

MPIA Network Session Paper

A Regional CGE Model with Distributional Analysis for the Philippines: The Geographic Dimension of Welfare Impact

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*A paper presented during the 5th PEP Research Network General Meeting,
June 18-22, 2006, Addis Ababa, Ethiopia.*

RESEARCH PROPOSAL

PRO-PEP 10661

**A Regional CGE Model with Distributional Analysis for the
Philippines: The Geographic Dimension of Welfare Impact**

Presented to PEP Network

By

Brain Trust: Knowledge and Options for Sustainable Development, Inc.

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PHILIPPINES

15 May 2006*

* Final version for presentation to the 5th PEP Conference, United Nations Conference Center, Addis Ababa, Ethiopia, 18-22 June 2006.

Abstract

The study proposes the construction of a regional CGE that is capable of simulating impacts on poverty and size distribution. The model extends the current version of the PhilCGE, one of the earliest CGE models of the Philippines. The regional structure of the model is applied to production and consumption, region-specific marketing margins, and regional labor markets in the short run. Capacity building consists of collaboration with junior researchers, as well as formulation and delivery of a training module for applying to support regional development planning. Dissemination will be undertaken in partnership with a national project aimed at policy reform and multi-sectoral capacity-building.

1. Main research questions and core research objectives

The main research questions to be addressed by the study are twofold:

- a. What are the regional differences in household welfare impacts for various economywide policies?
- b. What are the economywide implications of various regional development policies?

The core research objectives are:

- a. To construct a computable general equilibrium (CGE) model of the Philippines capable of analyzing impacts on poverty and welfare distribution by region;
- b. To apply the CGE model to experiments on economywide policies such as tariff reform, as well as regional policies such as geographically targeted public investment and safety nets;
- c. To discuss the implications of the foregoing for designing national and regional development strategies.

2. Knowledge gaps and scientific contribution of the research

2.1. Regional CGEs

Two important developments have recently been observed in CGE modeling. First is the application of CGEs to regional issues (Schreiner et al, 1999). Regional CGEs are naturally suited to examine geographic features of economic activity, which are crucial considerations on the speed and spread of economic development. These features include factor mobility, market integration, as well as transport and transaction cost. Regional CGEs may be used to geographically disaggregate the impact of economywide policies, e.g. examination of regional tax incidence. Furthermore, regional CGE models can examine regional development and welfare policies, such as geographically targeted transfers, location-based industrial incentives, and public investment allocation.

There are two approaches to regional CGE analysis: in the *top-down* approach, model equilibrium is obtained at the national level, and the national outcome is disaggregated to regional outcomes by some method (the simplest being fixed shares). In the *bottom-up* approach, each region is treated as a separate economy, linking with other regions through movements of goods and factors. The bottom-up approach is clearly a more flexible way of modeling regional interactions and outcomes, but is conditional on adequate data, in particular on sub-national, inter-regional flows.

Few regional CGEs have been constructed for the Philippines. One of the more recent ones is the TARFCOM model (Cabalu et al, 2001). TARFCOM is patterned after Australia's ORANI-G model. It is one of the country's most disaggregated CGE models, with 229 industries. However it has only one representative household. Regional breakdowns are top-down; this reflects the constraints to bottom-up regional modeling, mainly due to the absence

of data on interregional flows of goods and services (Yap, 2001). The TARFCOM translates national simulation results into income and employment at the regional level; however, there is no explicit theory of regional variations in prices, hence is less capable of capturing regional supply changes such as local excess demands or supplies of labor (Horridge, 2003).

Regional CGEs would be able to reflect the geographic dimension of impacts from economywide policies. For the Philippines, Pernia et al (1983) for example found that concentration of economic activities around the national capital was positively associated with effective protection rates. Regional CGEs would also be useful for analyzing policies which are implemented differently across regions, such as public investment allocation. Finally, bottom-up regional CGEs are able to capture geography within its modeling framework; this is highly advantageous as geography is a crucial determinant of market adjustment, particularly given archipelagic layout of the country.

2.2. Microsimulation

The second innovation is the incorporation of the size distribution of welfare in the impact assessment. Distributional analysis rose to prominence from the 1980s onwards, as strident criticisms of structural adjustment policies led to studies of the human aspects of macro-adjustment programs. One way to conduct distributional analysis is to integrate data from large household surveys into CGE analysis. This permits detailed calculations of changes across an income distribution profile, including impacts of external or policy shocks on poverty and inequality. In a full-blown *microsimulation*, the households behaviorally modeled within a CGE are represented by individual households corresponding to those drawn from a large cross-sectional survey. Microsimulation however comes with much greater data and computational requirements.

Cororaton and Cochrane (2005) have formulated a CGE microsimulation model for the Philippines. The model is calibrated to Philippine data for 1994, having 8 factors of production, 12 sectors, and all of 24,797 households in the 1994 Family Income and Expenditure Survey (FIES). Their analysis of the impact of tariff reform in the Philippines yields the following major findings: distributive impact results largely from the reallocation effects that favor the non-food manufacturing sector; as a result, overall income inequality worsens; meanwhile the major channel of welfare impact is the reduction in consumer prices, which is significantly higher than the effect of increased household income.

For the Philippines, there is as yet no regional model capable of explicit distributional analysis; in general, any type of CGE conducting distributional analysis rarely contains a regional dimension. Furthermore there appears to be no regional CGE model that explicitly models structural rigidities associated with geography. The proposed study will remedy this gap. Based on an existing conventional CGE, the study constructs a regional CGE which takes into account structural rigidities related to geographic barriers. The geographic barriers are related to short run immobility of factors across regions, and region-specific transaction cost. The regional model will also be able to conduct distribution analysis. It will also be capable of analyzing the economywide impact of regional policies, such as reduction in trade and transport costs, and geographically-targeted tax and transfer policies. The proposed model will be one of the first developing country models with these features.

3. Policy relevance

3.1. Status of development

The UNDP (2005) classifies the Philippines as a middle human development country, with a per capita GDP of US\$ 4,300 in 2003 (PPP-adjusted; compare this with US\$ 5,000 for China and US\$ 2,000 for Cambodia). Based on official statistics, 30% of the population is classified as poor, making mass poverty a paramount concern in development. Agriculture, which used to dominate the economic activity, accounts for only a minority share of GDP (19.6%), in common with other middle income countries (Table 1). Note however that the employment share of agriculture is much higher, at 37%; moreover agro-processing and agribusiness activities, combined with basic agriculture, account for as much as 40% of GDP and up to two-thirds of employment (Habito and Briones, 2005).

The Philippines is an archipelago of over 7,000 islands, only 700 of which are inhabited. There are three main island groups – Luzon (north), Visayas (central), and Mindanao (south). The topography is generally mountainous, though on the larger islands there are narrow valleys and alluvial plains. The country is further divided into 16 regions, which display striking development disparities (Table 1). The National Capital Region (NCR) has a per capita GDP of more than twice the national figure. NCR combined with the adjacent region of Southern Tagalog account for over 46% of national GDP, while containing only 28% of the national population.

Table 1: Selected regional indicators for the Philippines

Region	Per capita GDP indicators		Poverty incidence (2003)	Share of agriculture in GDP
	Relative index (2000)	average growth 1975-2000		
Philippines	1.00	2.9	30.4	19.6
NCR	2.40	3.0	7.3	0.0
CAR	1.31	-	31.2	12.8
Ilocos	.058	1.8	30.2	41.5
Cagayan Valley	0.62	2.2	24.5	52.7
Central Luzon	0.85	2.7	17.7	24.3
Southern Tagalog (I)	0.98	3.0	18.8	18.1
Southern Tagalog (II)		1.9	47.9	42.1
Bicol	0.44	1.9	48.4	33.0
Western Visayas	0.87	2.0	39.1	28.2
Central Visayas	0.91	3.1	28.4	12.3
Eastern Visayas	0.51	1.7	43.3	33.6
Western Mindanao	0.60	3.8	49.4	50.1
Northern Mindanao	0.87	3.5	44.3	30.2
Southern Mindanao	0.90	2.8	34.4	28.2
Central Mindanao	0.62	2.9	38.4	43.7
ARMM	0.30	-	53.1	57.8
Caraga	-		54.2	40.2

Note: Per capita GDP of Southern Tagalog and Caraga are reflected in the Southern Tagalog (I) and ARMM rows, respectively.

Source: Basic data from NSCB; Per capita GDP data compiled in Manasan and Chatterjee (2003).

The country's logistics system is a major source of market inefficiency. Poor roads, inadequate transportation systems, and inadequate market infrastructure for storage and warehousing contribute to damage, shrinkage and deterioration in the quality of farm products, as well as higher agricultural prices (Ordoñez, 2005). Studies have uncovered some degree of market disintegration in agriculture owing to geographic barriers, at least in the short run. While agricultural markets do tend to be integrated (Silvapulle and Jayasuriya, 1994; Coxhead et al, 2001), in the case of rice, integration between farmgate-to-wholesale prices are lower than integration between wholesale-to-retail prices (Sombilla et al, 2006). In the case of corn, while long run prices are integrated nationwide, market imperfections slow down the adjustment of regional prices to the market center in the national capital. These imperfections may be related to high transport costs and inadequacy of inter-island shipping vessels (Mendoza and Rosegrant, 1995).

As commodities are more mobile than production factors, there is every reason to suspect that geographic barriers are even more formidable for factor movement, especially of labor. Adjustment problems may be one factor behind the failure of the country to respond to wide-ranging economywide policy reforms; in turn geography may be an important factor constraining economic adjustment.

3.2. Development strategy

The country has undergone a number of structural adjustment reforms since the 1980s. In foreign trade, major reforms have been the elimination of export taxes, the repeal of most quantitative restrictions, and the reduction in tariffs for many major commodities. Currently the average tariff rate is only 6.82%. However the trade liberalization program remains far from complete. Recently the dispersion in tariff rates and effective protection

rates has increased. For specific manufacturing activities, effective protection remains high, such as for pesticides, insecticides, and motor vehicles. Trade protection has risen in agriculture, with the rice and corn receiving some of the highest rates of protection. (Aldaba, 2005). Overall, protectionist policies have been enacted in favor of agriculture, ironically in the aftermath of WTO accession in the mid-1990s (David 2003). There remains a strong political resistance towards trade liberalization; opponents are wont to cite the potentially adverse impact on foreign competition on small farmers and the rural poor, as well as the inadequacy of government support for globally competitive agricultural sector (Ramos, n.d.)

All the recent national economic plans have highlighted the need to reduce development disparities between the regions; the current administration highlights “decentralized development” as one of its 10 basic goals. Previously highly centralized, the national government has pursued devolution of government functions to local governments starting from 1991. Within this set-up, the regions provide the natural zone of convergence between regional and national government development strategies. Several mechanisms are in fact in place to promote coordination, such as the Regional Development Councils.

Modernization of agriculture is seen as precursor for regional development. Agricultural modernization entails an effective system of technology transfer, capital assistance and agricultural marketing services to the agriculture-dependent regions. Also essential would be public investments in irrigation and postharvest facilities. This would also require large public investments in quality road and transport infrastructure. The need to diversify infrastructure locations away from the highly congested capital is also highlighted (NEDA, 2004).

3.3. Regional microsimulation CGE as a tool for policymaking

The regional microsimulation CGE being proposed is highly relevant to economic policy and development strategy. At the economywide level, the implications of removing protection in vulnerable sectors such as agriculture has a strong regional dimension; simulations of welfare and poverty impact by region are therefore useful for assessing the merits of completing agricultural liberalization, in terms of its actual welfare and equity impact. By disaggregating all model results to the regional level, policymakers would have a better idea about where adjustment problems are likely to be most severe, where benefits of adjustment are concentrated, and where safety net measures are most properly targeted.

The model would also be helpful in assessing effects of regional development. The impact of reducing transport and marketing costs through infrastructure can be analyzed into its impacts on national and regional output, interregional and intraregional inequality, and poverty by region. This will help identify priority areas for investment, as well as provide a basis for comparing net welfare benefits with prospective investment costs.

4. Method

4.1. The PhilCGE model

The CGE model for the study will be an updated and expanded version of the PhilCGE, one of the first CGE models for the Philippines. A technical description of the PhilCGE is found in Habito (1986). The PhilCGE applied a developing country CGE model (Dervis, de Melo, and Robinson, 1982) and was designed for agricultural policy analysis. The PhilCGE has been updated to 1994 data (Briones 2006), with some modifications in model structure. The PhilCGE has 28 producing sectors, 10 household groups (corresponding

to income deciles), and three primary factors of production (capital, agricultural labor, and nonagricultural labor). Among the 28 commodity-producing sectors are the trade sector and the transport sector. Consumer demand is modeled by a Linear Expenditure System.

Households obtain income from factor endowments (sold in factor markets), transfers from government, and transfers from abroad. Savings is a fixed proportion of disposable income.

Primary production is described by a constant elasticity of substitution (CES) function. Intermediate factors are used according to a fixed coefficient (Leontieff) technology. Supply is disaggregated into a foreign component, corresponding to exports, and a domestic component; the disaggregation follows a Constant Elasticity of Transformation function. Imports are treated as imperfect substitutes for domestic goods; products of each sector are therefore treated as composites of the two, based on Armington aggregation. Producers also invest in new capital stock using savings, which is allocated to sectoral investment demand using fixed coefficients.

The government derives its income from direct and indirect taxes, public enterprises, households, and direct government transfers from abroad, and spends it on the products of the 28 sectors with fixed expenditure proportions; it also provides transfers to households and the foreign sector. Government and foreign savings are part of total savings. Model closure is based on full employment, fixed foreign savings, and a flexible exchange rate.

4.2. Regional PhilCGE

The following describes the regional extension to the PhilCGE. The extension is implemented in three ways: first, regional supplies and demands are introduced; second, marketing margins are distinguished by region; third, regional markets are introduced. Note

that in the construction of the regional data sets, national data will be disaggregated using the most plausible assumptions based on available secondary information or expert judgment.[†]

For the first extension, producers are distinguished by region, with at most 28 producing sectors in each of the 16 regions. This involves disaggregation of quantity supplied, as well as factor demands. In the model, the regional supplies are summed up to a nationwide supply for the national economy. To simplify the model, interindustry flows, investment demand, as well as foreign trade is restricted to the national model. On the demand side, each of the national households is disaggregated to their regional counterparts. Benchmark data disaggregation would involve incomes by source (and therefore factor endowments), as well as consumption demands (for at most 28 sectors). Regional demands are summed up to nationwide demand. Based on the findings of market integration studies, we assume that sectoral demands and supplies reach equilibrium at a common price at the national level. This contrasts with the treatment of labor markets (see below).

For the second extension, delivery of regional output to the national market requires inputs from the trade and transportation sector, which is treated as a form of unit transaction cost. This unit transaction is differentiated by region. That is, intermediate demand at the regional level is limited to purchases from the trade and transport sectors. Alternatively, we could disaggregate sectoral markets by region with marketing margins differentiating regional prices, based on spatial arbitrage; the treatment suggested here, following Lofgren et al (2002), is much simpler. Eskola (2005) shows that, with plausible assumptions on the effect of infrastructure on trade and transport costs, one can analyze the economywide impact of regional public investment.

[†] Owing to resource constraints, no new primary data will be collected for this study.

For the third extension, the labor market will be subdivided by region; in the short term, labor does not move across regions, resulting in different market-clearing regional wages. In the medium term, labor does move across regions, leading to national wage equilibrium regions (for simplicity we rule out cost-of-living differences across regions.) Finally in the long term we allow labor to move between agricultural and nonagricultural sectors (this last feature is already incorporated in the PhilCGE.)

Figure 1 presents in diagram form the basic approach for the regional extension. For simplicity we suppress the government and foreign sector, as well as investments and savings. At the regional level of the model are business firms, households, and labor markets. For commodities, national consumption demand, as well as intermediate demand for the trade and transport sectors, is the sum of regional demands. All other intermediate demand is determined nationwide. Factor supply and demand are the sum of regional supply and demand. Prices of both commodities and factors are determined nationwide; the exception is the wage, which is determined at the regional level.

Note that the model is only partly a bottom-up regional model; inter-industry flows for example occur only at the national level, once the regional outputs have been delivered to the national market. This “semi-bottom-up” approach allows the model to capture geographic barriers without requiring full-blown regional datasets.

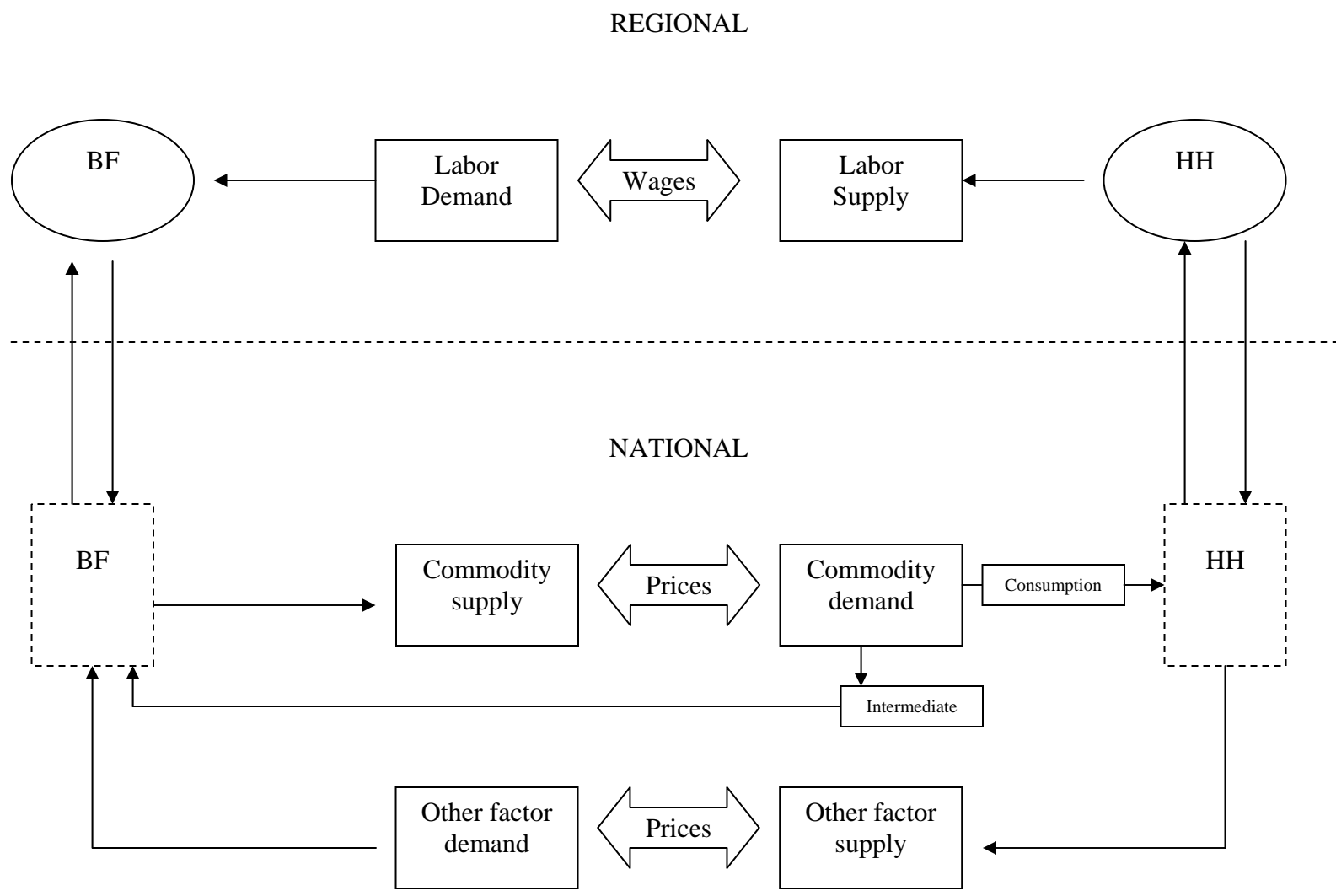


Figure 1. Schematic diagram of regional model

4.3. Microsimulation

The consumption side of the model contains 10 household deciles for each region. Each of the deciles represents an aggregation of households represented in a large nationwide household survey. By assumption, the individual households maintain a fixed share in consumption and income in their respective deciles. This “semi-microsimulation” approach permits calculation of impacts on poverty and distribution by region, without running into numerical solution problems associated from full microsimulation.

5. Data requirements and sources

The model will rely on two major sources of data: the Input-Output (IO) Table and the FIES. The 2000 IO table is scheduled for release this March 2006; this will be matched with the FIES data from the 2000 survey. (Compare this with the TARFCOM model, which is calibrated from the 1994 Input-Output Table, and the Cororaton-Cockburn model, which uses the 1994 FIES). Other supplementary data sources include the National Income Accounts, the Labor Force Survey (LFS), and other official data.

The FIES and LFS all identify regional variables. However other data, such as the inter-industry flows, is available only at the national level. As regional differentiation of the marketing margin is crucial for simulation results, the researchers will undertake data collection from the various government regional offices to be able to approximate the distinctions. Regional data may be used for other purposes, such as in framing the policy experiments, or informing some of the underlying model assumptions.

6. Dissemination strategy

Dissemination will be two-pronged: first is through communication and publication strategy, including posting the model on the Brain Trust website, as well as through journal publications, and policy briefs. The second is a more targeted strategy of engagement and advocacy with policymakers, public officials, and NGOs, using the wide network of Brain Trust Inc. members within the government, the academe, and civil society. Targeted dissemination will be carried out in partnership with the Economic Policy Reform and Advocacy (EPRA) project of the USAID. EPRA has established a mechanism for broad and cross-sectoral support to the formulation, implementation, enforcement, and monitoring of policy reforms, involving government officials, NGOs, research institutions, and other policy think-tanks. Within the context of the proposed study, partnerships will be oriented towards organizations and officials in the various regions, for whom results of the study will be most directly relevant. Specific activities include:

- a) Focused group discussion among academicians and research institutions involved or interested in the subject during project implementation. It will mainly be for purposes of consultation and validation but that would already inform participants of the expanded model and project results.
- b) Organization of a national multi-stakeholder policy forum that will explain the expanded model and how this can be used for planning, policy-making and resource allocation, as one of the culminating activities of the project. This forum will consist of key policy-makers in government (e.g., National Economic and Development Authority, Department of Trade and Industry, Department of Agriculture, Department of Budget and Management, Department of Interior and Local Governments,

Department of Social Welfare and Development, local government executives), academe and research institutions and civil society, particularly those organizations engaged in the subject (e.g., Global Call to Action Against Poverty, CODE-NGO) and donor institutions.

- c) Collaborating with key organizers such as the Philippine Economic Society, Philippine Institute for Development Studies, etc. for organizing economic forums that will present and discuss the methods and results of the study.

7. Key references

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8. Team members' relevant training and experience

The individual members of the Team have wide experience and proven expertise in the skills and competencies required for the proposed study. The team will be closely guided by the developer of the original PhilCGE, a former Socioeconomic Planning Secretary, currently EPRA Project Director, as well as Chairperson of Brain Trust Inc

The lead researcher is a development economist with a track record in economic modeling. He was a key person in the development of a macroeconomic model for Ateneo de

Manila University, as well as global and Asian supply-demand models of the fish sector for the WorldFish Center. Currently he is engaged in various consultancies related to macroeconomic, general equilibrium, and partial equilibrium modeling.

The junior researchers are sector specialists who have worked extensively in the industry, agriculture, environment and natural resources sectors in the National Economic Development Authority. Two continue as consultants in the same fields and in sustainable development at the international, national and local levels. Following years of active work in civil society, they have also developed a wide network with both government and non-government organizations. The remaining two are currently based in NEDA.

9. Expected capacity building and assignments

The research component of the project is carried out in partnership with the National Economic Development Authority (NEDA). Capacity building will be undertaken in two components, namely research collaboration and training.

Research collaboration will be undertaken between the lead and junior researchers.

The junior researchers are subdivided into two types of specialists:

1. Sector specialist – agriculture and social sector
2. Sector specialist – industry and regional development

In turn, each type of specialist will have a distinct concentration, one on policy and model evaluation, the other on data analysis. Hence there are four junior researchers (two each for the above types of sector specialists). Note though that throughout the study, the emphasis is on teamwork and collaboration across the broad range of tasks required, including data analysis, coding, model simulation, and report writing.

The two junior researchers focusing on data are both based in NEDA. One is an agriculture and social sector specialist, with a strong statistics background, experience in working with household surveys, and familiarity with statistical software. Her assignment would include working with the FIES for incorporation into the PhilCGE. The other is a regional development specialist, who will be tasked with compiling regional economic data based on expert opinion and secondary information. The other junior researchers, who are based in Brain Trust Inc, will handle other modeling tasks, such as formulation of agricultural and regional policy experiments, evaluation of model parameters and simulation results, and elicitation of expert opinion on the breakdown of trade and transport costs to the regional level.

As for training, the project will prepare a training course on using the regional model as decision support for regional planning exercises. Implementation of the training course will be undertaken on a demand basis, and subject to cost-sharing arrangements with participating institutions. Participants will include staff from local and national government agencies, and other parties interested in regional development. Marketing of the training component will be undertaken as a matter of course during dissemination activities.

10. Any ethical, social, gender or environmental issues or risks which should be noted.

None

11. List of past, current or pending projects in related areas involving team members (Selected, most recent)

USAID, Economic Policy Reform and Advocacy Project: Roehlano M. Briones – consultant;
Cielito F. Habito – Project Director

Australian Center for International Agricultural Research, Economic and Market Analysis of the Live Reef Fish Food Trade in Asia-Pacific Project: Roehlano M. Briones – consultant (quantitative modeling of live reef food fish trade using the AsiaFish model)

WorldFish Center, Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia (ADB RETA 5945):
Roehlano M. Briones – postdoctoral fellow (assists in construction of the AsiaFish model)

DA - World Bank Mindanao Rural Development Programme: Ma. Lourdes M. Lagarde, Poverty Alleviation Specialist/Development Economist (assess poverty situation in provinces and municipalities of Mindanao; developed criteria and procedures for identifying target groups and geographic areas that should be prioritized for program interventions).

GTZ-NEDA: Exercise Series on the Annual Macro Model with an Agriculture Module (ISP Project): Alellie Sobrevinas – Study Team leader.