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Dynamics of Development in Rural Communities

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Abstract

This paper explores the complex process of rural development at the community level in the Philippines. From the complementation among the essential elements of rural development (social infrastructure, physical infrastructure, and financial services), linkages are traced towards the attainment of goals. Roads initiate the delivery of other physical infrastructure to the usually isolated rural community. Roads also facilitate the delivery of capacity building activities and community organizing, which empower the community. An empowered community, in turn, will be able to stride a sustainable path towards development.

Although development assistance requires a certain density of a bundle to exhibit an effect in a community, expansion of the coverage from the current rate will be needed. Without expansive coverage of a comprehensive package of interventions similar to those provided through official development assistance, manifestation of rural development may be delayed further. A comprehensive package of development projects may be identified and formulated through a participatory approach. Substantial funding that will enable both intensity of intervention and wider coverage will be more efficient than a project implemented in phases spread over time covering different communities. This simultaneous implementation will generate rural development constructs and an expected multiplier effect, both of which are long-term outcomes. This effort will require efficient coordination and synchronized implementation of various development assistance intended for the rural sector.

Keywords: rural development, rural infrastructure, development intervention, spatial autoregression

JEL Classification: R11, R12, H54

I. INTRODUCTION

The intervention strategy used by the Philippine Department of Agrarian Reform (DAR) has evolved over the years. The real benefit from agrarian reform depends on assistance/interventions beyond land distribution to enhance tenure. Because agrarian reform beneficiaries are faced with isolation within the community, necessary supports to uplift their living conditions should be community-based, e.g., rural infrastructure. Therefore the strategy of DAR was to launch community-building interventions where the beneficiaries come from agrarian reform communities (ARC), including but not limited to agrarian reform beneficiaries. Interventions like support services are planned to transform these communities and their corresponding organizations into viable entrepreneurs integrating production activities (farm and non-farm) of the households. This is a necessary sustainability infrastructure since land is often distributed through the agrarian reform program only to be given up by beneficiaries for fast cash, restarting the cycle of poverty. Thus, to ensure more sustainable development, the whole community is provided with development-inducing tools including rural infrastructure and capability building activities.

In rural development intervention, direct provision of amenities has been used for improvement of living conditions or to enhance production. The strategy can provide an easy remedy within the highly vulnerable segment but the effect is non-sustainable and short-lived. The emerging paradigm shift from direct provision to facilitating access of such, and from universal intervention to targeting requires a clear understanding of the spatial and possibly temporal dynamics of rural development and infrastructure provision.

The role of roads, other rural infrastructure, support services, and other interventions in rural development is not necessarily a new field. However, an empirical community model that integrates spatial dependencies will potentially contribute toward better understanding the policy directions needed in targeting rural development. This can help mitigate the wasteful allocation of development assistance in rural areas, and identify where it is needed most and where higher benefits are expected. Correct policies can be hoped to resolve the vulnerability and inequality dominating the picture of rural communities. Results of this study may also be extended to cross-country comparisons so that broader policy orientation can be generated.

This study hopes to explain the dynamics between development-facilitating assistance provided to the rural communities (including tenure-enhancing features of the agrarian reform program) and the community-wide rural development manifestations. We will also simulate the impact of policy directions enumerated in the Philippine Medium-Term Development Plan 2004–2010 on the rural communities.

II. RURAL COMMUNITY DEVELOPMENT

Rural development has become one of the major outcomes identified among various assistance/intervention programs of either the individual developing countries, or of multilateral institutions/donors. A clear understanding of rural development dynamics is necessary for it to prosper. In addition, the inadequate indicators of rural development became a constraint in development planning, for an information gap in one of its facets will cripple a program that should rather be integrated. Thus, any contribution towards the understanding of rural development is valuable.

There are however, other points-of-view concerning the land ownership issues. Using modern theory of agrarian organization, Conning and Robinson (2002) offered a reason why tenure improvement, despite its economic advantages, has been so little used in countries where agrarian reform is a salient political issue, explaining the relative failure of land reform

in Latin America. In the Philippines, resistance among the landowners was very common, so no tangible results were observed during the first few years after the implementation of the Comprehensive Agrarian Reform Program (CARP). Now that the resistance has been reduced to a few regions only, real progress among agrarian reform communities (ARC) is starting to show. The features of the enabling policies of the agrarian reform law, however, can possibly dampen agricultural development. The CARP allows retention of 7 hectares of land only among the landowners, while the tenants can own an indeterminately small parcel of land. The average farm size cultivated by households is just a little more than half a hectare. This makes it impossible for farmers to benefit from technology advancement and other farm implements because it is not cost-effective given such a small parcel. This is consistent with the observation of Mundlak et al. (2002) that new technology changed the returns to fertilizer, irrigated land and capital, all of which proved scarce to varying degrees, partially explained by farm size. Since much of the production is done on small farms, increasing concentration of production on small farms can contribute to the declining productivity.

The implications of the lowering of transportation costs include: people are no longer tied to natural resources, consumer-related natural advantages are becoming more important, population is increasingly centralized in a few metropolitan regions, people are increasingly decentralized within those regions, high-density housing and public transportation are becoming increasingly irrelevant, location of manufacturing firms is not driven by proximity to customers or suppliers, and education becomes easier to provide.

A more advanced econometric approach was used by Fedderke et al. (2006) in analyzing the effect of expenditures on infrastructures on long-run economic growth in South Africa. They used a vector error correction model (VECM) and concluded that the role of infrastructure is in terms of raising the marginal productivity of capital and in encouraging private investments. This is especially true for roads that generally bring down transaction costs of trading. Investment in infrastructure leads economic growth, but there is only weak evidence of feedback from output towards new infrastructure.

The role of community participation in enhancing local public service delivery is emphasized. The dynamics between the local governance system, the local administrators, the community, and higher level of administration can facilitate or be a hindrance to development (DasGupta et al., 2003). The role of community participation is important because of their knowledge/understanding of the environment and the asymmetries of information among the households and they are directly affected by the outcomes later. A development directed state-community synergy should be enhanced by interventions that could reduce power imbalance among community members, e.g., land reform, development of non-crop source of income, etc. Policies at the higher level of governance can bypass the vested interest of local administrators thereby becoming more responsive to the needs of the households. Institutional reforms at local and community level enhanced by various factors including the generation of community demand for better public goods and services (participatory in nature) in fostering development. This may include empowerment strategies like capacity building and rural infrastructure resulting to lower transportation cost, access to farm inputs and access to markets. Improved accessibility will be minimized if not eliminate the information asymmetry between the suppliers (of inputs), the traders (of produce), retailers (of food products), and the producers.

Although they may be conceived with the best of intentions, stand-alone intervention strategies that spread resources too thin make benefits difficult to realize. Imagine, for instance, a one-kilometer rural road that adjoins the main road vein but is five kilometers away from the production area, or a solar dryer facility at the center of the community but without ample storage facilities. Similarly, a community could have a good road network with a well maintained irrigation system but these would be difficult to utilize without a source of

financing to procure production inputs; establishing a credit cooperative is a positive step, but it needs micro-enterprise to support its robustness to borrowing and lending behavior of members. Implementing a higher density of interventions in an area—while it might seem unfair at first—could allow each properly planned intervention to complement the others, resulting in multiplier effects that spread beyond the initially targeted community.

III. METHODOLOGY

The agrarian reform community (ARC) level of development assessment is panel data with ARCs as spatial units. It was collected for the years 2002, 2003, 2004, and 2005. An ARC may be composed of one or several *barangays* (villages; the smallest political unit in the Philippines). An ARC is formed based on the homogeneity of development-inducing endowments the barangays possess. The ARC level of development assessment was initiated in 1997; over the next couple of years it evolved, reaching a form in 2000 that is very similar to the most recent version in 2005. It is a complete enumeration of all ARCs launched by the Department of Agrarian Reform where intervention will be targeted. Not all households within an ARC are beneficiaries of the agrarian reform program. The data collected are specific indicators of the key result areas of agrarian reform, including tenure improvement, economic and physical infrastructure support, farm productivity improvement, and community development. Aside from the indicators that usually measure accomplishments in the provision of various infrastructure and support services, indices were computed for overall development (equated as an index of rural development), and for each of the key areas needed in the manifestation of rural development. The overall index provides a yardstick of development level of the community because it indicates how much effort that can stimulate development has been exerted.

Community Development Model

The community level data (panel) will be postulated in a time series cross-section framework. The objective of the econometric specifications will be to account for the effect of rural roads and other infrastructure on specific rural development targets. Temporal aggregation will be annual and spatial units will be agrarian reform communities (ARCs). Park's mixed model with autoregressive error of order 1 will be postulated and given by

$$y_{it} = \alpha_i + \beta_t + \gamma' x_{it} + \varepsilon_{it}, \text{ where } \varepsilon_{it} = \rho \varepsilon_{it-1} + \eta_{it}, \begin{matrix} \varepsilon_{it} \sim N & \sigma_\varepsilon \\ \left(\begin{matrix} 0 & 2 \end{matrix} \right) & \end{matrix} \text{ independent of } \begin{matrix} \alpha_i \sim N & \sigma_\alpha \\ \left(\begin{matrix} 0 & 2 \end{matrix} \right) & \end{matrix}$$

β_t is a temporal effect and may possibly vary across time points, and α_i is a spatial random factor. x_{it} is a vector of covariates including indicators of presence/quality of roads and other infrastructure.

The dependent variable will be the community-level index of rural development and income per household averaged at the community level. Total and breakdown of income from different sources will be analyzed. The covariates will include the magnitude and proportion of accomplished rural infrastructure projects (proportion computed over estimated needs), tenure improvement, and aggregate impact of various official development assistance received by the community.

IV. INFRASTRUCTURE AND RURAL DEVELOPMENT IN AGRARIAN REFORM COMMUNITIES

The community level models shall be able to characterize the multiplier effect that any targeted intervention is expected to generate, not only among the direct beneficiaries, but among the indirect beneficiaries as well. Even if only a segment of the community directly benefited from an intervention, if there is a viable sustainability facility for that intervention,

then the whole community can benefit as well. This analysis is expected to provide evidence on how the benefits received by direct beneficiaries are spread into the whole community. This evidence will further support the idea that resources should not be spread too thin, that a few bundles should be implemented instead of plenty single/stand alone interventions. This strategy will provide optimal gains and better chances of observing multiplier effects and subsequent sustainability.

Panel models are used to generate evidence on the accumulation effect of infrastructure and other development interventions at the community level. This will provide simple evidence of sustainability of development gains of the current strategies.

The Rural Communities

The data used here came from the Agrarian Reform Communities Level of Development Assessment (ALDA) conducted by the Department of Agrarian Reform. The yearly activity is aimed to generate information about the different aspects of development among the agrarian reform communities supported by the department. It collects basic indicators at the community level and aggregates them into an index for each of the key result areas (described in the next paragraph) and finally into an overall index. The index is a measure of a community's development, so if interventions among key result areas are accomplished, rural development will be feasible.

The department's major goal is land distribution. Since land distribution alone will not necessarily result in tenure improvement and eventually in rural development, other support services are also provided either directly or through facilitation of access to such. The key result areas of the department include land tenure improvement (LTI), economic and physical infrastructure support services (ECOPISS), farm productivity and income (FPI), organizational maturity (OM), basic social services (BSS), and gender and development (GAD). An index or a score (range of 0–100) is computed for each of the key result areas before the overall index is completed. The indicators are immediate outputs (either directly provided or facilitated to be attained), intended to meet the key result. A community's score depends on the amount of output resulted from the interventions delivered.

The department does not necessarily deliver all those services, but facilitates for other departments to deliver such in the ARCs. An ARC is comprised not only of agrarian reform beneficiaries (ARB), but of all households in the community regardless of whether they are beneficiaries. The idea is to develop the entire community for sustainability of the development gains. At present, the ARCs account for approximately 20% of all rural communities in the country.

To be able to deliver all those results, regular appropriation from the government as well as development assistance from multilateral agencies (grants or loans) are used. The development assistance called foreign-assisted projects (FAP) usually includes the following menu: physical infrastructure (construction and/or rehabilitation), community and institutional development support, agricultural productivity and rural enterprise development, basic education support (construction/rehabilitation of school buildings), and primary health care (construction of health centers, provision of medicines, etc.). Some projects include all these support services, while others include a subset and or only one of them.

As of 2005, the households in the ARCs have an average total income of PhP 92,773 per household, of which an average of PhP 53,802 comes from agricultural sources and PhP 39,420 comes from non-agricultural sources. These figures are along the same lines as those presented earlier, considering that the coverage is 20% of all communities only (total income is PhP 110,482). The ARCs have been in progress for about 8 years as of 2005.

The average overall index for all communities is 71.52, indicating that there is still ample room for the department to provide rural development inducing interventions. Among the key result areas, LTI is the only one approaching completion (100) with the average index of 92; the target is to complete land distribution by 2008. The BSS also yield a higher average score of 87, followed by ECOPISS with 68, OM with 67, FPI with 66, and GAD with 51. The communities are better served in terms of basic social services but work needs to continue, and even grow in intensity when it comes to economic and physical infrastructure, farm productivity improvement and gender and development.

The total land area distributed relative to scope averages 92% per ARC, consistent with the actual ARBs relative to the ARB scope of 93%. One negative effect of agrarian reform is that some beneficiaries did not appreciate the purpose and were easily lured by the quick cash value of the land. Only 77% of the ARBs are still cultivating the land as of 2005.

In terms of physical infrastructure, accomplishment rates are similar. Accomplishment of rural roads (length) averages 60%, 65% for bridges (length), 69% for the number of irrigation systems required, and 62% for area coverage of irrigation (relative to total irrigable area); 67% of ARBs needing irrigation are actually served, and 73% requiring post-harvest facilities (warehouse, dryers, etc.) are served.

For the economic infrastructure, accomplishment in credit provision is at 54%. This can be attributed to the low repayment rate at 44%. Some credit facilities are not sustainable because funds are easily drained due to low repayment rates. The adoption rate of modern agricultural technologies is low at 38%.

Among the foreign-assisted projects, the best profile of supported communities can be observed from the Agrarian Reform Communities Development Program by the World Bank (ARCDPWB), with an average index of 75.96, the highest among the projects as of 2005. This is supported with the highest income of PhP 102,300 per annum per household. One important feature of the project is that aside from the bundles of intervention provided, it implements a cost-sharing arrangement among stakeholders (beneficiaries, local government, and national government).

The Microfinance project has an average index of 75.29, also among the highest, but the average income is lower at PhP 90,915. This is one highly specialized project without diversity in menu, focusing only in credit, with minimal institutional capacity development. Similar is true for Agrarian Reform Infrastructure Support Project (ARISP) focusing on rural infrastructure with some institutional development, usually related to the infrastructure (user's group).

The Belgian Integrated Agrarian Reform Support Project (BIARSP) has a wide menu of interventions, thus the average index is high at 73.02, but income is only PhP 83,940. Although the menu is diverse, provision to a community is not necessarily bundled, spreading resources to several communities.

The Western Mindanao Community Initiatives Project (WMCIP) yields the lowest index (64.03) and income (PhP 72,471). Aside from a limited project menu, it was also implemented by government line agencies, local government units, and non-government organizations. The usual implementers of such projects are development consulting groups with established track records. The package of implementers could be detrimental to the project because of the complex political dynamics they engaged in.

The importance of bundling and diversity of interventions in rural development has been initially illustrated in the household data, and now in community-level data.

Rationale for the Models

The community (ARC) level data (ALDA) is a panel data of four years from over 1,000 communities. Models for overall index of rural development, indices for each of the key result areas, farm income, non-farm income, and total income are fitted using mixed panel models with and without autoregressive errors. Estimation was also done using the hybrid backfitting algorithm.

The empirical models therefore assess the dynamics between rural infrastructure and rural development indexed by a typical household in the community, based on short- and long-term outcome indicators. The outcome indicators are perception (summarized into an index), actual income measurements, or community level aggregate index representing various targets of the development interventions of the government.

The Dynamics of Rural Community Development

The availability of panel data (ARC level over a 4-year period, most recent is 2005) enabled the analysis to be conducted over time and space. The panel models with and without autocorrelation are fitted to investigate the dynamics of community level rural development across the ARCs and over time. The scores of each community for overall index, for each of the key results areas, farm, off-farm, non-farm, and total income were regressed on some infrastructure indicators provided to the community.

Two panel data models were fitted: a ordinary random effects model (results in Appendix 1), and a random effects model with autoregressive errors (results in Appendix 2). Models for income data have poor performance while those for indices yield adequate fit. The generation of income data that is based on some ad hoc procedure could have tampered with data quality, thus affecting model fit. Some statistics on model fit and model performance are summarized in Table 4.1.

Table 4.1: Random Panel Data Models for Community-Level Data

Dependent Variable	Random Effect Panel Data			Random Effect Panel Data with AR(1)			
	σ_{ARC}		σ_{error}	MAPE(%)	σ_{ARC}	σ_{error}	MAPE(%) ^θ
Overall Index	6.57	3.355	4.573	6.56	1.029	5.189	-0.3367
Farm Income	143.77	21130	23863	141.15	10313	25684	-0.3304
Off-Farm Income	119.18	9526	9808	114.55	5809	10228	-0.2632
Non-Farm Income	179.20	15861	14635	170.94	9752	15342	-0.2627
Total Income	40.52	34478	38571	38.96	16955	41311	-0.3278
OM	16.79	10.067	8.470	16.75	6.150	9.169	-0.2349
LTI	6.46	3.053	5.230	6.45	0	5.956	-0.3177
FPI	21.88	6.986	13.665	21.90	0	15.002	-0.3298
BSS	11.23	7.035	8.304	11.24	3.817	8.979	-0.2490
GAD	28.26	9.978	10.210	27.98	5.233	11.234	-0.2894
ECOPISS	12.03	4.32	7.79	12.10	0	9.339	-0.4130

The random variation of the indices and income data across the communities are clear in Table 4.1. This could mean that even if similar interventions are implemented, there is still an ARC-specific source of variation that will make the actual outcome different from the one expected from that intervention. The significance of the autoregressive parameter is evidence of the accumulation of outcomes in the key result areas as exhibited by the ARCs over the years. This could mean that the kinds of interventions currently implemented in these ARCs are leading towards sustainability. The basic strategy used by the Department of Agrarian Reform in the delivery of development intervention is a mixture of direct provision and facilitation. While facilitation is used for budget coming from the general appropriations,

direct provision and facilitation are used for foreign-assisted projects. The benefit of the facilitation effort is not only limited to cost minimization, but also the building up of the sustainability infrastructure, where the communities are gradually being empowered in the process.

Two sets of indicators at the community level are analyzed: the indices for each of the key result areas and the overall index representing the output level measures as a result of the intervention. On the other hand, average household income at the community level can be considered as the outcome (not necessarily immediate result) of various efforts/interventions including infrastructure and other development assistance.

The constant estimates for each of the models are summarized in Table 4.2 along with the average values of the indicators as of 2005. Considering that panel data is used, the constant can be used as a benchmark or a recurring level over the years. This is the value of the indicator cumulated over the years. The difference between the current level and this benchmark is a result of the efforts specific to the current period, the model specifying the details on who contributed what. Stability/robustness of the indicator to various recurring factors is said to have been established if the benchmark is equal to the current level. The proportion or percentage of the benchmark relative to the current level will give an indication of how stable the indicator is to the fluctuations of various determinants.

Consider farm income where the benchmark is 62% of the 2005 average. This means that new efforts in 2005 aimed to increase farm income resulted in one third more than what was expected (as a result of the cumulative efforts over the years), which is PhP 33,403 among typical rural households. The off-farm income, which can still be agriculture-based but was gained from different land cultivated by the household, has a lower benchmark at 42%. The non-farm income is worst at only 25%. This means that the activities in the past intended to generate non-farm income among rural households in the ARC have not been sustainable enough to expect more recurring income. The non-farm income level is determined mostly (75%) by the current interventions. This high percentage may also reflect problems of design specifics of an intervention that is not necessarily sustainable. Whatever gains were generated for the current year cannot be expected to happen again in the future. For the total income, which is like the weighted average of farm, off-farm and non-farm income, the benchmark is close to half of the current level. This means that as a whole, the income-generating interventions provided among the ARCs still require further tightening to make sure that gains they generate can be expected to recur in the future.

The proportion of the benchmark of **overall index** is similar to the one on farm income. The fact that **farm productivity and income**, which have been in the mandate of many departments, have very high proportion (84%) of benchmark can be interpreted as meaning that the interventions among the ARCs are focused mostly on farm income generation. There are less intensive, perhaps not sustainable interventions intended to generate non-farm income, confirmed by the low percentage of the benchmark of **economic and physical infrastructure support services** with only 21%. Although in terms of welfare (**basic social services** and **gender and development**), farm productivity and institutional development (**organizational maturity**) interventions towards the ARCs have been relatively successful, two key areas still need further improvement. Although **land tenure improvement** has been the flagship goal of the Agrarian Reform Program, and the Department is indeed relatively successful in land distribution, the problem occurs after land distribution. Land tenure improvements do not recur because there are beneficiaries who are easily tempted by easy cash and often exchange tenure for some money, either for a long period or permanently. Even if more land is distributed, the tenurial profile among the ARCs is not really improving; intensifying efforts towards income diversification would be more effective. However, while there is massive provision of rural infrastructure, maintenance and sustainability is not properly institutionalized before the project is turned over to the beneficiaries or the local

government. Furthermore, economic infrastructure activities are scanty (or nonexistent) or incorrectly designed. Even if roads are constructed to a reasonable length, they will not be optimally used without marketing support for both the agricultural produce and the products of microenterprises.

Table 4.2: Benchmark and Current Community Level Indicators

Indicator	Benchmark (Constant)	Average as of 2005	% Benchmark to 2005 Ave.
Farm Income	33,403	53,802	62
Off-Farm Income	6,706	16,012	42
Non-Farm Income	5,785	23,408	25
Total Income	44,953	92,773	48
Overall Index	44.35	71.52	62
Organizational Maturity	49.79	66.58	75
Land Tenure Improvement	28.76	92.42	31
Farm Productivity and Income	55.93	66.35	84
Economic and Physical Infrastructure Support Services	14.56	68.18	21
Basic Social Services	70.88	87.10	81
Gender and Development	44.79	50.95	88

The non-recurring part of the indicators is explained in terms of age of the ARC, tenurial conditions, rural infrastructure, credit, technology adoption, and benefits from official development assistance.

The age of the ARC is the number of years since the community was launched. The mechanism of identifying communities where the agrarian reform beneficiaries belong and helping not just the beneficiaries but the whole community was started in the early 90's. There are ARCs that have been launched only recently. Since intervention is provided for the whole community, it is expected that gains or status of the ARCs will be proportional to the age (on the assumption that the design of the intervention is correct). Farm income ($p < 0.000$), off-farm income (0.001), total income ($p < 0.000$), organizational maturity ($p < 0.005$), and economic and physical infrastructure support services ($p < 0.000$) are all increasing over the years. For every year added to the age of the ARC, these indicators are expected to grow as well. However, land tenure improvement ($p < 0.000$) is declining over the years. This is consistent with the discussion above, explained by the difficulty in ensuring that the beneficiaries will continue cultivating the land and do not forego their tenurial right over it.

There are three tenure indicators used in the analysis. Percentage of agrarian reform beneficiary to potential beneficiaries will indicate accomplishment level of the scope of the program. The percentage of distributed area to total area covered by the program will complement the counts of the number of beneficiaries. Then the percentage of beneficiaries who are still cultivating the land is a measure of maintenance of tenure after land distribution. Expectedly, all the three indicators contributed significantly to the land tenure improvement index. The total income is not affected significantly by any of these three tenure indicators because farm income, which comprises a big part of total income, is also not directly affected by these tenure indicators. Non-farm income, however, is affected by percentage of area distributed, while off-farm income is affected by percentage of beneficiaries to the potential number. Through land distribution alone, it is not really expected that income will increase instantaneously, until other dimensions of agrarian life also improve. In addition to land tenure improvement, indices for other key result areas will also improve, including the overall index. The proportion of accomplishment in area or beneficiary coverage will affect organizational maturity and gender and development indices because the institutional

strengthening efforts are intensified in areas where there are more beneficiaries. Economic and physical infrastructure support and correspondingly farm productivity indices are also affected by indicators of accomplishment in land tenure improvement.

Among the types of rural infrastructure usually provided or facilitated for the agrarian reform communities, rural roads exhibited effects on the largest number of indicators. Income from all sources as well as the total income increases for every accomplishment in roads constructed or rehabilitated relative to the demand identified by the communities. Rural roads facilitate accessibility by bringing the community out of isolation and exposing them to development in other areas. This will lead to growth in demand for other infrastructure and other development interventions. The expected mode of delivery of such intervention is not necessarily direct provision, but beneficiaries are willing to cooperate/contribute for as long as access to such needs will be facilitated. Among the indicators, only land tenure improvement and farm productivity did not exhibit direct benefits from meeting the needs for rural roads. Understandably, accomplishment in land distribution is dominated mostly by socio-political and legal factors, while farm productivity is dependent on soil fertility as well as on farming systems. These factors, however, can be enhanced with improved accessibility, thus resulting in indirect benefits from rural roads. Along with roads, bridges are needed to complete the accessibility network in rural areas, so similar benefits from bridges also manifest.

The irrigation indicators used include proportion of the number of irrigations to the identified needs, proportion of the serviced area to the total irrigable area, and proportion of agrarian reform beneficiaries with access to total beneficiaries within the service area. As expected, the indicators contribute to the index on economic and physical infrastructure support. This support also appeared to be an important determinant of the overall index, illustrating its role in the development of the community. However, the indicators do not contribute significantly to any of the income indicators or to indices of attainment of other key result areas. Irrigation will definitely have an indirect effect but the absence of a direct effect on other indicators may be explained by some details of the irrigation system. First of all, many canals are built without using concrete. Earthen canals have short lives and holes can be easily created by rodents and from cracks during dry spells in summer months. Maintenance of the canals would often be a major stimulus of conflicts among users, eventually threatening the sustainability of the infrastructure. For better understanding of the impact of irrigation, some indicators on how many of these irrigation systems are properly maintained may help. Similar results for post-harvest facilities hold.

Credit is as important as any other intervention. All the income indicators and indices except one index are affected positively by the proportion of credit needs met in the ARC. Farm productivity is not directly affected by credit because the loan proceeds must be spent on input procurement or planting before they result in increased productivity.

Adoption of farming technologies also affected almost all indicators, except off-farm income. Trainings on different farming technologies, although they may not individually benefit some households, can generally produce a positive effect for the whole community.

The Effect of Official Development Assistance

The effect of the different projects funded through official development assistance (ODA) could have been accounted for in the previous section since most of the projects included rural infrastructure in their menus. The effects presented here will be isolated as additional contributions of the project. Those presented above can be considered as the pooled effect of various efforts (including ODA) at the ARC level intended to push rural development. Organizational maturity can simplify the facilitation of access to development interventions.

The effects of some ODA-funded projects on target output or outcome (income and indices on key result areas) are explored below. ARISP is a project that was funded through a loan from the Japan Bank for International Cooperation (JBIC) and was followed by a second phase that is still on-going. The project menu of Phase 1 was dominated by rural infrastructure that includes irrigation, rural roads, and post-harvest facilities. There was an institutional development component, but the purpose was mainly the development of viable organizations or cooperatives of users that will ensure sustainability of the infrastructure. Still including the menu under Phase 1, Phase 2 includes potable water system, agricultural development support, and livelihood projects. Total income, farm income, and non-farm income of ARCs covered by ARISP are higher than those not covered. In addition, the overall index among beneficiary ARCs are also higher. This is an example of a comprehensive project that started with infrastructure and expanded to include other support services, resulting in actual income increase among beneficiaries.

The ARCDP project funded through a loan from ADB is also a comprehensive package of development interventions, but with a different implementation strategy, following a demand-driven approach. The project menu also includes rural infrastructure (roads, irrigation, and potable water), land surveying and titling (in support of land tenure improvement), agricultural development, rural enterprise development, community and institutional development, and credit. Total income and farm income of households in the ARC beneficiaries are higher. Although the project menu includes certain elements of non-farm income generation, no significant effect was established, probably because the menu is too diverse. In addition to income, farm productivity, economic and physical infrastructure support, and overall indices are also better among ARC beneficiaries.

Another ARCDP project, funded this time through a loan from the World Bank, started with a menu of rural infrastructure (roads, irrigation, and potable water), community development, technical assistance, and agriculture and enterprise development and in Phase 2, credit was included. The implementation strategy is innovative: cost-sharing between the beneficiaries, the local government, and the national government was required. Because of the arrangement, more ARCs were covered to be part of the project. Substantial dilution in the benefits could have occurred, judging by the fact that none of the income indicators among the ARC beneficiaries appeared to be different from those of the non-beneficiaries. The overall index, though, and those of some key result areas are better among beneficiary ARCs. This is an example of a project where, although the menu is good, spreading it too wide may have watered down the effect.

Finally, the BIARSP project with funding from the Belgian government has a wide range of interventions in the menu, including basic education, agricultural production, primary health care, water and sanitation. The menu excludes rural infrastructure. None of the income indicators are different among the ARC beneficiaries compared to the non-beneficiaries. Although farm productivity and the overall index of ARC beneficiaries are better off, all other indicators show no difference. This project illustrates the importance of rural infrastructure in targeting income increase as part of the development goals.

Some of the key development learning here highlights the importance of rural infrastructure if it is intended to target income increases. With rural infrastructure alone, income will not change, but with substantial support services, infrastructure will be used optimally. Given a good project menu, potential benefits will not be optimized if interventions are spread among too many areas. Although project diversity is good, making project menus exceedingly diverse is too much of a good thing.

V. SIMULATION

The data on the current state of the economy were obtained from the National Economic and Development Authority (NEDA, 2005), the macroeconomic plans also from NEDA (2004), the profile of the rural sector from the National Economic Development Authority and World Bank's Asia-Europe Meeting (NEDA-WB-ASEM, 2005), the income and expenditure structure of the rural Philippines from the National Statistics Office (NSO, 2004), community level data from DAR (2005), and the national expenditure program from the Department of Budget and Management (DBM, 2005). The data were then plugged into the models to assess the possible scenario should these plans and programs be implemented.

The Present Situation

In 2005, the population is projected at 85.2 million with a density of 282 per km², the highest in Southeast Asia (except for Singapore with 6,222 per km²); most other countries in the region have 2-digit population densities per km². In the 2000 Census, 51.9% of the population resided in rural areas.

Also in 2005, while 33% of the employed individuals are working in agriculture, the share of gross value added by the sector is only 14.4% of GDP. While the annual growth of GDP is 5.1%, growth in the agriculture sector is only 2%. Total revenue is 14.8% of the GDP, while total expenditure is 17.5% of the GDP, amounting to a budgetary deficit of 2.7% of the GDP.

The bulk of national government expenditures go to social services, social service subsidies to local government units (LGU), net lending, debt services, and land distribution with 41.85% of the total expenditures in 2005. Other expenditure items are economic services (17.2%), general public services (15.4%), education (14.7%), defense (4.8%), social security and welfare (4.4%), health (1.4%), and housing and other community amenities (0.2%). The expenditure on economic services is broken down into transportation and communications (5.9%); agriculture, agrarian reform and natural resources (3.6%); industry including trade and tourism (0.5%); electricity, gas and water (0.9%); and other economic services including subsidy to LGUs (6.4%). The details of budgetary allocation for 2005 are presented in Appendix 3.

In international trade, the Philippines is a net importer in 2005. The annual growth rate in exports is 4%, while imports are growing at 7.3%. Exports relative to GDP are 41.2% while imports are 48.9% of the GDP. Exports of food and live animals are 30% of the GDP in agriculture, while imports account for 54.7%. Among crude materials (excluding fuels), exports are 10.5% of the GDP in agriculture, while imports account for 19.7%. For animal, vegetable oils and fats, exports are 12.9% of GDP in agriculture while imports are only 2.8%.

While the ARCs do not cover all of the rural areas, they cover various representatives of sentinel groups. The ARCs also represent the beneficiaries of homogeneous outputs provided by the government in rural areas. Based on the monitoring system by DAR (2005), where indicators are summarized into a rural development index (0-least or no development, 100-optimal development or fully developed community), the average index is 71.52, still far away from the ideal rural conditions. Among the key result areas, land tenure improvement (92.42) and basic social services provision (87.1) are better off. The other key result areas need more intensive intervention. These include organizational maturity (66.58), economic and physical support services (68.18), farm production increase (66.35), and gender and development (50.95).

In terms of rural infrastructure, 60% of the total length of rural roads needed has been accomplished, 65% of bridges, 62% of irrigation service area, 73% of post-harvest facilities

and 54% of credit needs. The adoption rate of technology is still lower at 38%, requiring a more aggressive advocacy campaign and support services facilitation.

In rural development, the major physical infrastructure included accessibility enhancement and irrigation systems. Augmented with various capacity building activities, community organization and institutional development, and credit, rural development becomes theoretically feasible. The infrastructure and the public expenditure prioritization are presented here.

As discussed in the previous sections, accessibility and irrigation are the two most important components of physical infrastructure needed for agricultural production towards development. For the road system, the national roads are considered as the major arteries of the highway system. The rural roads are built to connect production and residential areas to these national road systems to diminish isolation of the rural communities.

Appendix 3 summarizes the accomplishments in rural and national road systems by region along with bridges and irrigation systems. For national roads, the total length was 28,664 kilometers as of 2005, or a density of about 1 kilometer of road for every 10 square kilometers of land area. In the national capital region (a highly urbanized region), the density is as much as 16 kilometers of road for every 10 square kilometer area. Cagayan Valley and Zamboanga Peninsula had the lowest road density, for every 10 square kilometer land area, a little more half a kilometer of road. For rural roads, almost two thirds of the recognized need has been completed, for a total length of 28,015 kilometers. Some regions, such as the Ilocos Region, are approaching the final fulfillment of the demand for rural roads, but other regions (Soccsksargen, Calabarzon, and Caraga) have barely fulfilled half of the demand for rural road systems.

There is already a total of 88,989 linear meters of bridges in rural areas. However, this is barely half of the total demand for rural bridges in 2005. In terms of density, this is about 3 linear meters for every 10 square kilometer of land area. In the Ilocos Region, there are about 7 meters of bridges for every 10 square kilometer of land area. In Central Visayas and Northern Mindanao, however, there is only 1 linear meter of bridge for every 10 square kilometer area.

From the administrative reports of the National Irrigation Administration, there is a total of 1,413,236 hectares of service area so far served by various types of irrigation from a total of 3,126,340 hectares of irrigable area (45%). In the Cordillera Administrative Region, accomplishment is already 76% because the irrigable area is relatively small due to the region being dominated by upland topography. On the other hand, in the Autonomous Region in Muslim Mindanao (ARMM), accomplishment of irrigated service areas is only 15%.

The total obligated funds for public expenditures in 2005 were 908 billion pesos, a growth of 5.3% from 2004, which in turn was a growth of 4.4% from 2003. The growth rate of public expenditures is even lower than the inflation rates for the period (7.6% in 2005 and 6% in 2004). The capital outlay for public infrastructure in 2005 is about 46 billion pesos, which is 5% of the total obligations, compared to 7% in 2003. The projects in 2005 were allocated 266 billion pesos or 30% of the total budget, of which 16% will be foreign-funded. The total budget of the main agencies responsible for the development of the rural communities (Departments of Agriculture, Agrarian Reform, and Environment and Natural Resources) is barely 1.5% of the total budget. Although the bulk of the expenditures are on education and defense (from which the rural areas benefit in terms of social development and peace and order), the budgetary structure may have allocated fewer resources to push the rural development targeted to alleviate the poor, who are mostly in the rural areas. The agriculture and fisheries modernization program received a total budget of 10 billion pesos, or about 3% of the total budget for projects.

The total appropriation for agriculture and fisheries modernization in 2005 is over 9 billion pesos, of which 33% will fund regular programs and 20% will fund locally-funded projects, while 47% will be for foreign-assisted projects. The regular programs constitute some support services aimed to develop certain aspects of agriculture and fisheries. Locally- and foreign-funded projects, on the other hand, include an integrated development package of physical and economic infrastructure, capacity-building, provision of basic social services, and other support services for the rural communities. Capital outlays commonly used for the physical infrastructure are allocated 5.5 billion pesos or 61% of the total budget for programs and projects.

The agrarian reform program is allocated 5.9 billion pesos, while the environment and natural resource program have 4.6 billion pesos. For the agrarian reform, 68% is for foreign-funded projects while 56% is allocated for capital outlay used in physical infrastructure. For the environment and natural resource program, 13% is allocated to foreign-assisted projects while 9% goes to capital outlay. Most of the interventions in the environment and natural resource programs are on capacity building, information dissemination, other advocacy and education strategies, and regulation/policing of various natural resources.

Policy Direction of the Development Plan

The Medium-Term Philippine Development Plan (MTPDP) for 2004–2010 (NEDA, 2004) serves as the blueprint of the development strategy of the Philippine government. Job generation and decentralization of development are two major agendas of the plan that directly affect the rural sector. To push the job generation agenda, microenterprise development supported by appropriate credit is considered and targets the middle class. This will in turn contribute to the expansion of the middle class base because income alleviation will spread into the lower class and further stabilize their income generation activities. In addition, agribusiness land will be developed (enhancing productivity) and products will be transported to the markets efficiently (marketing support, linkages, and road construction). The decentralization of development is achieved primarily through the development of the network of transport and digital infrastructure that will link the entire country. This will attempt to alleviate the isolation of many rural communities.

Simulation Scenarios

The broad policy thrust of the MTPDP that directly affects the rural sector can be summarized broadly into infrastructure, market development and institutional development. Infrastructure includes social, economic and physical facilities needed by rural households and institutions in the pursuit of development. This infrastructure includes rural roads, credit, irrigation and basic social services. Market development focuses on marketing support among the farmers and fisherfolk that are often at the losing end in their agreement with the middlemen. The interventions leading towards market development include rationalizing the grains sector trading by separating the regulatory and proprietary functions of the National Food Authority (NFA), rural roads and credit. For institutional development that usually facilitates sustainability of various interventions, the following tasks are targeted: stimulate the public-private sector collaboration especially on concerns of credit and rural investments; for sustainability, and ensuring service delivery of irrigation, pursue volumetric pricing, an incentive to properly maintain the distribution system; set up a tax system to prevent conversion and agrarian land ownership reconsolidation; provide interventions and safety nets during natural disasters and economic shocks; and empower the poor and the vulnerable through a comprehensive and integrated convergence approach.

While individually, none of the basic provisions for rural development are missing (need-availability balance is negligible), the pervasive rural poverty and rural-urban inequality needs further assessment. Empirical evidence supports the theoretical exploration on

bundling of infrastructure and support services and participatory provision of intervention presented earlier. The fact that the stakeholders think that there is really nothing more that they need that is not available, and that some things available are not needed, helps explain the need for stakeholder participation. Some projects may have been misplaced due to lacking community involvement in project identification. Also, the stakeholders may have perceived less need for an intervention because of deterioration of infrastructure due to poor maintenance.

In the community-level models, the determinants include ODA, rural roads and bridges, irrigation, farming technologies, and tenure improvement. The present ODA projects under the department of agrarian reform on the average cover about 5% of the agrarian reform communities; some very small projects have less than 1% coverage. One peculiar project that provides only capacity building intervention covered 20% of the communities. Simulation is done on the assumption that 10% more communities will be covered by various ODA projects. Roads, bridges, and irrigation construction that at present have 60%, 65%, and 62% completion rates, respectively, are assumed to reach 80% completion in the simulation. For other post-harvest facilities where the present accomplishment rate is relatively higher, a 90% completion rate is assumed. Provision of credit needs has very low completion rates, so 75% completion is assumed. Adoption rate of farming technologies is assumed to reach 75% from the current 38%. Tenure improvement that is already approaching completion is assumed to have been completed.

Simulating Official Development Assistance

Early development assistance in the rural Philippines was characterized mainly by direct provision of production inputs. Although not sustainable, it provided fast, short-lived relief especially among the highly vulnerable marginal group of farmers and fishermen. The thrust of development assistance has gradually evolved towards facilitation of access to inputs and social services, capacity building and physical infrastructure. These have become more sustainable, particularly if done in bundles of interventions and identified through a participatory approach.

Although there is a variety of development assistance targeting a cross-section of Philippine society as beneficiaries, we will focus only on those directly targeting agrarian reform communities. The effect was measured only at the community level, and contribution of the development assistance is indexed by the number of years a community has been covered by a development project. The effect may be interpreted as the outcome over time of the overall packaging of the project for all its components. Later on, we will consider specific factors of these development projects that may have contributed to development.

In terms of overall index of rural development at the community level, from the present coverage of about 5% of ARCs across various projects, if coverage is increased to cover 10% more (using the same project menu), the overall rural development index will grow by at most 0.18%. This occurred in a project that has a menu that balances provision of rural infrastructure, community development, capacity building, and facilitation of access to basic services. Other projects that are not as comprehensive will produce lower impact. This growth in overall index is only one seventh of the growth in 2005 of the index at 1.3%. As the project matures, however, growth in index to as much as 2% will be expected. Faster growth of the overall index to reach 100 (the maximum) can be achieved if other development assistance similar to this integrated menu is packaged and augmented with other implements discussed in subsequent sections. Otherwise, based on the settings in 2005 alone, it will take several decades before the overall index will attain a level close to 100.

Farm income grows to as much as 2% per year. This can be interpreted as the aggregate effect of all efforts to generate farm income, coming not only from development assistance

but also from all stakeholders. The impact of integrated development assistance is remarkable with at most a 0.63% increase in farm income with expansion of coverage by 10% more. In 2005, nominal farm income is growing by 1.30% and the rural inflation rate is 7.2%. While farm income grows very slowly, slower than the rural inflation rate, an appropriately identified package of development assistance can help fuel such growth.

The annual leverage of off-farm income growth is estimated at 2%. A development project that focuses on rural infrastructure with some support services and capability building assistance can contribute as much as 0.73% more off-farm income by an increase of 10% in the coverage of communities. Furthermore, this contribution can grow further to as much as 2% per year as a result of the project implementation maturing. The advantage of infrastructure-loaded projects (mostly rural roads and irrigation) is illustrated here in expanding livelihood opportunities among rural communities, alleviating their economic vulnerability from dependence on farming.

The total income is expected to grow by 1.69% a year. Expansion of coverage of different integrated development projects to 10% more communities will result in at most a 0.54% increase in total income, a rate that can be expected to grow as the project matures.

Although development assistance requires a certain density of a bundle to exhibit an effect in community-level indicators, coverage will need to expand from the current rate of about 5% of the communities. Otherwise, rural development will manifest among these communities after a longer period of time. A comprehensive package of development projects may be identified and formulated through a participatory approach. Substantial funding that will result in both intensity of intervention and wider coverage will be more efficient than a project that will be implemented in phases spread over time covering different communities in different phases. This will generate both the rural development constructs and the multiplier effect expected that are rather long-term outcomes.

Effect of Roads, Bridges, and Irrigation

In some income models, availability of roads and bridges is indicated by lower transportation cost, lower cost of utilities, and in a mid- to long-term range by diversification of employment opportunities. Electricity and water lines are installed in rural areas along paved road systems. Service cost is expected to be lower if the road system is favorable. A 10% reduction in transportation cost can result in a 0.69% increase in income from agriculture. Furthermore, a 10% reduction in cost of various utilities can result in at most a 0.71% increase in total income, a 0.50% increase in non-agriculture income, and at most a 2.91% increase in income from agriculture. Income from agriculture increases more since roads and bridges are expected to pave the way for other physical infrastructure and support services, and connect the producers to their consumers (more efficient marketing channels), thereby resulting in larger multiplier effects.

Given roads, investments in microenterprises will move towards the rural communities because it will be cost-effective to locate production facilities in areas where the raw materials originate. Employment/occupations will diversify as a result of the new production facilities. A change of occupation from farming to non-farming will benefit non-farm income but will be a loss to farm income. Still, total income will be expected to post a positive net growth. A 10% decline among households reporting themselves to be engaged in farming can result in a 1.1% increase in total income, expectedly coming from non-income sources (2.67% increase in income), but agriculture income can drop by as much as 11%. As a result of the 10% decline in farming households, suppose that any other non-farming occupation increases. Then, non-agriculture income can increase by at most 1.15%, while agriculture income will decline by at most 7%. While income source diversification is expected to propel total income growth, income from agriculture could suffer as a result of labor shortage in a

labor-intensive production system. Thus, reversion of the potential negative effect of improvement in accessibility to agricultural production requires that more efficient farming systems be introduced and adopted by farmers.

At the community level, availability of rural road systems is measured in terms of percentage accomplishment (in length) in comparison to the total requirement of the community. An accomplishment of 20% more required roads can result in a 1.20% increase in overall index of rural development, close to the registered growth in 2005. For farm incomes, 1.56% growth is expected, higher than the actual growth measured in 2005. Off-farm (still agriculture) income is likewise expected to grow by 1.68%. Non-agriculture income, however, benefits the most with an expected 1.95% growth. Total income can grow by as much as 1.57%. Clearly, rural roads here generate the largest impact on the rural development index and income growth. It should be noted, however, that the development assistance discussed in the previous section can partly be responsible for the increase in the accomplishment in rural road provision.

At the household level, the marginal effect of perceived availability and need for rural roads on income and perceptions are not significant. The role of their perception on availability of rural roads, however, is highlighted in bundles of infrastructure and other development interventions. Perceived improvement in accessibility is expected to improve the technical efficiency of the households in generating income by as much as 2.70%.

At the community level, a 20% increase of accomplishment in the provision of irrigation systems can result in a 0.74% increase in rural development index score. The marginal effects on total income and from different sources are not significant since irrigation is often included in the interventions menu of various development projects. Hence, these effects could have been accounted for in the discussion above.

Effect of Tenure Improvement

The distribution of covered land in the comprehensive agrarian reform program is nearing completion, with 92% already distributed in 2005. If land distribution is completed, this will result in a 0.70% increase in the rural development index while non-farm income will increase by 1.70%. If at least 90% of the beneficiaries continue cultivating the land (instead of relinquishing tenurial rights for cash), a 1% increase will result in the rural development index. Improvement in tenure will help loosen agrarian households' bondage to the soil, allowing them leeway to engage in non-farm livelihood activities.

Compared to those having other types of tenurial status, the amortizing owners of land they cultivate will have more than four times the odds of perceiving that there is rural development. Furthermore, the rural development index score can increase by 0.27% if there will be 10% more farmers who will be amortizing owner of the land they cultivate.

Despite the shortcomings of the present design of the agrarian reform program, it can be expected to help avert agrarian unrest as well as result in actual and perceived rural development. To make this expectation a reality, appropriate policies must be in place for the beneficiaries to not easily give up tenure. Community organizing, capacity building and the provision of other support services would also be beneficial.

Effect of Post-Harvest Facilities And Marketing

Like irrigation services, provision of post-harvest facilities is also commonly included in the menus of various projects funded from official development assistance. Thus, the marginal effect of post-harvest facilities alone could be negligible. For example, a 10% increase in the completion of post-harvest facilities among those who need it can result in an increase in

rural development index by 0.40%. An increase of 10% among those who perceived that millers are needed and available to them could mean a 3.44% increase in farm income.

Effect of Credit

Credit is evolving as one major component of a rural development intervention package. Various agencies (government and non-government) have integrated credit in their operations. Among the rural communities in the Philippines, both the agriculture and agrarian reform agencies are using it as a development strategy. Although initially, many credit projects failed because of the difficulty in improving the repayment rate, agencies have gradually implemented sustainability infrastructure. At present, about 55% of credit needs in agrarian reform communities are met by various sources.

At the community level, if credit becomes available to 20% more of those who need it, i.e., at least 3 of those 4 needing credit are able to get access, there will be a 1% increase in the overall rural development index, a 1.48% increase in farm income, a 1.43% increase in off-farm income, a 1.62% increase in non-farm income, and a 1.49% increase in total income. The income growth due to credit availability is a considerable contribution in view of the fact that total income in 2005 grew only by 5.08%. Credit has a high multiplier effect on non-farm income. This illustrates the efficiency and effectiveness of the use of credit for non-farm livelihood or in microenterprise development. The marginal farmers however are in need of capital to procure production inputs, but the repayment rate suffers when crops are destroyed due to weather conditions or infestation. It will be more viable then for sustainability of the microfinancing funds to set aside from the loan proceeds a premium for crop insurance. On the other hand, credit for livelihood should be provided along with appropriate trainings on microenterprise development to ensure efficient use of loan proceeds and later, to guarantee higher if not 100% repayment rates.

Effect of Training on Farming Technologies

Modern farming technologies are important in pushing for efficiency in agricultural production. Training modules have been conducted in various parts of the country but the adoption rate of these technologies remains low. The adoption rate could be a function of the effectiveness of the extension approach, availability of support and necessary implements to adopt the technology, and many others.

At the community level, the adoption rate of modern farming technologies is low at 38%. Suppose this will increase to 50%. This will result in a 1% increase in the overall rural development index (community level), a 5% increase in total income, a 2.54% increase in farm income, and a 7.71% increase in non-farm income. Trainings should not end at the delivery of the know-how, but should be monitored all the way to actual adoption. Once the new technologies are adopted, income will increase naturally. Note that even the non-farm income will increase as a result of improvement in the adoption rate because the efficiency in the farming system will reduce farm labor, freeing workers to engage in non-farm livelihoods and raising non-farm income, which was still very low as of 2005. The adoption rate can be increased through a strategic advocacy campaign and more effective training methods (e.g., exposure to demonstration farms pilot-tested using several technologies).

Spatial Effect

An increase of 10% in the regional average of the rural development index (community level) can result in a net increase in the index for each community by 16.87%. Income effect, although lower, is expected to grow by as much as 8.5% when the regional average income increases by 10%. For the non-farm sources, it is the increase in the average per project site

that will lead to an increase in non-farm income. Intervention per site usually varies and takes into consideration the topographic and site-specific needs of the site.

VI. CONCLUDING NOTES AND RECOMMENDATIONS

Rural roads generate the largest impact on rural development indexes and income growth. Furthermore, the rural households' production (income-generation) potential is also optimized with the availability of an accessibility network that alleviates their isolation. Provision of irrigation systems in a properly identified community necessarily fuels growth in farm income and optimizes the household's technical efficiency in perceiving rural development.

Community organizing and the active participation of stakeholders in various activities during project planning and implementation are some of the crucial elements that can encourage sustainability in development projects. The proportions of households who are members of any community or user's organization are very low. Membership in a user's group or any organization entitles one to avail of the services provided by the organization (e.g., irrigation, credit, marketing support, or even capacity building for some), leading to larger farm income growth. Community organizing and development should be an integral part of a social preparation scheme of any project, and not just be added in post-project evaluation recommendations.

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APPENDICES

APPENDIX 1: PANEL MODELS FOR ALDA INDICATORS RESULTS

The random effect model is given by $y_{it} = \mu + \beta x_{it} + u_i + \varepsilon_{it}$

Defined the following variables:

age= Age of the Agrarian Reform Community (ARC)
a_arisp=No. of years the ARC is supported by ARC Infrastructure Support Project
a_arisp2= No. of years the ARC is supported by ARC Infrastructure Support Project Phase 2
a_arcpadb=No. of years the ARC is supported by ARC Program-Asian Development Bank
a_arcdpwb=No. of years the ARC is supported by ARC Development Program-World Bank
a_arcdp2=No. of years the ARC is supported by ARC Development Program-World Bank Phase 2
a_arspeu=No. of years the ARC is supported by the Agrarian Reform Support Programme of the European Union
a_biarsp= No. of years the ARC is supported by the Belgian Integrated Agrarian Reform Support Programme
a_cida= No. of years the ARC is supported by the Canadian International Development Assistance
a_rascp=No. of years the ARC is supported by the Microfinance Project (RASCP)
a_undpsar=No. of years the ARC is supported by the UNDP
a_wmcip= No. of years the ARC is supported by the Western Mindanao Integrated Community Project
a_starcm= No. of years the ARC is supported by the STARCM Project
a_minssad= No. of years the ARC is supported by the MINSSAD Project
a_jica= No. of years the ARC is supported by the JICA Project
a_spots=No. of years the ARC is supported by the Solar Energy Project
areaact=cultivated area in the ARC covered by the Comprehensive Agrarian Reform Program (CARP)
areaper=percentage of CARP area to total cultivated area in the ARC
arbcu=number of Agrarian Reform Beneficiaries (ARB) still cultivating the land
arbcu_per=percentage of ARBs still cultivating the land
arbcu_tot=total ARB in the ARC
arbper=proportion of actual ARB to total potential ARB in the ARC
fmrcom=length of completed farm-to-market roads in the ARC
fmrper=percentage of completed farm-to-market roads to total road requirements of the ARC
brcom=number of completed bridges in the ARC
brper=percentage of completed bridges to total bridge requirements of the ARC.
nirrcm=number of completed irrigation systems in the ARC
nirrper=percentage of completed irrigation to total irrigation needs of the ARC
iareacom=total irrigated area in the ARC
iareaper=percentage of irrigated to total area in the community
arbfarai=total irrigated area among ARBs
arbfarper=percentage of irrigated areas among the ARBs
arbapph=number of ARBs needing post-harvest facilities
arbapphper=proportion of ARBs needing post-harvest facilities
accredit=number of ARBs with access to credit
creditper=percentage of ARBs with access to credit
adoptech=number of ARBs adopting modern farming technologies
adoprate=percentage of ARBs adopting modern farming technologies

For INDEX

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Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.2576                  Obs per group:  min =    1
      between = 0.5998                    avg =           3.8
      overall  = 0.4898                    max =           4
Random effects u_i ~ Gaussian          Wald chi2(38)   =  3752.59
corr(u_i, X) = 0 (assumed)             Prob > chi2     =   0.0000
    
```

index	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.0239447	.036842	0.65	0.516	-.0482642	.0961537
a_arisp	.2262932	.0910592	2.49	0.013	.0478206	.4047659
a_arisp2	.4636895	.1031451	4.50	0.000	.2615288	.6658503
a_arcpadb	.2402795	.083257	2.89	0.004	.0770988	.4034602
a_arcdpwb	.3297916	.061961	5.32	0.000	.2083503	.4512329
a_arcdp2	.8371574	.2218409	3.77	0.000	.4023571	1.271958
a_arspeu	.0210013	.0661395	0.32	0.751	-.1086297	.1506323
a_biarisp	.1315045	.06863	1.92	0.055	-.0030079	.2660168
a_cida	-.2876651	.201352	-1.43	0.153	-.6823078	.1069775
a_rascp	.0306991	.0978262	0.31	0.754	-.1610367	.2224349
a_undpsar	-.1114846	.0775886	-1.44	0.151	-.2635556	.0405863
a_wmcip	-.0884094	.4000596	-0.22	0.825	-.8725118	.6956931
a_starcm	-.4747588	.2516491	-1.89	0.059	-.9679821	.0184644
a_minssad	.0433837	.0463508	0.94	0.349	-.0474623	.1342297
a_jica	.203304	.147395	1.38	0.168	-.085585	.492193
a_spots	.0091568	.2461995	0.04	0.970	-.4733855	.491699
areaact	-.0006078	.0000874	-6.95	0.000	-.0007791	-.0004364
areaper	.064946	.0070938	9.16	0.000	.0510424	.0788496
arbcul	.0003488	.0004772	0.73	0.465	-.0005864	.0012841
arbculper	-.0212834	.0042926	-4.96	0.000	-.0296967	-.01287
arbact	.0007088	.0002491	2.85	0.004	.0002205	.0011971
arbper	.0530334	.0054078	9.81	0.000	.0424343	.0636326
fmrcom	-.0000888	.0002095	-0.42	0.672	-.0004994	.0003219
fmrper	.0429862	.0027905	15.40	0.000	.0375168	.0484556
brcom	.0012071	.0008311	1.45	0.146	-.0004217	.002836
brper	.0255379	.0023045	11.08	0.000	.0210211	.0300546
nirrcom	.0014771	.0016465	0.90	0.370	-.0017499	.0047041
nirrper	.0051608	.0029234	1.77	0.078	-.0005691	.0108906
iareacom	.0009106	.0002576	3.54	0.000	.0004058	.0014155
iareaper	.029551	.0035547	8.31	0.000	.022584	.036518
arbfarai	.0015147	.0005442	2.78	0.005	.0004481	.0025814
arbfarper	.0341745	.0034308	9.96	0.000	.0274503	.0408988
arbapph	.0005129	.0004547	1.13	0.259	-.0003783	.0014041
arbapphper	.0285426	.004103	6.96	0.000	.0205008	.0365845
acredit	.0009735	.0002686	3.62	0.000	.0004471	.0014999
creditper	.0337382	.0022895	14.74	0.000	.0292509	.0382254
adoptech	-.0002332	.0007296	-0.32	0.749	-.0016633	.0011968
adoprate	.0579893	.0045956	12.62	0.000	.048982	.0669966
_cons	44.36335	.8334782	53.23	0.000	42.72976	45.99693
sigma_u	3.355401					
sigma_e	4.5727573					
rho	.34998841	(fraction of variance due to u_i)				

. sum mindex1

Variable	Obs	Mean	Std. Dev.	Min	Max
mindex1	5780	6.566745	6.273143	.0026579	94.96854

For FARM INCOME

```

Random-effects GLS regression           Number of obs   =   5767
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0215                 Obs per group:  min =    1
      between = 0.1016                   avg   =    3.8
      overall  = 0.0677                   max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   258.87
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
    
```

finc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	1046.321	215.9974	4.84	0.000	622.9738	1469.668
a_arisp	2329.523	499.3975	4.66	0.000	1350.722	3308.325
a_arisp2	936.5365	584.7486	1.60	0.109	-209.5498	2082.623
a_arcpadb	1651.53	474.3926	3.48	0.000	721.738	2581.323
a_arcdpwb	591.8391	359.4322	1.65	0.100	-112.6351	1296.313
a_arcdp2	-160.1549	1179.249	-0.14	0.892	-2471.44	2151.13
a_arspeu	-466.7405	383.5746	-1.22	0.224	-1218.533	285.0518
a_biarsp	-558.9274	398.9206	-1.40	0.161	-1340.797	222.9426
a_cida	322.4093	1130.233	0.29	0.775	-1892.807	2537.625
a_rascp	-1583.967	513.7286	-3.08	0.002	-2590.857	-577.0779
a_undpsar	-377.1545	442.3717	-0.85	0.394	-1244.187	489.878
a_wmcip	285.9222	2228.863	0.13	0.898	-4082.569	4654.414
a_starcm	1682.178	1441.148	1.17	0.243	-1142.421	4506.776
a_minssad	-95.22337	243.4392	-0.39	0.696	-572.3555	381.9088
a_jica	-911.8561	817.6022	-1.12	0.265	-2514.327	690.6148
a_spots	2167.002	1339.368	1.62	0.106	-458.1106	4792.114
areaact	-1.686595	.4853621	-3.47	0.001	-2.637888	-.735303
areaper	-23.80173	39.44675	-0.60	0.546	-101.1159	53.51247
arbcul	-8.347713	2.604365	-3.21	0.001	-13.45218	-3.243251
arbculper	11.58492	23.35447	0.50	0.620	-34.189	57.35883
arbact	4.358422	1.318538	3.31	0.001	1.774136	6.942708
arbper	5.38778	29.00156	0.19	0.853	-51.45423	62.22979
fmrcom	-.4993097	1.137846	-0.44	0.661	-2.729446	1.730827
fmrper	41.89383	15.23504	2.75	0.006	12.0337	71.75397
brcom	-1.727852	4.587567	-0.38	0.706	-10.71932	7.263613
brper	24.12388	12.57547	1.92	0.055	-.5235804	48.77135
nirrcom	7.237874	8.923443	0.81	0.417	-10.25175	24.7275
nirrper	4.772994	15.80396	0.30	0.763	-26.2022	35.74819
iareacom	.5140546	1.461442	0.35	0.725	-2.350319	3.378428
iareaper	20.27382	19.23428	1.05	0.292	-17.42468	57.97232
arbfarai	8.77971	3.035454	2.89	0.004	2.83033	14.72909
arbfarper	-25.44167	18.49427	-1.38	0.169	-61.68978	10.80644
arbapph	6.884232	2.476571	2.78	0.005	2.030243	11.73822
arbappper	-44.83026	22.13093	-2.03	0.043	-88.2061	-1.454433
acredit	-1.551806	1.457851	-1.06	0.287	-4.409141	1.305529
creditper	37.99975	12.40132	3.06	0.002	13.6936	62.3059
adoptech	10.38935	3.992927	2.60	0.009	2.563354	18.21534
adoprate	56.27623	25.12134	2.24	0.025	7.039308	105.5131
_cons	33403.49	4693.877	7.12	0.000	24203.66	42603.32
sigma_u	21130.341					
sigma_e	23863.36					
rho	.43948104	(fraction of variance due to u_i)				

. sum mfincl

Variable	Obs	Mean	Std. Dev.	Min	Max
mfincl	5766	143.7707	5418.031	8.73e-06	398372.5

For OFF FARM INCOME

```

Random-effects GLS regression           Number of obs   =   5763
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0234                 Obs per group:  min =    1
      between = 0.0306                                 avg =    3.8
      overall  = 0.0250                                 max =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   137.64
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
    
```

ofinc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	319.7303	94.35288	3.39	0.001	134.8021	504.6586
a_arisp	312.4914	210.9354	1.48	0.138	-100.9344	725.9172
a_arisp2	599.8806	250.3511	2.40	0.017	109.2015	1090.56
a_arcpadb	21.71326	203.4735	0.11	0.915	-377.0874	420.5139
a_arcdpwb	-442.6743	155.9335	-2.84	0.005	-748.2983	-137.0503
a_arcdp2	-68.6596	488.6676	-0.14	0.888	-1026.43	889.1112
a_arspeu	-691.1423	166.1529	-4.16	0.000	-1016.796	-365.4885
a_biarisp	-674.3514	173.2225	-3.89	0.000	-1013.861	-334.8416
a_cida	-292.1282	481.1878	-0.61	0.544	-1235.239	650.9825
a_rascp	-297.8126	211.7717	-1.41	0.160	-712.8775	117.2524
a_undpsar	-250.8319	190.0883	-1.32	0.187	-623.3982	121.7344
a_wmcip	1292.226	945.7373	1.37	0.172	-561.3855	3145.837
a_starcm	-268.3062	622.7408	-0.43	0.667	-1488.856	952.2434
a_minssad	-2.938736	100.3347	-0.03	0.977	-199.5912	193.7137
a_jica	116.3325	345.83	0.34	0.737	-561.4818	794.1467
a_spots	-530.1627	560.7068	-0.95	0.344	-1629.128	568.8025
areaact	-.3768197	.2056048	-1.83	0.067	-.7797977	.0261583
areaper	-16.53676	16.74884	-0.99	0.323	-49.36388	16.29036
arbcul	-.2974137	1.093103	-0.27	0.786	-2.439857	1.84503
arbculper	13.39228	9.777044	1.37	0.171	-5.770372	32.55494
arbact	1.215837	.545204	2.23	0.026	.1472568	2.284417
arbper	28.8956	12.05254	2.40	0.017	5.273057	52.51814
fmrcom	.1634378	.4776399	0.34	0.732	-.7727193	1.099595
fmrper	13.48162	6.391945	2.11	0.035	.9536436	26.00961
brcom	-.1016411	1.935803	-0.05	0.958	-3.895745	3.692462
brper	9.093743	5.275173	1.72	0.085	-1.245405	19.43289
nirrcom	10.6026	3.731277	2.84	0.004	3.289427	17.91576
nirrper	6.211644	6.604507	0.94	0.347	-6.732952	19.15624
iareacom	.9393237	.6262026	1.50	0.134	-.2880109	2.166658
iareaper	7.014714	8.053603	0.87	0.384	-8.770057	22.79949
arbfarai	1.198211	1.289461	0.93	0.353	-1.329086	3.725509
arbfarper	-14.63117	7.736293	-1.89	0.059	-29.79402	.5316872
arbapph	.3720852	1.037103	0.36	0.720	-1.6606	2.40477
arbappper	-.0707571	9.200284	-0.01	0.994	-18.10298	17.96147
acredit	.4100608	.6112246	0.67	0.502	-.7879173	1.608039
creditper	10.9237	5.185636	2.11	0.035	.7600391	21.08736
adoptech	.7010521	1.680097	0.42	0.676	-2.591877	3.993981
adoprate	9.188527	10.55902	0.87	0.384	-11.50676	29.88382
_cons	6706.432	2004.382	3.35	0.001	2777.915	10634.95
sigma_u	9526.1243					
sigma_e	9808.4775					
rho	.48539959	(fraction of variance due to u_i)				

. sum mofincl

Variable	Obs	Mean	Std. Dev.	Min	Max
mofincl	5740	119.1849	311.6268	.0033875	15233.2

For NON FARM INCOME

```

Random-effects GLS regression           Number of obs   =   5738
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0197                 Obs per group:  min =    1
      between = 0.0416                   avg   =    3.8
      overall  = 0.0334                   max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   148.57
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
    
```

ninc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	192.0037	152.4796	1.26	0.208	-106.8507	490.8582
a_arisp	955.4877	328.4455	2.91	0.004	311.7463	1599.229
a_arisp2	461.7067	394.7212	1.17	0.242	-311.9326	1235.346
a_arcpadb	460.1894	320.8447	1.43	0.151	-168.6546	1089.033
a_arcdpwb	-591.1549	249.3871	-2.37	0.018	-1079.945	-102.3651
a_arcdp2	422.5921	740.6287	0.57	0.568	-1029.013	1874.198
a_arspeu	-1106.925	265.4611	-4.17	0.000	-1627.219	-586.6306
a_biarisp	-504.2116	277.3912	-1.82	0.069	-1047.888	39.46523
a_cida	-1250.66	751.0379	-1.67	0.096	-2722.667	221.3471
a_rascp	-651.6558	318.8222	-2.04	0.041	-1276.536	-26.77583
a_undpsar	-229.9831	302.2265	-0.76	0.447	-822.3362	362.37
a_wmcip	-494.4128	1470.857	-0.34	0.737	-3377.239	2388.414
a_starcm	-172.0527	983.2623	-0.17	0.861	-2099.211	1755.106
a_minssad	-178.3875	150.8613	-1.18	0.237	-474.0703	117.2952
a_jica	109.8388	535.4698	0.21	0.837	-939.6628	1159.34
a_spots	-560.6522	856.0619	-0.65	0.513	-2238.503	1117.198
areaact	-.6525782	.3190783	-2.05	0.041	-1.27796	-.0271963
areaper	51.22915	26.17741	1.96	0.050	-.0776292	102.5359
arbcul	-3.851923	1.679361	-2.29	0.022	-7.14341	-.5604364
arbculper	12.89048	14.97461	0.86	0.389	-16.45922	42.24018
arbact	2.230966	.8230567	2.71	0.007	.6178041	3.844127
brbper	22.98641	18.29224	1.26	0.209	-12.86573	58.83855
fmrcom	-.5603719	.7350331	-0.76	0.446	-2.00101	.8802665
fmrper	22.83402	9.841656	2.32	0.020	3.54473	42.12331
brcom	1.380569	2.992597	0.46	0.645	-4.484813	7.245951
brper	1.815278	8.099578	0.22	0.823	-14.0596	17.69016
nirrcom	-.3985105	5.701191	-0.07	0.944	-11.57264	10.77562
nirrper	8.088152	10.11037	0.80	0.424	-11.72781	27.90411
iareacom	-.1329361	.9857782	-0.13	0.893	-2.065026	1.799154
iareaper	5.536021	12.28609	0.45	0.652	-18.54427	29.61632
arbfarai	5.756926	2.004528	2.87	0.004	1.828124	9.685728
arbfarper	3.705822	11.80108	0.31	0.754	-19.42388	26.83552
arbapph	2.160557	1.58978	1.36	0.174	-.9553541	5.276468
arbapphper	-6.342061	14.01679	-0.45	0.651	-33.81446	21.13034
acredit	-.5018821	.934091	-0.54	0.591	-2.332667	1.328903
creditper	18.08492	7.938082	2.28	0.023	2.52656	33.64327
adoptech	2.241854	2.575895	0.87	0.384	-2.806806	7.290515
adoprate	48.37518	16.18183	2.99	0.003	16.65937	80.091
_cons	5785.368	3149.042	1.84	0.066	-386.6413	11957.38
sigma_u	15860.981					
sigma_e	14634.906					
rho	.54013969				(fraction of variance due to u_i)	

. sum mnincl

Variable	Obs	Mean	Std. Dev.	Min	Max
mnincl	5647	179.1962	1808.845	.014681	132474.5

For TOTAL INCOME

```

Random-effects GLS regression           Number of obs   =   5771
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0268                  Obs per group:  min =    1
      between = 0.0926                               avg =    3.8
      overall  = 0.0642                               max =    4
Random effects u_i ~ Gaussian           Wald chi2(38)   =   266.81
corr(u_i, X) = 0 (assumed)              Prob > chi2     =    0.0000
    
```

totinc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	1571.365	352.575	4.46	0.000	880.3307	2262.399
a_arisp	3481.423	812.4359	4.29	0.000	1889.078	5073.768
a_arisp2	1794.39	952.9572	1.88	0.060	-73.37151	3662.152
a_arcpadb	2104.771	772.714	2.72	0.006	590.2794	3619.263
a_arcdpwb	-462.7129	586.359	-0.79	0.430	-1611.955	686.5297
a_arcdp2	32.2741	1914.967	0.02	0.987	-3720.992	3785.54
a_arspeu	-1981.775	625.3264	-3.17	0.002	-3207.392	-756.1577
a_biarsp	-1698.748	650.8563	-2.61	0.009	-2974.403	-423.0931
a_cida	-1271.424	1840.476	-0.69	0.490	-4878.69	2335.843
a_rascp	-2589.958	833.7595	-3.11	0.002	-4224.096	-955.8193
a_undpsar	-894.9182	720.9793	-1.24	0.215	-2308.012	518.1753
a_wmcip	846.4369	3628.205	0.23	0.816	-6264.715	7957.589
a_starcm	1029.645	2349.375	0.44	0.661	-3575.045	5634.335
a_minssad	-270.0081	395.0827	-0.68	0.494	-1044.356	504.3398
a_jica	-622.6569	1330.525	-0.47	0.640	-3230.438	1985.124
a_spots	1022.068	2176.412	0.47	0.639	-3243.622	5287.758
areaact	-2.805166	.7899197	-3.55	0.000	-4.35338	-1.256952
areaper	16.18248	64.18852	0.25	0.801	-109.6247	141.9897
arbcul	-12.33615	4.232905	-2.91	0.004	-20.63249	-4.039805
arbculper	28.92337	37.9168	0.76	0.446	-45.39219	103.2389
arbact	7.85391	2.14041	3.67	0.000	3.658783	12.04904
arbper	64.11403	47.08158	1.36	0.173	-28.16416	156.3922
fmrcom	-.9598833	1.850054	-0.52	0.604	-4.585922	2.666156
fmrper	72.87389	24.76565	2.94	0.003	24.33412	121.4137
brcom	-.6734004	7.463006	-0.09	0.928	-15.30062	13.95382
brper	35.17681	20.44103	1.72	0.085	-4.886867	75.24048
nirrcom	18.11833	14.50439	1.25	0.212	-10.30975	46.5464
nirrper	20.08592	25.68332	0.78	0.434	-30.25247	70.42431
iareacom	1.616111	2.381261	0.68	0.497	-3.051075	6.283297
iareaper	33.8351	31.26035	1.08	0.279	-27.43405	95.10425
arbfarai	15.50611	4.941089	3.14	0.002	5.821751	25.19047
arbfarper	-36.99232	30.05156	-1.23	0.218	-95.8923	21.90765
arbapph	9.66965	4.022755	2.40	0.016	1.785195	17.5541
arbapphper	-48.87633	35.83515	-1.36	0.173	-119.1119	21.35926
acredit	-1.64749	2.369694	-0.70	0.487	-6.292005	2.997025
creditper	65.80037	20.14838	3.27	0.001	26.31026	105.2905
adoptech	12.6893	6.490353	1.96	0.051	-.0315563	25.41016
adoprte	124.2902	40.82602	3.04	0.002	44.27272	204.3078
_cons	44953.07	7642.552	5.88	0.000	29973.94	59932.19
sigma_u	34478.173					
sigma_e	38571.389					
rho	.44414198	(fraction of variance due to u_i)				

. sum mtotinc1

Variable	Obs	Mean	Std. Dev.	Min	Max
mtotinc1	5770	40.52375	45.1367	.007955	894.1651

For OM

```

Random-effects GLS regression           Number of obs   =   5776
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0342                 Obs per group:  min =    1
      between = 0.1995                                     avg   =    3.8
      overall  = 0.1485                                     max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   481.81
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
    
```

om	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.2630841	.0936595	2.81	0.005	.0795148	.4466534
a_arisp	.5702934	.1942034	2.94	0.003	.1896618	.950925
a_arisp2	1.264555	.2355096	5.37	0.000	.8029645	1.726145
a_arcpadb	.3669563	.1928007	1.90	0.057	-.0109262	.7448388
a_arcdpwb	.6768339	.1517942	4.46	0.000	.3793228	.974345
a_arcdp2	1.132186	.4290599	2.64	0.008	.2912436	1.973128
a_arspeu	.2552655	.1613101	1.58	0.114	-.0608964	.5714275
a_biarisp	.3851838	.1690609	2.28	0.023	.0538305	.716537
a_cida	.9344273	.4473153	2.09	0.037	.0577055	1.811149
a_rascp	-.018604	.184698	-0.10	0.920	-.3806054	.3433973
a_undpsar	.1297427	.1805408	0.72	0.472	-.2241108	.4835961
a_wmcip	-1.037528	.8736445	-1.19	0.235	-2.74984	.6747833
a_starcm	-.7040443	.5934659	-1.19	0.235	-1.867216	.4591274
a_minssad	.0970522	.0870751	1.11	0.265	-.0736119	.2677163
a_jica	.0984263	.3167287	0.31	0.756	-.5223505	.7192031
a_spots	-.6579774	.4993064	-1.32	0.188	-1.6366	.3206451
areaact	-.0004914	.0001892	-2.60	0.009	-.0008622	-.0001206
areaper	.0362912	.0154349	2.35	0.019	.0060394	.066543
arbcul	.0017364	.0009854	1.76	0.078	-.000195	.0036678
arbculper	-.0376059	.0087139	-4.32	0.000	-.0546849	-.0205269
arbact	.0002248	.0004765	0.47	0.637	-.000709	.0011586
arbper	.0504056	.0105637	4.77	0.000	.0297012	.07111
fmrcom	-.0002008	.0004333	-0.46	0.643	-.0010501	.0006485
fmrper	.0128295	.0057458	2.23	0.026	.0015679	.0240911
brcom	-.0000211	.0017625	-0.01	0.990	-.0034755	.0034332
brper	.0036981	.0047366	0.78	0.435	-.0055854	.0129816
nirrcom	.0000249	.0033353	0.01	0.994	-.0065122	.0065619
nirrper	.0067689	.0058885	1.15	0.250	-.0047723	.0183101
iareacom	-.0001833	.0005916	-0.31	0.757	-.0013428	.0009762
iareaper	.0071281	.007176	0.99	0.321	-.0069366	.0211927
arbfarai	.0026643	.0011902	2.24	0.025	.0003315	.0049971
arbfarper	.0043257	.0068532	0.63	0.528	-.0091062	.0177577
arbapph	-.0011451	.0009293	-1.23	0.218	-.0029664	.0006762
arbapphper	.0066905	.0080871	0.83	0.408	-.00916	.0225409
acredit	.0016833	.0005463	3.08	0.002	.0006126	.002754
creditper	.0254102	.0046147	5.51	0.000	.0163655	.0344549
adoptech	.0015404	.0015077	1.02	0.307	-.0014146	.0044954
adoprate	.0748564	.009358	8.00	0.000	.056515	.0931978
_cons	49.7861	1.876841	26.53	0.000	46.10756	53.46464
sigma_u	10.067236					
sigma_e	8.4704866					
rho	.58550078	(fraction of variance due to u_i)				

. sum mom1

Variable	Obs	Mean	Std. Dev.	Min	Max
mom1	5734	16.78526	29.09901	.0127031	1095.739

For LTI

```

Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.3108                 Obs per group:  min =    1
      between = 0.8175                   avg   =    3.8
      overall = 0.6967                   max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =  8637.28
corr(u_i, X) = 0 (assumed)            Prob > chi2     =   0.0000
    
```

lti	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.1608912	.0371781	-4.33	0.000	-.2337589	-.0880234
a_arisp	-.035903	.0989536	-0.36	0.717	-.2298486	.1580425
a_arisp2	.2129764	.1070824	1.99	0.047	.0030988	.422854
a_arcpadb	.0237197	.0861442	0.28	0.783	-.14512	.1925593
a_arcdpwb	.0790388	.0630066	1.25	0.210	-.0444517	.2025294
a_arcdp2	.0723946	.2474461	0.29	0.770	-.412591	.5573801
a_arspeu	.1256449	.0672616	1.87	0.062	-.0061855	.2574752
a_biarisp	.1253508	.0696464	1.80	0.072	-.0111536	.2618552
a_cida	.0701838	.2111133	0.33	0.740	-.3436293	.4839969
a_rascp	.0287797	.1108786	0.26	0.795	-.1885384	.2460979
a_undpsar	.0010076	.0801964	0.01	0.990	-.1561746	.1581897
a_wmcip	.0080279	.4238875	0.02	0.985	-.8227763	.8388321
a_starcm	-1.252475	.2590009	-4.84	0.000	-1.760108	-.7448425
a_minssad	.0298759	.0525371	0.57	0.570	-.073095	.1328468
a_jica	-.0505517	.1563918	-0.32	0.747	-.3570741	.2559707
a_spots	-.1136004	.2681775	-0.42	0.672	-.6392188	.4120179
areaact	-.0003979	.0000929	-4.28	0.000	-.00058	-.0002158
areaper	.462745	.007541	61.36	0.000	.447965	.477525
arbcul	.0017117	.0005175	3.31	0.001	.0006975	.0027259
arbculper	.0314485	.0046765	6.72	0.000	.0222828	.0406142
arbact	-.0001124	.0002797	-0.40	0.688	-.0006607	.0004358
arbper	.1806002	.0060042	30.08	0.000	.1688322	.1923682
fmrcom	.0000535	.0002299	0.23	0.816	-.000397	.000504
fmrper	.0015058	.0030176	0.50	0.618	-.0044086	.0074202
brcom	.0009002	.0008867	1.02	0.310	-.0008377	.0026382
brper	.0056076	.002494	2.25	0.025	.0007194	.0104958
nirrcom	.0032336	.0017931	1.80	0.071	-.0002807	.006748
nirrper	-.0037921	.0031955	-1.19	0.235	-.0100551	.0024708
iareacom	-.0000477	.0002677	-0.18	0.859	-.0005724	.000477
iareaper	.0038965	.0038826	1.00	0.316	-.0037133	.0115064
arbfarai	.000167	.0005752	0.29	0.772	-.0009604	.0012944
arbfarper	.0041481	.0037648	1.10	0.271	-.0032308	.0115271
arbapph	.0005357	.0004943	1.08	0.278	-.0004331	.0015045
arbapphper	.0060293	.0045357	1.33	0.184	-.0028605	.014919
acredit	-.0008907	.0002921	-3.05	0.002	-.0014633	-.0003182
creditper	.0064685	.0025008	2.59	0.010	.001567	.0113701
adoptech	-.0016801	.0007886	-2.13	0.033	-.0032257	-.0001346
adoprate	.0354758	.0049969	7.10	0.000	.0256819	.0452696
_cons	28.75944	.8752242	32.86	0.000	27.04403	30.47485
sigma_u	3.0526819					
sigma_e	5.2298422					
rho	.254127	(fraction of variance due to u_i)				

. sum mltil

Variable	Obs	Mean	Std. Dev.	Min	Max
mltil	5778	6.455079	108.9021	.0002899	8252.525

For FPI

```

Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0115                 Obs per group:  min =    1
      between = 0.1346                   avg   =    3.8
      overall = 0.0660                   max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   272.69
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
    
```

fpi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.1579621	.0900317	-1.75	0.079	-.3344211	.0184968
a_arisp	.3239472	.2489707	1.30	0.193	-.1640265	.8119209
a_arisp2	.0428238	.2623603	0.16	0.870	-.4713929	.5570405
a_arcpadb	.4730248	.2107992	2.24	0.025	.0598659	.8861836
a_arcdpwb	.4063367	.1529959	2.66	0.008	.1064702	.7062031
a_arcdp2	.7443813	.6288119	1.18	0.236	-.4880674	1.97683
a_arspeu	-.2244933	.1632921	-1.37	0.169	-.5445401	.0955534
a_biarisp	.3103092	.1689636	1.84	0.066	-.0208535	.6414718
a_cida	-.9087133	.5197009	-1.75	0.080	-1.927308	.1098817
a_rascp	-.2654135	.2843968	-0.93	0.351	-.8228209	.2919939
a_undpsar	.0594657	.196172	0.30	0.762	-.3250244	.4439557
a_wmcip	.1934147	1.050105	0.18	0.854	-1.864754	2.251583
a_starcm	.5547519	.6323169	0.88	0.380	-.6845665	1.79407
a_minssad	.1925208	.1347426	1.43	0.153	-.0715699	.4566115
a_jica	.2300636	.3870701	0.59	0.552	-.5285798	.988707
a_spots	.1359992	.6728183	0.20	0.840	-1.1827	1.454699
areaact	-.0004748	.0002303	-2.06	0.039	-.0009263	-.0000234
areaper	.0277451	.0187098	1.48	0.138	-.0089256	.0644157
arbcul	-.0010396	.0012962	-0.80	0.423	-.0035801	.0015009
arbculper	-.0078779	.011735	-0.67	0.502	-.0308781	.0151223
arbact	.0013153	.0007136	1.84	0.065	-.0000834	.0027139
arbper	.0501589	.0152206	3.30	0.001	.0203271	.0799908
fmrcom	.0003898	.0005809	0.67	0.502	-.0007488	.0015284
fmrper	-.0161295	.0075414	-2.14	0.032	-.0309103	-.0013486
brcom	.0004226	.0022008	0.19	0.848	-.0038909	.004736
brper	.0047037	.0062352	0.75	0.451	-.0075171	.0169246
nirrcm	-.001876	.0044969	-0.42	0.677	-.0106898	.0069378
nirrper	.0083135	.0080309	1.04	0.301	-.0074268	.0240538
iareacom	.0013865	.0006566	2.11	0.035	.0000996	.0026734
iareaper	.0005958	.0097552	0.06	0.951	-.0185241	.0197156
arbfarai	.0002956	.001422	0.21	0.835	-.0024914	.0030826
arbfarper	-.0140957	.0094823	-1.49	0.137	-.0326807	.0044893
arbapph	-.0000265	.0012392	-0.02	0.983	-.0024552	.0024022
arbapphper	.0060322	.0114716	0.53	0.599	-.0164517	.0285162
acredit	.0015374	.0007323	2.10	0.036	.000102	.0029727
creditper	.0081566	.006283	1.30	0.194	-.0041579	.0204711
adoptech	.000879	.0019706	0.45	0.656	-.0029833	.0047413
adoprate	.1079357	.0125249	8.62	0.000	.0833874	.1324841
_cons	55.9272	2.158573	25.91	0.000	51.69648	60.15793
sigma_u	6.9864446					
sigma_e	13.664845					
rho	.20722909	(fraction of variance due to u_i)				

. sum mfpil

Variable	Obs	Mean	Std. Dev.	Min	Max
mfpil	5780	21.88053	24.77413	.0003472	568.2824

For BSS

```

Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505
R-sq:  within = 0.0313                 Obs per group:  min =    1
      between = 0.1610                   avg   =    3.8
      overall  = 0.1066                   max   =    4
Random effects u_i ~ Gaussian          Wald chi2(38)   =   416.06
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
    
```

bss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.027693	.0727187	0.38	0.703	-.114833	.1702189
a_arisp	.0689195	.170891	0.40	0.687	-.2660206	.4038597
a_arisp2	.6713741	.1986653	3.38	0.001	.2819973	1.060751
a_arcpadb	-.1034974	.1608617	-0.64	0.520	-.4187806	.2117857
a_arcdpwb	.2181706	.1213905	1.80	0.072	-.0197504	.4560917
a_arcdp2	.7738552	.4068455	1.90	0.057	-.0235472	1.571258
a_arspeu	.0105751	.1295032	0.08	0.935	-.2432465	.2643967
a_biarisp	-.0390233	.1346627	-0.29	0.772	-.3029572	.2249107
a_cida	-.9792799	.3849365	-2.54	0.011	-1.733742	-.2248183
a_rascp	.0418011	.1777239	0.24	0.814	-.3065314	.3901335
a_undpsar	-.4962116	.1500589	-3.31	0.001	-.7903218	-.2021015
a_wmcip	-1.213026	.7603685	-1.60	0.111	-2.703321	.277269
a_starcm	-1.281757	.4883284	-2.62	0.009	-2.238863	-.3246511
a_minssad	-.0035187	.0841915	-0.04	0.967	-.1685309	.1614935
a_jica	.4464301	.2792821	1.60	0.110	-.1009526	.9938129
a_spots	-1.157754	.4583798	-2.53	0.012	-2.056162	-.2593457
areaact	-.0007618	.0001657	-4.60	0.000	-.0010866	-.000437
areaper	.0578754	.0134544	4.30	0.000	.0315052	.0842455
arbcul	-.0001896	.0008921	-0.21	0.832	-.001938	.0015588
arbculper	-.0115347	.0079928	-1.44	0.149	-.0272004	.0041309
arbact	.0008903	.0004551	1.96	0.050	-1.69e-06	.0017823
arbper	.0203056	.0099478	2.04	0.041	.0008083	.0398029
fmrcom	-.000075	.0003904	-1.92	0.055	-.0015151	.0000151
fmrper	.0153305	.00522	2.94	0.003	.0050995	.0255615
brcom	.0004004	.0015686	0.26	0.798	-.002674	.0034749
brper	.0123665	.0043084	2.87	0.004	.0039223	.0208108
nirrcom	.0022594	.003065	0.74	0.461	-.0037478	.0082667
nirrper	.0050014	.0054302	0.92	0.357	-.0056416	.0156444
iareacom	.0013636	.0004963	2.75	0.006	.0003909	.0023364
iareaper	.0060433	.0066066	0.91	0.360	-.0069054	.018992
arbfarai	-.0000109	.0010352	-0.01	0.992	-.0020399	.002018
arbfarper	.0096208	.0063569	1.51	0.130	-.0028384	.0220801
arbapph	.0021755	.0008481	2.57	0.010	.0005133	.0038377
arbapphper	.0110852	.0075691	1.46	0.143	-.00375	.0259204
acredit	.0004713	.0005005	0.94	0.346	-.0005096	.0014522
creditper	.0105352	.0042544	2.48	0.013	.0021967	.0188737
adoptech	-.0003947	.0013658	-0.29	0.773	-.0030717	.0022822
adoprate	.0567915	.0085665	6.63	0.000	.0400015	.0735815
_cons	70.88487	1.59511	44.44	0.000	67.75851	74.01122
sigma_u	7.0351114					
sigma_e	8.3035113					
rho	.41786843	(fraction of variance due to u_i)				

. sum mbssl

Variable	Obs	Mean	Std. Dev.	Min	Max
mbssl	5779	11.23168	12.02953	.0013971	212.1883

For GAD

```

Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505

R-sq:  within = 0.0157                 Obs per group:  min =    1
      between = 0.0487                                     avg  =    3.8
      overall  = 0.0361                                     max  =    4

Random effects u_i ~ Gaussian          Wald chi2(38)   =   142.34
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
    
```

gad	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.2374262	.0983201	-2.41	0.016	-.43013	-.0447223
a_arisp	-.1730696	.219333	-0.79	0.430	-.6029544	.2568151
a_arisp2	.1813757	.2605753	0.70	0.486	-.3293425	.692094
a_arcpadb	.1938705	.2118378	0.92	0.360	-.221324	.6090649
a_arcdpwb	.5520257	.1624786	3.40	0.001	.2335734	.870478
a_arcdp2	1.262304	.5076744	2.49	0.013	.2672805	2.257328
a_arspeu	-.2830664	.1731398	-1.63	0.102	-.6224142	.0562814
a_biarisp	-.1258567	.1805418	-0.70	0.486	-.4797121	.2279986
a_cida	-.0601019	.500804	-0.12	0.904	-1.04166	.9214559
a_rascp	.4095346	.219889	1.86	0.063	-.0214399	.8405091
a_undpsar	-.0657413	.1978747	-0.33	0.740	-.4535685	.3220859
a_wmcip	-.3344959	.9841444	-0.34	0.734	-2.263384	1.594392
a_starcm	-.0415922	.6464341	-0.06	0.949	-1.30858	1.225395
a_minssad	.0458306	.1041315	0.44	0.660	-.1582635	.2499247
a_jica	.0101701	.3597925	0.03	0.977	-.6950103	.7153504
a_spots	.2797387	.580286	0.48	0.630	-.8576009	1.417078
areaact	-.0003934	.0002139	-1.84	0.066	-.0008125	.0000258
areaper	.0407353	.0173831	2.34	0.019	.006665	.0748057
arbcul	.0002571	.0011352	0.23	0.821	-.0019677	.002482
arbculper	-.0134766	.0101209	-1.33	0.183	-.0333131	.00636
arbact	.0003636	.0005659	0.64	0.521	-.0007456	.0014727
arbper	.0079262	.0124501	0.64	0.524	-.0164756	.0323281
fmrcom	-.0010577	.0004967	-2.13	0.033	-.0020312	-.0000842
fmrper	.0193384	.0066384	2.91	0.004	.0063273	.0323495
brcom	.0044793	.0020128	2.23	0.026	.0005342	.0084243
brper	-.014353	.005476	-2.62	0.009	-.0250857	-.0036203
nirrcom	.0011513	.0038788	0.30	0.767	-.006451	.0087537
nirrper	.0046813	.0068582	0.68	0.495	-.0087605	.0181231
iareacom	.0008161	.0006519	1.25	0.211	-.0004616	.0020938
iareaper	-.0168479	.0083498	-2.02	0.044	-.0332132	-.0004826
arbfarai	-.0016623	.0013404	-1.24	0.215	-.0042894	.0009648
arbfarper	.0183798	.0080099	2.29	0.022	.0026806	.034079
arbapph	.0004293	.001076	0.40	0.690	-.0016797	.0025382
arbapphper	-.0055065	.0094992	-0.58	0.562	-.0241246	.0131116
acredit	.0016534	.0006341	2.61	0.009	.0004106	.0028963
creditper	.0208604	.0053756	3.88	0.000	.0103245	.0313964
adoptech	-.0013699	.0017388	-0.79	0.431	-.0047779	.002038
adoprate	.0319447	.0108577	2.94	0.003	.010664	.0532254
_cons	44.78616	2.081695	21.51	0.000	40.70612	48.86621
sigma_u	9.9781563					
sigma_e	10.209542					
rho	.4885398	(fraction of variance due to u_i)				

. sum mgad1

Variable	Obs	Mean	Std. Dev.	Min	Max
mgad1	5780	28.26275	40.29182	.0024387	1003.84

For ECOPISS

```

Random-effects GLS regression           Number of obs   =   5780
Group variable (i): arcid              Number of groups =   1505

R-sq:  within = 0.5346                  Obs per group:  min =    1
      between = 0.8316                  avg   =    3.8
      overall  = 0.7394                  max   =    4

Random effects u_i ~ Gaussian           Wald chi2(38)   =  12426.72
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
    
```

ecopiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.2193065	.0538914	4.07	0.000	.1136813	.3249317
a_arisp	.1814517	.1456916	1.25	0.213	-.1040985	.467002
a_arisp2	.3401074	.1559962	2.18	0.029	.0343605	.6458543
a_arcpadb	.2564336	.1254257	2.04	0.041	.0106037	.5022634
a_arcdpwb	.0231783	.0914407	0.25	0.800	-.1560423	.2023988
a_arcdp2	.7169447	.3659051	1.96	0.050	-.0002162	1.434106
a_arspeu	.0486533	.0976091	0.50	0.618	-.142657	.2399636
a_biarisp	-.0061122	.101038	-0.06	0.952	-.204143	.1919187
a_cida	-.4309688	.3081718	-1.40	0.162	-1.034974	.1730368
a_rascp	.1747161	.1645675	1.06	0.288	-.1478303	.4972626
a_undpsar	-.0602284	.1167467	-0.52	0.606	-.2890478	.1685909
a_wmcip	.8342952	.6202723	1.35	0.179	-.3814161	2.050007
a_starcm	-.5549167	.3767362	-1.47	0.141	-1.293306	.1834727
a_minssad	-.0475528	.0779742	-0.61	0.542	-.2003794	.1052739
a_jica	.0138078	.228793	0.06	0.952	-.4346181	.4622337
a_spots	.2187731	.3945104	0.55	0.579	-.5544531	.9919992
areaact	-.0004322	.000136	-3.18	0.001	-.0006988	-.0001656
areaper	-.0202718	.0110418	-1.84	0.066	-.0419133	.0013697
arbcul	-.0010237	.0007607	-1.35	0.178	-.0025147	.0004672
arbculper	-.0487286	.00688	-7.08	0.000	-.0622131	-.0352441
arbact	.0009396	.0004143	2.27	0.023	.0001276	.0017516
arbper	.056816	.0088697	6.41	0.000	.0394316	.0742003
fmrcom	.0003136	.000339	0.92	0.355	-.0003509	.0009781
fmrper	.1613759	.0044321	36.41	0.000	.1526891	.1700628
brcom	.0030936	.0012987	2.38	0.017	.0005482	.0056391
brper	.0940633	.0036637	25.67	0.000	.0868826	.101244
nirrcom	.00449	.0026374	1.70	0.089	-.0006792	.0096592
nirrper	.0088729	.0047041	1.89	0.059	-.000347	.0180929
iareacom	.0011484	.0003901	2.94	0.003	.0003837	.001913
iareaper	.116424	.0057151	20.37	0.000	.1052227	.1276253
arbfarai	.0047085	.000841	5.60	0.000	.0030601	.0063569
arbfarper	.1344731	.0055472	24.24	0.000	.1236009	.1453454
arbapph	.0014163	.0007269	1.95	0.051	-8.40e-06	.0028409
arbapphper	.1048599	.0066941	15.66	0.000	.0917397	.1179801
acredit	.0004742	.0004296	1.10	0.270	-.0003678	.0013162
creditper	.0960762	.003681	26.10	0.000	.0888615	.103291
adoptech	-.0007144	.0011582	-0.62	0.537	-.0029844	.0015555
adoprate	.0244615	.0073481	3.33	0.001	.0100595	.0388635
_cons	14.56172	1.278388	11.39	0.000	12.05612	17.06731
sigma_u	4.315816					
sigma_e	7.7918708					
rho	.23476658	(fraction of variance due to u_i)				

. sum mecopiss1

Variable	Obs	Mean	Std. Dev.	Min	Max
mecopiss1	5780	12.02694	42.17304	.0052057	1995.615

APPENDIX 2: PANEL MODELS FOR ALDA INDICATORS WITH AR(1) ERROR RESULTS

The random effect model with autocorrelated error is given by $y_{it} = \mu + \beta x_{it} + u_i + \varepsilon_{it}$, where $\varepsilon_{it} = \rho \varepsilon_{it-1} + v_{it}$.

For INDEX

RE GLS regression with AR(1) disturbances
 Group variable (i): arcid
 R-sq: within = 0.2556
 between = 0.6018
 overall = 0.4903
 corr(u_i, Xb) = 0 (assumed)
 Number of obs = 5780
 Number of groups = 1505
 Obs per group: min = 1
 avg = 3.8
 max = 4
 Wald chi2(39) = 3770.15
 Prob > chi2 = 0.0000

----- theta -----
 min 5% median 95% max
 0.0170 0.0776 0.1040 0.1040 0.1040

index	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.0368805	.0353209	1.04	0.296	-.0323472	.1061082
a_arisp	.2438178	.0933791	2.61	0.009	.0607982	.4268374
a_arisp2	.4591688	.1025795	4.48	0.000	.2581166	.6602211
a_arcpadb	.2468468	.0812736	3.04	0.002	.0875534	.4061402
a_arcdpwb	.340627	.0587976	5.79	0.000	.2253859	.4558681
a_arcdp2	.7363332	.2420782	3.04	0.002	.2618686	1.210798
a_arspeu	.0314504	.0634523	0.50	0.620	-.0929138	.1558146
a_biarisp	.1535312	.0658744	2.33	0.020	.0244197	.2826428
a_cida	-.3448741	.2038833	-1.69	0.091	-.7444781	.0547298
a_rascp	.0541502	.1100273	0.49	0.623	-.1614993	.2697997
a_undpsar	-.0712112	.0762342	-0.93	0.350	-.2206276	.0782051
a_wmcip	-.1367957	.4085042	-0.33	0.738	-.9374492	.6638578
a_starcm	-.4132553	.2475308	-1.67	0.095	-.8984069	.0718962
a_minssad	.0498515	.0454549	1.10	0.273	-.0392385	.1389415
a_jica	.2607634	.1505834	1.73	0.083	-.0343745	.5559013
a_spots	-.1967017	.2589692	-0.76	0.448	-.7042721	.3108686
areaact	-.0005841	.0000867	-6.73	0.000	-.000754	-.0004141
areaper	.0671711	.0070879	9.48	0.000	.0532791	.0810632
arbcu	.0003093	.0004735	0.65	0.514	-.0006187	.0012372
arbcuiper	-.0210273	.0042162	-4.99	0.000	-.0292908	-.0127638
arbact	.0007245	.0002413	3.00	0.003	.0002516	.0011975
arbper	.0529136	.0054097	9.78	0.000	.0423108	.0635165
fmrcom	-.0001177	.0002089	-0.56	0.573	-.0005271	.0002918
fmrper	.0426697	.0028519	14.96	0.000	.0370801	.0482593
brcom	.0013461	.0008375	1.61	0.108	-.0002953	.0029874
brper	.0245209	.0023342	10.50	0.000	.0199459	.0290959
nirrcom	.0021979	.0017033	1.29	0.197	-.0011405	.0055362
nirrper	.0046624	.0029891	1.56	0.119	-.0011961	.0105209
iareacom	.0008577	.0002544	3.37	0.001	.0003591	.0013562
iareaper	.0289205	.0036222	7.98	0.000	.021821	.0360199
arbfarai	.001675	.0005491	3.05	0.002	.0005987	.0027513
arbfarper	.0341234	.0034939	9.77	0.000	.0272754	.0409714
arbapph	.0004486	.0004626	0.97	0.332	-.0004582	.0013553
arbappper	.029331	.004136	7.09	0.000	.0212246	.0374374
acredit	.0009953	.0002735	3.64	0.000	.0004592	.0015314
creditper	.0333578	.0023429	14.24	0.000	.0287657	.0379499
adoptech	-.000421	.0007535	-0.56	0.576	-.0018978	.0010557
adoprate	.0591386	.0045995	12.86	0.000	.0501238	.0681533
_cons	44.05495	.8110279	54.32	0.000	42.46536	45.64453
rho_ar	-.33673395	(estimated autocorrelation coefficient)				
sigma_u	1.028841					
sigma_e	5.1894976					
rho_fov	.03781838	(fraction of variance due to u_i)				

```
-----
. predict index2
(17 missing values generated)

. gen mindex2=100*abs(index-index2)/index
(17 missing values generated)

. sum mindex2
```

Variable	Obs	Mean	Std. Dev.	Min	Max
mindex2	5780	6.562739	6.247788	.0053934	94.77899

For FARM INCOME

```
RE GLS regression with AR(1) disturbances      Number of obs      =      5767
Group variable (i): arcid                     Number of groups   =      1505
R-sq: within = 0.0187                         Obs per group: min =          1
        between = 0.1058                       avg                =          3.8
        overall = 0.0692                       max                =          4
                                                Wald chi2(39)      =      233.37
                                                Prob > chi2        =      0.0000
```

```
corr(u_i, Xb) = 0 (assumed)
-----theta-----
min      5%      median      95%      max
0.0649  0.2363  0.2928    0.2928  0.2928
```

finc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	1065.517	207.482	5.14	0.000	658.8597	1472.174
a_arisp	2074.864	481.6206	4.31	0.000	1130.905	3018.823
a_arisp2	916.0499	589.334	1.55	0.120	-239.0235	2071.123
a_arcpadb	1517.219	464.5207	3.27	0.001	606.7747	2427.662
a_arcdpwb	582.7315	340.5353	1.71	0.087	-84.70539	1250.168
a_arcdp2	-456.1328	1282.957	-0.36	0.722	-2970.683	2058.417
a_arspeu	-241.1582	366.6858	-0.66	0.511	-959.8492	477.5328
a_biarisp	-343.9172	384.3808	-0.89	0.371	-1097.29	409.4554
a_cida	545.1855	1131.848	0.48	0.630	-1673.195	2763.566
a_rascp	-1567.472	556.6729	-2.82	0.005	-2658.53	-476.4128
a_undpsar	-213.7298	434.0112	-0.49	0.622	-1064.376	636.9166
a_wmcip	334.2682	2249.116	0.15	0.882	-4073.918	4742.454
a_starcm	1318.977	1422.632	0.93	0.354	-1469.33	4107.284
a_minssad	-.6618437	228.0846	-0.00	0.998	-447.6995	446.3758
a_jica	-1154.643	833.6555	-1.39	0.166	-2788.578	479.2914
a_spots	1408.517	1418.36	0.99	0.321	-1371.418	4188.453
areaact	-1.52872	.4744064	-3.22	0.001	-2.458539	-.5989003
areaper	-22.38752	38.61955	-0.58	0.562	-98.08044	53.3054
arbcul	-7.240417	2.515133	-2.88	0.004	-12.16999	-2.310846
arbculper	9.427647	22.23847	0.42	0.672	-34.15895	53.01425
arbact	4.363232	1.224679	3.56	0.000	1.962906	6.763559
arbper	8.379029	27.89808	0.30	0.764	-46.30021	63.05827
fmrcom	-.1437293	1.059263	-0.14	0.892	-2.219846	1.932387
fmrper	41.28531	15.24605	2.71	0.007	11.4036	71.16701
brcom	-4.452724	4.576522	-0.97	0.331	-13.42254	4.517095
brper	21.67702	12.45464	1.74	0.082	-2.733624	46.08767
nirrcom	12.77711	9.080826	1.41	0.159	-5.020984	30.5752
nirrper	-1.99373	15.74257	-0.13	0.899	-32.8486	28.86114
iareacom	.0649638	1.438875	0.05	0.964	-2.755179	2.885106
iareaper	17.21924	19.13555	0.90	0.368	-20.28575	54.72424
arbfarai	9.764045	3.043644	3.21	0.001	3.798612	15.72948
arbfarper	-20.24512	18.33329	-1.10	0.269	-56.17771	15.68746
arbapph	5.43347	2.457598	2.21	0.027	.6166669	10.25027
arbapphper	-20.21494	21.47327	-0.94	0.346	-62.30179	21.8719
acredit	-1.690397	1.454934	-1.16	0.245	-4.542015	1.161221
creditper	40.96586	12.35084	3.32	0.001	16.75867	65.17305
adoptech	8.549147	4.088627	2.09	0.037	.535585	16.56271
adoprate	51.4223	24.47802	2.10	0.036	3.446258	99.39835
_cons	31132.22	4475.644	6.96	0.000	22360.12	39904.32
rho_ar	-.3304132	(estimated autocorrelation coefficient)				
sigma_u	10312.671					
sigma_e	25683.588					
rho_fov	.13884004	(fraction of variance due to u_i)				

. sum mfinc2

Variable	Obs	Mean	Std. Dev.	Min	Max
mfinc2	5766	141.1515	5385.226	.0028112	396906.2

For OFF FARM INCOME

```

RE GLS regression with AR(1) disturbances
Group variable (i): arcid
R-sq:  within = 0.0215
      between = 0.0313
      overall = 0.0252
Number of obs   = 5763
Number of groups = 1505
Obs per group: min = 1
              avg  = 3.8
              max  = 4
Wald chi2(39)  = 113.74
Prob > chi2    = 0.0000
corr(u_i, Xb)  = 0 (assumed)
    
```

```

-----theta-----
min      5%      median      95%      max
0.1230  0.3449  0.4071  0.4071  0.4071
    
```

ofinc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	301.0416	90.41287	3.33	0.001	123.8356	478.2476
a_arisp	122.0516	198.6173	0.61	0.539	-267.2311	511.3343
a_arisp2	467.6983	252.4835	1.85	0.064	-27.16015	962.5568
a_arcpadb	-41.98131	199.0128	-0.21	0.833	-432.0393	348.0767
a_arcdpwb	-399.5462	147.6543	-2.71	0.007	-688.9433	-110.149
a_arcdp2	10.10725	524.4305	0.02	0.985	-1017.758	1037.972
a_arspeu	-564.1707	158.0269	-3.57	0.000	-873.8979	-254.4436
a_biarsp	-567.2341	166.6265	-3.40	0.001	-893.8161	-240.6521
a_cida	-343.0517	475.7423	-0.72	0.471	-1275.49	589.3861
a_rascp	-162.2132	223.8476	-0.72	0.469	-600.9465	276.52
a_undpsar	-354.4885	185.1514	-1.91	0.056	-717.3785	8.401522
a_wmcip	1096.213	945.5571	1.16	0.246	-757.0453	2949.47
a_starcm	-173.2837	609.8268	-0.28	0.776	-1368.522	1021.955
a_minssad	38.22364	94.02538	0.41	0.684	-146.0627	222.51
a_jica	93.79468	349.7363	0.27	0.789	-591.6758	779.2652
a_spots	-354.0846	591.3671	-0.60	0.549	-1513.143	804.9736
areaact	-.2461704	.199893	-1.23	0.218	-.6379535	.1456127
areaper	-15.3331	16.22814	-0.94	0.345	-47.13968	16.47347
arbcul	.1010166	1.048106	0.10	0.923	-1.953233	2.155266
arbculper	11.19988	9.249716	1.21	0.226	-6.929227	29.32899
arbact	1.039556	.5070906	2.05	0.040	.0456762	2.033435
arbper	28.85975	11.48936	2.51	0.012	6.341018	51.37848
fmrcom	.2035602	.4336671	0.47	0.639	-.6464117	1.053532
fmrper	12.41956	6.324531	1.96	0.050	.0237054	24.81541
brcom	-.0126265	1.918412	-0.01	0.995	-3.772646	3.747393
brper	7.73265	5.17128	1.50	0.135	-2.402873	17.86817
nirrcom	9.693425	3.750551	2.58	0.010	2.342481	17.04437
nirrper	6.019817	6.504646	0.93	0.355	-6.729054	18.76869
iareacom	.7589541	.6133859	1.24	0.216	-.4432601	1.961168
iareaper	7.286512	7.93925	0.92	0.359	-8.274132	22.84715
arbfarai	1.84946	1.283563	1.44	0.150	-.6662767	4.365197
arbfarper	-13.86401	7.594002	-1.83	0.068	-28.74798	1.019963
arbapph	-.204434	1.018936	-0.20	0.841	-2.201511	1.792643
arbapphper	5.603605	8.836714	0.63	0.526	-11.71604	22.92325
acredit	.1722702	.6049869	0.28	0.776	-1.013482	1.358023
creditper	12.47	5.101439	2.44	0.015	2.471358	22.46863
adoptech	.0443361	1.705879	0.03	0.979	-3.299125	3.387797
adoprate	10.64932	10.20789	1.04	0.297	-9.35778	30.65642
_cons	6208.12	1894.93	3.28	0.001	2494.125	9922.115
rho_ar	-.26323784	(estimated autocorrelation coefficient)				
sigma_u	5809.3243					
sigma_e	10227.795					
rho_fov	.24392321	(fraction of variance due to u_i)				

. sum mofinc2

Variable	Obs	Mean	Std. Dev.	Min	Max
mofinc2	5740	114.5494	300.4639	.0086627	14690.07

For NON FARM INCOME

```

RE GLS regression with AR(1) disturbances
Group variable (i): arcid
R-sq:  within = 0.0173
      between = 0.0449
      overall = 0.0348
Number of obs   = 5738
Number of groups = 1505
Obs per group: min = 1
                  avg  = 3.8
                  max  = 4
Wald chi2(39)   = 140.34
Prob > chi2     = 0.0000
    
```

```

corr(u_i, Xb) = 0 (assumed)
-----
      min      5%      median      95%      max
0.1475  0.3874  0.4502  0.4502  0.4502
    
```

ninc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	211.5923	143.0869	1.48	0.139	-68.85291 492.0375	
a_arisp	581.4555	303.0153	1.92	0.055	-12.44352 1175.355	
a_arisp2	382.0748	394.9743	0.97	0.333	-392.0606 1156.21	
a_arcpadb	238.5115	310.6755	0.77	0.443	-370.4013 847.4244	
a_arcdpwb	-558.4006	231.8379	-2.41	0.016	-1012.794 -104.0068	
a_arcdp2	445.248	797.6827	0.56	0.577	-1118.181 2008.677	
a_arspeu	-1057.444	247.7532	-4.27	0.000	-1543.032 -571.857	
a_biarsp	-417.8223	262.297	-1.59	0.111	-931.915 96.27041	
a_cida	-1253.276	734.9666	-1.71	0.088	-2693.784 187.2321	
a_rascp	-532.2834	337.8767	-1.58	0.115	-1194.51 129.9428	
a_undpsar	-264.6663	290.0534	-0.91	0.362	-833.1606 303.8279	
a_wmcip	-664.0043	1461.383	-0.45	0.650	-3528.261 2200.253	
a_starcm	-588.2786	951.4116	-0.62	0.536	-2453.011 1276.454	
a_minssad	-124.5956	141.2823	-0.88	0.378	-401.5038 152.3126	
a_jica	80.16551	538.9882	0.15	0.882	-976.232 1136.563	
a_spots	-315.3161	906.5565	-0.35	0.728	-2092.134 1461.502	
areaact	-.5969988	.3075714	-1.94	0.052	-1.199828 .00583	
areaper	50.45765	25.11496	2.01	0.045	1.233239 99.68206	
arbcul	-2.791067	1.600023	-1.74	0.081	-5.927055 .3449209	
arbculper	9.191399	14.09734	0.65	0.514	-18.43887 36.82167	
arbact	1.881042	.7645734	2.46	0.014	.3825052 3.379578	
arbper	27.27196	17.37302	1.57	0.116	-6.778539 61.32247	
fmrcom	-.5856582	.6584416	-0.89	0.374	-1.87618 .7048636	
fmrper	20.03966	9.677316	2.07	0.038	1.072473 39.00686	
brcom	1.198838	2.949769	0.41	0.684	-4.582603 6.980279	
brper	1.484614	7.895968	0.19	0.851	-13.9912 16.96043	
nirrcom	-.3754902	5.716271	-0.07	0.948	-11.57918 10.8282	
nirrper	7.364709	9.920965	0.74	0.458	-12.08003 26.80944	
iareacom	-.4586477	.9548288	-0.48	0.631	-2.330078 1.412782	
iareaper	6.445012	12.06922	0.53	0.593	-17.21022 30.10024	
arbfarai	6.420911	1.980793	3.24	0.001	2.538627 10.30319	
arbfarper	4.247182	11.54194	0.37	0.713	-18.3746 26.86896	
arbapph	1.508556	1.555169	0.97	0.332	-1.53952 4.556632	
arbapphper	2.977531	13.41471	0.22	0.824	-23.31481 29.26987	
acredit	-.3900083	.9216648	-0.42	0.672	-2.196438 1.416422	
creditper	20.36513	7.775116	2.62	0.009	5.126187 35.60408	
adoptech	.8370395	2.61093	0.32	0.749	-4.28029 5.954369	
adoprate	50.54981	15.57128	3.25	0.001	20.03067 81.06895	
_cons	4376.021	2938.063	1.49	0.136	-1382.477 10134.52	
rho_ar	-.26269312	(estimated autocorrelation coefficient)				
sigma_u	9751.7944					
sigma_e	15342.22					
rho_fov	.28775461	(fraction of variance due to u_i)				

. sum mninc2

Variable	Obs	Mean	Std. Dev.	Min	Max
mninc2	5647	170.944	1773.797	.0038894	130121.3

For TOTAL INCOME

```
RE GLS regression with AR(1) disturbances      Number of obs      =      5771
Group variable (i): arcid                    Number of groups   =      1505
R-sq: within = 0.0235                        Obs per group: min =         1
      between = 0.0975                        avg               =         3.8
      overall  = 0.0660                        max               =         4
                                              Wald chi2(39)     =      233.37
                                              Prob > chi2       =      0.0000
```

```
corr(u_i, Xb) = 0 (assumed)
-----
min      5%      median      95%      max
0.0676  0.2428  0.3001    0.3001  0.3001
```

totinc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	1588.559	335.5369	4.73	0.000	930.9188	2246.199
a_arisp	2733.955	775.7924	3.52	0.000	1213.43	4254.48
a_arisp2	1553.851	952.5867	1.63	0.103	-313.185	3420.886
a_arcpadb	1688.345	749.4384	2.25	0.024	219.4732	3157.218
a_arcdpwb	-407.1559	550.4927	-0.74	0.460	-1486.102	671.7901
a_arcdp2	-230.869	2067.434	-0.11	0.911	-4282.965	3821.227
a_arspeu	-1623.02	592.2244	-2.74	0.006	-2783.759	-462.2814
a_biarisp	-1298.054	621.4591	-2.09	0.037	-2516.092	-80.01693
a_cida	-1121.965	1826.538	-0.61	0.539	-4701.915	2457.984
a_rascp	-2360.421	895.8426	-2.63	0.008	-4116.24	-604.6015
a_undpsar	-823.534	701.0305	-1.17	0.240	-2197.529	550.4606
a_wmcip	583.5103	3629.524	0.16	0.872	-6530.227	7697.247
a_starcm	377.1324	2298.707	0.16	0.870	-4128.251	4882.516
a_minssad	-61.13127	367.3147	-0.17	0.868	-781.0548	658.7923
a_jica	-898.0666	1345.282	-0.67	0.504	-3534.771	1738.638
a_spots	490.6873	2287.859	0.21	0.830	-3993.434	4974.809
areaact	-2.473778	.7654793	-3.23	0.001	-3.97409	-.9734665
areaper	18.19358	62.28162	0.29	0.770	-103.8761	140.2633
arbcul	-9.60184	4.053315	-2.37	0.018	-17.54619	-1.657489
arbculper	20.79486	35.80437	0.58	0.561	-49.38042	90.97014
arbact	7.257141	1.972661	3.68	0.000	3.390797	11.12349
arbper	71.03596	44.90383	1.58	0.114	-16.97393	159.0459
fmrcom	-.5727372	1.705365	-0.34	0.737	-3.915192	2.769717
fmrper	67.61354	24.57562	2.75	0.006	19.4462	115.7809
brcom	-3.554492	7.382741	-0.48	0.630	-18.0244	10.91541
brper	30.93679	20.07431	1.54	0.123	-8.408129	70.28171
nirrcom	22.58597	14.63734	1.54	0.123	-6.102676	51.27462
nirrper	12.71573	25.36943	0.50	0.616	-37.00744	62.4389
iareacom	.753647	2.323822	0.32	0.746	-3.800961	5.308255
iareaper	32.16346	30.84253	1.04	0.297	-28.28678	92.6137
arbfarai	17.62536	4.912036	3.59	0.000	7.997944	27.25277
arbfarper	-30.451	29.54332	-1.03	0.303	-88.35484	27.45284
arbapph	6.99107	3.958697	1.77	0.077	-.7678344	14.74997
arbappper	-7.69079	34.49207	-0.22	0.824	-75.294	59.91242
acredit	-1.900993	2.345335	-0.81	0.418	-6.497765	2.69578
creditper	72.27091	19.88744	3.63	0.000	33.29224	111.2496
adoptech	8.829203	6.590985	1.34	0.180	-4.08889	21.7473
adoprate	122.3202	39.45092	3.10	0.002	44.99784	199.6426
_cons	41091.83	7221.706	5.69	0.000	26937.54	55246.11
rho_ar	-.32781236	(estimated autocorrelation coefficient)				
sigma_u	16954.566					
sigma_e	41310.821					
rho_fov	.14415816	(fraction of variance due to u_i)				

```
. sum mtotinc2
```

Variable	Obs	Mean	Std. Dev.	Min	Max
mtotinc2	5770	38.96083	43.62637	.006882	882.4811

For OM

```

RE GLS regression with AR(1) disturbances      Number of obs      =      5776
Group variable (i): arcid                    Number of groups   =      1505
R-sq: within = 0.0319                       Obs per group: min =         1
      between = 0.2021                       avg                =         3.8
      overall  = 0.1488                       max                =         4
Wald chi2(39)                               =      574.60
Prob > chi2                                  =      0.0000
corr(u_i, Xb)                               = 0 (assumed)
    
```

```

----- theta -----
min      5%      median      95%      max
0.1623   0.4021   0.4642   0.4642   0.4642
    
```

om	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.3417079	.0866965	3.94	0.000	.1717859	.5116299
a_arisp	.6212805	.1836851	3.38	0.001	.2612644	.9812967
a_arisp2	1.092775	.2381593	4.59	0.000	.625991	1.559558
a_arcpadb	.537655	.188299	2.86	0.004	.1685957	.9067144
a_arcdpwb	.7358796	.1407369	5.23	0.000	.4600404	1.011719
a_arcdp2	1.093269	.4785882	2.28	0.022	.1552531	2.031284
a_arspeu	.3399037	.150215	2.26	0.024	.0454876	.6343198
a_biarsp	.5009885	.1589633	3.15	0.002	.1894263	.8125507
a_cida	.7465224	.4442673	1.68	0.093	-.1242255	1.61727
a_rascp	-.01562	.2036071	-0.08	0.939	-.4146825	.3834426
a_undpsar	.1604036	.1746359	0.92	0.358	-.1818765	.5026837
a_wmcip	-1.925834	.882724	-2.18	0.029	-3.655941	-.1957265
a_starcm	-.1504732	.5770188	-0.26	0.794	-1.281409	.9804629
a_minssad	.0538804	.0860255	0.63	0.531	-.1147265	.2224874
a_jica	.1423695	.3254191	0.44	0.662	-.4954402	.7801791
a_spots	-.9008607	.5446834	-1.65	0.098	-1.968421	.1666992
areaact	-.000538	.0001864	-2.89	0.004	-.0009033	-.0001726
areaper	.0340122	.0151037	2.25	0.024	.0044095	.063615
arbcul	.0019626	.000969	2.03	0.043	.0000634	.0038617
arbculper	-.038834	.0085056	-4.57	0.000	-.0555048	-.0221633
arbact	.0002372	.0004654	0.51	0.610	-.000675	.0011494
arbper	.058452	.0104715	5.58	0.000	.0379282	.0789757
fmrcom	-.0001985	.0003997	-0.50	0.619	-.0009819	.0005849
fmrper	.0144179	.0058352	2.47	0.013	.0029812	.0258546
brcom	.0005347	.0017819	0.30	0.764	-.0029577	.004027
brper	.0026554	.0047687	0.56	0.578	-.006691	.0120018
nirrcom	.0016524	.0034519	0.48	0.632	-.0051131	.0084179
nirrper	.0036982	.0059866	0.62	0.537	-.0080352	.0154317
iareacom	-.0001558	.0005779	-0.27	0.787	-.0012884	.0009768
iareaper	.0093278	.0073026	1.28	0.201	-.004985	.0236407
arbfarai	.0029818	.0011971	2.49	0.013	.0006356	.005328
arbfarper	.0041475	.0069639	0.60	0.551	-.0095014	.0177965
arbapph	-.0013525	.0009387	-1.44	0.150	-.0031924	.0004873
arbapphper	.0076353	.0080617	0.95	0.344	-.0081652	.0234359
acredit	.0018029	.0005573	3.24	0.001	.0007106	.0028951
creditper	.0263003	.0046853	5.61	0.000	.0171171	.0354834
adoptech	.0019677	.0015703	1.25	0.210	-.0011101	.0050455
adoprate	.0789928	.0093213	8.47	0.000	.0607233	.0972623
_cons	48.12254	1.775966	27.10	0.000	44.64171	51.60337
rho_ar	-.2348909	(estimated autocorrelation coefficient)				
sigma_u	6.1499951					
sigma_e	9.1693534					
rho_fov	.31027564	(fraction of variance due to u_i)				

. sum mom2

Variable	Obs	Mean	Std. Dev.	Min	Max
mom2	5734	16.75344	29.17103	.0031102	1120.854

For LTI

```

RE GLS regression with AR(1) disturbances
Group variable (i): arcid
R-sq: within = 0.3093
      between = 0.8182
      overall = 0.6969
Number of obs   = 5780
Number of groups = 1505
Obs per group: min = 1
                  avg = 3.8
                  max = 4
Wald chi2(39)  = 9064.47
Prob > chi2    = 0.0000
corr(u_i, Xb)  = 0 (assumed)
    
```

```

-----theta-----
min      5%      median      95%      max
0.0000  0.0000  0.0000  0.0000  0.0000
    
```

lti	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.1530019	.0361318	-4.23	0.000	-.223819	-.0821849
a_arisp	-.0377658	.1034006	-0.37	0.715	-.2404272	.1648957
a_arisp2	.2291162	.10605	2.16	0.031	.021262	.4369703
a_arcpadb	-.0048155	.0843508	-0.06	0.954	-.17014	.160509
a_arcdpwb	.0768893	.0605325	1.27	0.204	-.0417522	.1955309
a_arcdp2	.0742407	.2628622	0.28	0.778	-.4409596	.5894411
a_arspeu	.1431285	.0652807	2.19	0.028	.0151807	.2710764
a_biarsp	.1294084	.067519	1.92	0.055	-.0029265	.2617432
a_cida	.0391438	.2139301	0.18	0.855	-.3801516	.4584391
a_rascp	.0405477	.1232257	0.33	0.742	-.2009703	.2820656
a_undpsar	-.0342412	.0790745	-0.43	0.665	-.1892245	.120742
a_wmcip	.0760336	.434059	0.18	0.861	-.7747063	.9267735
a_starcm	-1.14419	.2555796	-4.48	0.000	-1.645117	-.6432627
a_minssad	.052933	.0515026	1.03	0.304	-.0480102	.1538761
a_jica	-.0921285	.1585364	-0.58	0.561	-.4028541	.2185971
a_spots	-.1160838	.276097	-0.42	0.674	-.6572241	.4250565
areaact	-.0003771	.0000923	-4.09	0.000	-.000558	-.0001963
areaper	.4665215	.007561	61.70	0.000	.4517022	.4813407
arbcu	.0018776	.0005139	3.65	0.000	.0008704	.0028847
arbcuiper	.026857	.0046001	5.84	0.000	.017841	.0358731
arbact	-.0001957	.0002712	-0.72	0.470	-.0007272	.0003357
arbper	.1789581	.0060064	29.79	0.000	.1671858	.1907304
fmrcom	.00008	.0002338	0.34	0.732	-.0003783	.0005382
fmrper	-.0000932	.0030705	-0.03	0.976	-.0061113	.0059248
brcom	.0012114	.0008897	1.36	0.173	-.0005324	.0029552
brper	.0047834	.0025185	1.90	0.058	-.0001528	.0097196
nirrcom	.0041891	.0018359	2.28	0.022	.0005909	.0077873
nirrper	-.0038771	.0032517	-1.19	0.233	-.0102502	.002496
iareacom	-.0000434	.0002652	-0.16	0.870	-.0005632	.0004764
iareaper	.003938	.0039353	1.00	0.317	-.0037751	.011651
arbfarai	.0000339	.000579	0.06	0.953	-.0011008	.0011687
arbfarper	.0045061	.0038148	1.18	0.238	-.0029707	.0119829
arbapph	.0004815	.0005016	0.96	0.337	-.0005015	.0014646
arbappper	.0085675	.0045673	1.88	0.061	-.0003844	.0175193
acredit	-.0009601	.0002958	-3.25	0.001	-.0015399	-.0003803
creditper	.007536	.002549	2.96	0.003	.0025401	.012532
adoptech	-.0018068	.0008061	-2.24	0.025	-.0033867	-.0002269
adoprate	.0357862	.0049908	7.17	0.000	.0260045	.0455679
_cons	28.66016	.8589669	33.37	0.000	26.97661	30.3437
rho_ar	-.31774396	(estimated autocorrelation coefficient)				
sigma_u	0					
sigma_e	5.9560443					
rho_fov	0	(fraction of variance due to u_i)				

. sum mlti2

Variable	Obs	Mean	Std. Dev.	Min	Max
mlti2	5778	6.454067	108.3132	.0000156	8207.637

For FPI

```
RE GLS regression with AR(1) disturbances      Number of obs      =      5780
Group variable (i): arcid                    Number of groups   =      1505
R-sq: within = 0.0113                       Obs per group: min =         1
        between = 0.1337                      avg               =         3.8
        overall = 0.0656                      max               =         4
                                                Wald chi2(39)     =      267.08
                                                Prob > chi2       =      0.0000
```

```
corr(u_i, Xb)      = 0 (assumed)
-----theta-----
min      5%      median      95%      max
0.0000   0.0000   0.0000   0.0000   0.0000
```

fpi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.1673676	.0919564	-1.82	0.069	-.3475988	.0128635
a_arisp	.2966674	.2610815	1.14	0.256	-.2150429	.8083778
a_arisp2	.0451493	.2693467	0.17	0.867	-.4827605	.573059
a_arcpadb	.4747421	.2141689	2.22	0.027	.0549787	.8945055
a_arcdpwb	.382266	.1538585	2.48	0.013	.0807089	.6838231
a_arcdp2	.6740224	.6632659	1.02	0.310	-.6259548	1.974
a_arspeu	-.2212188	.1660403	-1.33	0.183	-.5466518	.1042142
a_biarisp	.3876907	.1717514	2.26	0.024	.0510641	.7243172
a_cida	-.9619747	.5432757	-1.77	0.077	-2.026776	.1028262
a_rascp	-.2032452	.3105108	-0.65	0.513	-.8118352	.4053447
a_undpsar	.1349021	.2009255	0.67	0.502	-.2589047	.5287089
a_wmcip	-.1149735	1.100215	-0.10	0.917	-2.271355	2.041408
a_starcm	.6399442	.6496685	0.99	0.325	-.6333827	1.913271
a_minssad	.2138217	.1291245	1.66	0.098	-.0392576	.4669011
a_jica	.3712404	.4020332	0.92	0.356	-.4167303	1.159211
a_spots	.0473144	.6979356	0.07	0.946	-1.320614	1.415243
areaact	-.0004448	.0002336	-1.90	0.057	-.0009026	.000013
areaper	.0289447	.0191468	1.51	0.131	-.0085824	.0664718
arbcu	-.0014075	.0012976	-1.08	0.278	-.0039508	.0011358
arbcuiper	-.0061679	.0116072	-0.53	0.595	-.0289176	.0165818
arbact	.001485	.0006806	2.18	0.029	.000151	.002819
arbper	.0520401	.0151217	3.44	0.001	.0224021	.0816781
fmrcom	.0005013	.0005898	0.85	0.395	-.0006547	.0016572
fmrper	-.0161368	.0077665	-2.08	0.038	-.0313589	-.0009146
brcom	.0002023	.0022531	0.09	0.928	-.0042137	.0046183
brper	.0055548	.0063674	0.87	0.383	-.0069251	.0180346
nirrcom	-.0006052	.0046417	-0.13	0.896	-.0097027	.0084924
nirrper	.0052893	.0082117	0.64	0.519	-.0108054	.0213841
iareacom	.0012076	.0006733	1.79	0.073	-.0001121	.0025273
iareaper	-.0005104	.0099368	-0.05	0.959	-.0199862	.0189653
arbfarai	.0006841	.001468	0.47	0.641	-.0021932	.0035614
arbfarper	-.00973	.0096258	-1.01	0.312	-.0285962	.0091361
arbapph	-3.96e-06	.0012674	-0.00	0.998	-.002488	.00248
arbappper	.0043884	.0115112	0.38	0.703	-.0181732	.02695
acredit	.0013092	.0007473	1.75	0.080	-.0001556	.0027739
creditper	.0083709	.0064383	1.30	0.194	-.004248	.0209898
adoptech	.0012048	.0020395	0.59	0.555	-.0027926	.0052022
adoprate	.1058915	.0126048	8.40	0.000	.0811865	.1305966
_cons	55.69121	2.177173	25.58	0.000	51.42403	59.95839

```
rho_ar      | -.32977454      (estimated autocorrelation coefficient)
sigma_u     | 0
sigma_e     | 15.001727
rho_fov     | 0      (fraction of variance due to u_i)
```

. sum mfp2

Variable	Obs	Mean	Std. Dev.	Min	Max
mfp2	5780	21.9035	24.79388	.0028477	566.7706

For BSS

```

RE GLS regression with AR(1) disturbances
Group variable (i): arcid
R-sq: within = 0.0297
      between = 0.1636
      overall = 0.1075

Number of obs   = 5780
Number of groups = 1505
Obs per group: min = 1
                  avg = 3.8
                  max = 4

Wald chi2(39) = 436.49
Prob > chi2   = 0.0000

corr(u_i, Xb) = 0 (assumed)
    
```

```

----- theta -----
min      5%      median      95%      max
0.0753  0.2404  0.2956  0.2956  0.2956
    
```

bss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.0481326	.0690629	0.70	0.486	-.0872281	.1834933
a_arisp	.1253203	.1674731	0.75	0.454	-.202921	.4535616
a_arisp2	.6741706	.198172	3.40	0.001	.2857606	1.062581
a_arcpadb	-.1260847	.1568362	-0.80	0.421	-.433478	.1813085
a_arcdpwb	.2373318	.1146937	2.07	0.039	.0125363	.4621274
a_arcdp2	.6553074	.4417959	1.48	0.138	-.2105967	1.521212
a_arspeu	-.0006633	.1230607	-0.01	0.996	-.2418577	.2405312
a_biarisp	-.0787483	.1285609	-0.61	0.540	-.3307231	.1732264
a_cida	-1.197278	.3833786	-3.12	0.002	-1.948686	-.4458695
a_rascp	-.0073269	.1932299	-0.04	0.970	-.3860505	.3713967
a_undpsar	-.505922	.1461264	-3.46	0.001	-.7923245	-.2195196
a_wmcip	-1.195366	.7641425	-1.56	0.118	-2.693057	.3023261
a_starcm	-1.195056	.4772057	-2.50	0.012	-2.130362	-.2597496
a_minssad	.0048122	.0823999	0.06	0.953	-.1566887	.1663131
a_jica	.6313126	.283495	2.23	0.026	.0756726	1.186953
a_spots	-1.27363	.4850342	-2.63	0.009	-2.224279	-.3229803
areaact	-.0006973	.0001632	-4.27	0.000	-.0010173	-.0003774
areaper	.0620848	.0132443	4.69	0.000	.0361265	.0880431
arbcu	-.000154	.0008761	-0.18	0.860	-.001871	.0015631
arbcuiper	-.0126896	.0077775	-1.63	0.103	-.0279332	.0025541
arbact	.0008554	.0004405	1.94	0.052	-8.08e-06	.0017188
arbper	.0167946	.0098245	1.71	0.087	-.0024611	.0360502
fmrcom	-.0009059	.0003707	-2.44	0.015	-.0016326	-.0001793
fmrper	.0144126	.0052646	2.74	0.006	.0040943	.024731
brcom	.0003656	.0015713	0.23	0.816	-.0027141	.0034453
brper	.0107001	.0043119	2.48	0.013	.0022489	.0191514
nirrcom	.0029561	.0031355	0.94	0.346	-.0031893	.0091015
nirrper	.0054442	.0054808	0.99	0.321	-.005298	.0161864
iareacom	.0013281	.0004863	2.73	0.006	.000375	.0022811
iareaper	.0034304	.0066652	0.51	0.607	-.0096332	.0164939
arbfarai	.0002399	.0010356	0.23	0.817	-.0017897	.0022696
arbfarper	.011315	.0064063	1.77	0.077	-.0012412	.0238712
arbapph	.0019007	.0008514	2.23	0.026	.0002321	.0035693
arbapphper	.0163987	.007514	2.18	0.029	.0016715	.031126
acredit	.0006328	.0005055	1.25	0.211	-.000358	.0016236
creditper	.0113225	.0042911	2.64	0.008	.0029122	.0197329
adoptech	-.00084	.0014006	-0.60	0.549	-.0035852	.0019052
adoprate	.0551328	.0084842	6.50	0.000	.0385042	.0717615
_cons	70.45556	1.52994	46.05	0.000	67.45694	73.45419
rho_ar	-.248996	(estimated autocorrelation coefficient)				
sigma_u	3.8169915					
sigma_e	8.9790069					
rho_fov	.15305305	(fraction of variance due to u_i)				

. sum mbss2

Variable	Obs	Mean	Std. Dev.	Min	Max
mbss2	5779	11.24344	11.9354	.0032932	211.6363

For GAD

```

RE GLS regression with AR(1) disturbances      Number of obs      =      5780
Group variable (i): arcid                    Number of groups   =      1505
R-sq: within = 0.0136                       Obs per group: min =         1
      between = 0.0524                       avg                =         3.8
      overall  = 0.0376                       max                =         4
                                              Wald chi2(39)      =      146.66
                                              Prob > chi2        =      0.0000
corr(u_i, Xb) = 0 (assumed)

```

```

-----theta-----
min      5%      median      95%      max
0.0867  0.2784  0.3379    0.3379  0.3379

```

gad	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	-.1861623	.0929505	-2.00	0.045	-.368342	-.0039827
a_arisp	-.086297	.213113	-0.40	0.686	-.5039909	.3313969
a_arisp2	.1706958	.2632468	0.65	0.517	-.3452583	.68665
a_arcpadb	.2618626	.2076008	1.26	0.207	-.1450275	.6687527
a_arcdpwb	.5910515	.1527229	3.87	0.000	.2917201	.890383
a_arcdp2	1.176167	.5664414	2.08	0.038	.0659622	2.286372
a_arspeu	-.2963092	.1639246	-1.81	0.071	-.6175955	.0249772
a_biarisp	-.0790887	.1721332	-0.46	0.646	-.4164635	.258286
a_cida	.0166058	.5026859	0.03	0.974	-.9686404	1.001852
a_rascp	.4235346	.2443662	1.73	0.083	-.0554144	.9024835
a_undpsar	-.0170904	.1935312	-0.09	0.930	-.3964047	.3622238
a_wmcip	-.7243105	.9993956	-0.72	0.469	-2.68309	1.234469
a_starcm	-.1748446	.6350041	-0.28	0.783	-1.41943	1.069741
a_minssad	.0568089	.1018364	0.56	0.577	-.1427867	.2564046
a_jica	.0393545	.3704647	0.11	0.915	-.6867429	.7654519
a_spots	.0157417	.6289466	0.03	0.980	-1.216971	1.248454
areaact	-.0003998	.0002115	-1.89	0.059	-.0008144	.0000148
areaper	.0416063	.0171664	2.42	0.015	.0079608	.0752519
arbcul	.0003599	.0011185	0.32	0.748	-.0018323	.0025522
arbculper	-.0103364	.0098706	-1.05	0.295	-.0296823	.0090096
arbact	.0003896	.0005471	0.71	0.476	-.0006828	.0014619
arbper	.002307	.012331	0.19	0.852	-.0218614	.0264754
fmrcom	-.0012913	.000468	-2.76	0.006	-.0022086	-.0003741
fmrper	.0187758	.0067628	2.78	0.005	.0055209	.0320306
brcom	.0046368	.0020364	2.28	0.023	.0006456	.008628
brper	-.0154199	.0055251	-2.79	0.005	-.0262488	-.004591
nirrcom	-.000034	.0040242	-0.01	0.993	-.0079212	.0078532
nirrper	.0043207	.0069851	0.62	0.536	-.0093699	.0180114
iareacom	.001027	.0006419	1.60	0.110	-.0002311	.0022852
iareaper	-.0191578	.0085002	-2.25	0.024	-.0358179	-.0024976
arbfarai	-.0018305	.0013541	-1.35	0.176	-.0044846	.0008235
arbfarper	.0175155	.0081397	2.15	0.031	.0015621	.0334689
arbapph	.000222	.0010892	0.20	0.839	-.0019129	.0023569
arbapphper	-.00899	.0094774	-0.95	0.343	-.0275654	.0095855
acredit	.0018833	.0006467	2.91	0.004	.0006159	.0031508
creditper	.0175684	.0054703	3.21	0.001	.0068469	.02829
adoptech	-.0016333	.0018109	-0.90	0.367	-.0051827	.001916
adoprate	.0417788	.0108218	3.86	0.000	.0205685	.0629892
_cons	44.57935	1.993592	22.36	0.000	40.67198	48.48672
rho_ar	-.28942121	(estimated autocorrelation coefficient)				
sigma_u	5.2329867					
sigma_e	11.23397					
rho_fov	.17829821	(fraction of variance due to u_i)				

. sum mgad2

Variable	Obs	Mean	Std. Dev.	Min	Max
mgad2	5780	27.97925	39.63384	.0014573	996.96

For ECOPISS

```

RE GLS regression with AR(1) disturbances      Number of obs      =      5780
Group variable (i): arcid                    Number of groups   =      1505
R-sq: within = 0.5353                       Obs per group: min =         1
      between = 0.8298                       avg                =         3.8
      overall  = 0.7385                       max                =         4
                                              Wald chi2(39)      =    10209.37
                                              Prob > chi2        =         0.0000
corr(u_i, Xb) = 0 (assumed)

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-----theta-----
min      5%      median      95%      max
0.0000  0.0000  0.0000    0.0000  0.0000

```

ecopiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.2480861	.0596631	4.16	0.000	.1311485	.3650237
a_arisp	.2035101	.1597368	1.27	0.203	-.1095682	.5165885
a_arisp2	.263708	.1717823	1.54	0.125	-.0729792	.6003951
a_arcpadb	.2487002	.1363022	1.82	0.068	-.0184473	.5158476
a_arcdpwb	.0270371	.0987546	0.27	0.784	-.1665183	.2205926
a_arcdp2	.5092871	.4033779	1.26	0.207	-.2813191	1.299893
a_arspeu	.0493311	.1071336	0.46	0.645	-.1606469	.2593092
a_biarisp	-.0040153	.1109388	-0.04	0.971	-.2214514	.2134208
a_cida	-.4154588	.3460644	-1.20	0.230	-1.093733	.2628149
a_rascp	.212978	.1869525	1.14	0.255	-.1534422	.5793981
a_undpsar	-.0230424	.1287178	-0.18	0.858	-.2753246	.2292397
a_wmcip	.7763206	.6915243	1.12	0.262	-.5790422	2.131683
a_starcm	-.5284482	.4172907	-1.27	0.205	-1.346323	.2894266
a_minssad	-.0277385	.0750645	-0.37	0.712	-.1748623	.1193853
a_jica	.1210393	.2533471	0.48	0.633	-.3755118	.6175905
a_spots	-.0021624	.4296564	-0.01	0.996	-.8442734	.8399486
areaact	-.0004187	.0001455	-2.88	0.004	-.0007038	-.0001336
areaper	-.0159862	.0119578	-1.34	0.181	-.039423	.0074505
arbcul	-.0012367	.0007938	-1.56	0.119	-.0027925	.000319
arbculper	-.0496209	.0070578	-7.03	0.000	-.063454	-.0357878
arbact	.0008785	.0003989	2.20	0.028	.0000967	.0016602
arbper	.0480762	.0090469	5.31	0.000	.0303446	.0658077
fmrcom	.0005201	.000359	1.45	0.147	-.0001836	.0012237
fmrper	.1582629	.0048023	32.96	0.000	.1488506	.1676752
brcom	.0034323	.0014051	2.44	0.015	.0006785	.0061862
brper	.0929158	.0039237	23.68	0.000	.0852255	.100606
nirrcom	.004702	.0028627	1.64	0.100	-.0009088	.0103128
nirrper	.0098779	.0050199	1.97	0.049	.0000391	.0197166
iareacom	.0012169	.0004286	2.84	0.005	.0003769	.002057
iareaper	.1172321	.0060679	19.32	0.000	.1053392	.1291249
arbfarai	.0044906	.0009247	4.86	0.000	.0026782	.0063029
arbfarper	.1325919	.0058492	22.67	0.000	.1211277	.1440561
arbapph	.0018437	.000778	2.37	0.018	.0003188	.0033687
arbapphper	.0983769	.0069423	14.17	0.000	.0847702	.1119836
acredit	.0004977	.000458	1.09	0.277	-.0004	.0013954
creditper	.0906334	.0039405	23.00	0.000	.0829101	.0983567
adoptech	-.0008634	.0012642	-0.68	0.495	-.0033413	.0016144
adoprate	.0249042	.0077143	3.23	0.001	.0097845	.040024
_cons	15.62706	1.36983	11.41	0.000	12.94224	18.31188

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rho_ar | -.41299048 (estimated autocorrelation coefficient)
sigma_u | 0
sigma_e | 9.33901
rho_fov | 0 (fraction of variance due to u_i)
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. sum mecopiss2

Variable	Obs	Mean	Std. Dev.	Min	Max
mecopiss2	5780	12.10421	42.24861	.0023524	1997.948

APPENDIX 3: DATA USED IN SIMULATION

Accomplishment and Density of Rural and National Roads (2005)

Region	Land Area (In Square Kilometer)	Required Rural Roads (In Kilometer)	Completed Rural Roads (In Kilometer)	Accomplish- ment Rural Roads (%)	Density of Rural Roads (Km/Sq.Km)	National Roads (In Kilometer)	Density of Nat'l Roads (Km/Sq.Km)
Ilocos	12,845	3,201	2,716	84.85	0.2114	1,609	0.1253
Cagayan Valley	26,792	6,707	4,017	59.89	0.1499	1,751	0.0654
Central Luzon	18,211	3,249	2,103	64.71	0.1155	1,981	0.1088
Bicol	17,641	2,188	1,435	65.57	0.0813	2,171	0.1231
Western Visayas	20,224	2,754	1,543	56.02	0.0763	2,875	0.1422
Central Visayas	14,963	1,839	1,211	65.89	0.0810	1,911	0.1277
Eastern Visayas	20,869	2,038	1,250	61.32	0.0599	2,245	0.1076
Zamboanga Peninsula	16,017	3,478	2,281	65.57	0.1424	1,068	0.0667
Northern Mindanao	14,018	3,051	1,770	58.00	0.1262	1,604	0.1144
Davao Region	19,731	3,519	2,376	67.53	0.1204	1,439	0.0729
SOCCSKSARGEN	14,515	2,711	1,262	46.56	0.0870	1,301	0.0896
CAR	14,371	2,923	1,546	52.89	0.1076	1,795	0.1249
CALABARZON	46,987	2,392	1,136	47.50	0.0642	2,394	0.0971
MIMAROPA		3,045	1,882	61.79		2,170	
CARAGA	18,877	2,988	1,488	49.82	0.0788	1,357	0.0719
ARMM	11,432						
NCR	636					992	1.5597
TOTAL	299,995	46,082	28,015	60.79	0.0934	28,664	0.0955

Source: Agrarian Reform Communities Level of Development Assessment (ALDA), Department of Public Works and Highways.

Accomplishment and Density of Irrigation System

Region	Land Area (Square Kilometers)	Estimated Irrigable Area (Has.)	Service Area (Hectares)	Accomplish- ment (Percent)	Density of Area (Ha/Sq.Km)	Area of Farm (Hectare)	Irrigated Parcel (Hectare)	Irrigated Farm Area (Percent)
Reference Year		2,005	2,005	2005	2005	2002*	2002*	2002*
Ilocos	12,845	277,180	178,664	64.46	13.909	210,589	185,323	88.00
Cagayan Valley	26,792	472,640	202,386	42.82	7.554	361,374	281,691	77.95
Central Luzon	18,211	498,860	268,438	53.81	14.741	429,743	384,391	89.45
Bicol	17,641	239,660	118,781	49.56	6.733	304,988	217,052	71.17
Western Visayas	20,224	197,250	77,652	39.37	3.840	337,642	256,405	75.94
Central Visayas	14,963	50,740	29,348	57.84	1.961	185,699	142,710	76.85
Eastern Visayas	20,869	84,380	50,118	59.40	2.402	224,820	136,560	60.74
Zamboanga Peninsula	16,017	76,080	36,814	48.39	2.298	148,322	107,657	72.58
Northern Mindanao	14,018	120,700	52,413	43.42	3.739	169,322	99,354	58.68
Davao Region	19,731	149,610	54,327	36.31	2.753	211,614	157,563	74.46
SOCCSKSARGEN	14,515	293,610	83,140	28.32	5.728	271,663	203,917	75.06
CAR	14,371	99,650	75,258	75.52	5.237	142,161	97,270	68.42
CALABARZON	46,987	246,960	122,511	49.61	2.607	176,446	125,796	71.29
MIMAROPA						324,122	254,072	78.39
CARAGA	18,877	162,300	40,117	24.72	2.125	196,254	129,772	66.12
ARMM	11,432	156,720	23,269	14.85	2.035	134,928	111,124	82.36
TOTAL	299,995	3,126,340	1,413,236	45.20	4.711	3,875,350	2,930,029	75.61

*From 2002 Census of Agriculture

Source: Agrarian Reform Communities Level of Development Assessment (ALDA), National Irrigation Administration

Summary of Budgetary Allocation in 2005 (in '000 pesos)

Particulars	2003 (Actual)	2004 (Adjusted)	2005 (Proposed)
Total Obligations	825,113,313	861,628,593	907,589,726
New General Appropriations	609,432,059	573,312,289	446,040,346
Automatic Appropriations	269,861,682	312,926,412	496,403,900
Continuing Appropriations	41,213,150	38,070,860	
All Departments and Agencies	407,133,223	373,213,407	377,667,539
Special Purpose Funds	417,980,090	488,415,186	529,922,187
Capital Outlay: Public Infrastructure	54,189,418	41,405,436	46,807,230
Department of Agrarian Reform	7,863,585	14,763,579	14,748,549
Department of Agriculture	3,088,459	3,115,959	2,916,015
Department of Environment and Natural Resources	5,471,015	5,868,418	5,511,256
Projects	229,334,108	262,363,369	265,903,383
Locally-Funded	193,435,579	227,063,048	224,590,169
Foreign-Assisted	35,898,529	35,300,321	41,363,986
Agriculture and Fisheries Modernization Program	8,408,829	8,686,796	10,025,706
New Appropriation	9,796,627	7,711,869	9,032,531
Automatic Appropriation	653,901	974,927	993,175
Continuing Appropriation	2,372,455	2,797,275	

Source: 2005 Public Expenditure Program, Department of Budget and Management

Budgetary Allocation for 2005 for Agriculture and Fisheries Modernization Program

Particulars	Personal Services	Maintenance and Other Operating Expenses	Capital Outlays	Total
Programs	19,023,000	2,682,872,000	256,779,000	2,958,674,000
Development of the Crop Sector	15,644,000	2,264,158,000	222,346,000	2,502,148,000
GMA Rice and Corn Nationwide Operations		1,877,789,000	151,939,000	2,029,728,000
Technology Gen./Diss. For Vegetable Industry	6,277,000	8,886,000		15,163,000
Agricultural Intensification and Diversification Program	5,991,000	10,224,000		16,215,000
Bohol Agricultural Promotion Center	3,376,000	6,376,000	168,000	9,920,000
Subsidy for Crop Insurance		113,771,000		113,771,000
GMA High Value Commercial Crop		247,112,000	70,239,000	317,351,000
Development of the Livestock Sector	3,379,000	226,810,000	29,433,000	259,622,000
Breeder Base Expansion-Genetically Superior Breed	3,379,000	5,565,000		8,944,000
GMA Livestock		221,245,000	29,433,000	250,678,000
GMA Fisheries		627,828,000	201,440,000	829,268,000
Various Agricultural Research Projects		155,000,000		155,000,000
VSAT Communication System (National Info. Network)		36,904,000	5,000,000	41,904,000
Locally-Funded Projects	8,661,000	128,062,000	1,712,307,000	1,849,030,000
Repair/Rehab./Const. of Rural Road in Production Areas			200,000,000	200,000,000
Basilan Integrated Peace and Development Strategy		11,766,000	12,302,000	24,068,000
ZAMBAS Integrated Agricultural Development Program		28,457,000	42,775,000	71,232,000
Davao Integrated Development Project		24,400,000	46,832,000	71,232,000
SOCKSAREN Integrated Food Security Program	8,661,000	13,328,000	59,350,000	81,339,000
Metro Kutawato Development Alliance		9,784,000	11,550,000	21,334,000
CARAGA Integrated Development Project		26,345,000	44,887,000	71,232,000
HH Enhan. and Livelihood Prog. for Muslim Comm.		4,655,000	345,000	5,000,000
Pagkain Para sa Masa for Upland Mindanao		4,319,000	681,000	5,000,000
Iranum Sustainable Integrated Area Development		5,008,000	18,325,000	23,333,000
Casecnan Social Measures Project			30,000,000	30,000,000
Various Irrigation Projects			1,245,260,000	1,245,260,000
Foreign-Assisted Projects (Includes Loan Proceeds)	20,621,000	692,660,000	3,511,546,000	4,224,827,000
Infrastructure for Rural Productivity Enhancement		201,512,000	187,500,000	389,012,000
Expanded Human Resource Development		70,000,000		70,000,000
Phil. Agri. And Fish. Biotechnology Program		98,061,000	5,800,000	103,861,000
Scholarship Program for Agri and Fish. Modernization		109,800,000		109,800,000
Support to Emer. And Live. Assist. And Peace Program		166,359,000	1,640,000	167,999,000
Catubig Agricultural Advancement Project		2,698,000	3,225,000	5,923,000
Gen. Santos Fishport Complex Expansion/Improvement		8,328,000	391,672,000	400,000,000
Upland Development Project in Southern Mindanao	20,621,000	3,000,000		23,621,000
Water Buffaloes and Beef Cattle Improvement		4,802,000		4,802,000
Phil.-Sino Center for Agricultural Technology		28,100,000	1,400,000	29,500,000
Various Irrigation Projects			2,920,309,000	2,920,309,000
Total New Appropriations	48,305,000	3,503,594,000	5,480,632,000	9,032,531,000

Source: 2005 Public Expenditure Program, Department of Budget and Management

Budgetary Allocation for 2005 for Agrarian Reform Program

Particulars	Personal Services	Maintenance and Other Operating Expenses	Capital Outlays	Total
Total New Appropriations	1,505,578,000	659,898,000	2,715,779,000	4,881,255,000
General Administration and Support	138,425,000	23,262,000		161,687,000
Support to Operations	76,156,000	12,370,000		88,526,000
Planning, Monitoring, Policy Research and Proj. Mgt.	29,286,000	2,623,000		31,909,000
Agrarian Reform Information and Education	9,048,000	4,728,000		13,776,000
Agrarian Legal Assistance	4,935,000	637,000		5,572,000
Land Acquisition and Distribution	13,822,000	1,035,000		14,857,000
Land Use Management and Land Development	11,002,000	783,000		11,785,000
Agrarian Reform Beneficiaries Development	8,063,000	2,564,000		10,627,000
Operations	1,290,997,000	44,686,000		1,335,683,000
Agrarian Legal Assistance	13,415,000	891,000		14,306,000
Agrarian Reform Information and Education	16,661,000	2,256,000		18,917,000
Agrarian Legal Services	138,802,000	3,785,000		142,587,000
Land Acquisition and Distribution	1,063,252,000	34,356,000		1,097,608,000
Land Use Management and Land Development	49,002,000	1,856,000		50,858,000
Agrarian Reform Beneficiaries Development	9,865,000	1,542,000		11,407,000
Foreign-Assisted Projects (Includes Loan Proceeds)		579,580,000	2,715,779,000	3,295,359,000
Agrarian Reform Communities Development II		86,800,000	203,400,000	290,200,000
Agrarian Reform Communities Development (ADB)		13,669,000	856,136,000	869,805,000
Agrarian Reform Infrastructure Support II		198,393,000	701,607,000	900,000,000
Mindanao Sustainable Settlement ARC Dev. Project		115,000,000	445,000,000	560,000,000
N. Mindanao Comm. Init. and Res. Mgt. Project		53,328,000	62,026,000	115,354,000
Solar Power Technology Support Project to ARC		112,390,000	447,610,000	560,000,000

Source: 2005 Public Expenditure Program, Department of Budget and Management

Budgetary Allocation for 2005 for Environment and Natural Resources Program

Particulars	Personal Services	Maintenance and Other Operating Expenses	Capital Outlays	Total
Total New Appropriations	3,173,131,000	950,568,000	432,836,000	4,556,535,000
General Administration and Support	692,145,000	169,113,000	20,775,000	882,033,000
Support to Operations				
ENR Sector Plans and Policies	125,028,000	15,814,000	320,000	141,162,000
M&E of ENR Programs and Projects	25,615,000	17,685,000		43,300,000
Information System Development and Maintenance	12,045,000	6,570,000	990,000	19,605,000
Statistical Services	6,872,000	7,468,000		14,340,000
Materials on Conservation, Dev. of NR, Env. Educ.	30,755,000	26,342,000	82,000	57,179,000
Legal Services, Op. Against Unlawful Titling of Land	68,879,000	9,655,000		78,534,000
Specials Studies for Forestry, Mining and Env. Mgt.	7,438,000	23,475,000	1,250,000	32,163,000
Operations Against Illegal Forest Res. Extraction		5,000,000		5,000,000
Laboratory Services		894,000		894,000
Operations	2,190,655,000	385,405,000	112,620,000	2,688,680,000
Forest Management	1,280,471,000	183,880,000	99,731,000	1,564,082,000
Land Management	642,822,000	63,210,000	250,000	706,282,000
Protected Areas and Wildlife Management	124,769,000	67,970,000	11,907,000	204,646,000
Ecosystem Research and Development	142,593,000	70,345,000	732,000	213,670,000
Foreign-Assisted Projects (Includes Loan Proceeds)	13,699,000	283,147,000	296,799,000	593,645,000
Southern Mindanao Integrated Coastal Zone Mngt.	2,608,000	26,500,000	240,428,000	269,536,000
Land Administration Management Project	4,255,000	6,000,000		10,255,000
San Roque Multi-Purpose Irrigation Project		100,000,000		100,000,000
Metro Manila Air Quality Improvement	4,315,000	128,247,000	56,371,000	188,933,000
Water Resources Development Project	2,521,000	22,400,000		24,921,000

Source: 2005 Public Expenditure Program, Department of Budget and Management