**Regional Training of Trainers
on how to design, negotiate, and implement FTAs**

Session 1C:
Trade Related Empirical Methods and Analysis
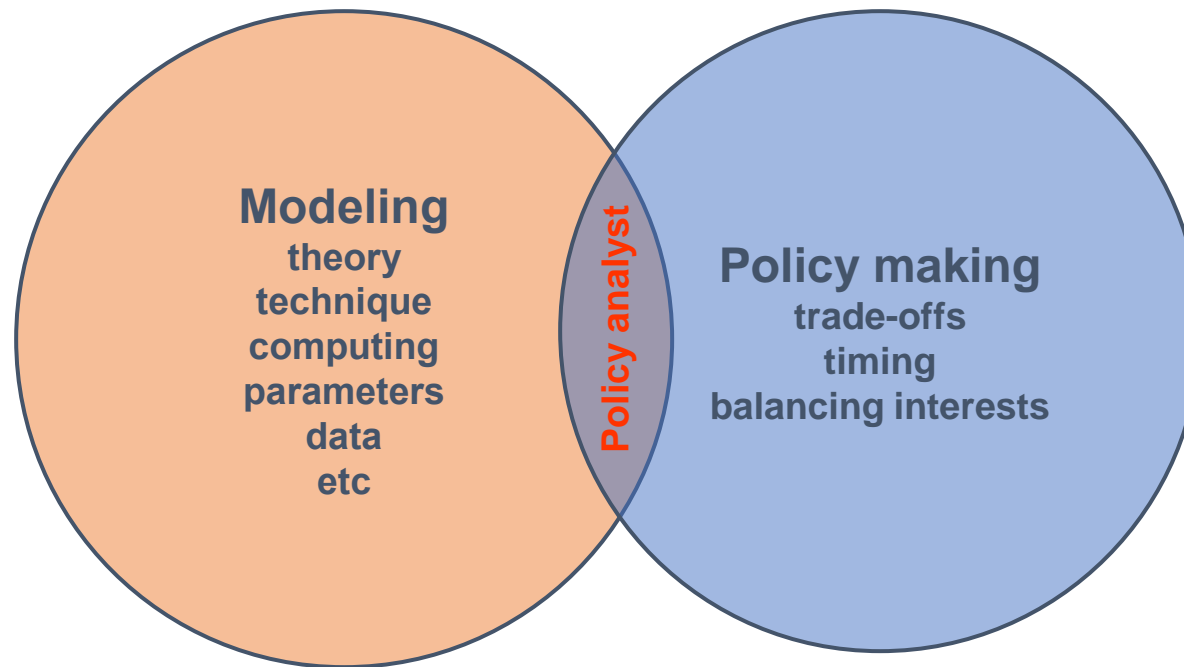
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Contents

1. General considerations for Policy Modeling
2. Examples of GE applications
3. Overview of Social Accounting Methods
4. Overview of GE Modeling

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The policy research balancing act

Modeling
theory
technique
computing
parameters
data
etc

Policy analyst

Policy making
trade-offs
timing
balancing interests

What General Equilibrium (GE) Modeling Offers

The modern economy is far too complex for simple rules of thumb to achieve anything approaching optimality.

To support more effective responses, General Equilibrium (GE) models improve visibility for policy makers in three important areas:

• Linkages and Indirect (and otherwise invisible) effects – these may significantly outweigh direct effects

• Tradeoffs and Substitution patterns – ex ante assessment

• Effects of resource and other constraints

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Examples of GE Applications

- Agricultural Policy
- Resource Development
- **Trade policy**
- Public Finance
- Infrastructure Investment
- Environmental Policy
- Poverty and Inequality

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Basic Tenets of Modeling Strategy

Policy makers need visibility about trends and linkages.

Economic models and their results can make a lasting contribution to this under three conditions:

1. They must incorporate reliable data and methods.
2. Results must be transparent.
3. Should be locally implementable

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Two Structural Model Strategies

1. Multiplier Impact Model
    1. Advantage – More detailed structure
    2. Disadvantage – Unrealistic assumptions

2. Computable General Equilibrium (CGE) Model
    1. Advantage – Detailed structure and dynamics
    2. Disadvantage – Very data and technique intensive

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Two Policy Modeling Frameworks

1. **National research prototype models** – A state-of-the-art single country model

2. **Multiregional and Multi-national models** – A model based on a multi-country framework, with flexible regional aggregation.

    1. Examples
        1. GTAP – Global (124 countries, 65 sectors)
        2. CARGO– CAREC economies
        3. EAGLE– US (50 states, 509 sectors)

A Generic Modeling Facility

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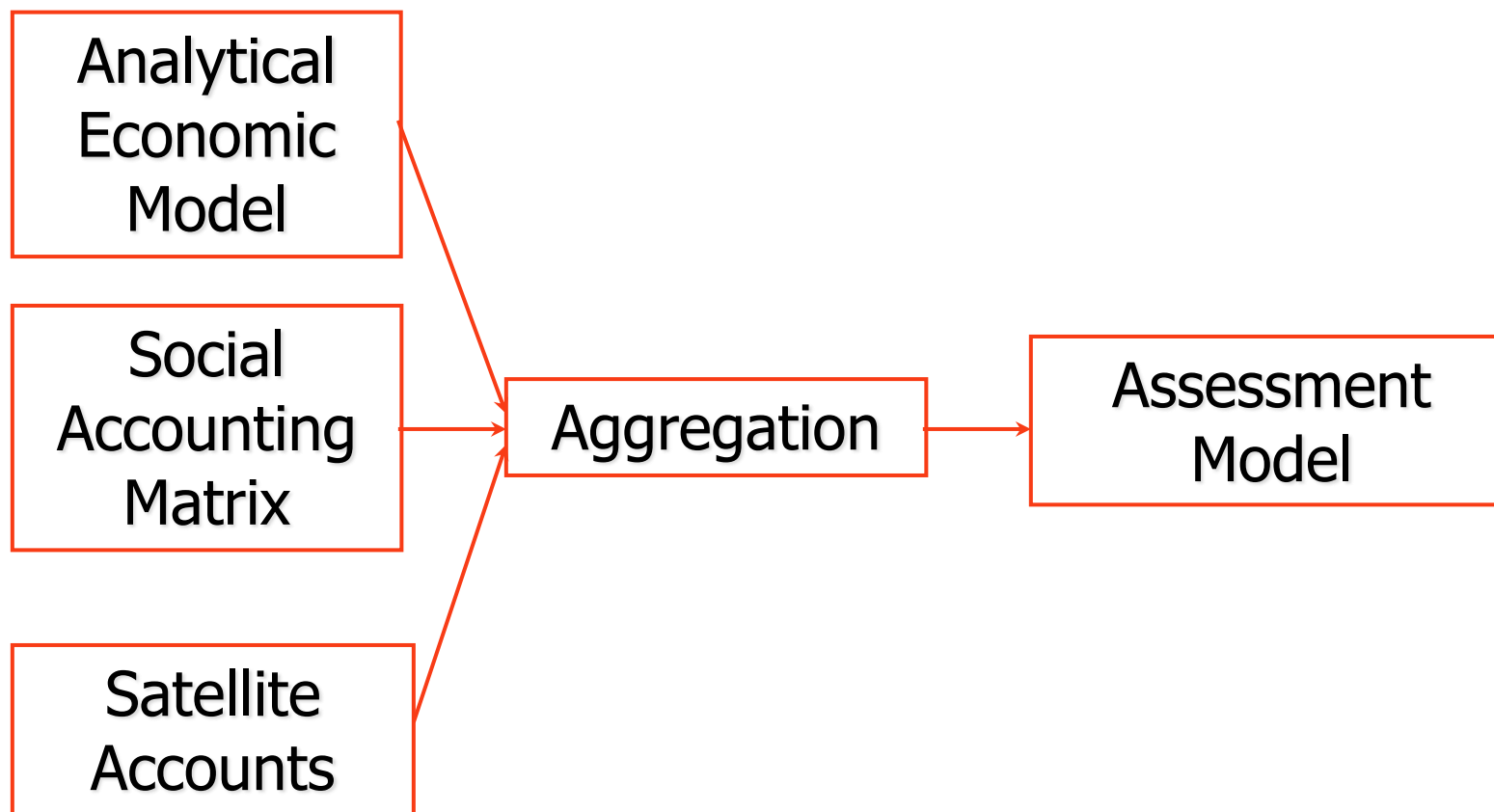
Introduction to Social Accounting Matrices (SAMs)

- Detailed and rigorous accounting practices always have been at the foundation of sound and sustainable economic policy.

- A consistent set of real data on the economy is likewise a prerequisite to serious empirical work with economic simulation model.

- For this reason, a complete general equilibrium modeling facility stands on two legs: consistent economywide data and analytical modeling methodology

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What is a SAM?

- An economy-wide accounting device to capture detailed interdependencies between institutions and sectors/regions. An extension of input-output analysis.

- A SAM is a form of double-entry book keeping that itemizes detailed income and expenditure linkages across the economy.

- It is a closed form accounting system, reflecting the general equilibrium structure of the underlying economic relationships.

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SAM Concepts

- A SAM is a square matrix that builds on the input-output table - but it goes further.

- A SAM considers not only production (Input-Output) linkages, but tracks income-expenditure feedbacks (institutions are introduced).

- Each transactor (such as factors of production, households, enterprises, the government and the ROW) has a row (income sources) and a column (expenditures) – double entry national income accounting.

- A SAM is consistent data system that provides a snapshot of the economy – note that the SAM reconciles data from different sources.

- Detail is on the the biggest virtues of the SAM approach, but we actually build SAMs from the top down.

Where it all Started:
# Input-Output Analysis and Central Planning

Wassily Wassilyevich Leontief

(Васи́лий Васи́льевич Лео́нтьев) Aug 5, 1906

An American economist of Russian descent.

Invented Input-Output analysis in 1937, providing a new basis for central planning and structural analysis: how changes in one economic sector may affect other sectors.

Leontief won the Nobel Memorial Prize in Economic Sciences in 1973, and three of his PhD students have also been awarded the prize (Paul Samuelson 1970, Robert Solow 1987, Vernon L. Smith 2002).
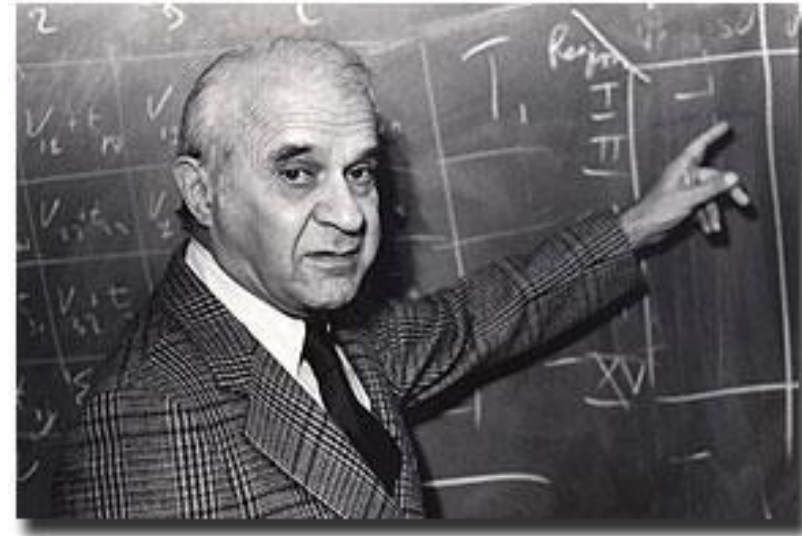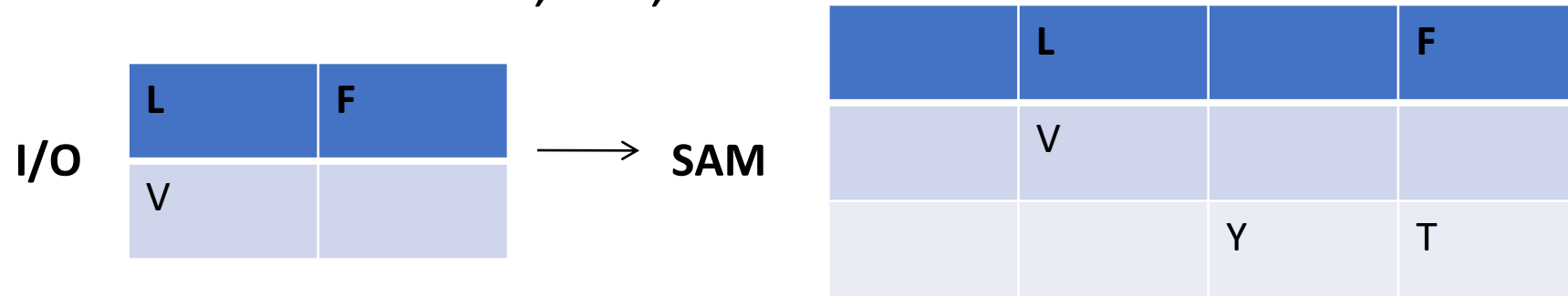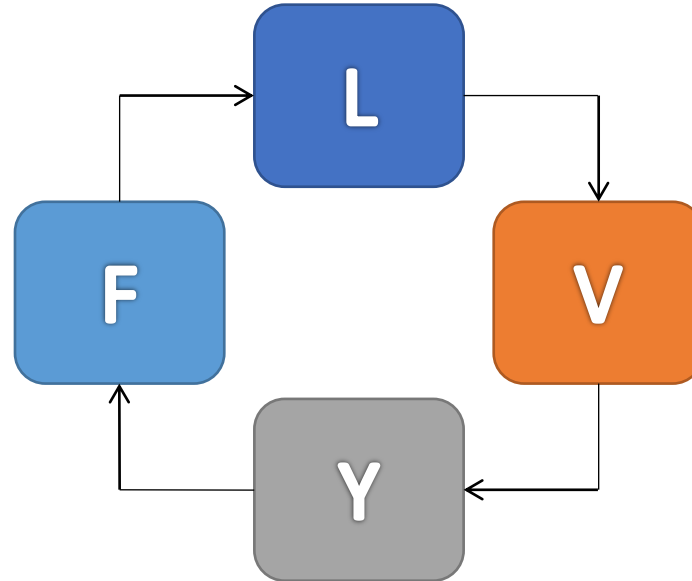
Input-Output to SAM

- At a basic level, the SAM extends the Input-Output table by adding income and transfer accounts, thereby closing the flow of income, i.e.,

I/O

L	F
V	

$\longrightarrow$ SAM

	L		F
V			
		Y	T

where L is the matrix of I/O intermediate transactions, V is value added, F is final demand expenditure, Y is the domestic income, and T represents institutional transfers.

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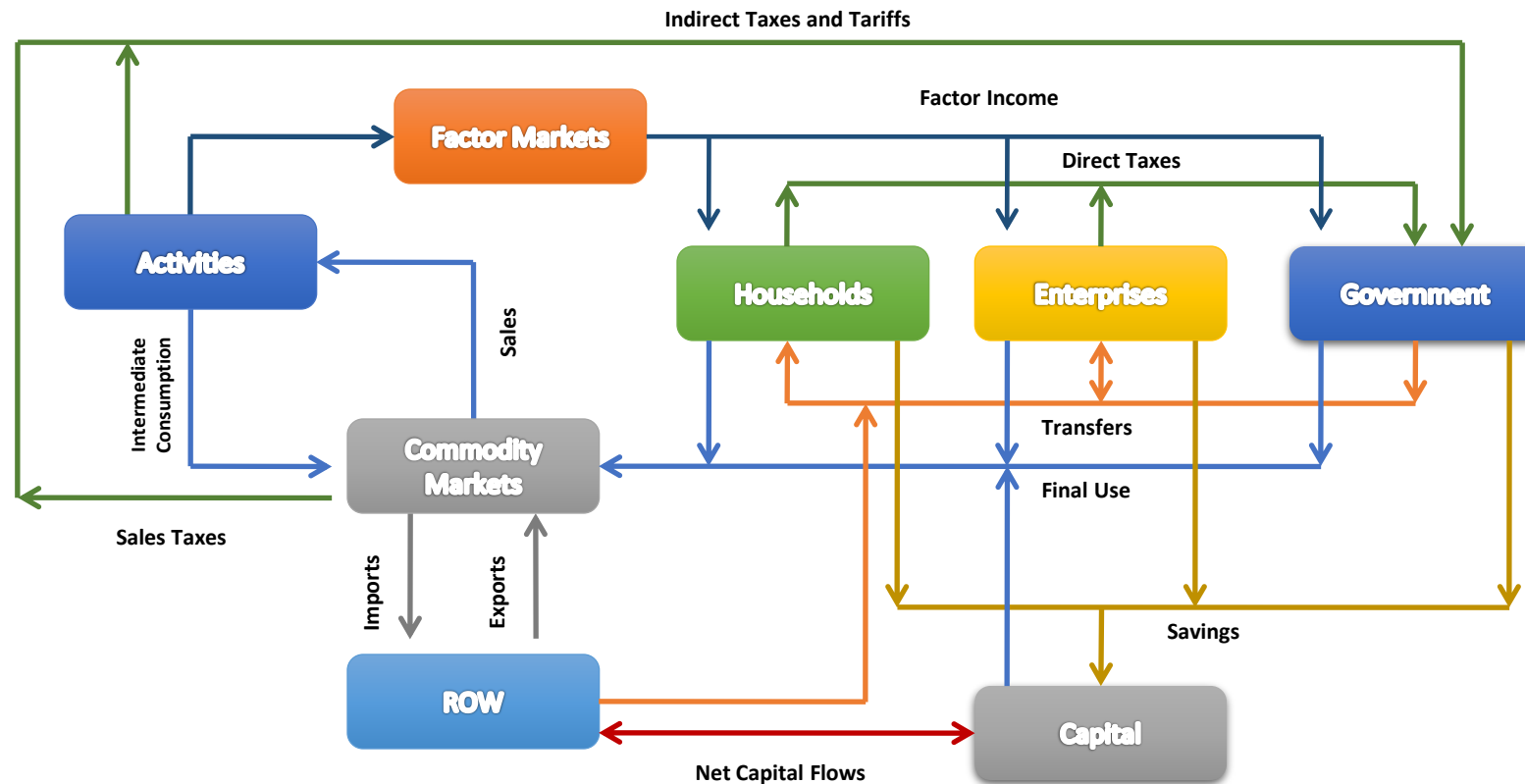
SAM Circular Flow of Income

- A simplified circular flow of income is clearly visible from the SAM

- V maps income to factors, Y maps factors to institutions, F maps institutional income to A, A pays V.

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SAM Circular Flow of Income

- A more detailed mapping of income flows:

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GE Trade Modeling Examples

1. Remittances and Income Distribution - Kyrgyz

2. Trade Corridors and Regional Integration – Kazakhstan

3. Trade Facilitation and Infrastructure – Pakistan

4. Resources and Development - Mongolia

5. Asian Regionalism and Globalization - China

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Remittances and Income Distribution: Kyrgyz Republic

Any external inflow can affect the variables we are talking about, but the net effect is an empirical question.

For the Kyrgyz republic, we contrast two simple scenarios:

1. A 10% increase in baseline remittance flows.
2. Scenario 1 combined with a 1% increase in total factor productivity.

NB: The results would be larger in an inter-temporal comparison, but the qualitative effects do not change.
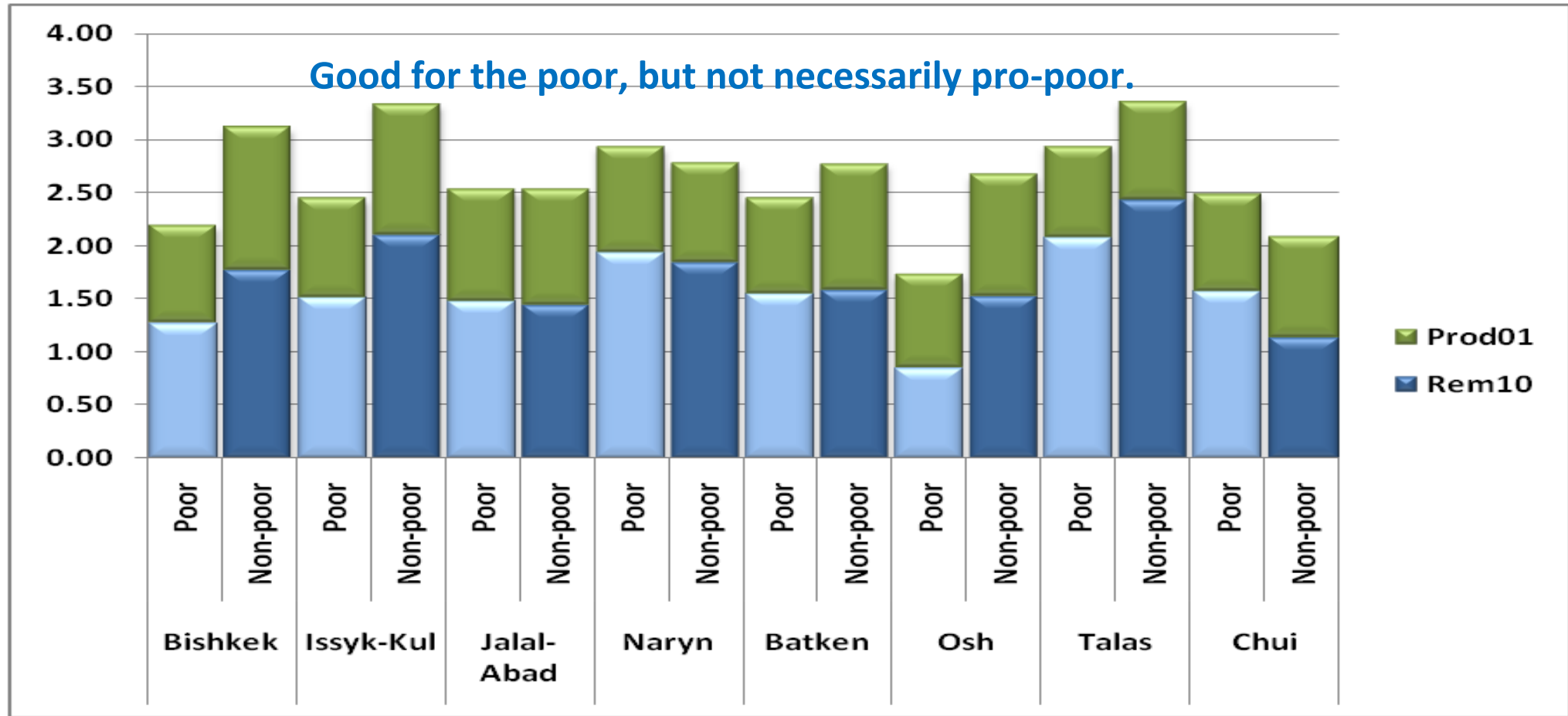
Project: http://bearecon.com/portfolio-item/car-remittances/

Meso Results
Real Household Income

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Trade Facilitation and Infrastructure: Pakistan

- Single country model – Pakistan
    - More detailed incidence and adjustment
    - Fiscal/finance experimentation
    - Targeting

    Project: http://bearecon.com/portfolio-item/car-remittances/

Pakistan CGE and SAM

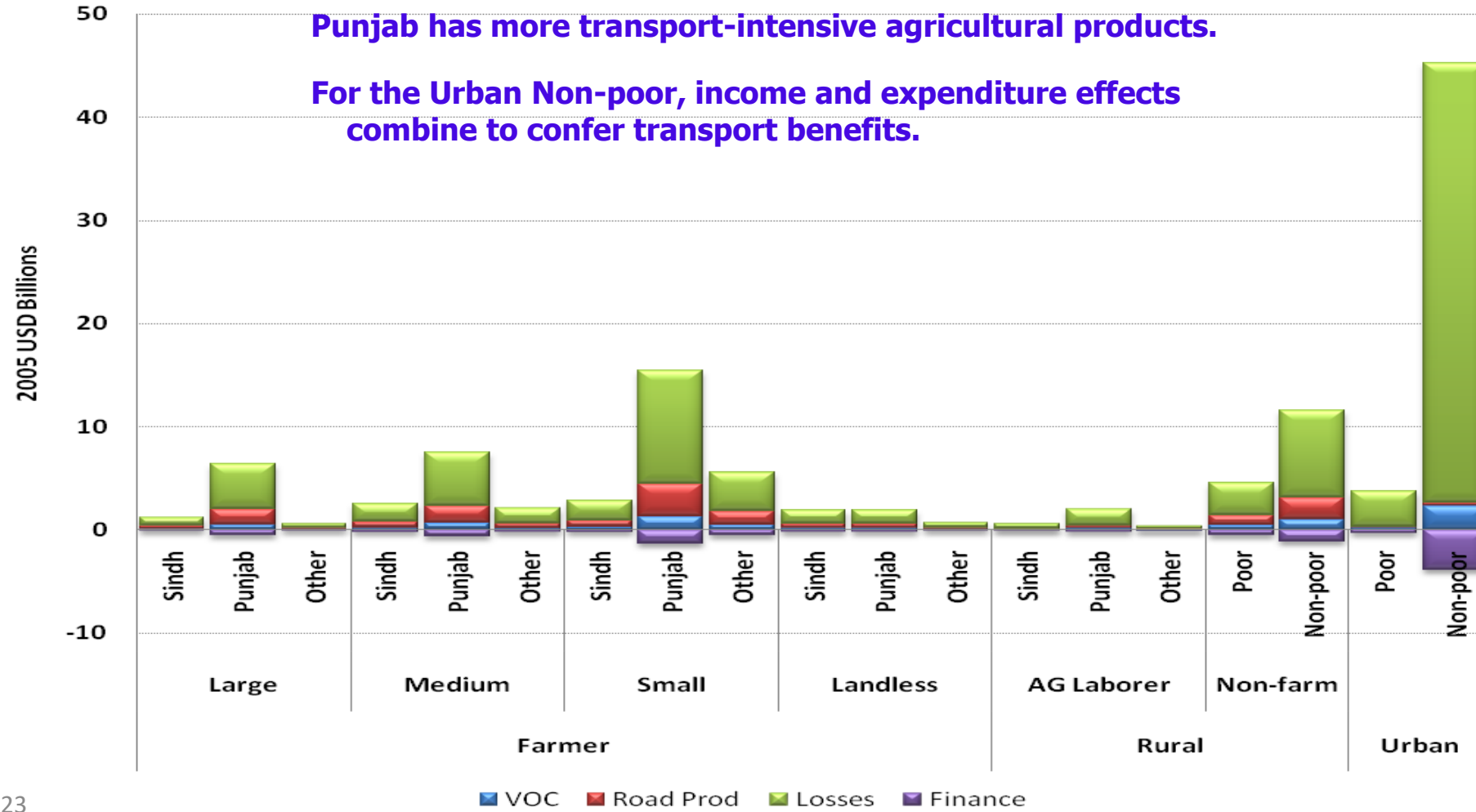**CGE** - a single-country dynamic GE model

SAM – very detailed

- 82 domestic production activities/ 82 commodities
- 27 factors of production
    - 22 labour categories
    - 3 Capital Types
    - Land and Water Resources
- 19 household types
- 3 enterprises (Private, Public, and Foreign)
- State (detailed fiscal instruments including NCHWIP project finance)
- Consolidated capital account
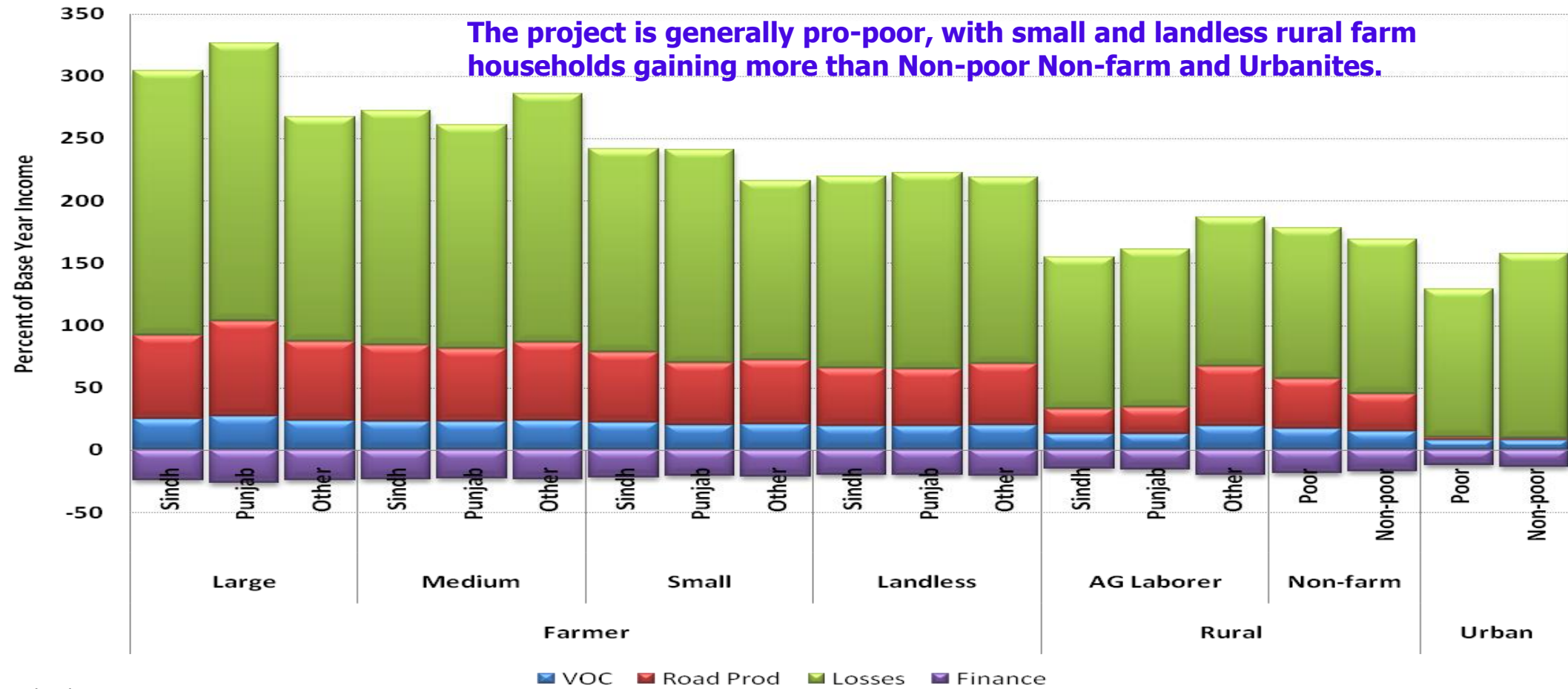- A Rest of World aggregate trading partner

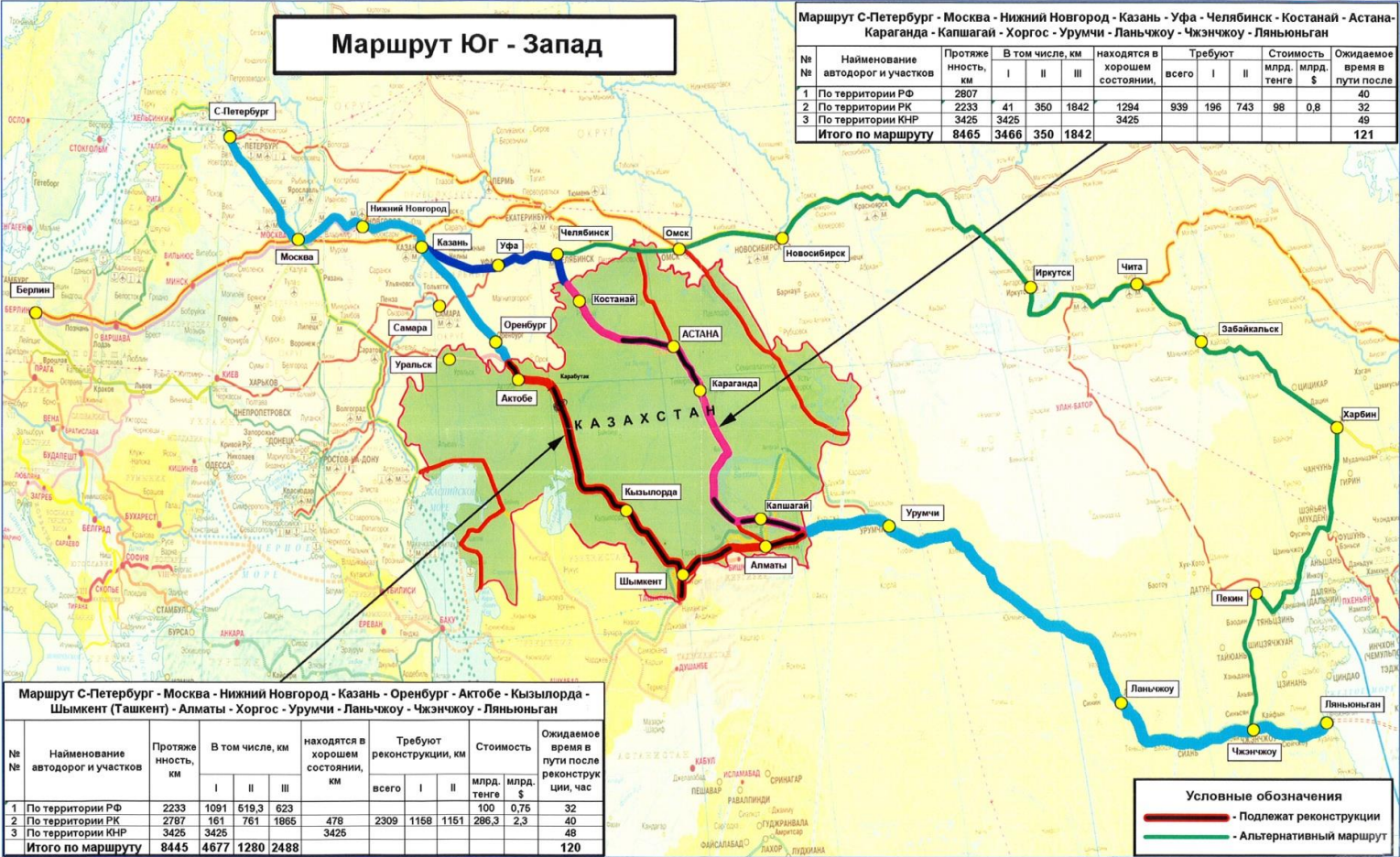# Pakistan Household Real Income Growth (cumulative Over Baseline, 2006-2030)

Punjab has more transport-intensive agricultural products.

For the Urban Non-poor, income and expenditure effects combine to confer transport benefits.

Pakistan Household Income Growth (percent of 2006)

The project is generally pro-poor, with small and landless rural farm households gaining more than Non-poor Non-farm and Urbanites.

Legend: ■ VOC ■ Road Prod ■ Losses ■ Finance

Multi-country Modeling: Kazakhstan Corridor

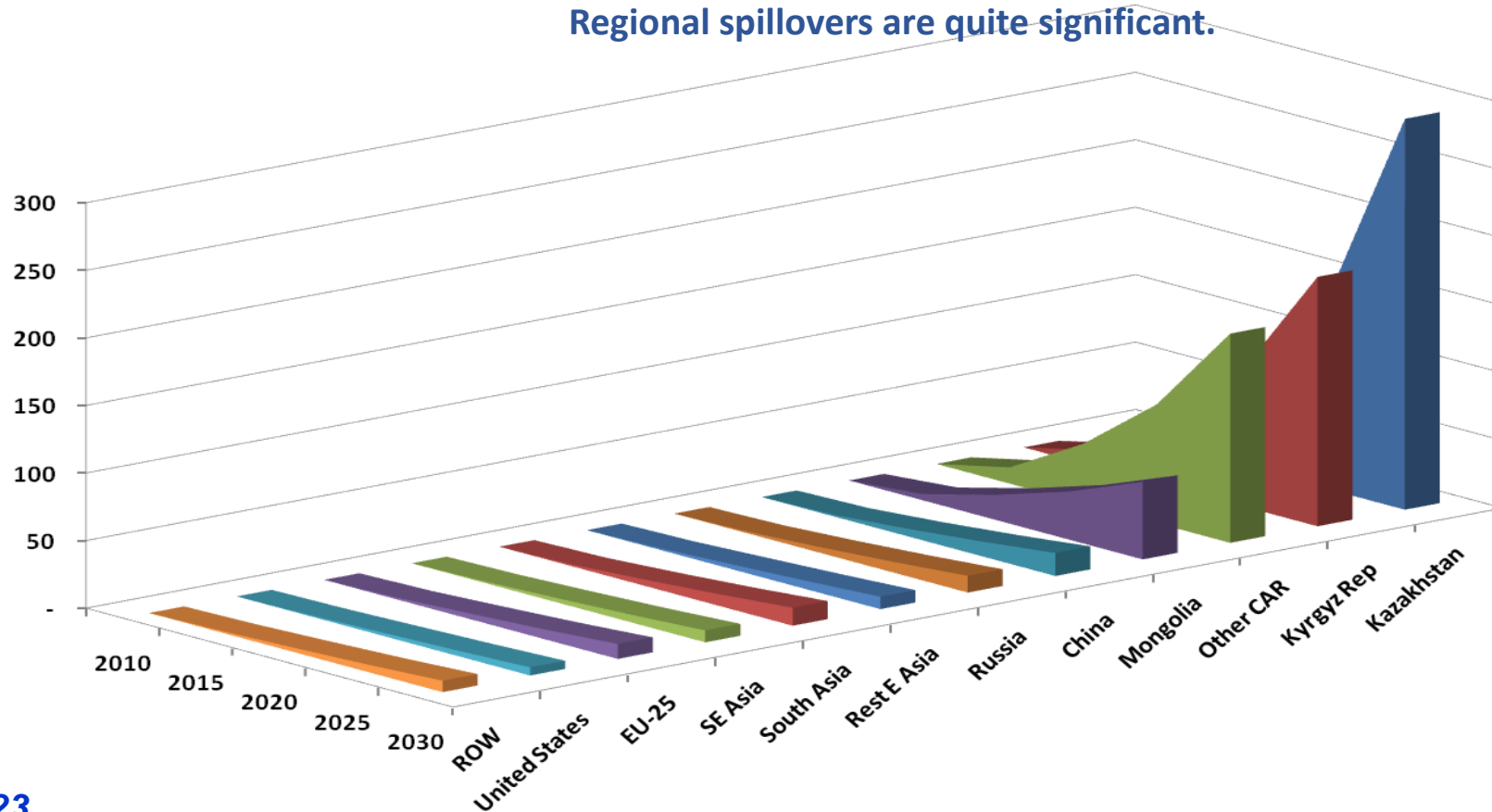Project: http://bearecon.com/all-projects/kazakhstan-road-corridor-economic-impact/

Real GDP Growth
(Percent of 2010, annual with respect to Baseline)

**The main beneficiaries in relative growth terms are Kazakhstan and proximate economies.
Regional spillovers are quite significant.**

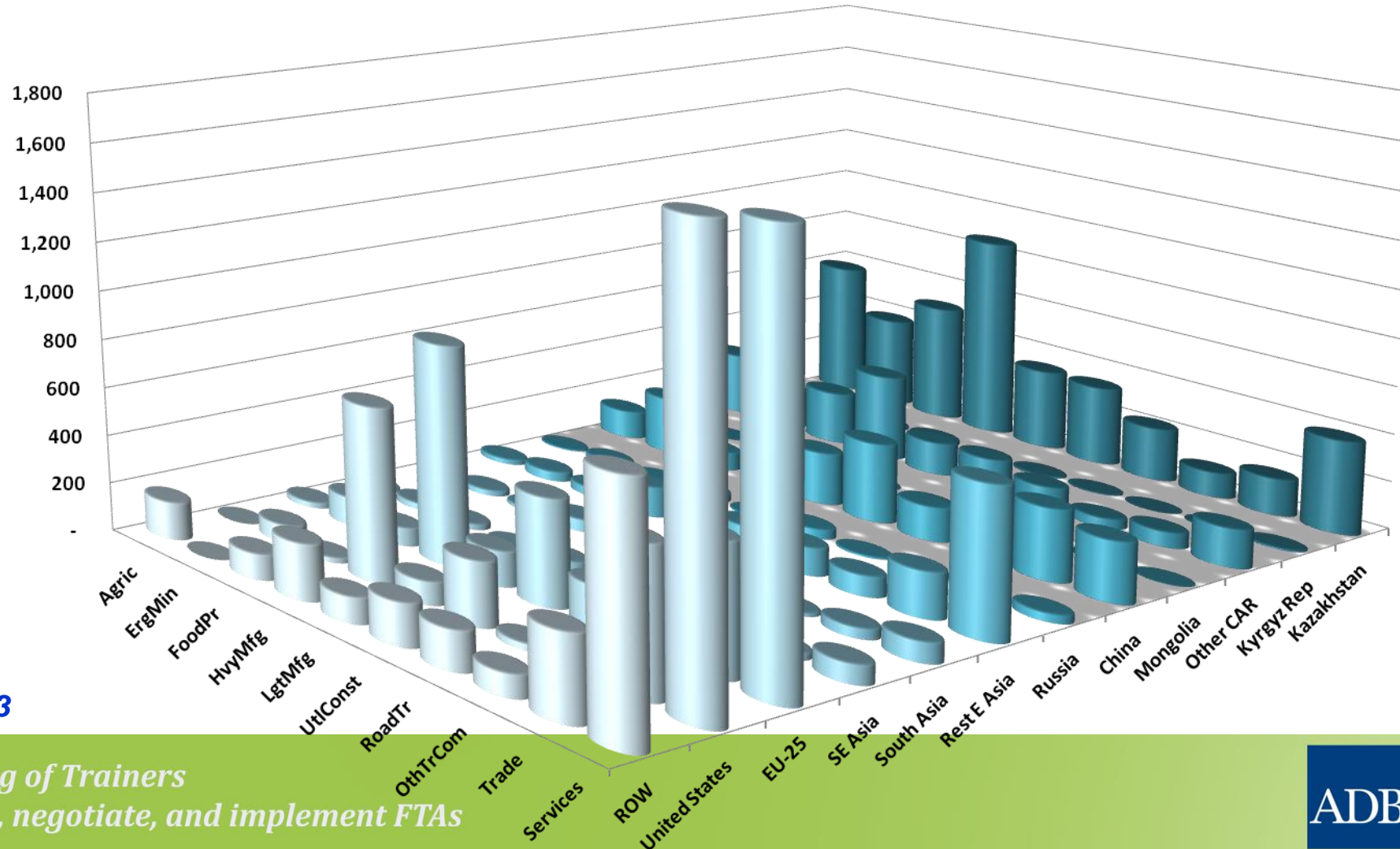# Sectoral Output Growth
(USD 2010 Millions, difference from Baseline in 2030)

Nominal gains are much more varied, depending on initial scale and trade shares.

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CARGO:
Central Asian Policy Simulation Model

- The basic architecture of this regional modeling facility is based on a global prototype designed at the University of California, Berkeley.

- This combines a multi-country Computable General Equilibrium (CGE) forecasting model with an interactive, user-friendly, browser-based "dashboard" for decision makers.

- These tools are designed to be implemented on local computers/tablets with a browser interface.

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Basic CARGO Ingredients

Like all good economic policy, CARGO stands on two legs, highest quality data and analytical methods:

- Data: A country-by-country, integrated database for assessing economic linkages, policy and market outcomes, energy flows, and environmental impacts
  - Calibrated to GTAP-10, plus estimated Social Accounting Matrices for other CAREC economies
  - Up to 65 sectors/commodities
  - Annual projections to 2050
- Model: A state-of-the-art, economic scenario forecasting tool – downscaled from a global CGE developed at UC Berkeley
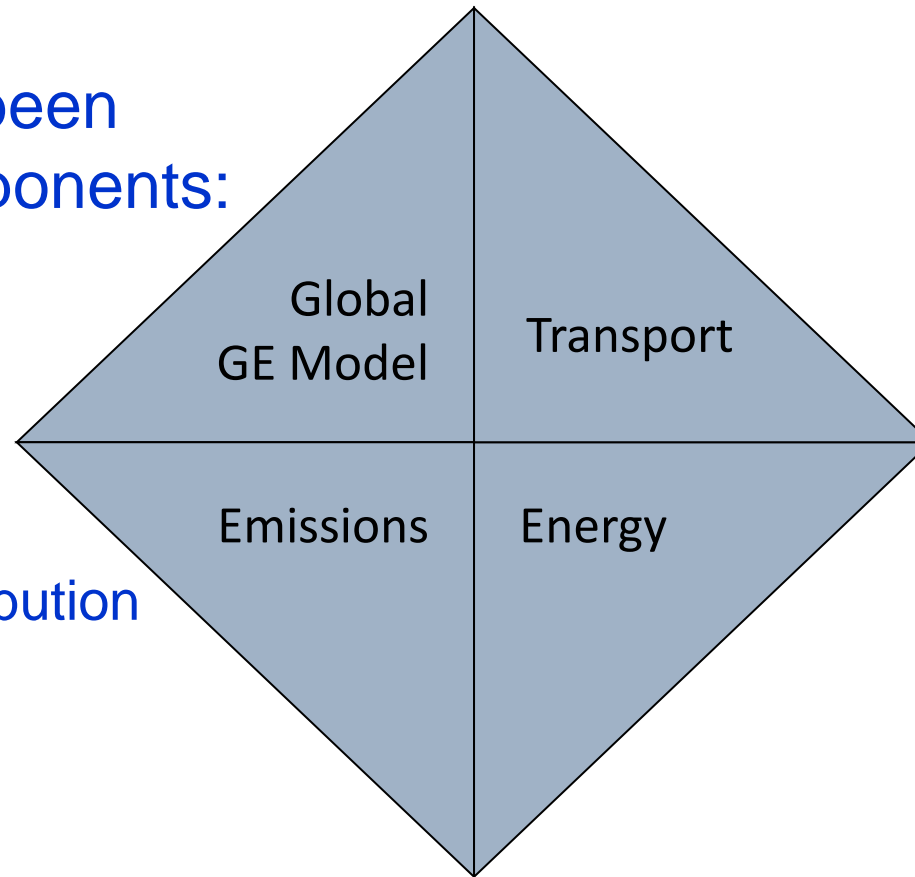
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Central Asian Regional General equilibrium mOdel (CARGO)

	Countries/Regions		Sectors
1	Afghanistan	1	Crops
2	Azerbaijan	2	Livestock and Fishery
3	Kazakhstan	3	Coal
4	Kyrgyzstan	4	Oil
5	Mongolia	5	Gas
6	Pakistan	6	Processed Food
7	Xinjiang/PRC	7	Textiles and Apparel
8	Tajikistan	8	Light Manufacturing
9	Turkmenistan	9	Heavy Manufacturing
10	Uzbekistan	10	Transport
11	Rest of PRC	11	Services
12	Russian Federation		
13	India		
14	High Income Asia		
15	Rest of Asia		
16	EU		
17	United States		
18	Other Americas		
19	Rest of World		

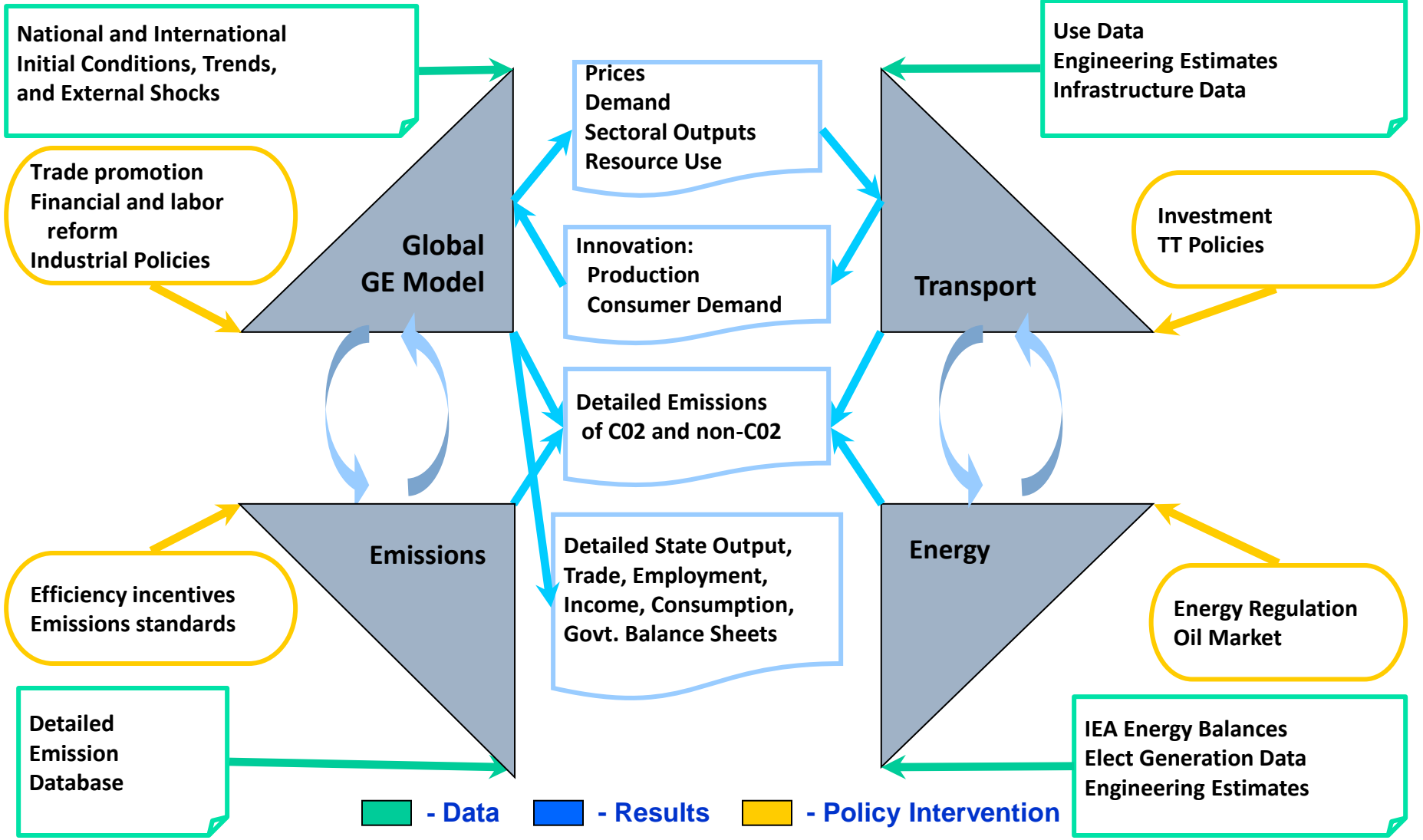ADB   CAREC INSTITUTE   CAREC

How we Forecast

The CARGO model has been
developed in four components:

1. Core Economic model

2. Transport module
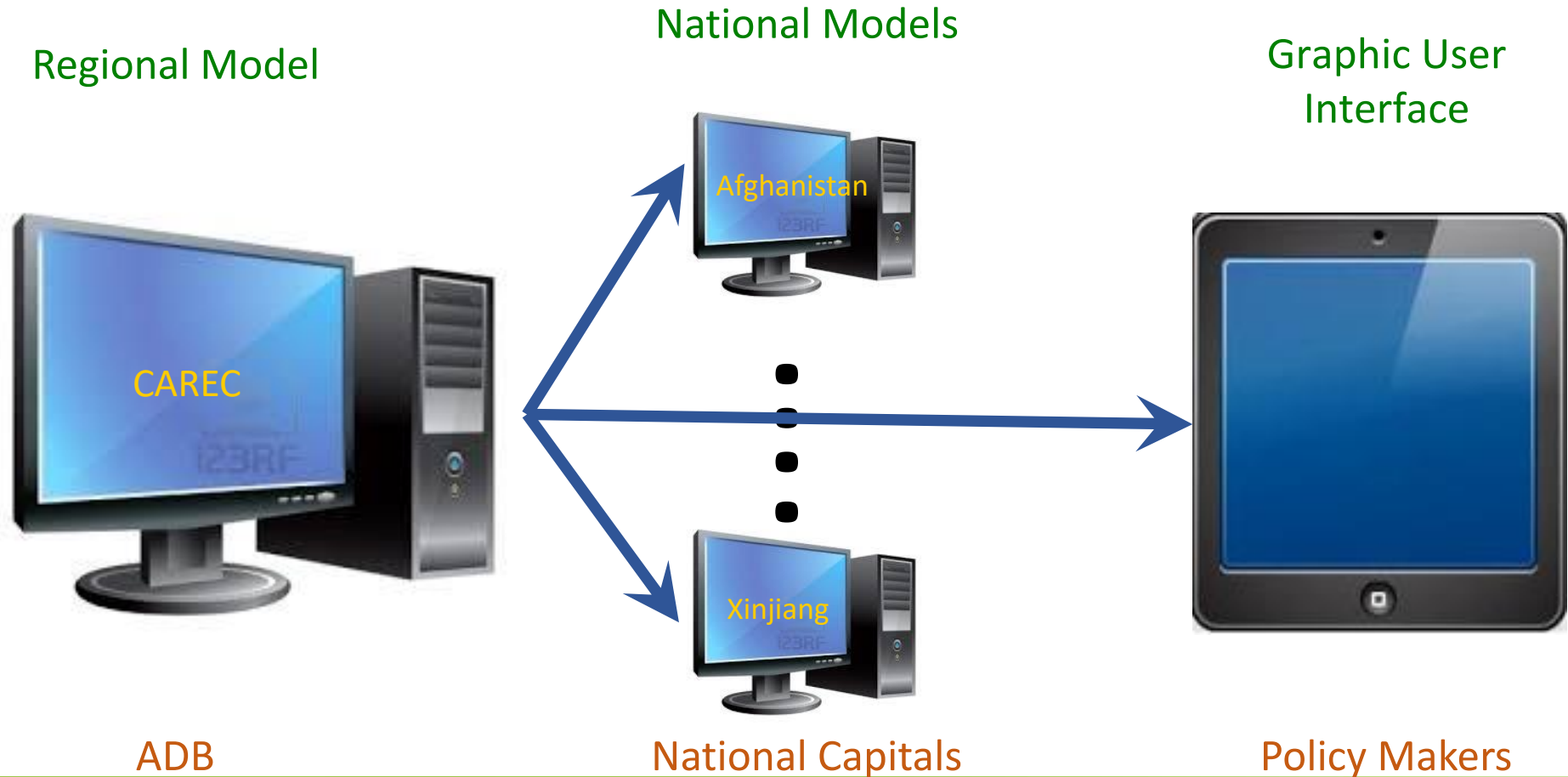
3. Energy production/distribution

4. Emissions module

Global GE Model	Transport
Emissions	Energy

Detailed CARGO Framework

National and International Initial Conditions, Trends, and External Shocks

Trade promotion
Financial and labor reform
Industrial Policies

Global GE Model

Prices
Demand
Sectoral Outputs
Resource Use

Innovation:
Production
Consumer Demand

Detailed Emissions of CO2 and non-CO2

Detailed State Output, Trade, Employment, Income, Consumption, Govt. Balance Sheets

Use Data
Engineering Estimates
Infrastructure Data

Investment
TT Policies

Transport

Emissions

Efficiency incentives
Emissions standards

Detailed Emission Database

Energy

Energy Regulation
Oil Market

IEA Energy Balances
Elect Generation Data
Engineering Estimates

■ - Data   ■ - Results   ■ - Policy Intervention

1/10/2023

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CARGO System Architecture

Regional Model

Graphic User Interface

Afghanistan

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Xinjiang

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National Capitals

Policy Makers

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Sample Model Inputs:
CAREC Modeling Scenarios

Transport and Infrastructure Policies
Regional corridor schemes for national,
regional, and global perspectives
Regional implications of national investments
Motorization and urbanization

Trade Facilitation and Trade Policies
Asian regional integration – national, regional, and global implications
Bilateral and regional TT measures
Integrated Trade Facilitation

Energy Policies
Strategy for Regional Cooperation in the
Energy Sector
Energy Action Plan Framework
Regional energy security

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Resources and Development: Mongolia

Sample Policy Scenarios

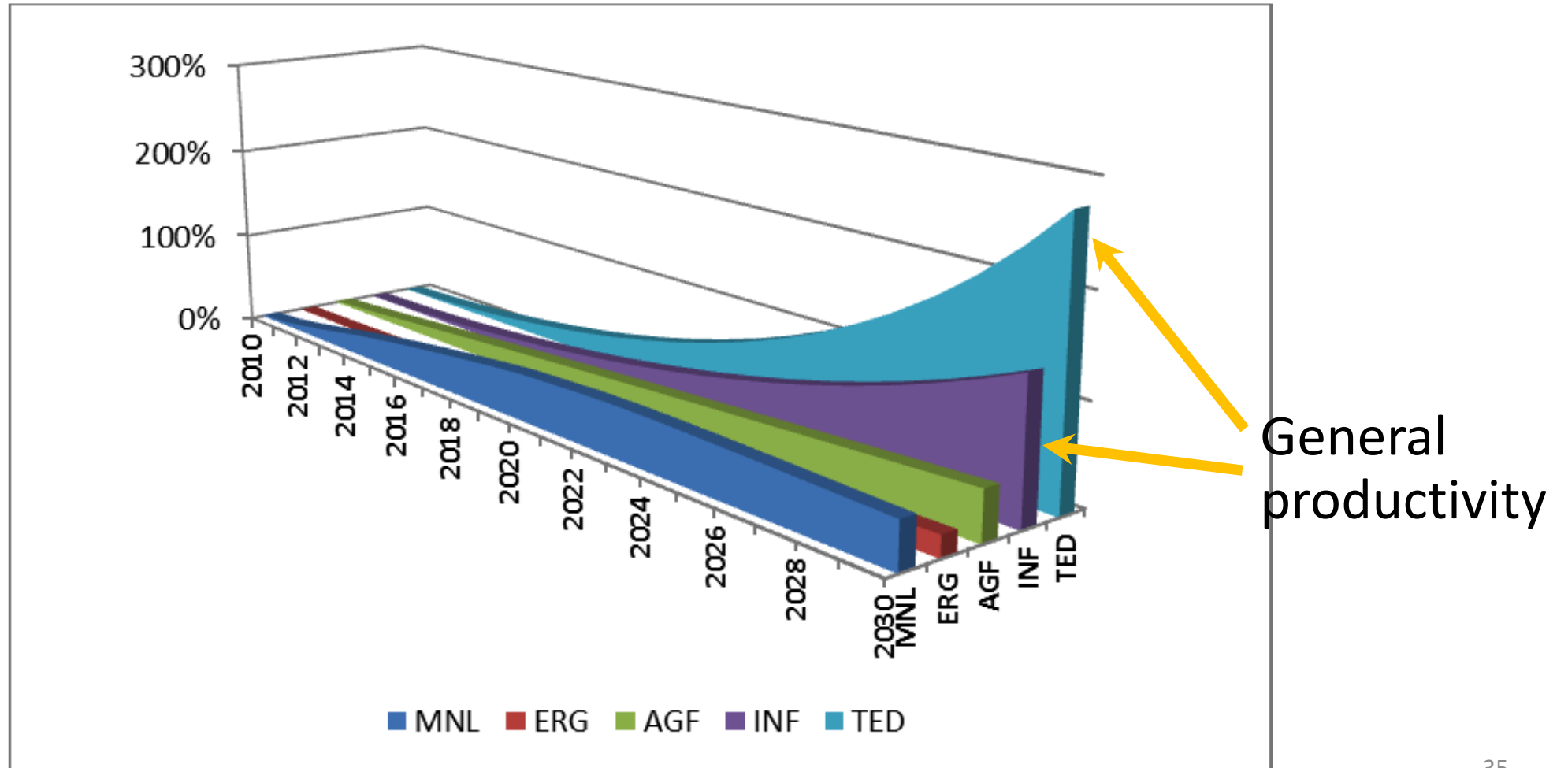|	Scenario	Description
1	Mining	Primary mining and mineral resource development. Assumed to contribute 5% per annum to target sector total factor productivity.
2	Energy	Energy sector development. Contributes 5% per annum to target sector TFP.
3	AgFood	AgroFood development. Contributes 5% per annum to agrofood TFP.
4	Infra	Infrastructure development. Assumed to increase infrastructure dependent sectors TFP by 5% per annum.
5	Ted	Technology and education investment. Assumed to increase skill intensive sector TFP by 5% per annum.

Project: http://bearecon.com/portfolio-item/mon-invest/

Real GDP Impacts
(percent change from Baseline)

General productivity

What's wrong with this picture?
What policy makers can't control.
Wholesale Copper Prices

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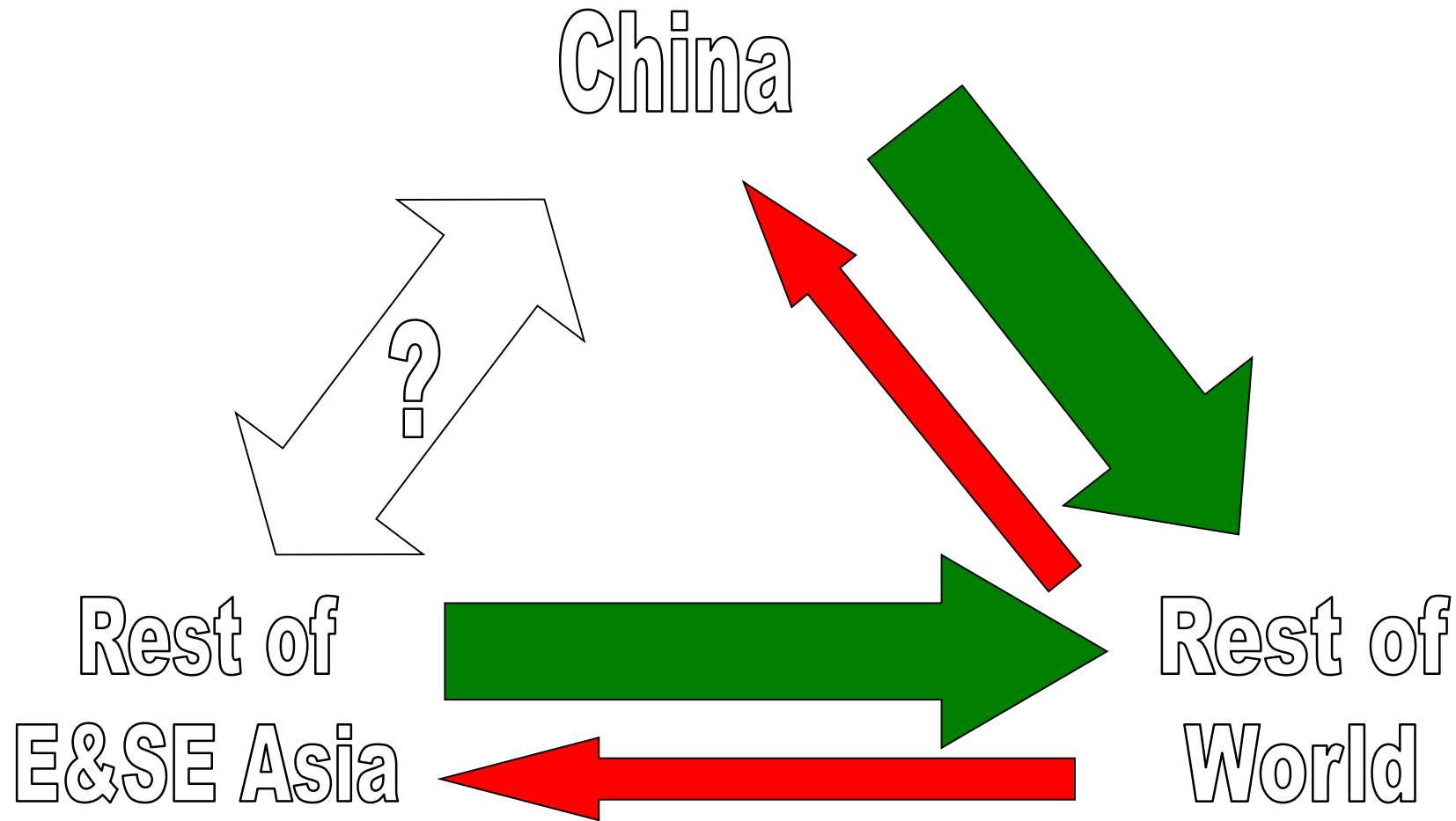*on how to design, negotiate, and implement FTAs*

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Asian Regionalism and Globalization: China

- Head-to-head export global competition with China will continue to be difficult.

- More attention should be given to leveraging opportunities presented by East Asia's fastest growing internal market.

- In these areas, the best strategy for East and Southeast Asia is to pursue globalism through more comprehensive regionalism.
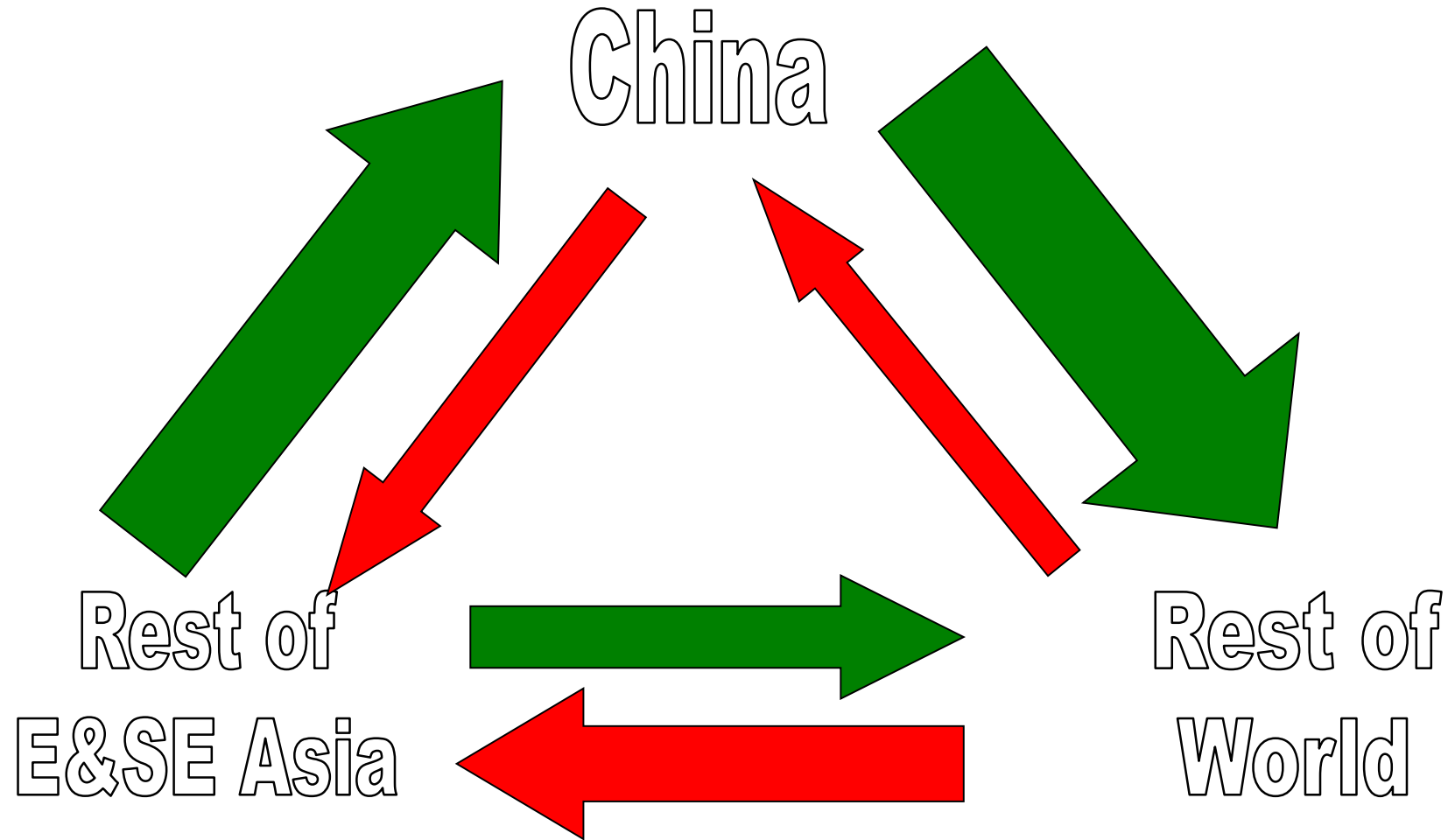
Project: http://bearecon.com/portfolio-item/chn-wto/

Asian Trade Triangle 2000

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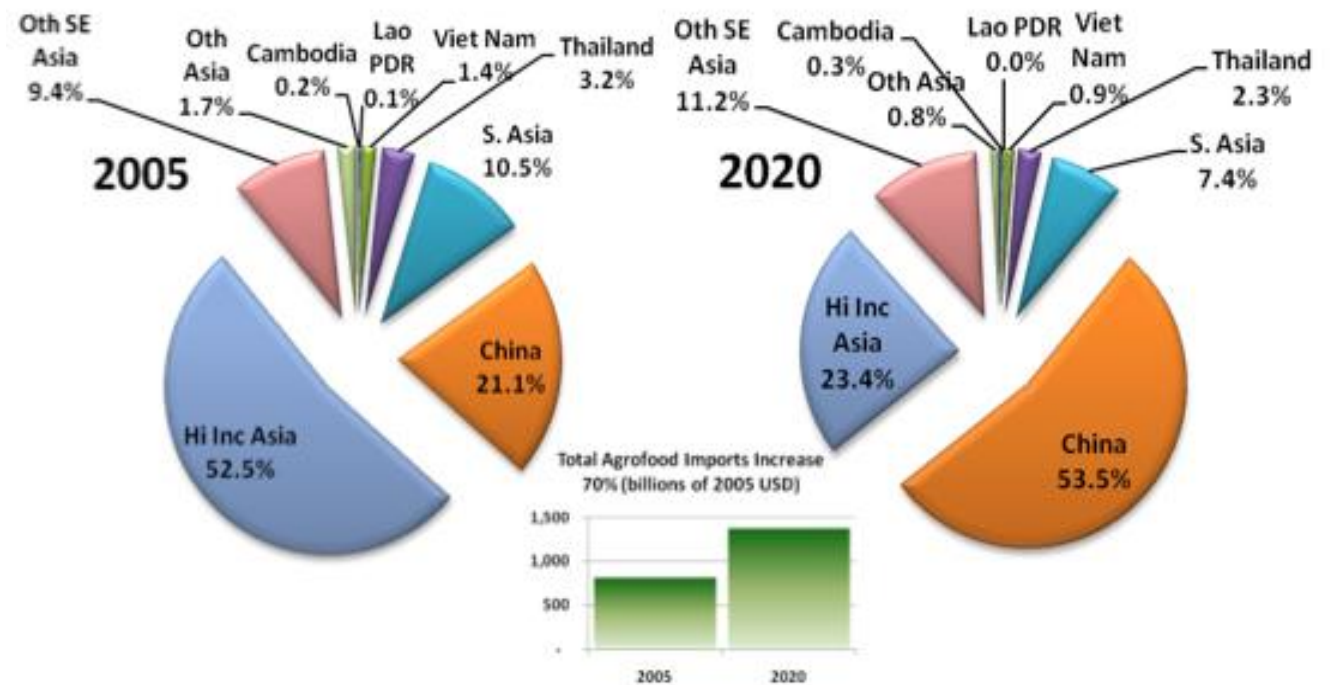
Asian Trade Triangle 2020

As China becomes the world's largest food importer, this presents an enormous trade opportunity to its neighbors

In two decades, rising income and resource constraints have moved China from self-sufficiency to become Asia's largest food importer.
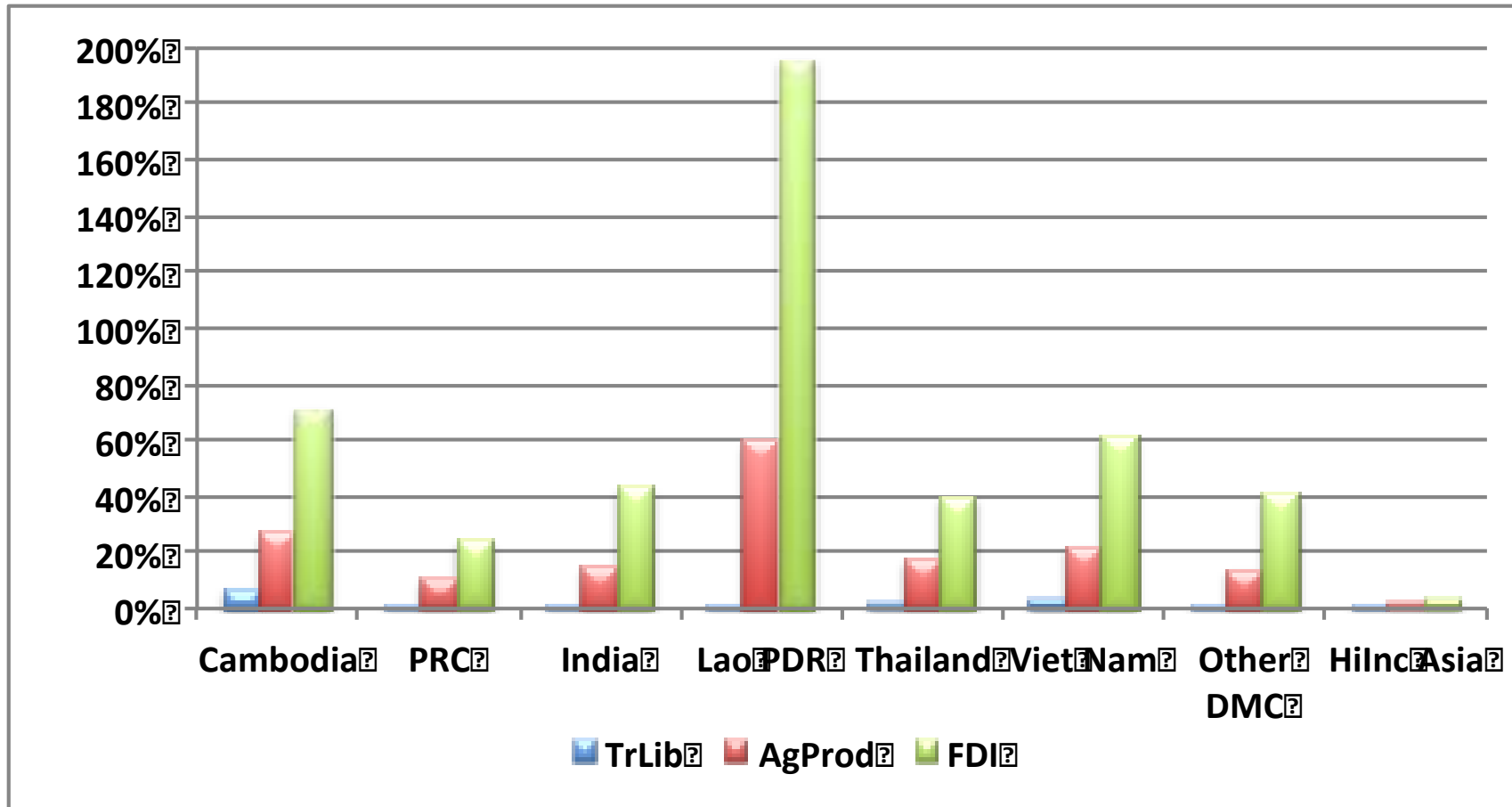
To improve long-term food security, China should step-up supply-side commitments to overseas agrifood partnership.

Particular attention should be given to lower income Asian neighbors. Where agrifood productivity remains low, China can promote self-directed poverty reduction and greater food security for on both sides.

Figure 30: Shares of Asian Food Imports (percent)

2005
- Oth SE Asia 9.4%
- Oth Asia 1.7%
- Cambodia 0.2%
- Lao PDR 0.1%
- Viet Nam 1.4%
- Thailand 3.2%
- S. Asia 10.5%
- China 21.1%
- Hi Inc Asia 52.5%

2020
- Oth SE Asia 11.2%
- Cambodia 0.3%
- Oth Asia 0.8%
- Lao PDR 0.0%
- Viet Nam 0.9%
- Thailand 2.3%
- S. Asia 7.4%
- China 53.5%
- Hi Inc Asia 23.4%

Total Agrofood Imports Increase 70% (billions of 2005 USD)

CumulativeReal GDP by DMC,
Percent Change 2010-2030

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Agrofood Productivity Growth can be Pro-poor

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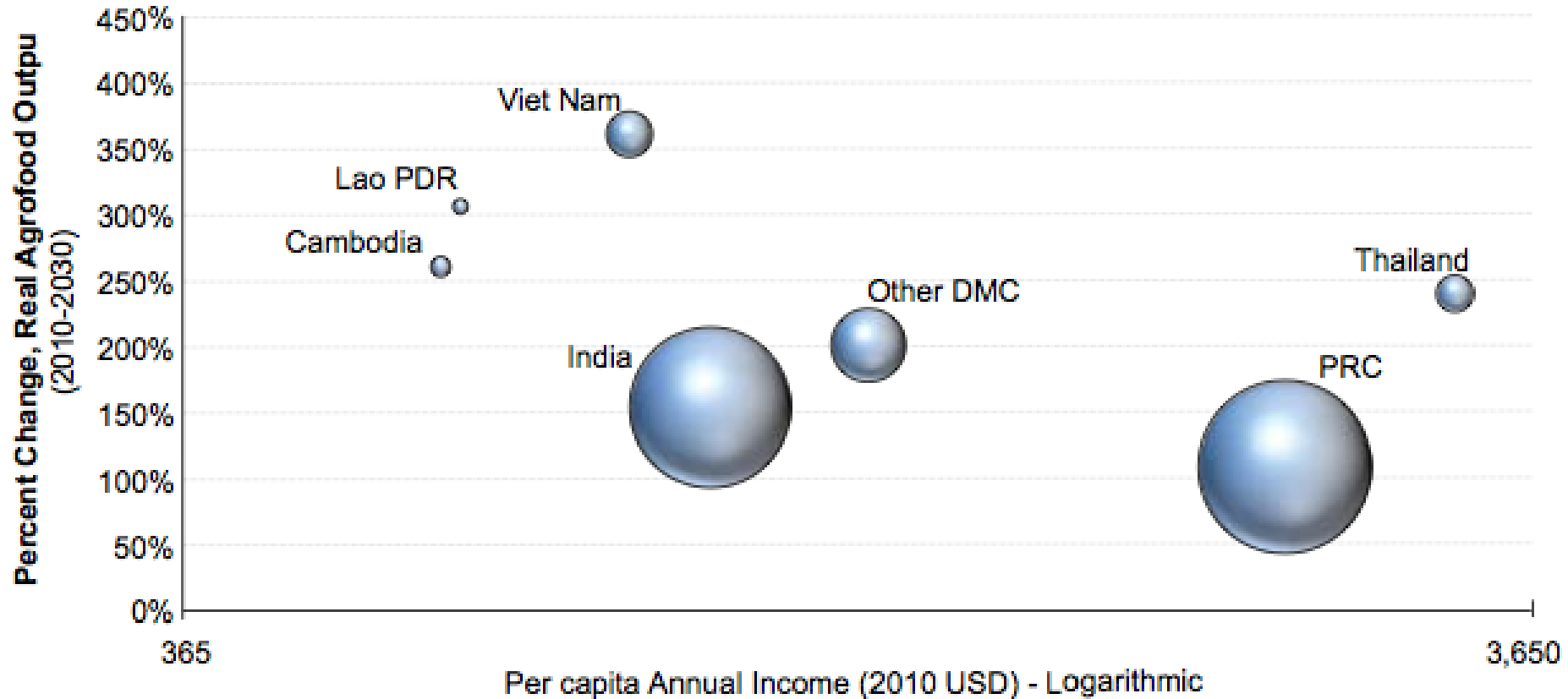
Extensions

1. Regional assessment of trade and investment potential.
2. Transport pathways: Detailed regional impact evaluation.
3. Energy pathways: Detailed regional impact evaluation.
4. Dynamics of regional growth and poverty reduction.
5. Policy impacts on development indicators, MDG's, etc.
6. Trends in urbanization and rural development.
7. Resource development, public investment, and fiscal impacts.
8. Demographic assessment, including migration, labor force development and employment patterns, and other socioeconomic trends.
9. More detailed agent-based GIS modeling to improve policy targeting and impact evaluation.

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Thank you!

Questions: dwrh@berkeley.edu

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