrium development models, as discussed earlier, e.g., Kyotaki & Moree (1997), and this tradition continues below. But we know already from strands of the literature in various subfields that assumptions do seem to matter. For example, limited commitment versus costly state verification - as in Gertler & Rogoff (1990) versus Boyd & Smith (1994), which both deal with international phenomena.

MEASUREMENT AT THE MICRO LEVEL AND THE TESTING OF UNDERPINNINGS/MODELS IS KEY: Samphantharak & Townsend (2010) shows how to convert the micro data from the Townsend Thai monthly survey into financial accounts: income statement, balance sheet, and statement of cash flow. This is used to distinguish productivity and the exogenous TFP, over agents and time, from liquidity and constraints. Likewise, Kinnan & Townsend (2012), discussed further below, distinguishes consumption from investment smoothing and the diverse role of kinship and financial networks.

Measurement and Modeling in Applied General Equilibrium Development Economics: Flow of Funds

▸ Adjustment and equilibrium in asset demand and supply (or policy) equations
  ◦ India: Green, Moore, Murinde and Suppakitjarak (2012) building on Brainard and Tobin (1968)
▸ VAR's distinguish firms, households in response to monetary shock: Christiano, Eichenbaum and Evans (2006)
  ◦ Indonesia: Ridhwan, de Groot, Rietveld and Nijkamp (2011)
▸ In the U.S., and cross-country, but much in the tradition of households as firms
  ◦ Credit crisis and liquidity trap: Guerrieri and Lorenzoni (2011)
  ◦ Inflation and prices of real assets: Piazzesi and Schneider (2010)
  ◦ Consumer bankruptcy: Chatterjee, Corbae, Nakajima, Rios-Rull (2007); Livshits, MacGee, Tertilt (2007)
  ◦ Wealth distribution and international capital flows: Mendoza, Quadrini and Rios-Rull (2009)
▸ Distribution within firm sector, self-finance and dividends vs. borrowing firms: Chari, Christiano and Kehoe (2008); Armenter and Hnatkovska (2011)
▸ CFSP projects underway: Measure and Model
  ◦ Flow of funds in Thailand, Mexico, Brazil
  ◦ But distinguish SME's from large corporate, urban vs. rural, geographic flows
  ◦ Transactions outside formal banking system

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FLOW OF FUNDS THROUGH THE FINANCIAL SYSTEM IS A KEY, NATURAL MEASUREMENT FOR THE CONSTRUCTION OF FINANCIAL MODELS: Flow of funds accounts (FFAs) use the traditional sectors of the NIPA (firms, household, government, and the rest of the world) and measure financial flows among them. There is, however, a heavy reliance on flows of the sectors with financial corporations and financial markets, as these are best measured given typical reporting requirements. But that is a limitation in the measurement, which can be improved, and not a limitation in the conceptualization of accounts and their link to standard national income. The latter, NIPA, is the basis for most of the models considered previously (CGE, DSGE). Better measurement adds the mechanics of assets and adjustments as a key part of the story. This can and should be done at the micro level (firm, household, financial institution) as well as aggregated up to key sectors, depending on the model or application.

WHAT ARE FLOW OF FUNDS ACCOUNTS: Essentially, savings comes from income statements and, via an identity, savings (plus gifts and remittances) are put as a flow into real and financial investments. The portion which is not retained earnings creates a financial flow. Adjustments are made so that income is on a cash flow rather than accrual basis. Roughly, a flow is created by difference over time of the line items in the balances sheets (adjusting for capital gains and losses). Flows of funds do often feature the balance sheet directly as well, not just differences and flows. The point: we can see directly the use of financial markets and institutions by asset type.

TWO TRADITIONS OF FLOW OF FUNDS IN THE LITERATURE:
- **VAR and FFAs-** There is relatively recent work by Christiano, Eichenbaum & Evans (2006) which uses VAR with FFAs at a detailed level to gauge the impact of monetary policy in the U.S. This digs a bit deeper than the imposed sectors and measured flows in their macro financial models, reviewed earlier. Ridhwan et al. (2011) is a VAR study of the regional impacts of monetary policy in Indonesia using provincial level data on GDP and trade. As the authors note, Indonesia is a diverse, heterogeneous set of islands and a good place to expect to find geographic or sectorial variations in impact and to try to distinguish the interest rate channel from the bank lending channel of Bernanke, Gertler, & Gilchrist (they have data on firm size).
- **Demand Equations-** There is an older tradition emanating from the seminal work of Brainard & Tobin (1968) understanding the financial systems through demand equations and costs of adjustment (supply equations or policy variables match the demand). In short, that paper emphasizes the interconnectedness across assets and sectors which the flow of funds make explicit. An example of a demand equation approach that takes this into account for policy is a study of Green et al (2012), using flow of funds accounts from the Reserve Bank of India.

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  - Transactions outside formal banking system

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NOTES, CONTINUED…

MODELING: The interest in this lecture is the use of FFAs for modeling. We can focus on the household side, as in some literature, and on the firm side, in other literature. Recent work of Guerrieri & Lorenzoni (2011) and Piazzesi & Schneider (2010) uses the flow of funds data from the household sector to model financial crisis and to determine the impact of shifts in inflation expectations, respectively.

- **HOUSEHOLD SECTOR AND FINANCIAL DECISIONS:** The focus of Guerrieri and Lorenzoni's paper is on the household sector and financial decisions (though the instruments and choices are typically restricted, exogenously, as in borrowing constraint models). Households consumers solve dynamic stochastic optimization problems by their choice of consumption (durables and nondurables), labor supply (at a wage determined by exogenously variation productivity, subject to a Markov process), and saving and borrowing (up to a limit). An unexpected, permanent tightening in a consumer borrowing capacity forces borrowers to deleverage and savers to accumulate more buffers, as future borrowing is more limited. This direct and indirect net increase in saving forces the interest rate on bonds (saving accounts) down. In fact, the interest rate overshoots due to the nontrivial distribution of wealth; there is a strong adjustment for those with low wealth. Cuts in consumption and increases in labor supply move output in opposite directions. The consumption effect is stronger when there are nominal rigidities. Durable goods adds another asset and another margin of adjustment. This model is as applicable to macro as it is to financial access, where, presumably, the process runs in reverse, toward liberalization rather than tightening.

- **FLOW OF FUNDS AND CHANGES IN WEALTH:** Piazzesi and Schneider's paper draws explicitly on flow of funds for studying large changes in the size and composition of net wealth driven by demographics and expectations. In the U.S. in the 1970's, net worth dropped by 25% on average and the portfolio shifts from equity to real-estate dropped by about 20%. The authors attribute these to entry into the market by baby boomers, lower aggregate saving, increased price of housing, changed expectations, and the erosion of bond portfolio by surprise inflation. The key state variables are the joint distribution of asset holdings and incomes as well as heterogeneous expectations. All these are taken from the Survey of Consumer Finances micro data and the Michigan Survey of Expectations of Prices and Income. The authors adopt a temporary equilibrium framework so that they can equate asset demands to supply (coming from the other sectors in the FFAs) without solving forward looking optimization problems.

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▸ CFSP projects underway: Measure and Model
  ◦ Flow of funds in Thailand, Mexico, Brazil
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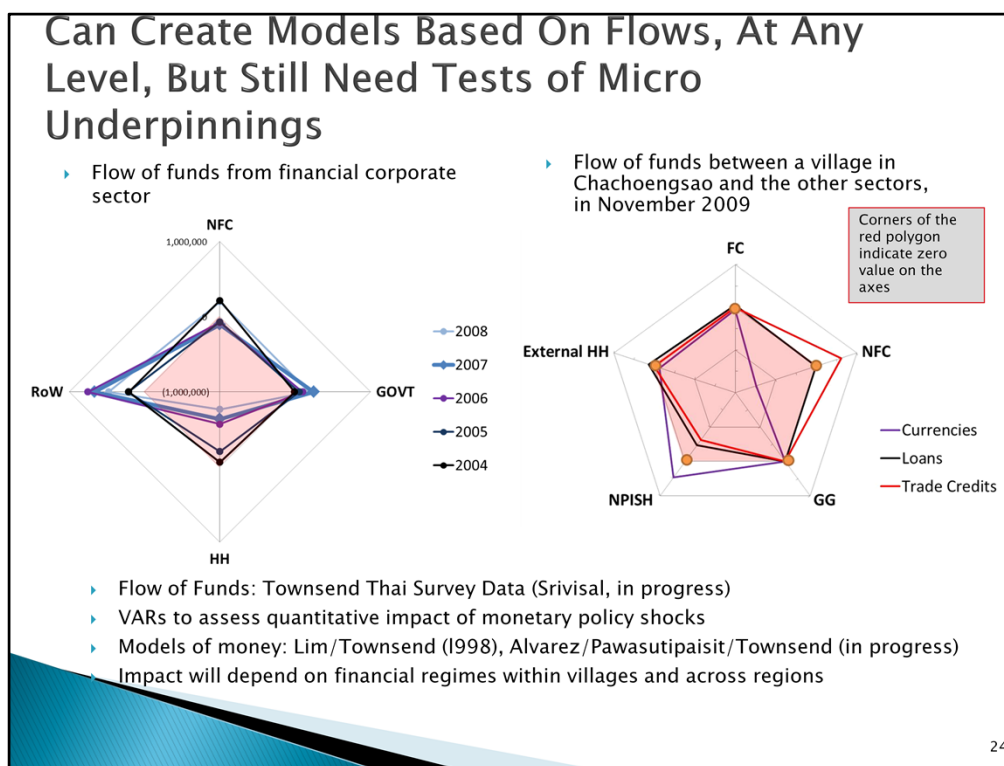 ◦ Transactions outside formal banking system

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NOTES, CONTINUED…

OTHER PAPERS IN THE HOUSEHOLD TRADITION: Chatterjee et al. (2007) model consumers and their borrowing subject to understood contingencies that allow them to default on lenders. They use the model to match both micro statistics on bankruptcy and unsecured credit as well as macro aggregates, earnings, and the distribution of wealth. Livshits et al. (2007) use a life cycle model and directly parameterize expense shocks.

FIRMS: A firm financing literature begins with the key financing constraint in representative firm models of macro (reviewed earlier in this lecture). As reviewed in Chari et al. (2008), there are supposed to be binding collateral constraints, wedges between internal and external funds, and fluctuations in these which impact investment. But looking at the U.S. flow of funds, the typical non-financial firm sector is not a net borrower seeking to finance investment or other activities; in fact, the firm is paying dividends. Chari et al. (2008) thus argue that we need data on non-financial firms. This is crucial to an understanding of how financial market disturbances affect the broader economy and for learning how to design appropriate regulatory policy for financial markets.

CONSORTIUM ON FINANCIAL SYSTEMS AND POVERTY (CFSP): CFSP is a research organization that features a working group on flow of funds with the goal of enhancing measurement and using FFAs in models. Many of the papers discussed on this page were featured at a recent conference. More information on this event, including the proceedings and presentations, can be found at http://www.cfsp.org/research/workshops/flow-funds-accounts-and-savings-workshop. The Consortium has also entered into partnerships with developing countries, including Mexico and Thailand, to improve flow of funds and their use in models and in policy making. For more information on the project with Mexico, please visit http://www.cfsp.org/research/research-projects/regional-approach-financial-savings-and-intermediation#.UJGZvG8mToE.

Can Create Models Based On Flows, At Any Level, But Still Need Tests of Micro Underpinnings

MEANING OF THE FIGURES: FFAs can be used within a country at various levels of aggregation. Traditional FFAs are illustrated by the figure on the left for Thailand, and unconventional FFAs (as in the future) are on the right for Thai villages. Both of these pictures are possible due to the standardization of measures through NIPA. These figures come from Srivisal (2012).

WHAT THE FIGURES SHOW: In both figures, deficits and surplus are measured relative to diamonds. On the left, net flows of each traditional sector with the formal financial system are shown for various years. Typically, there is a surplus generated from the household sector (HH) and deficits from the rest of the world (ROW). The dividing line between a surplus and a deficit is the edge of the pink diamond. We see variation at the national level over time. On the right, a village in the Townsend Thai Data is running a deficit with the village fund (NIPISH) in cash and a surplus in trade credit with outside nonfinancial corporations (NFC).

This measurement tells us that economies at various levels are interacting with each other, but the exercise is not a substitute for modeling. For example, cash plays a large role in mediation in the relationship between a village economy with the outside world. Alvarez et al. (2012) study the transaction demand for cash, i.e. when to hold and when to go to the bank. Cash is, as observed, a financial transaction on center stage. Holding a lot of cash might suggest transaction costs are high. Ultimately, the impact of monetary policy on the village economy will be determined.

Outline

1. Understanding the unit of analysis and the data
2. What Applied General Equilibrium Development Economics is (and what it is not)
3. **Micro Underpinnings**
   1. Insurance
   2. Credit
   3. Obstacles to Trade
4. Putting together micro and macro
5. Conclusion

In the slides that follow, we focus on what we learn when we interact micro data with the benchmark standards that come from the as-if-complete-market hypothesis, how to do this, directions of the literature, and what we have learned. We focus first on the topic of insurance and credit, though it is really about financial intermediation. We then turn to obstacles to trade and how to test for exogenous and endogenous markets and for financial/information regimes.

Tests of Micro Underpinnings I: Insurance

- Benchmark standard: Pooling idiosyncratic risks, sharing aggregate risks
  - Standard methods, from theory: Wilson (1968)
  - Efficiency of village economies: Townsend (1994); Udry (1994)
  - U.S.: Altug and Miller (1990); Mace (1991); Cochrane (1991); Altonji, Hayashi and Kotlikoff (1992)
  - International, cross-country: Leme (1984)
  - Critiques/Improvements
    - Fixed effects: Ravallion and Chaudhury (1997)
    - No content to average coefficient/co-movement: Deaton (1990)
    - Noisy income measurement and difficulty of detecting idiosyncratic from aggregate shocks: Alderman and Paxson (1992)
    - Low vs. high frequency, low is worse: Attanasio and Davis (1996)
      - If individual is on his/her own, then back to life cycle: Attanasio and Weber (2010)
- Heterogeneity in risk preferences: Needs to be included
  - Schulholfer-Wohl (2008); Chiappori and Paiella (2011); Mazzocco and Saini (2012)
  - Chiappori, Samphantharak, Schulhofer-Wohl and Townsend (2012)
    - Accept null in 15 out of 16 villages; not just pooling idiosyncratic risks, also co-movement with aggregate shocks

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METHODS USING BENCHMARK STANDARDS: Originally these methods were used in U.S., as well. The literature has now settled on what is standard and there is consensus on how to carry out these tests.

HETEROGENEITY: Risk aversion seems to vary across household units. This can be determined by the way in which economies deal with aggregate shocks, namely, how to share them ex ante. With heterogeneity, the benchmark standard Is not rejected. This is telling us how to think about policy and how to handle aggregate risks.

Tests of Micro Underpinnings I: Insurance (cont.)

- **Identification, non-parametric: Possible in principle, sample size issue**
  - Mutuality principal, no consumption crossings
  - With labor, unitary household literature: Chiappori (1988, 1992); Chiappori and Eckland (2009)
  - Ordinal and cardinal identification with individual labor supply and consumption dat : Bonhomme, Chiappori, Townsend and Yamada (2012)
  - Contrast: infinite family, pseudo islands: Heathcote, Storsletten and Violante (2012)
    - In development, kinship networks, actual village islands, and real space constraints
- **Extension to multiple variables: Should be done systematically**
  - Alem and Townsend (2012)
    - If full risk sharing ⇒ joint implications for consumption and investment
    - Shadow price of aggregate consumption ⇒ as if "risk neutral" firm, maximizing expected profit
- **Extension: Consumption-based capital asset pricing model, contemporary finance meets development**
  - Euler equation delivers expected return and risk premium if there exists co-variation with aggregate shocks: Samphantharak and Townsend (2012)
- **Distinguishing from permanent income, incomplete markets: Can be done**
  - Previously, hard to distinguish: Paxson and Alderman (1992)
  - But now, can distinguish insurance against permanent and transitory shocks, related to excess smoothness literature: Campbell and Deaton (1989); Lim (1992); Blundell, Pistaferri and Preston (2008)
  - New wave of explicit tests across regimes, of risk sharing vs. permanent income model, and in general equilibrium (see below!)

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INDENTIFICATION: One should make sure that findings are robust (as free as possible from parametric functional form assumptions). One can then test for what goes on within the black box of the family or risk sharing group through limited observables, e.g., labor supply only. This can help macro find empirical analogues to "islands."

MULTIPLE VARIABLES: It is not exclusively about consumption and income anymore. The same framework has implications for multiple variables such as investment, through common shadow prices, and these implications need to be tested at the same time. In applications, one can do better on one variable and not the other, giving a potentially misleading picture. If one is doing well on both variables this would rationalize the separation of households from firms, and the latter would appear to maximize expected profits.

CAPM: We can test for financial market/institution efficiency analogous to a method from finance, applied to risk sharing groups. The rate of return on an investment project (or collection of household/firm assets) should be higher the more the project return co-moves with the group average return. In contrast, idiosyncratic risks are pooled away entirely, with prices equal to probabilities.

TESTS OF COMPLETE VERSUS INCOMPLETE REGIMES: Despite early controversies, methods now exist to distinguish the permanent income model (widely used in macro) and the risk sharing model (now used in both micro and macro). This goes to the heart of the a priori division of these fields, with some convinced that the world is a place with exogenously incomplete markets and others convinced of a world with endogenously incomplete contacts/markets, closer to full risk sharing. This is now reduced to an empirical question, though we should be mindful that in the context of more fully specified models there remains a question of tractability if we stop short of full risk sharing (see the slides that follow).

Tests of Micro Underpinnings I: Insurance (cont.)

- Geography: Key building blocks
  - Individual vs. household vs. village, region, nation, cross-countries
    - Kenya: Suri (2011)
    - Cote d'Ivoire; Deaton (1990)
    - Pakistan; Rashid (1990)
    - Thailand: Paweenawat and Townsend (2012) and Kilenthong, Phongthiengtham and Townsend (in progress)
- Battery of tests all in one country: Needed, become part of policy toolkit
  - Shocks
    - Rainfall: Paxson (1992)
    - Rubber: Townsend Vickery (2004)
  - "Macro markets: Creating institutions to manage society, greatest economic risks" Shiller (1995)
    - But what is really missing: Need these micro tests!
- A priori targeting, financial access vs. theory/data tests
  - Within village but poor with family ⇒ do well
  - Across village still quite good ⇒ remittances and rainfall
  - Despite safety net literature, groups not actually vulnerable ⇒ female, elderly: Alem and Townsend (2008)
  - Rainfall insurance: Gine (2010); Cole, Gine, Tobacman, Topalova, Townsend and Vickery (2012)
    - Take up is mixed: Lack of underlying test of benchmarks haunts the discussion
    - But see using take up to distinguish models: Karlan, Osei, Osei-Akoto and Udry (2012)

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GEOGRAPHY: Risk sharing can be tested at various levels of geographic aggregation. It is a nice theory in that way, as we don't have to take an a priori stand on the risk sharing unit. This also tells us how the country is put together, geographically, and thus how to do segment macro models into key micro categories.

BATTERY OF TESTS: Likewise, we move beyond tests of one theory in one sub-unit to think about a battery of tests, all in one country, across a variety of shocks. That is, we use benchmark standards to see if anything is missing, as in missing macro markets.

CAVEAT ON A PRIORI TARGETING: Similarly, we should not target a priori vulnerable groups using only supposition. This links policy to measurement, theory, tests, and the algorithm mentioned earlier, an operational agenda. Research that brings a fixed financial product to an economy to see if it works only to find take-up low can miss this fundamental point: that the product may not be needed in some instances.

Evaluation of Existing Institutions

- Formal Institutions: Alem and Townsend(2012)
  - Joint tests, consumption, cash flow, investment
  - Score card for formal institutions
    - commercial banks, BAAC, credit cooperatives
  - Not what is done in "international best practice"
- BAAC risk contingency systems, part of operating system, misdiagnosed in Asia crisis
  - ⇒ inappropriate capital adequacy ratios (Townsend and Yaron 2001)
- Informal networks: Hot topic, rightly so
  - Lamoreaux (1986); Rosensweig (1988); Mueller Townsend (1998); Munshi (2002); Dercon (2002); Angelucci and DeGeorgi (2009); Fafchamps and Lund; Chandreskar, Kinnan and Larreguy (2011); Banerjee, Chandrasekhar, Duflo, and Jackson (2012); Interaction of formal/informal:
- Interaction:Gine (2001), Mobarak and Rosenzweig (2012, Kinnan and Townsend (2010)
  - Indirect connection is as good as direct
  - Those not connected at all ⇒ shown to be much more vulnerable
    - Difference between consumption and investment
    - Modeling investment requires kinship, penalties for reneging
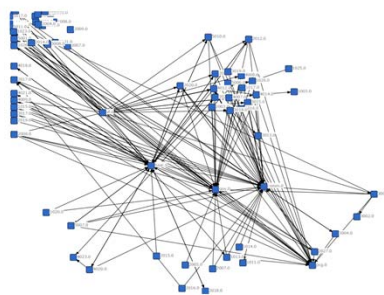
Networks: Measured Connections Across Households and with Outside Financial Institutions (Kinnan–Townsend, 2010)

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KEY BUILDING BLOCKS: What are the appropriate sectors, dichotomies, and/or micro labels?

FORMAL INSTITUTIONS: This slide features formal financial institutions and the role they play in risk reduction, in terms of how they could be rated based on the general equilibrium framework and how they can be misunderstood and thus regulated inappropriately.
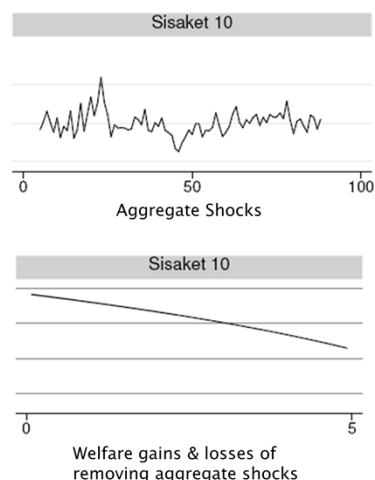
INFORMAL INSTITUTIONS: The informal kinship groups and networks are also featured, playing the salient role, at least for local shocks.

INTERACTION BETWEEN THE TWO: The interaction between formal and informal categories creates a kind of hierarchy. Some agents are directly connected to formal sector, while others are indirectly connected via informal ties (either transactions-based or family-based). Thus the role of the informal system in support of formal financial access is featured, something not clear in the first generation models which featured a strict dichotomy between financial intermediation and financial autarky. This matters for policy. Not making this distinction leads to underestimating the outreach and role of the formal financial system and to underestimating the degree of vulnerability of those not connected at all.

NOT ALL SMOOTHING IS ALIKE: Though full risk sharing has implications for the smoothing of consumption and investment against income fluctuations in practice, the data shows that there are differences with consumption smoothing supported by active transactions in gifts and loans and investment smoothing supported by the threat of kinship penalties.

Policy Implications from General Equilibrium slide (slide 30)

TARGETING CAN CAUSE DAMAGE: Given the existence of risk syndicates, the opening of markets and greater financial access can have counterintuitive, adverse effects.

THROUGH HETEROGENEITY IN RISK PREFERENCES: The more risk tolerant members of a risk sharing group absorb more of the aggregate shocks, as pictured in the figure in the upper right, and receive an implicit premium in the form of higher average consumption. If access to an outside institution or government program allowed greater insurance against aggregate risk, there would be welfare losses for that risk tolerant group, as shown in the graph; the zero line is the second horizontal line from the top.

THROUGH BORROWING AND LENDING: Likewise, an informal risk syndicate might be providing ex ante inter-temporal insurance against shocks, some of which make some households more urgent to increase expenditures while others cause households to remain patient. If these types of shocks are private information, even within the risk syndicate, then in a group social optimum there should be high powered incentives to reveal truthfully. This is best done by restricting ex post borrowing and lending ex-post, even after shocks are realized. Increased borrowing and lending with outside markets can undercut high powered incentives and cause everyone in the syndicate to be worse off, ex ante. The latter ex ante criterion is the correct welfare criterion from the perspective of setting up institutions or, ideally, governments making policy.

GUIDANCE FOR REGULATION AS WE FACE THIS MIX: The bottom line is that financial access is a blunt instrument which may not respect heterogeneity in risk preferences and shocks. On the other hand, as was noted earlier, indirect financial access can be beneficial. Thinking through this tension can be productive. With better theory we can get some guidance for regulations being debated and implemented in the U.S., Europe, and other places. We do not want one ad hoc framework for developing countries and another for the seemingly more advanced economies. We do want regulation based on theory and measured environments.

Theory of Endogenous Groups: What Is Done Within a Group vs. Outside It?

- Joint liability is key helpful example in development
- How to test theory/models
  - Using repayment data to test across models of joint liability lending: Ahlin and Townsend (2007 *EJ*)
  - Testing these theories
    - Project choice: Stiglitz (1990)
    - Monitoring: Banerjee, Besley and Guinnane (1994)
    - Reneging: Besley and Coate (1995)
    - Adverse selection: Ghatak (1999)

Repayment Implications

An entry marked with a "‡" corresponds to a variable not included in the original model.

	Effect on Repayment			
Variable	Stiglitz	BBG	BC	Ghatak
liability payment q	↓^{a}	↑		↓
positive correlation	↑‡^{b}		↓‡*	↑‡*
cooperative behavior	↑‡	↓‡*	↓‡*	
cost of monitoring		↓		
official penalties			↑	
unofficial penalties			↑	
screening				
productivity H	↑‡	↑‡	↑‡	↑‡
interest rate r	↓	↓	↓	↓
loan size L	↓	↓‡		↗↘‡

  - Adverse selection into groups: Ahlin and Townsend (2007 *JE*)
    - Testing relative performance vs. groups: Holmstrom and Milgrom (1990)
    - Including the distribution of wealth: E.S. Prescott and Townsend (1999)
- Note: This approach is applicable more generally to industrial conglomerates, literature on tunneling, and again formal and informal banking– Bertrand, Mehta Mullainathan (2002), Bond (2004), Samphantharak (2003,) Bertrand, Johnson, Samphantharak, Schoar (2008)

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WHAT GOES ON INSIDE THE BLACK BOX OF SYNDICATES, BUSINESS GROUPS, AND NETWORKS: What is really going on inside a risk syndicate? Theories of joint liability provide candidates. Many of these seem to be about borrowing (the next topic below) but in fact they are really about creating, controlling, and sharing good and bad outcomes. In Stiglitz (1990) it is coordination of the choice of risky project i.e., what kind of risk to bring into the group. In Banerjee, Besley & Guinnane (1994) it is internal monitoring of one member by another in order to mitigate the disincentives of effort. In Besely & Coate (1995) it is about penalties and sanctions for reneging, i.e. not paying when outcomes are successful, and in Ghatak (1999) it is about control of adverse selection through screening, with some types likely to contribute to losses/low income.

HOW TO DISTINGUISH MOTIVE FOR GROUPS (THE MEANING OF THE TABLE): The point is that by looking at the correlation of observed variables with external repayments (as if to an outside lender), the internal mechanics within groups can be inferred. The Townsend Thai surveys contain variables measuring the magnitude of joint liability payments and correlations of income across members, cooperative behavior, the cost of monitoring, official and informal penalties, screening, and productivity along the key default rate on loans.

IT MATTERS FOR VOLATILITY AND THE RESPONSE TO POLICY: Default rates will increase or decrease with interest rates, or with loan size, depending on which model captures reality best. That is one reason for policy makers to care.

ENDOGENOUS GROUP FORMATION, KEY MARGINS: In many instances, groups are desirable for the sharing of risk or for other reasons. They can help outside insurers and outside lenders, as well as member participants, ex ante. But risk sharing and internal ex post transfers can undercut incentives if relative performance contacts are used to award or penalize one member as a function of the performance of another. Different forms of organization, cooperative or competitive, will emerge in a cross section as a function of the correlations of returns of actual or potential members, as well as levels and the distribution of wealth. In Madeira & Townsend (2008) the form of organization for a given group of people moves around over time, occasionally in erratic fashion.

WHY DOES IT MATTER: Macro models built from the bottom up need to take stands on key dichotomies. Business groups may be seemingly stealing from outside investors by channeling resources away from the successful to the less successful members of the group, but the same transfers may benefit internal risk sharing. We also know that cooperative or competitive behavior seems to vary depending on normal time or crisis events. We can use these theories fitted against data to help us think through such phenomena and resolve regulatory controversies, even in advanced countries.

Tests of Micro Underpinnings II: Credit
Savings, Investment, Rates of Return

- This is a test of financial intermediation
  - GE efficiency of entire economy – our main theme
- Unlike consumption smoothing, here there are dramatic failures
  - Certainly in Thai data
  - And failures robust to heterogeneity, geography, formal/informal institutions
- Benchmark standard
  - Equalizing rates of return on assets (better estimated marginal product, but see below)
    - Literature review: Banerjee and Duflo (2005)
      - Persistence of (some) high rates of return
      - High dispersion in rates
      - Money is not flowing from low to high productivity firms
      - Slow adoption of HYV: Foster and Rosenzweig (1995)
      - High returns on fertilizer: Duflo, Kremer and Robinson (2001)
      - High returns to grants/transfers: McKenzie, De Mel and Woodruff (2007)
      - Networks, money does not flow in: Banerjee and Munshi (2004)
    - Coexistence and persistence of productivity differences in the data: Pawasutipaisit and Townsend (2011)
      - Lesson for TFP macro modeling

CREDIT IS ABOUT FINANCIAL INTERMEDIATION: We cannot think about credit alone but rather need to ask about the supply, about lenders. So, this topic is about credit, savings, and outcomes such as measured rates of return.

FINANCIAL INTERMEDIATION IS TYPICALLY TERRIBLE BY THIS STANDARD: Lack of financial intermediation according to the usual benchmark standards is a robust finding in the data and many studies cited in this slide. Topics include high dispersion in rates of return measured in econometric and experimental studies, persistence in rates, money not flowing to those with high returns, and slow adoption of high return technologies. In contrast to the work on insurance described in earlier slides, this failure of financial intermediation holds regardless of region, formal/informal status, and allowance for heterogeneity. One caveat concerns the difficulty in accurately measuring marginal rates of return econometrically when there is unobserved heterogeneity (which we return to in the following slides).

Impact of Micro Finance: Interventions in Thailand and India

- Thailand: Kaboski and Townsend (2012, *AEJ*)
  - Million Baht Village Funds
  - Quasi natural village variation in per capita household treatment
  - Consumption up, income growth up, asset growth down
  - Increase in within-village wage
    - "Cross-country" experiment, confirming devo GE models below
- Banerjee, Breza and Townsend (2012)
  - Strong hints that funds move toward high productivity entrepreneurs
- Hyderabad: Banerjee, Duflo, Glennerster and Kinnan (2010)
  - Heterogeneous impact
    - With existing business, durable expenditures up
    - High propensity to start new business, decrease in non-durables
    - Low propensity, increase in non-durables

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POLICY INTERVENTIONS: For the topic of credit, this lecture focuses more on quasi-natural experiments and policy interventions to see what we can learn through this lens.

IMPACT WITH HETEROGENEITY: RCTs and quasi-natural experiments in Thailand and Hyderabad conducted in different ways yield a nuanced picture of impact with a common theme: impact is not uniform. A government program capitalizing a local fund of one million baht, regardless of the number of households in a village, created quasi-natural exogenous variation in per capita treatment. Using pre-intervention data, there are strong indications that the most productive households got the funds. Note then that the impact is heterogeneous. In a RCT of an NGO in Hyderabad, the impact on consumption and investment varies by propensity to become an entrepreneur.

GENERAL EQUILIBRIUM IMPACTS: The study in Thailand also showed that increased credit, presumably allowing increased local intermediation, also raised local, within-village wages. This is consistent with work in applied general equilibrium development economics, thinking of the intervention as a cross-country experiment, that is, with villages as entire economies (an experiment that would be impossible across actual countries).

IMPACT THROUGH THE LENS OF A STRUCTURAL MODEL: Kaboski & Townsend (2012) adopt a buffer-stock model, that is, borrowing and lending with an upper bound on credit, and also include the arrival of fixed-size, lumpy/large investment opportunities. They estimate the model using GMM on six years of pre-intervention data, model the Million Baht Fund intervention as making credit availability more liberal, and then compare model predictions with what happened in reality. This is a dynamic, forward-looking model in which households maximize discounted expected utility. Investment increases the growth of permanent income but there are transitory shocks layered on top of that. There is also a safe way to save, in the bank at fixed interest.
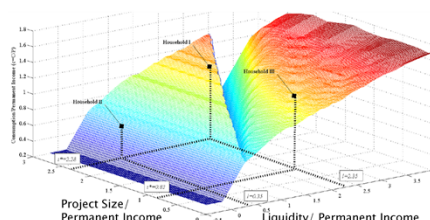
WHAT THE FIGURE SHOWS, HETEROGENEITY: The impact of weakening credit constraints depends on the household's current situation; the stated variables of the model are an investment-size draw and current liquidity (income plus savings in the bank), both relative to permanent income. Some households are in "bankruptcy," allowed by the model, and cannot make current payments on debt even at the maximum credit limit, the flat lower edge of the figure. For these households the program actually makes them worse off, as they are now forced to borrow at interest rather than default. Others are constrained in current consumption and are hand-to-mouth consumers. For these households, an increase in credit leads to a 1-1 increase in consumption. Another class of households are not currently constrained. They do take into account future borrowing, so they need less buffer stocks today and cash out safe-return savings, spending it on consumption. There is also a group of households near the threshold of taking up investment opportunities, and for them the intervention pushes them over the edge, not only investing using funds from credit but also funds from reducing consumption.

PARALLELS TO MACRO IN THE U.S.: The model of household decision making is quite close to Guerrieri & Lorenzoni (2011), though for them, the focus is on the effect of tightened credit as in a financial crisis and its effect in lowering the interest rate. Heterogeneity plays a big role.

UNOBSERVED HETEROGENEITY ALSO MATTERS: What the household sees we as econometricians do not. Namely, we do not see permanent income but rather current income draws, and we see the size of investment only when an investment project is undertaken.

NOTES, CONTINUED…

THE IMPACT OF COUNTERFACTUALS ON POLICY: Many households, but not all, would have preferred to receive government money in the form of a lump sum transfer. But the constrained households gain quite a bit since for them the program focuses on weakening that constraint. Alternative programs such as credit directed to investment, only if undertaken and hence observed, generate alternative (lower) welfare gains.

WHICH MODEL DO WE USE: The underlying financial information regime is imposed in this exercise and indeed the impacts of policy interventions would differ if we are getting the imposed model wrong. Fortunately, the financial/information regime imposed is close to one which fits the data best in data from rural areas (as shown on the next slide). But the point remains that in other contexts an investigation can be vulnerable to the critique that a model is imposed without attention to micro underpinnings and parameter estimates, hence the emphasis in the next slides on estimating financial/information regimes.

ARE THERE THEORY-FREE TESTS; THE MEANING OF IMPACT PARAMETERS IN AN RCT: An alternative thought is that structural models are simply too limiting and that RCT evidence is more robust. However, this reasoning is typically incorrect. The policy impact parameters in instrumented regressions, including tests of mean differences comparing control and treatment samples, rely on two assumptions: monotonicity, that treatment moves everyone in the same direction and independently, and that error terms in outcomes equations are independent of treatment. With these, the impact parameter is the effect of the program on those induced to take it up (the local average treatment effect). But without these two assumptions, the impact parameter is some mongrel weighted average across the population, weighted by unobserved heterogeneity, and so we do not know much at all about who is benefiting and who is not.

AN EXAMPLE OF LOST MEANING WHICH MATTERS QUANTITATIVELY: For example, we can estimate the impact of improved financial intermediation on incomes, but we cannot estimate the impact of that intervention on the profits of entrepreneurs. This is due to a double margin: financial take up and occupation choice (the key ingredients of applied general equilibrium development economics). For example, some current entrepreneurs drop out of business and put money in savings, and other talented actual and would-be entrepreneurs borrow and expand or start businesses. The imagined target, actual businesses, are in business due in part to a talent variable which also appears as an error terms in the regressions.

Modeling These Interventions

- ▸ Kaboski and Townsend (2012, *Econometrica*)
- ▸ Heterogeneous impact: Key variables are liquidity, size/permanent income, which are unobservable
  - ◦ Near default ⇒ consumption flat
  - ◦ Binding liquidity ⇒ consumption up
  - ◦ Near investment threshold ⇒ consumption drops
- ▸ Advantage of structural model
  - ◦ Can quantify distribution of welfare gains
  - ◦ Can do counterfactual policies
  - ◦ This is very much like Guerrieri and Lorenzoni (2011), impact of credit tightening in financial crisis (with interest rate effects), mentioned earlier!
  - ◦ See also Davila, Hong, Krusell, Rios-Rull (2007) on ge efficiency considerations
- ▸ Disadvantage: Sensitive to assumed financial structure
- ▸ On the other hand, with unobserved heterogeneity there are few "theory free" tests ⇒ back to identification
- ▸ Estimation of impact parameters needs monotonicity, independence
  - ◦ Angrist and Imbens (1994); Heckman and Vittacil (2006); Heckman and Urzua (2009)
  - ◦ Townsend and Urzua (2009)
    - · Cannot cleanly estimate impact on profits of entrepreneurs due to double margin
    - · Microfinance (saving and credit) jointly with occupation choice
- ▸ Future Directions: Where we are and where we need to go
  - ◦ Where to put the structure: Attanasio , McGuire and Santiago (2005); Todd and Wolpin (2006)
  - ◦ Model selection bias, over-fitting: Wolpin (2007)
    - · Remedies: Split sample, experimental data
  - ◦ Sufficient statistics: Chetty (2009):
    - · But not universally applicable as with mechanism design
  - ◦ Data come from an equilibrium: Hotz and Miller (1993); Bajari, Benkard and Levin (2007)

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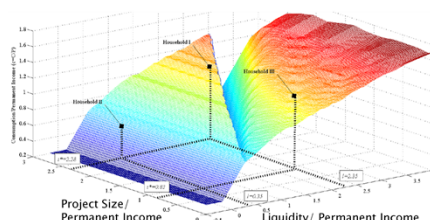
NOTES, CONTINUED…

HOW TO CHOOSE MODELS: The literature cited in the slide compares two different structural models applied to the same program, worries that repeated efforts to fit structure to a given data set or experiment can lead to over fitting (and bad predictions out of sample), argues for the holding back of samples to do model validation, focuses on welfare criterion directly and consequently reduced form elasticities, and acts as if the data we see is an equilibrium so that we do not need to solve for dynamic stochastic paths. The bottom line, though, is that there is no magic bullet.

Micro Underpinnings III: Obstacles to Trade/Mechanism Design
(We no longer need to assume complete or incomplete markets without looking)

- ▸ Motivating facts: Testing for full insurance in repeated cross-sections/panel/inequality histograms: Deaton and Paxon (1994); Jappelli and Pistaferri (2009)

But, rejects to what?

Exogenous incomplete markets
- ○ Deaton (1987, 1991, 1992); Campbell and Deaton (1989); Carroll (1992); Huggett (1993); Aiyagari (1995); Bewley (1997); Krueger and Perri (2007)

Endogenous incomplete, mechanism design
- ○ Breakthrough, dynamics: promised utility dynamics: Green (1987); Abre, Pearce and Stacchetti (1986); Spear and Srivastava (1990)

Empirical Implementation

Numeric, linear programs
- ○ Phelan and Townsend (1991)
- ○ Fernandez and Phelan (1991)
- ○ Doepke and Townsend (2006)
- ○ Lehnert, Ligon, Townsend (1999)

First order approach
- ○ Moral Hazard: Rogerson (1985)
- ○ Permanent income vs. moral hazard: Ligon (1998)
- ○ Limited commitment: Ligon, Thomas, Worral (2002)
- ○ Moral hazard, unobserved output: Kinnan (2012)
- ○ Permanent income vs. private information: Abraham and Pavoni (2004); Attanasio and Pavoni (2010)

Methods of bringing it back together: Linear programs, dynamic programs, maximum likelihood estimation, fitting histograms, multiple variables (Karaivanov and Townsend, 2012)

○ Autarky	○ Unobserved output
○ Buffer stock	○ Moral hazard
○ Borrowing/lending	○ Moral hazard with
○ Limited commitment	unobserved capital

Need to reintegrate

▸ Findings
- ○ Consumption smoothing good
- ○ With joint variables
  - · Urban, towns ⇒ endogenous mechanism design
  - · Rural, villages ⇒ saving, borrow/lending

- ○ New Dynamic Public Finance: Mirlees (1971)
- ○ Review: Golosov, Tsyvinski and Werning (2006)

▸ Exciting direction!
- ○ Lim (l992), Meh and Quadrini (2006); Ai and Yang (2007); Schmid (2008); Dubois, Julienan and Magnac (2008); Kocherlakota and Pistaferri (2009),

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WHAT TO DO WHEN THE BENCHMARK STANDARDS FAIL: The point is to estimate in one way or another the best fitting financial information regime, comparing regimes statistically rather than assuming an underlying model and/or outcome. All of the references on this slide have that in common, so the main message of the slide is that the empirical work can and is being done to judge what obstacles are important, or in some instances, if there are obstacles at all.
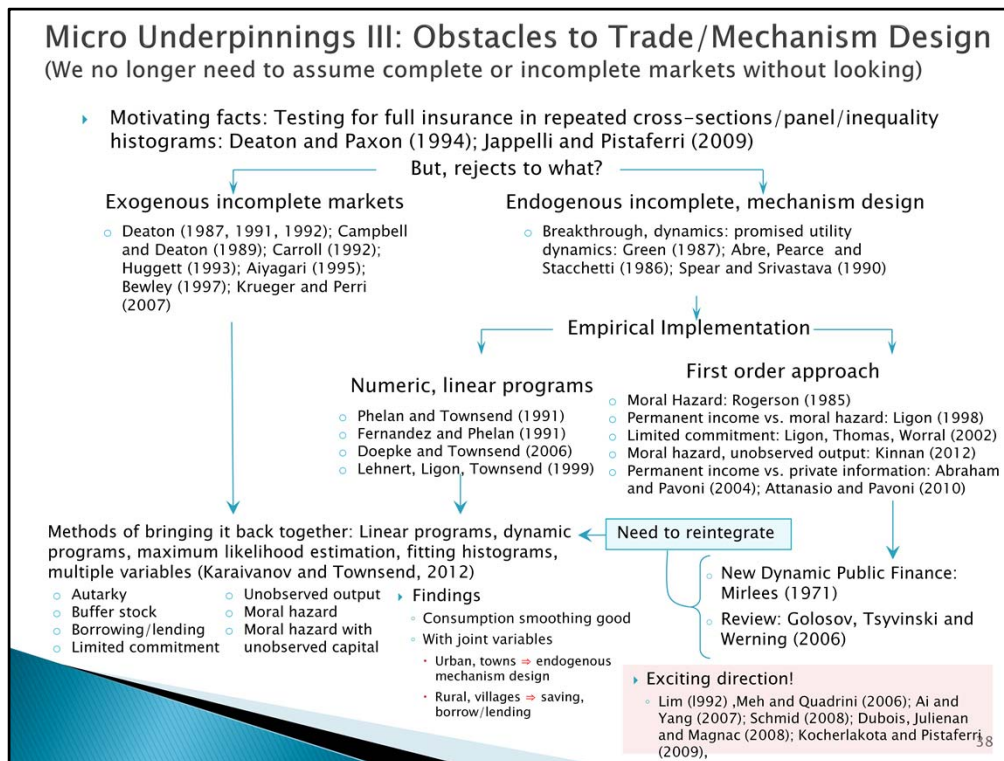
WHAT THE SCHEMATA MEANS: There are two branches: one imposing incomplete markets on the left and another with endogenous contracts on the right that is trying to estimate and distinguish financial information regimes.

INCOMPLETE MARKETS: Permanent income and incomplete markets is the path on the left, with references beginning with Deaton, as marked.

MECHANISM DESIGN: The alternative path, less traveled initially, is that of mechanism design on the right. A breakthrough is the recognition that in the theory, promised future utility is a key state variable (for incentives, decision makers care only about contemporary and future utility consequences), with references beginning with Green, as marked.

SUB BRANCHES: In turn there are two sub branches on the right, with the break in the middle of the page. The far right branch derives first-order conditions of recursive problems like moral hazard, e.g., Rogerson and others. In turn, this has led to the New Dynamic Public Finance beginning with Mirlees, as marked. The second sub path recognizes that the first-order approach may be violated. Binding incentives constraints may involve jumps to combinations of counterfactual behavior. This begins with Phelan and Townsend, as marked.

INTEGRATION, BRINGING IT ALL TOGETHER: There is integration and a unified view at the bottom of the slide. This includes reintegration of new dynamic public finance with mechanism design. We can convert any financial/information regime to a collection of linear programming problems, making use of linearity even when the underlying environment is not convex (e.g. incentive-constrained allocations). This is marked Karaivanov and Townsend. Distinguishing regimes is thus possible empirically, implemented by making use of dynamic programs, these linear programs, and likelihood functions. Actually, one is fitting empirical histograms which was the start of the top of the slide, marked as Deaton and Paxon.

Micro Underpinnings III: Obstacles to Trade/Mechanism Design
(We no longer need to assume complete or incomplete markets without looking)

NOTES, CONTINUED…

FINDINGS FROM THE THAI RESEARCH AS A SALIENT EXAMPLE: The Thai research project tests across a large spectrum of financial information regimes: financial autarky, savings only, credit constrained, borrowing and lending, moral hazard, moral hazard with unobserved capital, unobserved output, and limited commitment/reneging. We find that savings only, or unrestricted borrowing and lending, fits best in the rural data, though this is due to the influence of persistent capital as anticipated earlier in the discussion on rates of return. But an endogenous constrained regime, moral hazard, fits best in urban communities. Networks help particularly with consumption data, where the full information regimes can be a close tie for first place, but this is never the case for investment. Using multiple variables helps in goodness of fit (and in simulated data in Monte Carlos overcomes considerable measurement error). The bottom line is that a single overall economy, Thai economy, has multiple information financial regimes coexisting with each other.

RECOMMENDED LITERATURE: There are others working on making these distinctions across financial information regimes both in macro, using U.S. data, and in development. There is a unity to these efforts, i.e. the whole in greater than the sum of the parts. Distinctions into subfields, such as macro versus development, is artificial.

Outline

1. Understanding the unit of analysis and the data
2. What Applied General Equilibrium Development Economics is (and what it is not)
3. Micro Underpinnings
   1. Insurance
   2. Credit
   3. Obstacles to Trade
4. **Putting together micro and macro**
5. Conclusion

Back to the Bigger Economy–Wide Picture: Applied General Equilibrium Development Economics Using Measured Micro Underpinnings

- Background: Finance causes growth, empirical facts
  - Reduced form: King and Levine (1993); Levine (1997); Rajan and Zingales (1998); Beck, Demirguc–Kunt and Levine (2004)
- Qualitative theory becomes quantitative, theories now estimated in data
  - Occupation choice, investment and credit
    - Lloyd Ellis Bernhardt (1993) LEB; Galor and Zeira (1993); Banerjee and Newman (1993); Aghion and Bolton (1997) → • Big wage effects on poverty reduction, wage more than doubles: Gine and Townsend (2004)
      • Endogenous TFP in transition 78%: Jeong and Townsend (2005)
  - Risk sharing, insurance and endogenous financial deepening
    - Greenwood & Jovanovic (1990) GJ; Bencivenga and Smith (1991) → • Cannot run regressions on transition data: Townsend and Ueda (2006)
      • Welfare losses from government takeover of banking, up to 28% gain from liberalization: Townsend and Ueda (2010)
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    - Roadmap for next generation of models
      - Next wave of models: The literature takes off
        - Financial reforms and the persistence of history: Buera and Shin (2010), Peters (2012)
        - Distinguishing two sectors: Kaboski, Buera and Shin (2009)
        - IInequality and growth: Blaum (2012
      - Transient misallocations: Moll (2010); Banerjee and Moll (2010)
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      - Links to "micro" international Helpman, Itskhoki, Muendler, Redding (2012)

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REDUCED FORM EVIDENCE THAT FINANCE MATTERS: This body of work is now large and influential. The best of these efforts establishes causality. On occasion, results are at the level of compelling correlations, which requires further analysis. There is a literature cited earlier which is also at the level of atheoretic accounting decompositions, namely changes in per capita income and change in inequality, that shows that financial access, education, and sectoral shifts are key drivers.

A THEORETICAL LITERATURE ON GROWTH MADE OPERATIONAL EMPIRICALLY: There are two branches coming off of the Thai research project. One on occupation choice with endogenous wages is associated with a literature on poverty traps and growth dynamics. A second branch has endogenous financial deepening as part of the transitional growth process.
- One of these models Lloyd, Ellis & Bernhardt (1993), LEB, was estimated with micro data and with the work of Gine, mentioned in an earlier slide on discrete choice. Model simulations show that these increases in intermediation can have large, doubling effects on wages, and hence reduce poverty.
- Greenwood & Jovanovic (1990), or GJ, was again estimated in micro data, in the work with Ueda. One paper established that running regressions as in the finance-causes-growth literature leads to spurious interpretations. In a second paper with Ueda, the welfare losses from government take over of the banking system in Thailand, and the gains from a subsequent financial liberalization, can be large, up to 50%.

GROWTH AND INEQUALITY: MODEL EVALUATION AND ESTIMATION:
In Jeong & Townsend (2008) both GJ and LEB capture trends and movements in income and inequality key sectors. Much micro data is compared with the implications of the model, and the models are compared to each other.

The distinction of those participating in the formal financial sector, versus those who are not, is a key building block in both of the models and one which shows up in the data in the direction predicted. The income difference between entrepreneurs and wage earners is positive but decreasing both in the LEB model and in the data, and is lower for financial sector participants. The GJ model gets the trends of income, financial participation, and inequality almost exactly right, and again the income difference of participants versus non participants is as predicted. However, there is more heterogeneity within each sector in reality than predicted by the models, and distinctions across sectors are exaggerated in the models relative to the data (see also below, in the discussion on firm size and a link to international trade). Dynamic movements over time are not in sync entirely with model predictions, i.e. more co-movement and less choppy in the data than predicted by GJ despite aggregate shocks and less movement driven by factor prices than predicted by LEB.

Back to the Bigger Economy–Wide Picture: Applied General Equilibrium Development Economics Using Measured Micro Underpinnings

- Background: Finance causes growth, empirical facts
  - Reduced form: King and Levine (1993); Levine (1997); Rajan and Zingales (1998); Beck, Demirguc–Kunt and Levine (2004)
- Qualitative theory becomes quantitative, theories now estimated in data
  - Occupation choice, investment and credit
    - Lloyd Ellis Bernhardt (1993) LEB; Galor and Zeira (1993); Banerjee and Newman (1993); Aghion and Bolton (1997) ⟶
      - Big wage effects on poverty reduction, wage more than doubles: Gine and Townsend (2004)
      - Endogenous TFP in transition 78%: Jeong and Townsend (2005)
  - Risk sharing, insurance and endogenous financial deepening
    - Greenwood & Jovanovic (1990) GJ; Bencivenga and Smith (1991) ⟶
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NOTES, CONTINUED…

SECOND GENERATION MODELS: A growing literature is rightly attracting much attention.

- **Song, Storsletten & Zilibotti (2011):** Closest to the idea of transitions, they feature an inefficient state-managed manufacturing sector, essentially a state bank-financed sector, in contrast with a highly productive free enterprise sector reliant on self-financed entrepreneurs. Resources, including labor released over time from the inefficient state sector, generate growth without increases in factor prices while ever-increasing savings are invested abroad. Within China, cross-province regressions in which the proportion of private enterprise varies, tell a consistent story for growth of employment, value added, and savings, for example. All of this has to do only with transition dynamics, as is natural for emerging market countries.

- **Blaum (2012):** This paper focuses on inequality and non monotone dynamics. He features sectors within a country which vary in financial dependence due to varying fixed costs. Empirically, there is significant evidence of interaction effects between income inequality and financial development. The negative effect of inequality on the value-added of externally dependent sectors becomes at first stronger and then weaker, as financial development improves. The model itself features a simple proportional collateral constraint on borrowing and does not have a non–intermediated or other inefficient financial sector. A key driver is an inferred and exogenous distribution of wealth.

- **Buera, Kaboski & Shin (2009):** Here, attention is drawn more to cross-country comparisons and much less to within-country dynamics. The key financing constraint is varied consistent with aggregate financial dependency ratios, with other parameters calibrated to match U.S. firm size distributions. Buera et al. has forward looking dynamics, which is elegant but limits tractability, hence the focus on steady states, though Buera & Shin (2010) does feature nice transition dynamics as liberalization of non-financial distortions kicks the system off the steady state.

Back to the Bigger Economy–Wide Picture: Applied General Equilibrium Development Economics Using Measured Micro Underpinnings

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NOTES, CONTINUED…

- **Greenwood, Sanchez & Wang (2012)**: The role of varying financial intermediation with alternative micro underpinnings and costly state verification are featured in this paper. The likelihood of a successful audit is increasing and concave in the amount of resources devoted to monitoring, and the cost of auditing is increasing and convex in the amount of resources spent on this activity. The presence of informational frictions leads to a distortion between the expected marginal product of capital and its user cost, the interest paid to savers, as emphasized earlier. As the efficiency of auditing increases due to exogenous technological progress in the financial sector the size of this distortion shrinks. Attention is focused on steady state growth paths and the fit of the model to data is entirely to cross-country facts, not to transitional dynamics within a country, but again the paper does allow unbalanced growth paths.

- **Helpman et al. (2012):** This paper shows that there are related links to applied general equilibrium development economics in recent efforts in international economics. It focuses on wage and firm heterogeneity and an export sector, using matched work firm data in Brazil. This returns the focus to what is going on within a given emerging market country.

Future Directions for Modeling Under Applied General Equilibrium Development Economics

- Transitions vs. steady state
  - Issues of analytics, computation
- Incorporating mechanism design ⟷
  - Moll, Townsend and Zhorin (2012)
    - Moral hazard vs. limited commitment
      - Urban vs. rural
      - Regional patterns
    - Matters for aggregate TFP, etc.
    - Micro underpinnings matter for aggregation: The premise of this lecture all along
- Incorporating Geography
  - Financial deepening models: Felkner and Townsend (2011)
    - Zooming back into Thai villages, CDD data
    - Occupation choice: LEB fits geographic patterns of concentration
    - Risk sharing: GJ does not fit observed patterns of financial expansion
  - Trade, development and cities
    - Thailand: Paweenawat and Townsend (2012)
    - India: Donaldson (2010); Eaton and Kortum (2012)
    - U.S.: Rossi–Hansberg (2005); Costinot and Donaldson (2012)

	First–Best	Moral Hazard	Limited Comm.	Mixed MH–LC Regime	
GDP	1	0.582	0.614	0.684	
TFP	1	0.704	0.720	0.760	
Capital Stock	1	0.533	0.623	0.676	
Wage	1	0.583	0.641	0.663	
Interest Rate	0.007	–0.046	0.006	–0.010	
% Entrepreneurs	0.089	0.170	0.133	0.133	0.118

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TRANSITIONS VS. STEADY STATE: Largely, we seem to be limited more by computational considerations than by conceptualization of the problem.
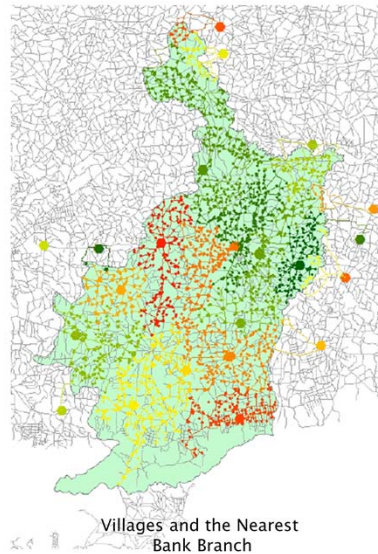
INCORPORATING MECHANISM DESIGN: Moll, Townsend & Zhorin (2012) use the financial regimes estimated in Karaivanov & Townsend (2012) to show that the steady state measures of TFP, productivity and firms' size dispersion, wages, and interest rates vary with the regime. This is the first integrated picture incorporating mechanism design, that is, with a macro model using estimated micro contract underpinnings. The most realistic case of financial regimes which vary within a country, by urban versus rural specification, is not a convex combination of the two integrated countries each with its on single regime. Rather, there are feedback effects through endogenous prices which make the choice of enterprise vary with financing mechanism indirectly, not just directly with variation in distinct constraints.

INCORPORATING GEOGRAPHY: Financial deepening models are integrated with the geography of villages and cities in Felkner & Townsend (2012). The LEB model is consistent with geographic patterns of concentration of enterprise. The GJ model of financial deepening is not consistent with observed patterns of expansion into rural and urban areas; hence, the path is not Pareto optimal. Trade, development, and cities are discussed in a small but growing literature.

Merging Industrial Organization and Development
Applied GE and Respect For Data Leads To Innovations Across Fields

Villages and the Nearest Bank Branch

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THE BEHAVIOR OF FINANCIAL SERVICE PROVIDERS: Mid-way between macro and micro lies the behavior of financial service providers. This slide addresses modeling financial service providers as an explicit supply side. Much intermediation comes through these, as in the flow of fund accounts, rather than through secondary markets. There is exciting work on modeling what the providers do and how they interact with each other, with much of it geographic and transitional given expansion into new markets.

SPATIAL ANALYSIS: The map shows a number of key points. Assuncao, Mityakov & Townsend literally connect patterns of access of villages to the location of bank branches and then model expansion as a dynamic sequential game. The dots represent villages in the Sisaket province with nearby bank locations in 1986. That is, the colors represent associated market catchman area, based on actual travel time on road networks. A model of a profit maximizing bank's interaction strategically with an altruistic government bank is estimated with these data. The outcome is not Pareto efficient.

ENDOGENOUS CONTRACTS FROM EQUILIBRIUM INDUSTRIAL ORGANIZATION: Work underway by Townsend & Zhorin incorporates financial service providers competing not only in location but in financial contracts. Efficiency and the distribution of welfare is the focus.

Larger GE Framework for Policy, Using the Two Welfare Theorems

Works

- Infinite horizon economies
  - "Valuation Equilibrium and Pareto Optimum" Debreu (1954)
  - "Existence of Equilibria with Infinitely Many Consumers and Infinitely Many Commodities: A Theorem Based on Models of Commodity Differentiation" Jones (1983)
- Private information
  - "General Competitive Analysis in an Economy with Private Information" E.C. Prescott and Townsend (1984)
- Indivisibilities
  - "Indivisible labor, lotteries and equilibrium" Rogerson (1988)

May Work

- Externalities and Lindahl Equilibria
- Private information:
  - "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard" E.C. Prescott and Townsend (1984)
  - "Efficient Competitive Equilibria with Adverse Selection" Bisin and Gottardi (2006)
- Collateral constraints and remedies to pecuniary externalities
  - "Information–Constrained Optima with Retrading: An Externality and Its Market–Based Solution" Kilenthong and Townsend (2011)
  - "Market Based, Segregated Exchanges in Securities with Default Risk" Kilenthong and Townsend (2011)
- Application 1: Optimal market design in developing countries

Does not work

- Need Systemic Policy
- OLG, at least in general
- Incomplete markets
- Monetary economies
- Application 2: e–Money

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The welfare theorems, coupled with key general equilibrium environmental features, give guidance to public policy without prejudice; that is, laissez faire or interventionists. Cases can be distinguished as to whether the environment is such that these fundamental theorems hold or not. Various cases can be distinguished.

WORKS: The fundamental theorems of welfare economics hold. This is true even with an infinite horizon, private information, and/or indivisibilities.

MAY WORK: Externalities associated with private information and the way that prices interact with collateral may cause the welfare theorems to fail. A competitive equilibrium may not be optimal. However, this can be remedied by creating and pricing the appropriate market institutions.
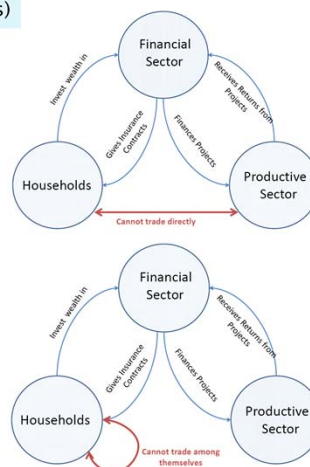
DOES NOT WORK: Systematic, sustained policy is needed, such as the provision of liquidity.

EX ANTE & EX POST COMPETITION: One application under the "May Work" header from the previous slide draws out the distinction between ex ante versus ex post competition. Ex ante competition among intermediaries in the provision of financial services is good; regulatory standards should not create artificial niches that impede that outcome. Ex post trade among households can, however, weaken incentives. Likewise , allowing household direct access to equity markets can cause a problem if that undercuts commitments needed to cover fixed costs of project choice.

Application 2: Kenya, e–Money: Regulation and Monetary Policy in Economies Where Spatial is Real and Matters

- Money, financial deepening, and economic growth
  - Wicksell (1935); Cass and Yaari (1966); Lucas (1980); Townsend (1983)
- Real bills vs. quantity theory, inside and outside money; inflation and growth are not appropriate welfare targets
  - Townsend (1980); Sargent and Wallace (1982); Manuelli and Sargent (2009), Howitt (2003)
- Money as a communication device for history, shocks
  - Townsend (1987); Ireland (1994); Kocherlakota and Wallace (1998); Cavalcanti and Wallace (1999); Kocherlakota (2005)
- Circulating private debt, need for a coordinating device
  - Townsend and Wallace (1982)
- Models of settlement, limited market participation, monetary policy
  - Lucas (1990); Grossman and Weiss (1983); Rotemberg (1984); Romer (1987); Christiano and Eichenbaum (1992); Fuerst (1992); Lacker (1997); Perez–Verdia (2000)
  - Actual optimal liquidity management
  - Friedman and Schwartz (1963)
    - Interest rates and agricultural cycle in the U.S. prior to and need for Federal Reserve
  - Freeman (1996); Green (1999)

Jack, Suri and Townsend (2010)
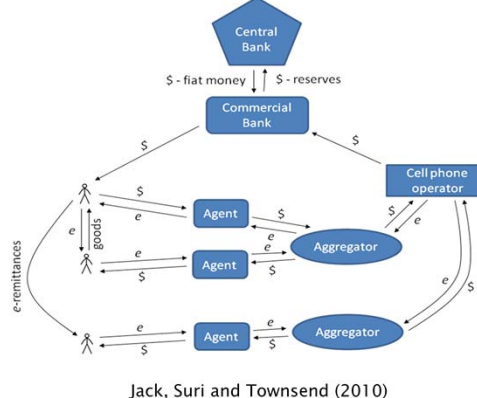
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THE PROCESS OF E-MONEY: This schemata describes the process of e-money by noting the flow of funds and payments; this type of description is needed in other countries. Cash is a payment device, as well, but e-money allows more centralization.

POLICY IMPLICATIONS: Several policy implications for e-money can be drawn from existing literature.

- Improved (tele) communications with credit facilitates growth.

- The metrics for policy are the Pareto criterion and not monetary aggregates and inflation per se, as private intermediation and private money can be a good things.

- Money, especially with electronic records, can serve as a communication device.

- Multiple circulating private e-moneys can cause a coordination problem.

- Models of limited asset market participation already tell us, depending on who is trading with whom, what the impact of monetary policy can or should be. Kenya provides a setting where we can be explicit and realistic about separation in space. Monetary policy as related to liquidity follows naturally.

Outline

1. Understanding the unit of analysis and the data
2. What Applied General Equilibrium Development Economics is (and what it is not)
3. Micro Underpinnings
   1. Insurance
   2. Credit
   3. Obstacles to Trade
4. Putting together micro and macro
5. **Conclusion**

Conclusions: Understanding

- Micro financial underpinnings are key for understanding
  - Village, regional and macro financial phenomena
  - Welfare/policy analysis
- Well-measured and tested micro underpinnings are needed
  - Choices made in model construction do matter
- Have created a platform, method of analysis, which goes beyond development
- New directions that emerged as we explored the interface of theory and data, micro and macro
  - Formal vs. informal, and their interaction
  - Geography
  - Hierarchy/layers
    - villages as open economies
    - endogenous liability groups
  - Heterogeneity
  - Identification
  - Mechanism design
  - The merging of subfields (macro, finance, development, io)

Conclusions: Policy

▸ Policy evaluation and policy recommendations emerged
  ◦ Diverse impact of interventions with heterogeneity
  ◦ Indirect GE effects are large
  ◦ Endogenous TFP with improved intermediation
  ◦ Welfare losses from government takeover of banking systems
  ◦ New approach to targeting
    • Use scorecard/rating for financial institutions
  ◦ Policymakers help create and improve crucial flow of funds (and other) accounts
  ◦ Not blind "international best practice" to regulation of financial institutions
  ◦ The two fundamental theorems of welfare economics provide an overall guide to policy
    • Recommendations for the overall optimal market design and regulation
    • Systematic monetary interventions with the advent of e-Money

Conclusions: Operational Agenda

▸ We are on the ground doing it, not just abstract theory talk
▸ Thailand: Incorporation of key variables in BoT Financial Access Survey
▸ World Bank–IMF Spring Meeting on Financial Inclusion, G20, April, 2012: Financial access
  ◦ Some do not need insurance
    · Informal networks in village
  ◦ Guidance for targeting
    · Poor without family in village
  ◦ Some risks covered, some not
    · Rain vs. rubber prices
  ◦ Access and quality (efficiency) are distinct concepts
▸ Consortium on Financial Systems and Poverty–CFSP
  ◦ Country–specific MOU's, partnerships
    · Design of payment systems: Mexico
    · Flow of funds: Mexico (CNBV); Thailand (NESDB)
    · Micro financial models of macro economy: Brazil (BACEN)
▸ Conference on "Financial Deepening, Macro–Stability, and Growth in Developing Countries"
  ◦ Co–hosted by the International Monetary Fund, the World Bank, the Consortium for Financial Systems and Poverty, and the UK Department for International Development, September 24, 2012, Washington DC