INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

IFPRI Discussion Paper 00898

September 2009

Lagging Regions and Development Strategies

The Case of Peru

James Thurlow

Samuel Morley

Alejandro Nin Pratt

Development Strategy and Government Division

and

Markets, Trade, and Institutions Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

FINANCIAL CONTRIBUTORS AND PARTNERS

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

AUTHORS

James T. Thurlow, International Food Policy Research Institute
Research Fellow, Development Strategy and Governance Division
Email: j.thurlow@cgiar.org

Samuel Morley
Visiting Senior Research Fellow
Markets, Trade and Institutions Division
Email: s.morley@cgiar.org

Alejandro Nin Pratt, International Food Policy Research Institute
Research Fellow, Development Strategy and Governance Division
Email: a.ninpratt@cgiar.org

Notices

[1] Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI–wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at www.ifpri.org/pubs/otherpubs.htm#dp.

[2] IFPRI Discussion Papers contain preliminary material and research results. They have not been subject to formal external reviews managed by IFPRI's Publications Review Committee but have been reviewed by at least one internal and/or external reviewer. They are circulated in order to stimulate discussion and critical comment.

Contents

List of Tables

ACKNOWLEDGEMENTS

We are grateful to Maximo Torero (IFPRI) for comments, and to participants of workshops held at Grupo de Análisis para el Desarrollo and the Inter-American Development Bank in Lima, Peru. We are also thank the Inter-American Development Bank for funding this research.

ABSTRACT

Despite the economic transformation of Peru's coastal economy, the country's inland region remains poor and underdeveloped. We herein examine the economic linkages between the two regions using a multi-regional computable general equilibrium model based on a regionalized social accounting matrix. The model results show that coastal growth undermines the inland economy by increasing import competition and internal migration. Peru, therefore, cannot rely solely on rapid national growth to generate broad-based poverty reduction. When we simulate policies aimed at curbing divergence, we find that reducing interregional transaction costs stimulates national economic growth, but widens divergence by shifting inland production towards agriculture and concentrating investment in coastal manufacturing. In contrast, conditional cash transfers reduce regional and rural-urban inequality, but do not stimulate national growth. Finally, investing in inland productivity (through extension services and improved rural roads) reduces regional divergence, but the resulting market constraints worsen rural-urban inequality. These findings suggest that isolated interventions may worsen inequality, and that complementarities exist between supply-side investments and policies aimed at stimulating demand and improving access to national markets.

Keywords: regional development; public investments; economic growth; Peru

1. INTRODUCTION

The persistence of rural poverty in Peru's inland Sierra and Selva regions is one of the country's most pressing socioeconomic problems. Peru made some progress in reducing national poverty during the 1990s, but this was later reversed by the economic slowdown during 1997-2001 (World Bank, 2005). The Peruvian economy has boomed since then, with national gross domestic product (GDP) growing at over 5 percent per year and poverty declining significantly. This recent expansion has been driven by particularly strong growth in mining and manufacturing (INEI, 2008). However, employment creation is still dominated by low-paying informal services (World Bank, 2005) and poverty remains high, with two-fifths of the population living below the poverty line in 2007 (INEI, 2009). Moreover, the gains from this rapid economic growth have been largely concentrated in urban areas and along the coast, with poverty, particularly extreme poverty, declining only marginally in the rural inland regions.

Inland poverty would be a less serious problem for the country as a whole if the population of these regions were small. However, the Sierra and Selva regions contain half of Peru's total population and 90 percent of its extremely poor population (INEI, 2006). The problem would also be less serious if these regions were catching up with the coastal economy. However, there is little evidence to suggest that regional convergence is taking place. Currently Peru's economy is expanding at over 7 percent per year, but the problem of the country's backward regions persists. Indeed, the very success of the coastal agro-industrial sectors is widening regional inequality, increasing divergence and exacerbating social and political pressures in and between the regions. What is striking about this recent boom period is the difference in poverty trajectory between the urban and rural sectors, in particular the gap that is emerging between Lima on the ond hand and the Coast and Sierra-Selva regions on the other.[1] For instance, the overall poverty rate in the rural sector of Peru increased during the boom, largely because the poverty reductions in the Coast and Selva regions were offset by poverty increases in the more populous *rural* sector of the Sierra region. Indeed, overall poverty rates fell by 35.6 percent on the coast between 2004 and 2007, but by only 9.4 percent in the Sierra and Selva regions. Moreover, poverty rates in the inland region remained virtually unchanged during the first two years of the economic boom (i.e., 2004-2006), while they declined dramatically along the coast. The contrast between the regions is even more evident for extreme poverty, which rose in the Sierra region during 2004-2006. In short, poverty in the coastal region has proven to be highly sensitive to the rate of economic growth, whereas inland poverty has not (World Bank, 2005).

Thus, Peru has a structural 'lagging regions' problem common to many fast-growing developing countries. It has a geographic area containing a significant share of the population, whose development has systematically lagged behind that of the rest of the country. The underlying mechanics that have generated growth at the national level in the past have not improved incomes for the poor in Peru's inland regions. This raises two important developmental issues. First, we can conclude that the poor in the Sierra and Selva regions are either not well linked to the more advanced coastal economy, or they are linked in a way that reinforces regional divergence. Second, as a result of these weak or adverse regional linkages, it is unlikely that Peru will be able to solve its rural poverty problem by focusing on accelerating its national growth rate. Peru is a clear example of a case in which growth does not trickle down to the poor. For this reason, policy interventions or changes in the country's growth strategy will be required to improve the linkages between the inland and coastal economies and allow the poor to benefit more from the growth process.

In this paper, we address both of these development issues. In Section 2, we measure the linkages between the inland and coastal economies using regional social accounting matrices (SAM) and evidence from the literature. Drawing on this information, we construct a dynamic multi-region computable general equilibrium (CGE) model, which is described in Section 3. In Section 4, we use the model to consider how the recent boom in Peru's coastal economy affects the inland economy. We find that, while coastal

[1] For an analysis of the regional poverty statistics between 1997 and 2004, see Escobal and Valdivia (2004); for the 2004-2006 period, see INEI, 2009.

growth increases household incomes, it has adverse effects on regional and rural/urban divergence. In Section 5 we examine three possible policy responses to this divergence. We first consider the effects of investing in interregional road infrastructure, thereby reducing the 'remoteness' of Peru's lagging region. Secondly, we consider the impact of increasing social transfers to inland households and raising productivity in the region. Finally, we consider investments aimed at improving agricultural productivity in the inland and coastal regions. These three scenarios reflect alternative uses of public resources to address the concentration of growth and poverty reduction within the coastal region, and are therefore relevant to the allocation decisions underlying the current system of regional public transfers. The final section draws conclusions for the lagging region problem in Peru and elsewhere.

2. REGIONAL LINKAGES IN PERU

Uneven development is characteristic of rapid growth episodes in most countries. However, lagging regions may become a national development problem when regional inequalities persist over a long period of time despite the occurrence of structural transformation elsewhere in the economy. Regions may initially fall behind for a number of reasons, including climatic handicaps, ethnic differences, regionally discriminatory policies, and civil wars. Regional divergence may continue even after the initial differences become less binding, due to the agglomeration of economic activity and the resulting path-dependency of the development process. In Peru, mountains form a natural division between the narrow coastal region and the inland Sierra and Selva regions. While the coast contains half of the country's population and two-thirds of its urban population, the inland region contains most of the rural population, and a large proportion of the poor and extremely poor. Given this sharp regional division, it might seem appropriate to treat the lagging and leading regions as isolated countries, thus implicitly assuming that there are no linkages between them. In this section, we consider the appropriateness of this assumption. Drawing on a multi-regional SAM constructed by Morley et al. (2008), we examine four kinds of linkages: production and trade flows; labor markets and internal migration; capital markets and investment; and public spending and social transfers.

Production and Trade Linkages

The coastal and inland regions have very different economic structures. The coastal economy, which accounts for 70 percent of national GDP, is dominated by urban-based manufacturing and private services (see Table 1). Agriculture is less important and consists mainly of larger-scale commercial enterprises. In contrast, the inland regions are heavily dependent on agriculture, most of which is undertaken by smallholder farmers. Although mining and the refinement of non-ferrous metals are major sectors in the inland region, most heavy manufacturing takes place on the coast. Inland manufacturing, on the other hand, consists mainly of light industries, such as food processing, textiles and wood products. Despite its smaller economy, however, the inland region accounts for almost half of Peru's foreign earnings. This can be seen in the macro SAM for the two regions (see Table 2).[2] In the table, 'foreign exports' are payments from the rest of the world for locally produced commodities, while exports appear in the 'rest of world' column and the 'commodities' row (i.e., coastal and inland foreign exports equaled 18.2 and 14.6 billion soles, respectively, in 2002). The inland region's large contribution to exports is primarily through mining and metals, although coffee, fish and wood products are also important inland exports. Thus, while the inland region runs a foreign trade surplus equal to 11 percent of its GDP, the coastal region runs an equally large trade deficit. This is the first trade-related linkage between the two regions, and comes through their contributions to a common current account balance. If the two regions were separate countries, then the inland region could offset its competitive disadvantage through adjustments to its exchange rate policy. By devaluing its exchange rate, the inland region could improve the competitiveness of its foreign exports. However, because the regions are part of a single country with a common trade policy, changes in the terms-of-trade or export performance of one region will influence the other region by inducing changes in Peru's exchange rate.

[2] A SAM is a consistent framework that captures all of the economic flows in an economy. The SAM is a square matrix, in which rows represent receipts and columns are payments. The Macro SAM in Table 2 is an aggregate version of the detailed SAM described in Morley et al. (2008).

Table 1. Summary statistics of coastal and inland regions

	Year	National	Coastal			Inland		
			Both	Rural	Urban	Both	Rural	Urban
Population (1000s)	2004	26,420	13,109	1,259	11,850	13,311	7,224	6,086
Poverty rate (%)	2004	46.8	35.1	51.2	33.5	62.7	72.9	50.4
	2006	44.5	28.7	49.0	26.5	61.5	73.1	43.4
	2007	39.3	22.6	38.1	21.2	56.8	68.9	37.6
Extreme poverty rate (%)	2004	17.1	4.0	13.8	3.1	30.9	40.7	15.3
	2006	16.1	3.0	14.4	1.8	30.1	41.2	12.9
	2007	13.7	2.0	10.5	1.2	26.1	36.6	9.3
Expenditure per capita (S/p.a.)	2002	5,414	7,627	3,212	8,096	3,234	1,592	5,182
GDP per capita (S/p.a.)	2002	6,798	9,541	-	-	4,096		
GDP at factor cost (S/mil)	2002	179,592	125,069	-	-	54,523	-	-
Agriculture		13,962	4,407	-	-	9,556	-	-
Mining		8,190	2,174	-	-	6,016	-	-
Manufacturing		28,246	20,056	-	-	8,190	-	-
Other industry		15,404	8,817	-	-	6,587	-	-
Services		113,789	89,614	-	-	24,175	-	-
Dependency ratio (people/worker)	2004	2.67	2.45	2.85	2.42	2.94	3.40	2.53
Employment (1000s)	2002	9,879	5,347	442	4,905	4,532	2,126	2,406
Skilled		1,148	758	0	758	390	0	390
Semi-skilled		3,764	2,539	84	2,455	1,225	254	971
Unskilled		4,967	2,050	358	1,692	2,917	1,872	1,045
Wage rates (S/per worker p.a.)	2002	8,174	10,470	-	-	5,466	-	-
Skilled		15,918	18,031	-	-	11,811	-	-
Semi-skilled		10,981	11,687	-	-	9,519	-	-
Unskilled		4,258	6,167	-	-	2,916	-	-
Regional trade surplus	2002	0	15,056	-	-	-15,056	-	-
Foreign trade surplus	2002	-5,692	-11,688	-	-	5,996	-	-
Fiscal surplus	2002	-1,650	2,057	-	-	-3,707	-	-

Source: Population is from 2004 ENAHO (INEI, 2006); poverty rates are from INEI (2009); data on expenditures, GDP and trade and fiscal surpluses are from the 2002 Peru SAM (Morley et al., 2008); employment, wages and dependency ratios are the authors' calculations using the 2002 Peru SAM and 2004 ENAHO.
Note: Labor skills are based on occupational categories (skilled includes professional and managers; semi-skilled includes formal sales workers and machinery operators; unskilled includes agricultural and domestic workers and informal retailers). We assume that rural households have (at most) semi-skilled labor.

Table 2. Macro social accounting matrix (SAM) for Peru's coastal and inland regions (2002, millions of Soles)

	Activities	Commo dities	Factors	House-holds	Govern-ment	Taxes	Invest-ment	Regional linkages	Rest of World	Total
Activities		221,122 100,699								221,122 100,699
Commodities	96,053 46,176			99,984 43,045	12,932 7,302		23,409 13,950	23,197 9,295	18,216 14,610	273,791 134,377
Factors	125,069 54,523							1,154 0		126,223 54,523
Households			120,124 50,024		6,288 2,157					126,413 52,181
Government						21,278 5,751				21,278 5,751
Taxes		15,104 4,176	4,465 1,037	1,709 538						21,278 5,751
Savings				24,720 8,597	2,057 -3,707			-15,056 15,056	11,688 -5,996	23,409 13,950
Regional linkages		9,295 23,197								9,295 24,351
Rest of World		28,270 6,305	1,634 2,308							29,904 8,614
Total	221,122 100,699	273,791 134,377	126,223 54,523	126,413 52,181	21,278 5,751	21,278 5,751	23,409 13,950	9,295 24,351	29,904 8,614	

Source: Morley et al. (2008)
Note: The top number in each cell represents the coastal region and the bottom number represents the inland region

The SAM also captures interregional trade between the two regions. These are payments by one region for the other region's commodities (i.e., the 'regional linkages' row and column in Table 2, representing regional exports and regional imports, respectively). The macro SAM shows that interregional trade is as important as international trade for the two regions: first, the inland region imports most of its manufactured goods from the coast; and second, international imports must travel through the coastal region to reach the inland region. As such, the inland region relies heavily on imported trade services, which are embodied in its imported manufactures. This results in high transaction costs between the coastal and inland regions. Overall, the inland region's regional trade deficit is equal to 27 percent of its GDP. This is partially offset by agriculture-related exports to the coast (e.g., horticultural products, livestock and wood products). These exports supply around half of the coastal consumption of these goods. Since the regional trade balance is far larger than most countries' external balances, it is clear that there are substantial interregional trade linkages in Peru despite the country's difficult terrain. Production changes in the coastal region will therefore have significant implications for producers and consumers in the inland region. If the inland region were a separate country, it could adjust its trade policies. For example, the inland region could protect local producers by imposing tariffs on coastal imports. However, there are no sub-national trade policies in place at present, and domestic producers face regional competition (albeit constrained by high interregional transaction costs).

Capital Markets and Investment

The second linkage between the regions is in the capital market. Both regions generate savings and make investments. The SAM does not have a regionalized financial sector, which is equivalent to assuming that all savings go into a national pool to be allocated to investment as determined by relative profit rates. In essence, all sectors in both regions compete for the national supply of savings, which means that if profit rates are higher on the coast, inland savings should be drawn out of the region, thus exacerbating tendencies toward divergence. Conversely, if returns are higher in the inland region, then investment could be drawn away from the coast, thereby helping to reduce divergence between the regions.

The investment column in the macro SAM distributes total investment across the two regions, while the savings row identifies how investment is financed. Under the ex post equilibrium condition, total investment equals total saving in each region. As mentioned above, the coastal region runs a large trade surplus with the inland region and a smaller trade deficit with the rest of the world. Coastal households also generate a larger share of domestic private savings. To some extent, this explains the larger allocation of investment to the coastal region. However, investment is not allocated to regions according to savings contributions. The macro SAM shows that the coastal region financed a quarter of inland investment during 2002. If the two regions were separate countries, they could use capital controls to prevent large outflows to other regions. However, as regions within a country and given Peru's established financial systems, there are few policies and barriers to prevent the inland region's profits and savings from being reinvested in the coastal region where returns may be higher. Conversely, national capital markets may provide the financing needed to allow investment to rise beyond regional savings. Finally, it is worth noting that investment responds to sectoral or firm-level profit differentials. For this reason, while the inland region is dominated by land-intensive agriculture, the region may still attract a larger share of investment due to higher returns to more capital-intensive mining and manufacturing. It is therefore more difficult to predict sectoral capital movements than it is to predict regional labor migrations.

Public Sector and Social Transfers

Government is a potential channel for reducing regional inequality, through either targeted expenditures or social transfers. Governments raise revenues through taxes and use these revenues to finance public investments, social transfers, and recurrent expenditures. Due to its low-income population and small formal sector, the inland region ran a large fiscal deficit during 2002 (equal to 6.8 percent of its GDP). Conversely, the coastal region raised more tax revenues than were spent in the region, and therefore financed a large share of the inland region's fiscal deficit. These transferred tax revenues contributed to the provision of social services (e.g., education and health) in the inland region; in 2002, they were equal to the social transfers paid directly to inland households. However, despite the interregional subsidization of public services, the coastal region still attracted more than 70 percent of public sector spending in that year, a large proportion of which was directed towards the central government. Only 8 percent of national tax revenues were redistributed from the coast to the inland region. Thus, compared to interregional trade, the reallocation of public funds is a less significant source of regional linkages. However, in the absence of other possible policy interventions, the public sector is currently the primary mechanism for stimulating regional growth and convergence.

Labor Markets and Internal Migration

The fourth linkage between the two regional economies is the migration of labor from inland regions to the coast. Employment in the inland region primarily consists of lower-skilled jobs, reflecting the importance of agriculture. Most better-paying semi-skilled jobs are in manufacturing, while skilled labor is almost exclusively employed in the public sector. In contrast, the coastal economy generates far more employment opportunities for semi-skilled workers. There are also large between-region differences in average wages. This is especially true for lower-skilled workers, with inland workers earning less than half what workers in similar occupations earn in the coastal region. Semi-skilled wage differentials are narrower, due in large part to the existence of higher-paying mining and public sector jobs in the inland region. Finally, dependency ratios are also higher in the inland region, suggesting that not only do inland workers tend to have lower skills and wages, each worker's income also typically supports more dependents than is the case in coastal households. This accounts for some of the differences in per capita expenditure between the inland and coastal regions.

Evidence suggests that workers respond to relative wage differentials by moving over time from low-wage occupations in the inland region to higher-wage labor markets on the coast (Laszlo and Santor, 2004). A key empirical question is what fraction of the low-wage region's labor force moves per time period. If the fraction is large, then the regional disparities in earnings are likely to be transitory. However, if the fraction is small, then large income disparities may persist. Furthermore, it may seem obvious that migration is a dynamic equilibrating mechanism, since the movement of workers will tend to reduce regional wage differentials. However, since the rate of return to capital is a positive function of the supply of labor, out-migration from the inland region will also tend to increase the rate of return to capital on the coast. Since the regional allocation of investment is a function of the relative rates of return, both investment and the capital stock will tend to move toward the area that receives migrants and away from the sending region. This exacerbates differences in regional growth rates and further highlights the importance of regional linkages.

3. MODELING THE LINKAGES BETWEEN THE COASTAL AND INLAND REGIONS

The discussion in the previous section suggests that it would be incorrect to treat Peru's lagging region as an isolated economy or a separate country. There are numerous linkages between the coastal and inland regions, some of which exist because these regions are part of the same country. Here, we construct a multi-regional recursive-dynamic CGE model designed to capture the linkages described in the previous section. This section describes the structure and behavior of the model, while a detailed mathematical specification is provided in the appendix.

A Two-Region CGE Model of Peru

The coastal region contains most of Peru's manufacturing and private services, while the inland region depends more on agriculture and mining. To capture this heterogeneity, the model contains detailed information on the demand and supply of 37 economic sectors/commodities in each of the two regions.[3] Producers employ land, labor and capital under the assumption of constant returns-to-scale and profit maximization. For this, we use a nested production system, with a constant elasticity of substitution (CES) function that determines factor demand and a Leontief function that combines value-added and intermediates. The model separates skilled, semi-skilled and unskilled workers, which are used with differing intensity in each sector. We assume that workers within each region migrate between sectors according to labor demand, and that Peru's total labor supply grows at a fixed rate (i.e., national unemployment rates remain constant). Agricultural producers use unskilled labor, region-specific land, and (to a lesser extent) capital. Nonagricultural producers also use labor and capital, although the mining sector has its own capital stock. All existing capital is immobile across sectors, earning sector-specific profits. The detailed specification of production and factor markets in the model allows it to capture the unique structure of these two regions' economies.

The first regional link is trade. The model explicitly allows for interregional and international trade. Import competition and export opportunities are captured by allowing producers and consumers in each region to shift between regional and foreign markets depending on the relative prices of imports, exports and local goods. More specifically, the decision of producers in each region to supply local, regional or foreign markets is governed by a constant elasticity of transformation (CET) function, while substitution possibilities between local and imported goods are captured with a CES Armington function. Although this specification allows for two-way trade between the two domestic regions, it is only possible to estimate net flows. This means that if a region is initially a net importer of a commodity, then it cannot later become a net exporter. In most cases, this is not an unreasonable assumption. For example, natural conditions make it unlikely that the coastal region could become a net exporter of agricultural and mining goods to the inland region. Increased coastal production can, however, expand its exports to international markets and/or substitute for imports from the inland region. Finally, the model also captures interregional transaction costs, which are imposed on all goods entering or leaving the inland region. We assume that this additional cost of regional trade generates demand for the exporting region's trade sector. Therefore, by explicitly allowing for interregional trade and transaction costs, the model captures the commodity market linkage between the two regions.

Household income and expenditure patterns vary considerably across regions and between rural and urban areas. These differences are important, since the incomes earned by workers in different sectors will benefit households differently according to their location and factor endowments. To capture these differences, the model separates rural and urban households in each region. These representative households receive factor incomes and per capita transfers from the national government. Rural households receive most of their incomes from land and lower-skilled workers, while urban households receive a greater share from non-mining capital and higher-skilled workers. All households save some of their incomes (based on fixed marginal propensities to save), but only urban households pay taxes (based

[3] The model focuses on the agricultural and manufacturing sectors, which have 15 and 12 sub-sectors, respectively. However, the model captures all sectors, including mining, construction, utilities, and various private and public services. For more details on the database, see Morley et al. (2008).

on fixed tax rates). Each household uses its remaining income to consume commodities under a linear expenditure system (LES) of demand.

The second regional link is internal labor migration. The model allows workers in each region to migrate to the other region if relative wages are higher. However, the labor markets in the model are imperfect, and regional wages may not equalize over the medium-term. Using a linear migration function, we assume that if the coastal wage differential rises by 1 percent relative to the base period differential, then there is a 0.2 percent net out-migration of inland workers to the coast. As mentioned in the previous section, large wage differentials already exist between the coastal and inland regions. To some extent, this reflects differences in regional living costs and the socioeconomic costs of migration. We therefore assume an equilibrium-compensating wage, such that long-run factor mobility tends to the initial wage differential rather than equalization. The model also captures the influence of migration on population growth. Each migrating worker co-migrates with a third of the dependents from their representative household. This assumption is consistent with the observation that younger workers with smaller families more often migrate, leaving an aging non-working population in the inland region. Since there is no demographic model embedded in the CGE model, we assume that the national population grows in line with the labor force (i.e., the national dependency ratios remain constant). Finally, the allocation of new migrants between rural and urban areas occurs in proportion to the working population of the home and destination regions. This specification of migration and population growth allows the model to capture labor market linkages between the two regions and the demographic effects of this linkage.

The third regional link is the public sector. Being connected to a larger economy allows the inland region to run a larger recurrent fiscal deficit than would be possible if it were a separate country. In the base period, the inland region receives a larger share of government spending than its share of tax revenues. The model captures this by pooling all tax collections at the national level, including region-specific sales and income taxes and import tariffs. Public sector borrowing, which is a fixed share of public revenues, is also pooled. The national government first uses these revenues to fund per capita-based household transfers in each region. The remaining funds are then used for recurrent consumption expenditures, which are allocated in fixed proportions across regions.[4] Therefore, regional tax collections vary with each region's GDP, but regional public spending is determined by population growth and past expenditure patterns. The latter include the current system of regional transfers to local municipalities (e.g., the canon).

The fourth and final regional link is savings and capital investment. As discussed above, it is possible for a region to receive a larger share of investment than its contribution to savings if producers in that region are able to earn a higher return on capital. The model captures this as follows. First, all public and private savings and foreign borrowing are pooled at the national-level, thus determining the total amount of investment spending in the economy. Second, investment spending is allocated across sectors and regions according to profit-rate differentials. Sectors and regions with above-average returns receive larger shares of new capital, which is needed to augment depreciating stocks. Capital accumulation is therefore endogenous and investment spending is determined at the sectoral level. Under this specification, inland savings may be invested in the coastal region if profit rates are higher there. Conversely, the inland region can attract investment beyond the level that can be financed by the region's own savings.

Calibrating the Model

The main database used to calibrate the model is a 2002 multi-regional SAM for Peru (Morley et al., 2008). The SAM captures the structure of the country after the economic crisis and before the recent growth acceleration. In the SAM, data on regional production come from agricultural surveys and national accounts. Information on labor markets and household income and expenditure patterns are taken from the 2004 Encuesta Nacional de Hogares (a nationally-representative household survey, see INEI, 2006). Interregional trade flows are calculated as a residual, after reconciliation of regional production

[4] Notably, while the government's recurrent consumption spending is exogenously allocated across regions based on past trends, public investments are endogenously determined alongside private investments (i.e., based on regional profit differentials).

and demand data. The model also contains a number of elasticities. Trade elasticities are taken from Dimaranan et al. (2006),[5] while commodity-specific income elasticities are econometrically estimated for rural and urban households using data from the 2004 household survey.

[5] The Global Trade Analysis Project's (GTAP) model estimates lower elasticities for manufactures and traded services, and higher elasticities for agricultural goods, which are more disaggregated or homogenous in both the GTAP and the current model.

4. SOURCES OF GROWTH AND DIVERGENCE

Recent growth in Peru has reduced poverty, but mainly along the coast. This implies that growth in the coastal region may not stimulate growth throughout the economy. The previous sections highlight the linkages between the two regions. In this section, we use the CGE model to examine the implications of these linkages.

Scenario 1: A 'Balanced Growth' Baseline Scenario

We initially calibrate the model to produce a baseline scenario in which both regions grow equally fast. We run the model forward over 10 periods while updating exogenous parameters. For convenience, we refer to these time periods as years. We assume that the total supply of land and skilled, semi-skilled and unskilled labor grows at 2 percent per year. We also calibrate investment prices such that capital stocks grow at roughly 2 percent per year (after applying a 5 percent depreciation rate). Finally, we impose 1 percent annual total factor productivity (TFP) growth in all sectors in both regions. Together, 2 percent factor growth and 1 percent TFP growth yield a national GDP growth rate of around 3 percent (see Table 3). GDP growth deviates only slightly between the two regions. This is due to differences in their economic structures and elasticities. For example, the income elasticities for the kinds of goods produced in the inland region are typically lower than those for most coastal goods. Since growth is fairly balanced across the regions, there is no significant shift in wage differentials and few incentives for labor to migrate between regions. Accordingly, employment grows at about 2 percent in both regions, which also means that the population shares remain unchanged. Thus, under the baseline scenario, we do not see significant regional or divergence.

Table 3. Macroeconomic results for growth scenarios

	Initial values	**Baseline scenario (1)**	**Coastal boom (2)**	**Trans. costs (3)**	**Social transfer (4)**	**Inland prod. (5)**
		Final period values				
Consumer prices (index)	1.00	1.01	0.93	1.00	1.00	1.04
Coastal	1.00	1.01	0.92	0.99	0.99	1.05
Inland	1.00	1.00	0.97	1.01	1.00	1.01
Real exchange rate (index)	1.00	1.02	1.03	1.00	1.02	1.02
		Average growth rate (%)				
Total GDP (2002 soles)	179,592	3.07	4.18	3.30	3.05	3.23
Coastal	125,069	3.11	4.80	3.43	3.09	3.04
Inland	54,523	2.99	2.65	2.99	2.95	3.64
Investment demand	37,359	3.00	3.96	3.32	2.89	3.30
Coastal	23,409	3.02	5.37	4.60	2.99	2.77
Inland	13,950	2.98	1.13	0.79	2.72	4.13
International exports	32,826	2.90	3.99	3.47	2.77	3.03
Coastal	18,216	3.28	5.76	3.40	3.26	2.99
Inland	14,610	2.42	1.32	3.56	2.13	3.09

Table 3. (Continued)

	Initial values	Baseline scenario (1)	Coastal boom (2)	Trans. costs (3)	Social transfer (4)	Inland prod. (5)
International imports	34,576	2.94	4.00	3.36	2.89	3.03
Coastal	28,270	2.98	4.39	3.63	2.89	2.96
Inland	6,305	2.73	2.12	2.11	2.88	3.34
Regional exports						
Coastal	23,197	2.97	3.80	2.98	3.10	3.17
Inland	9,295	3.29	4.01	5.65	2.73	3.68
		Percentage point contribution to GDP growth rate				
Coastal GDP (%)	100.0	3.11	4.80	3.43	3.09	3.04
Labor employment	44.8	0.90	1.00	1.02	0.89	0.86
Capital stocks	53.7	1.17	1.44	1.33	1.17	1.15
Land area	1.5	0.03	0.03	0.03	0.03	0.03
TFP	0.0	1.01	2.32	1.05	1.01	1.01
Inland GDP (%)	100.0	2.99	2.65	2.99	2.95	3.64
Labor employment	45.4	0.90	0.74	0.70	0.92	0.97
Capital stocks	45.8	0.97	0.83	0.83	0.94	1.09
Land area	8.7	0.17	0.17	0.17	0.17	0.17
TFP	0.0	0.94	0.90	1.28	0.91	1.41

Source: Peru CGE model results.
Note: The exchange rate index is local currency units per foreign currency unit (increase is an appreciation). The consumer price index is relative to the inland region's domestic price index (i.e., the model's numeraire).

Scenario 2: Faster Nonagricultural Growth along the Coast

Manufacturing and private services tend to dominate growth in Peru, accounting for 36.5 and 48.2 percent of GDP growth, respectively, during 2001-2006 (INEI, 2008). Most of this growth has taken place within urban centers along the coast (Giugale et al., 2007). Thus, in the second scenario we simulate an expansion of the coastal economy by increasing nonagricultural TFP growth from 1 to 2.5 percent per year (excluding the mining sector). This productivity increases the coastal GDP growth rate from 3.1 percent in the baseline scenario to 4.2 percent per year, which is larger than the increase in TFP (see Table 3). Moreover, GDP growth in the inland region falls from 3 to 2.7 percent per year. To understand why faster coastal growth comes at the expense of inland growth, we consider the various linkages discussed in the previous sections.

Higher productivity in the coastal region stimulates production, particularly in manufacturing, which sees a growth rate increase of an additional 2.2 percentage points (see Table 3). Expanding production causes coastal prices to fall relative to inland prices. As a result, exports from the coast to the inland region increase by an additional 0.8 percentage points per year, mainly through manufacturing (see Table 4). Increased competition undermines growth in the inland region's heavier manufacturing sectors and causes overall manufacturing to contract relative to the Baseline scenario. However, faster growth and higher incomes in the coastal region increase the demand for commodities produced in the inland region. Unlike the coastal region, though, the increase in the inland regional exports comes at the expense of its foreign exports. Inland producers, who are not more productive in this scenario, shift their production away from foreign markets towards domestically oriented agricultural sectors (e.g. livestock and forestry) and light manufacturing (e.g. textiles and clothing). Ultimately, faster growth in the coastal region encourages interregional trade, but undermines inland manufacturing and reduces export opportunities. It also increases the inland region's dependency on agricultural production.

Table 4. Sectoral GDP growth results for the growth scenarios

	Initial GDP values (2002 soles)		Baseline average growth (1)		Percentage point deviation from baseline growth rate							
					Coastal boom (2)		Trans. costs (3)		Social transfer (4)		Inland prod. (5)	
	Coast	Inland	Coast	Inland	Coast	Inland	Coast	Inland	Coast	Inland	Coast	Inland
Total GDP	125,069	54,523	3.11	2.99	1.69	-0.35	0.33	0.00	-0.02	-0.04	-0.06	0.65
Agriculture	4,407	9,556	3.05	2.98	0.43	0.11	-0.08	0.19	0.02	0.19	-0.13	0.51
Cereals	520	1,097	2.54	2.62	0.48	0.07	0.73	-0.47	0.48	0.25	-0.21	0.38
Roots	159	1,420	2.33	2.58	0.58	0.08	0.06	-0.09	0.21	-0.02	-0.25	0.27
Horticulture	1,604	3,439	3.06	3.02	-0.16	-0.04	-0.60	0.34	-0.04	0.08	-0.11	0.54
Coffee	40	400	2.60	3.63	2.23	-0.59	-1.08	2.59	0.15	-0.36	-0.82	1.44
Other export	855	1,164	3.29	2.87	0.06	0.32	0.45	-0.22	-0.24	0.53	0.02	0.36
Livestock	483	1,302	3.11	3.25	1.49	0.52	-0.68	0.18	0.21	0.50	-0.26	0.49
Forest	22	216	3.26	3.39	1.34	0.65	-0.06	0.11	0.36	0.27	-0.17	0.50
Fish	724	519	3.25	3.41	1.17	0.08	0.22	0.07	-0.08	0.22	-0.18	0.82
Mining	2,174	6,016	2.38	2.28	0.98	-1.02	0.28	0.70	0.03	-0.24	-0.19	0.55
Manufacturing	20,056	8,190	3.20	3.04	2.15	-0.24	0.28	-0.33	-0.03	0.03	-0.16	0.67
Food	7,253	2,870	3.09	2.84	1.88	0.18	0.40	-0.40	-0.08	0.33	-0.15	0.40
Textiles	2,689	1,271	3.59	3.32	3.38	0.32	-0.12	-0.38	0.00	0.14	-0.39	0.55
Wood	53	672	3.21	3.57	3.90	0.53	-0.48	0.80	-0.02	-0.28	-0.84	0.63
Chemicals	4,768	348	3.12	3.07	1.76	-0.62	0.14	-0.74	0.02	-0.04	-0.08	0.85
Non-metals	1,320	804	3.11	3.04	2.34	-1.36	0.89	-1.55	-0.02	-0.20	-0.25	1.06
Metals	1,389	1,311	3.04	2.65	1.41	-1.18	0.47	0.59	-0.07	-0.26	0.10	0.82
Machinery	982	540	3.36	3.38	2.73	-0.76	0.33	-1.44	0.02	-0.26	-0.23	1.09
Other	1,603	373	3.33	3.34	2.23	-0.60	0.20	-0.64	-0.01	-0.12	-0.14	0.99
Construction	7,313	4,422	3.05	3.03	2.40	-1.87	1.43	-2.06	-0.03	-0.29	-0.27	1.21
Utilities	1,504	2,165	3.04	3.13	1.99	0.26	0.16	0.34	-0.02	-0.15	-0.21	0.49
Trade/transport	40,988	9,380	3.04	2.98	1.52	-0.54	0.26	-0.33	-0.02	0.07	-0.04	0.75
Regional trade	634	2,681	2.88	2.98	1.03	-0.12	0.66	2.36	0.22	-0.55	0.08	0.60
Private services	38,649	6,839	3.14	3.10	1.65	-0.19	0.23	-0.30	-0.03	0.02	-0.03	0.68
Public services	9,343	5,275	3.34	3.50	1.71	0.27	0.39	0.41	0.07	-0.15	0.16	0.38

Source: Peru CGE model results.

Rising productivity increases the returns to capital in the coastal region (see Table 5). This allows coastal sectors to attract a greater share of new capital investment, thereby displacing investment in the inland region (see Table 3). Faster accumulation of capital in the coastal region also increases the demand for labor and places greater upward pressure on coastal wages. This widens the regional wage differentials and encourages workers to migrate to the coast (see Table 5). Out-migration is especially pronounced for semi-skilled workers, who are used more intensively in the coastal region's nonagricultural sectors. This contributes to a decline in inland manufacturing and private services. In contrast, there are relatively fewer job opportunities for lower-skilled workers in the coastal region. Although this dampens some of the out-migration of these workers, it further encourages a shift towards inland agriculture and lower-skilled manufacturing. Thus, labor migration and slower capital accumulation contribute to the inland economy's decline by reducing the productive capacity of the region.

Table 5. Factor market results for growth scenarios

	Initial values	Average annual growth rate				
		Baseline scenario (1)	Coastal boom (2)	Trans. costs (3)	Social transfer (4)	Inland prod. (5)
Skilled labor wages (2002 soles)						
Coast	18,031	1.33	2.76	1.78	1.28	1.59
Inland	11,811	1.34	2.52	1.65	1.23	1.72
Semi-skilled labor wages (2002 soles)						
Coast	11,687	1.12	2.33	1.37	1.07	1.28
Inland	9,519	1.11	1.85	1.08	1.03	1.45
Unskilled labor wages (2002 soles)						
Coast	6,167	1.03	2.22	1.18	1.18	1.16
Inland	2,916	1.03	1.86	0.86	1.13	1.28
Capital returns	-					
Coast	-	0.88	1.67	0.97	0.82	0.98
Inland	-	0.83	1.30	0.59	0.78	1.00
Land rental rate	-					
Coast	-	0.96	2.04	0.69	1.07	0.77
Inland	-	0.55	1.65	1.36	1.17	0.50
Skilled labor employment (1000s)						
Coast	758	1.97	2.10	2.10	1.99	1.87
Inland	390	2.06	1.81	1.81	2.03	2.24
Semi-skilled labor employment (1000s)						
Coast	2,539	2.01	2.23	2.30	2.01	1.92
Inland	1,225	1.98	1.50	1.35	1.98	2.16
Unskilled labor employment (1000s)						
Coast	2,050	2.06	2.39	2.44	1.90	1.94
Inland	2,917	1.96	1.72	1.68	2.07	2.04
Capital stock	-					
Coast	-	2.18	2.69	2.47	2.18	2.13
Inland	-	2.12	1.81	1.81	2.06	2.38

Source: Peru CGE model results.

Although GDP falls in the inland region, there is higher overall growth at the national level. This raises national tax revenues and permits an expansion of the public sector in both the coastal and inland regions (see Table 3). Therefore, with falling or stagnant growth in most inland sectors, the public sector becomes an important source of inland growth and employment. This offsets some of the migration of higher-skilled workers from the inland region. Moreover, while the out-migration of workers causes inland dependency ratios to rise (see Table 6), it does not affect the provision of per capita-based social transfers, which are mainly financed by coastal taxes. Thus, with a booming coastal region, the public sector becomes an increasingly important part of the inland region's economy.

Table 6. Household results for growth scenarios

		Average growth rate (%)				
	Initial values	**Baseline scenario (1)**	**Coastal boom (2)**	**Trans. costs (3)**	**Social transfer (4)**	**Inland prod. (5)**
Population (1000s)	26,420	2.00	2.00	2.00	2.00	2.00
Coastal	13,109	2.01	2.11	2.13	1.99	1.97
Inland	13,311	1.99	1.89	1.87	2.01	2.03
Dependency ratio (people)	2.67	2.67	2.67	2.67	2.67	2.67
Coastal	2.45	2.45	2.41	2.41	2.46	2.46
Inland	2.94	2.94	3.00	3.01	2.93	2.92
Per capita equivalent variation (2002 soles)						
Coastal rural	3,212	1.03	2.31	1.35	1.42	1.03
Coastal urban	8,096	1.10	2.53	1.37	0.95	1.12
Inland rural	1,592	0.90	1.61	0.53	2.42	1.18
Inland urban	5,182	1.03	1.72	0.53	0.97	1.33

Source: Peru CGE model results
Note: Dependency ratio is the number of non-working people per worker. Equivalent variation is a welfare measure (i.e., additional income required to increase household utility to its final year value based on initial prices). Initial values are annual per capita expenditures.

The above results suggest that regional trade and factor market linkages are not weak. Rather, they act against growth in the inland region, with the public sector only partially offsetting these adverse linkages. This implies that there is greater economic divergence as a result of the coastal and inland regions being part of the same country. However, while GDP declines in the inland region, its factor returns increase in real terms due to decreases in local prices and the falling cost of goods imported from the coast (see Table 5). This allows real incomes to rise, especially for rural households, which also benefit from increases in the food crops, livestock and textile sectors. Accordingly, most of the income growth among rural inland households comes from higher returns to land and unskilled labor. However, coastal households see greater income increases, driven by increased employment opportunities and falling consumer prices.

In summary, all households in Peru benefit from faster growth in the coastal economy. However, there is a widening income gap between coastal and inland households, and greater regional divergence in economic growth. Furthermore, there is an increased specialization of the inland economy in agriculture and public services. This suggests that, despite positive public sector linkages, regional trade and migration linkages reinforce slower growth in the Sierra and Selva regions compared to the coastal region. This is consistent with the observed divergence in regional incomes and the persistence of inland poverty despite the accelerated economywide growth seen in recent years.

5. POLICIES TO ENCOURAGE REGIONAL CONVERGENCE

Faster growth in the coastal economy increases regional divergence, partly by slowing growth in the inland region. Thus, Peru cannot rely solely on national growth to significantly reduce poverty throughout the country. Overcoming the regional development trap will require targeted policies that increase the participation of lagging regions in the national growth process. In this section, we consider potential policies designed to encourage regional convergence, including road investments aimed at reducing interregional transaction costs; the use of mining taxes to finance transfers to rural households; and productivity-enhancing investments within the lagging region.

In order to make the policy scenarios comparable, we use the same fiscal envelope for each simulation. In the social transfer scenario, we provide a conditional cash transfer of US$30 to all poor rural households in both regions of Peru. This is similar to an existing program in Peru called Pro-Peru, which provides US$30 cash transfers to poor rural households with children under the age of 14 years (World Bank, 2005). The budget allocated to these transfers in 2006 was 200 million Nuevos Soles, covering about 170,000 households. In our scenario, we provide transfers to all 1.3 million poor rural households at a total cost of 1.6 billion Nuevos Soles, or US$435 million. This is equivalent to 6 percent of government revenues or 0.9 percent of total GDP in 2002. We use the same amount of public resources for the two investment scenarios, where we increase government spending on interregional roads and inland productivity. For comparability, we also use the same investment-productivity elasticities for the two investment scenarios. We assume that a 1 percent increase in public expenditure yields a 0.08 percent increase in national TFP. This is consistent with findings from other countries on the returns to public investment (see, for example, Fan et al., 2004). Finally, we assume that the government finances additional transfers and investments by raising mining and corporate tax collection rates by approximately 2.5 percentage points, so as to maintain the fiscal deficit.[6] The three policy scenarios are therefore comparable, since they involve the same additional expenditures, assume the same returns on investments, and involve the same tax rate adjustments.

Scenario 3: Reducing interregional transaction costs

There are high transaction costs between the coastal and inland regions. We compare consumer prices for similar commodities in markets close to the border between the two regions,[7] and use these price differences to estimate the trade margin associated with moving goods from the lowland coastal region to the highland Sierra region. The price differentials range from 10 percent for nonagricultural goods (e.g. machinery) to 36 percent for perishable agricultural goods (e.g. vegetables). In the first policy scenario, we examine the impact of reducing these transaction costs by investing in interregional roads, thereby improving the efficiency of regional trade. More specifically, we increase TFP in the regional trade sector by 10 percent per year. This halves the price of trade services between the two regions over the 10-year simulation period. At the national level, TFP growth increases by an additional 0.15 percentage points per year, which is consistent with an investment-productivity elasticity of 0.1.

This raises Peru's national GDP growth rate from 3.1 to 3.3 percent per year (see Table 3). However, this is driven entirely by faster growth in the coastal region, with overall growth in the inland region remaining unchanged. To understand these outcomes, we again consider the various linkages between the two regions.

Lowering transaction costs increases the competitiveness of inland goods in coastal markets. Accordingly, exports to the coastal region grow more rapidly at 5.7 percent per year, which is considerably higher than the 3.3 percent growth rate seen under the baseline scenario (see Table 3). Agricultural exports grow particularly fast due to high initial transaction costs, with growth driven by the

[6] Collection rates are based on actual funds received by the government and are thus lower than statutory rates due to tax exemptions and evasion.

[7] From author worksheets.

fruit, vegetables and livestock product sectors. Lowering transaction costs also improves the inland region's access to foreign markets. Foreign exports therefore also expand, primarily due to the coffee, wood, and non-ferrous metal sectors. This strong export performance generates faster GDP growth, especially in agriculture (see Table 4). However, the reduction of transaction costs also increases import competition in inland markets, primarily from coastally manufactured goods. The GDP growth rate of inland manufacturing declines and the inland economy becomes more dominated by agricultural production. Thus, reducing transaction costs encourages structural changes based on each region's comparative advantage; for the inland region, this involves a shift into agriculture.

The rising importance of agriculture in the inland region has implications for the labor and capital markets. Agriculture is much less capital-intensive than manufacturing, meaning that a shift into agriculture reduces the returns to capital in the inland region. This is reflected in the falling contribution of capital to growth in the inland region (see Table 3). The decrease in capital returns in the inland region diverts new investments towards the coast, with subsequent investment decreases reducing GDP growth for the inland region's construction and machinery sectors (see Table 4). In contrast, the expansion of coastal manufacturing increases investments in this region, with growth spillovers into less skill-intensive construction. Thus, while the returns to agricultural land rise substantially in the inland region, the returns to semi- and unskilled labor fall relative to those in the coastal region, leading to faster out-migration of workers to the coastal region (see Table 5). Ultimately, reducing the economic distance between the two regions encourages greater regional specialization. Furthermore, the inland region's shift out of manufacturing and into agriculture offsets improvements in export opportunities for inland producers. Consequently, while there is a significant change in the composition of inland growth, there is no effect on the region's overall GDP growth rate.

Faster coastal growth leads to greater regional divergence in both GDP and per capita expenditure (see Table 6). First, the out-migration of workers drives up the dependency ratios in the inland region, meaning that each worker's labor income is now distributed across a larger non-working population. The reverse is true for the coastal region. Second, households in the coastal region benefit from faster economic growth and lower prices for agricultural goods from the inland region. Real incomes and per capita expenditures for coastal households rise accordingly, driven mainly by higher returns to lower-skilled labor for rural households and higher returns to capital for urban households. In contrast, the shift into inland agriculture increases land returns but reduces capital returns, meaning that inland urban incomes fall by more than rural incomes. However, rural households spend a larger share of their incomes on agricultural goods, which show rising prices due to increased demand for inland exports in the coastal region. Urban households, on the other hand, spend more of their incomes on manufactured goods, which show price decreases due to the falling costs of imports from the coast. Taken together, these changes in dependency ratios, incomes and prices produce similarly large declines in per capita expenditure for rural and urban households in the inland region.

In summary, reducing transaction costs to lessen the consequences of Peru's internal geographic divide may produce adverse outcomes. On one hand, this strategy is projected to provide inland agricultural producers with greater opportunities to supply coastal markets, thereby stimulating interregional trade and increasing the returns to land. However, this shift into agriculture, which is strengthened by rising import competition from coastal producers, does not bring about regional convergence. Rather, it reduces incentives for capital investment in the inland region, thereby undermining manufacturing employment opportunities and encouraging faster out-migration to the coast. While migration provides inland households with an exit option, this is constrained by the coastal region's capacity to absorb new migrants. Ultimately, reducing interregional transaction costs favors faster economic growth at the national level, but lowers incomes in the lagging region and exacerbates regional divergence.

Scenario 4: Expanding Social Transfers to Rural Households

A second policy option is to tax urban-based growth to finance social transfers to low-income households. This approach has been adopted by the Peruvian government, which in recent years has spent considerable resources on welfare programs aimed at reducing poverty. The bulk of these programs have focused on improving nutrition and providing social safety nets, such as temporary worker programs. As mentioned above, the government recently implemented a new program that provides conditional cash transfers to poor rural households throughout the country. Here, we simulate a similar transfer program and examine both the impact of the transfer on household incomes and the impact of the increased taxes that would be necessary to finance the program.

The conditional cash transfer has a profound impact on rural incomes. Since the transfer is provided to all poor rural households, rural incomes increase in both the coastal and inland regions. However, since the majority of Peru's poor rural population lives in the inland region, the incomes of these households rise by substantially more. Our model results show that in the inland region, the growth rate in rural per capita expenditure rises from 0.9 percent per year under the baseline scenario to 2.4 percent per year under the social transfer scenario (see Table 6). Since urban households generate the vast majority of government tax revenues, the increased corporate and personal tax reduces disposable incomes for these households in both regions. However, given their initially higher incomes in absolute terms, the percentage decline in urban expenditure is substantially lower than the percentage increase in rural expenditure. Furthermore, coastal urban households pay higher average tax rates, so their per capita expenditure declines by more relative to the baseline scenario. The social transfer program therefore effectively reduces both rural-urban inequality and regional income divergence, but has little effect on aggregate national income.

The model suggests that social transfers produce few growth effects at the national level, with the aggregate GDP growth rate remaining largely unchanged (see Table 3). This is partly a result of the model's specification, which assumes that there is full employment in the inland region. This supply constraint may not reflect the capacity of the inland region to respond to a demand-led stimulus. However, even assuming full employment, the model results suggest that some rural growth linkages emerge as a result of the social transfers. While the social transfer accounts for most of the increase in per capita income under the transfer scenario, there is also an expansion in the returns to land and lower-skilled labor. This is caused by increased demand for agricultural goods. Poor rural households spend a larger share of their incomes on commodities produced within the inland region. As such, providing additional incomes to these households stimulates growth in agricultural GDP growth and light manufacturing, such as the food processing, textile and clothing sectors (see Table 4). Thus, about a quarter of rural inland households' income growth under the social transfer scenario is due to demand multipliers or regional growth linkages.

At the national level, faster income growth in the inland region increases the region's demand for imported goods, but reduces export incentives for inland producers. Coastal exports to the inland region therefore grow more rapidly under the social transfer scenario, driven by heavier manufacturing (see Table 3). Again, rising demand for coastally manufactured goods and the shift into inland agriculture increases the returns to investment along the coast. For this reason, the coastal region is less affected by the decline in overall investment, which is caused by falling urban incomes and the higher savings rates of urban households. However, despite some sectoral and regional shifts in the structure of production, the macroeconomic impacts of social transfers remain relatively small.

Scenario 5: Productivity-enhancing investments in the highlands

We see above that social transfers reduce regional and rural-urban inequality without greatly reducing economic growth, while investments in interregional infrastructure promote growth, but this is concentrated along the coast. These two policy scenarios highlight a potential trade-off between growth and equity objectives. In this section, we examine the impact of investing directly in productivity growth in the lagging region. Although we do not model specific policies, such growth could arise through a number of initiatives in the government's national and rural development strategies. For example, inadequate extension services are seen as a binding constraint limiting further rural development in the highland region, and it has been suggested that improvements in extension services in the region would raise crop yields and overall agricultural productivity (World Bank, 2005). Poor access to credit is a further constraint affecting both farm and non-farm sectors (Laszlo and Santor, 2004). Finally, investing in rural roads to improve access to local markets has been shown to enhance incomes (Escobal and Valdivia, 2004). To model these interventions, we increase the TFP growth rate in the inland region's agricultural, manufacturing and trade sectors by an additional 1 percentage point per year. By including the local trade sector, we capture investments in rural roads similarly to how they are captured in the transaction cost scenario. As with the previous scenarios, we increase public expenditures and social transfers by the same amount, while increasing TFP growth such that the productivity-investment elasticity is 0.08.

Raising productivity in the inland region produces results that mirror those of the coastal boom scenario. GDP growth accelerates in the inland region, especially for agricultural exports, such as horticultural products and coffee (see Table 4). Inland manufacturing also benefits from stronger productivity growth, especially in the textile, wood and non-metallic mineral product sectors. Coastal production declines slightly as a result of increased export competition, while the coastal region benefits from expanded demand from the inland economy. However, unlike in the coastal boom scenario, regional demand is insufficient to offset import competition, and GDP growth declines even in sectors where the coastal region has a comparative advantage. Overall, GDP growth in the inland region accelerates from 3 to 3.7 percent per year, but slows slightly along the coast.

Inland growth raises factor demands, which leads to higher returns in the region compared to the coast. This encourages greater investment in the inland region (see Table 3) and a reversal of out-migration from the lagging region. Skilled and semi-skilled labor benefit from expanding manufacturing employment in the inland economy, while land returns rise due to increased agricultural production. This shift in the flow of labor migration increases the productive capacity of the inland region, further supporting faster overall economic growth. Increased employment opportunities also favor income growth for households located in the inland region. While inland rural households benefit from higher labor incomes, the returns to land decline as agricultural prices fall in response to increased production and fewer market opportunities. Urban incomes therefore rise more rapidly than rural incomes, but falling agricultural prices increase the real incomes for both rural and urban households and allow per capita expenditure to rise (see Table 6). Productivity-enhancing investments therefore encourage regional convergence and economic diversification within the inland region. However, they also widen the gap between rural and urban incomes, primarily due to market constraints that limit farm production.

6. CONCLUSION

Peru has made considerable progress in accelerating and sustaining its economic growth since the macroeconomic crisis of the late 1990s. However, despite the economic recovery of this country, the severe poverty in the lagging inland regions has remained largely unchanged. The resilience of inland poverty suggests that either the lagging region is not well connected to the coastal-led growth process, or the existing linkages work against regional convergence. By combining evidence from numerous sources into a consistent multi-regional SAM, we herein capture and quantify the relative importance of these linkages and show that it would be misleading to treat the inland region as if it were de-linked from the coast.

We first use the model to examine the effects of Peru's coastal-led growth process, and find that accelerated growth in the coastal economy undermines economic growth in the inland region, primarily through the out-migration of workers to the coast and a shift in investment towards the fast-growing coastal region. However, both inland and coastal households are better off due to the positive effect of coastal growth on labor wages and land returns. From these growth scenarios, we conclude that coastal-led growth produces adverse outcomes for the inland region. Therefore, policies focusing on accelerating national growth rates will be insufficient to encourage economic growth and regional convergence.

We then use the model to assess alternative policy options aimed at reducing regional income inequality. We first consider the effects of lowering interregional transaction costs in order to reduce the economic distance between the inland region and the coastal and international markets. We find that improving road infrastructure between the two regions is a double-edged sword. On one hand, it enhances export opportunities for inland producers, especially for agricultural goods. On the other hand, it allows greater market penetration by coastal producers, which undermines the inland region's manufacturing sector. This encourages capital and semi-skilled labor to migrate to the coastal region, where employment opportunities and returns are better. Transaction costs therefore act as a non-tariff barrier preventing coastal producers from displacing better-paying inland jobs. Reducing these margins causes the inland region to shift towards its comparative advantage in lower-paying agriculture, which worsens inland incomes and increases regional inequality.

The second policy that we consider is the extension of social transfers to poor rural households. This effectively reduces regional and rural-urban inequality and generates positive growth linkages within the inland rural economy without substantially reducing urban incomes. However, the transfers have little effect on economic growth at the national level. Given the positive growth effects of the other policy options, this scenario highlights the opportunity cost of social transfers and the trade-offs among national growth, regional equity, and social welfare. However, in the model we assume that productivity growth is unaffected by the transfers and we limit demand-side effects by assuming full employment. Further micro-level analysis will be required in order for us to fully understand the relationships among social transfers, productivity and employment.

The third policy option we consider is investment in agricultural and manufacturing productivity in the inland region, such as that through agricultural extension, credit provision and rural roads. Such investments accelerate inland growth, but at the expense of the coastal economy, primarily due to increased competition over factors. However, growth in inland agriculture is constrained by markets, with agricultural prices falling significantly after production increases. Thus, while these policies encourage regional convergence, they exacerbate rural-urban inequality.

The inability of individual policy options to address both growth and inequality highlights the importance of packaging and sequencing interventions. For example, reducing interregional transaction costs without investing in inland productivity opens the inland region to greater import competition without improving the ability of inland producers to compete for export opportunities in coastal markets. Similarly, investing in inland productivity without improving market access causes prices to fall and yields fewer benefits for smallholder farmers. These market constraints could be avoided (at least partially) through demand-side injections via social transfers.

APPENDIX

Table A1. CGE model sets, variables and parameters

Sets			
a c	Activities and commodities	h	Households
f (l $k \in f$)	Factors (labor/capital)	t (r $w \in t$)	Trade regions (domestic/foreign)
y	Time periods ($y = 0..10$)		
Variables			
AR	National average capital rental rate	QH_{rch}	Per capita household demand
CPI_r DPI_r	Consumer & producer price indices	QI_{rc}	Investment demand quantity
K_{rka}	Sectoral capital allocation	QN_{rca}	Intermediate commodity demand
M_{wrc}	Trade margin per unit traded	QQ_{rc}	Composite commodity quantity
PA_{ra}	Activity price	QT_{rc}	Transaction cost quantity
PD_{rc}	Domestic price	$QR_{tt'c}$	Trade quantity
PQ_{rc}	Composite commodity price	QV_{ra}	Value-added quantity
$PR_{tt'c}$	Trade price (excl. export margins)	WD_{rfa}	Sectoral wage distortion
PV_{ra}	Value-added price	WF_{rf}	Regional average factor returns
QA_{ra}	Activity production quantity	X	Exchange rate (LCU per FCU)
QD_{rc}	Domestically sold quantity	YF_{rf}	Factor income
QF_{rfa}	Factor demand quantity	YG	Government revenue
QG_{rc}	Government demand quantity	YH_{rh}	Household income
Parameters			
α_r^k	Investment-capital adjustment	θ_{rca}^n θ_{ra}^v	Intermediate & value-added shares
α_l^l	Compensation wage adjustment	$\theta_{rc'c}^q$	Domestic sales trade margin rate
α_{rc}^q α_{rc}^t α_{ra}^v	Production & trade shift parameter	drm	Share of dependents migrating
β_{rc}^c β_{rc}^d	Consumer & producer price shares	$hlab_{rhl}$	Household labor endowment
β_{rc}^g	Government budget share	$hpop_{rhl}$	Household population per worker
β_{rch}^h	Household marginal budget share	gh_{rh}	Per capita social transfers
β_{rc}^i	Investment demand share	gl_{rl}^y gp^y	Labor & TFP growth rate
β^k	Capital allocation adjustment	lm_{rl}	Number of new migrants
β_l^l	Wage-migration elasticity	pe_{rc} pm_{rc}	World export and import prices
λ_{rch}^h	Subsistence consumption	qfs_{rf}	Total factor supply
λ_{rka}^k	Regional capital stock	$rr_{rr'f}$ rw_{rf}	Regional & foreign remittance rate
δ_{trc}^q δ_{rtc}^t δ_{rfa}^v	Production & trade shares	sf	Absolute value of foreign savings
ρ_{rc}^q ρ_{rc}^t ρ_{ra}^v	Production & trade exponent	sg sh_{rh}	Public & private savings rates
$\theta_{tt'c'c}^e$ $\theta_{tt'c'c}^m$	Export & import trade margin rate	tf_{rf} th_{rh}	Corporate & personal tax rates
θ_{rhf}^{hf}	Household factor income shares	tm_{rc} tq_{rc}	Import tariff and sales tax rates

Table A2. CGE model equations

Within-period prices	
Foreign export price	$PR_{rwc} = pe_{rc} \cdot X$
Foreign import price	$PR_{wrc} = pm_{rc} \cdot \left(1 + tm_{rc}\right) \cdot X + M_{wrc}$
Export & import trade margins	$M_{rtc} = \sum_{c'} PQ_{rc'} \cdot \theta^{e}_{rtc'c}$ and $M_{wrc} = \sum_{c'} PQ_{rc'} \cdot \theta^{m}_{wrc'c}$
Absorption	$PD_{rc} \cdot QD_{rc} + \sum_{t} PR_{trc} \cdot QR_{trc} = \left(PQ_{rc} \cdot \left(1 - tq_{rc}\right) - \sum_{c'} PQ_{rc'} \cdot \theta^{q}_{rc'c} \right) \cdot QQ_{rc}$
Marketed output value	$\sum_{a \sim c} PA_{ra} \cdot QA_{ra} = PD_{rc} \cdot QD_{rc} + \sum_{t} \left(\left(PR_{rtc} - M_{rtc} \right) \cdot QR_{rtc} \right)$
Activity revenue and costs	$PA_{ra} \cdot QA_{ra} = PV_{ra} \cdot QV_{ra} + \sum_{c} PQ_{rc} \cdot QN_{rca}$
Consumer & producer price indices	$CPI_{r} = \sum_{c} \beta^{c}_{rc} \cdot PQ_{rc}$ and $DPI_{r} = \sum_{c} \beta^{d}_{rc} \cdot PD_{rc}$
Within-period production and trade	
CES production function	$QV_{ra} = \alpha^{v}_{ra} \cdot \left(\sum_{f} \delta^{v}_{rfa} \cdot QF_{rfa}^{-\rho^{v}_{ra}} \right)^{-1/\rho^{v}_{ra}}$
CES production function (first-order condition)	$WF_{rf} \cdot WD_{rfa} = PV_{ra} \cdot QV_{ra} \cdot \left(\sum_{f'} \delta^{v}_{rf'a} \cdot QF_{rf'a}^{-\rho^{v}_{ra}} \right)^{-1} \cdot \delta^{v}_{rfa} \cdot QF_{rfa}^{-\rho^{v}_{ra}-1}$
Leontief intermediate demand	$QN_{rca} = \theta^{n}_{rca} \cdot QA_{ra}$
Leontief aggregate value-added	$QV_{ra} = \theta^{v}_{ra} \cdot QA_{ra}$
CET export function	$\sum_{a \sim c} QA_{ra} = \alpha^{t}_{rc} \cdot \left(\sum_{t} \delta^{t}_{rtc} \cdot QR_{rtc}^{\rho^{t}_{rc}} + \left(1 - \sum_{t} \delta^{t}_{rtc}\right) \cdot QD_{rc}^{\rho^{t}_{rc}} \right)^{1/\rho^{t}_{rc}-1}$
CET export function (first-order condition)	$\frac{QR_{rtc}}{QD_{rc}} = \left(\frac{PR_{rtc} - M_{rtc}}{PD_{rc}} \cdot \frac{1 - \sum_{t'} \delta^{t}_{rt'c}}{\delta^{t}_{rtc}} \right)^{1/\rho^{t}_{rc}-1}$

Table A2 continued. CGE model equations

Non-exported or produced commodities	$\sum_{a\sim c} QA_{ra} = QD_{rc} + \sum_{t} QR_{rtc}$
Armington import function	$QQ_{rc} = \alpha_{rc}^{q} \cdot \left(\sum_{t} \delta_{trc}^{q} \cdot QR_{trc}^{-\rho_{rc}^{q}} + \left(1 - \sum_{t} \delta_{trc}^{q}\right) \cdot QD_{rc}^{-\rho_{rc}^{q}} \right)^{-1/\rho_{rc}^{q}}$
Armington import function (first-order condition)	$\frac{QR_{trc}}{QD_{rc}} = \left(\frac{PD_{rc}}{PR_{trc}} \cdot \frac{\delta_{trc}^{q}}{1 - \sum_{t'} \delta_{t'rc}^{q}} \right)^{1/1+\rho_{rc}^{q}}$
Non-imported or produced commodities	$QQ_{rc} = QD_{rc} + \sum_{t} QR_{trc}$
Transaction services demand	$QT_{rc} = \sum_{t} \sum_{c'} \left(icm_{trcc'} \cdot QR_{trc'} + ice_{rtcc'} \cdot QR_{rtc'} \right) + \sum_{c'} icq_{rcc'} \cdot QQ_{rc'}$
Within-period incomes and demand	
Factor incomes	$YF_{rf} = \sum_{a} WF_{rf} \cdot WD_{rfa} \cdot QF_{rfa} + \sum_{r'} \left(rr_{r'rf} \cdot YF_{r'f} - rr_{rr'f} \cdot YF_{rf} \right)$
Household incomes	$YH_{rh} = \sum_{f} \theta_{rhf}^{hf} \cdot \left(1 - rw_{rf}\right) \cdot \left(1 - tf_{rf}\right) \cdot YF_{rf} + gh_{rh} \cdot CPI_{r} \cdot \sum_{l} hpop_{rhl}$
Government revenues	$YG = \sum_{rh} th_{rh} \cdot YH_{rh} + \sum_{rf} tf_{rf} \cdot YF_{rf} + \sum_{rwc} tm_{rc} \cdot pm_{rc} \cdot QR_{wrc} \cdot EXR + \sum_{rc} tq_{rc} \cdot QQ_{rc}$
Per capita household consumption demand	$PQ_{rc} \cdot QH_{rch} = PQ_{rc} \cdot \lambda_{rch}^{h} + \beta_{rch}^{h} \cdot \left(\left(1 - sh_{rh}\right) \cdot \left(1 - th_{rh}\right) \cdot YH_{rh} \Big/ \sum_{l} hpop_{rhl} - PQ_{rc} \cdot \lambda_{rch}^{h} \right)$
Government consumption demand	$PQ_{rc} \cdot QG_{rc} = \beta_{rc}^{g} \cdot \left(\left(1 - sg\right) \cdot YG - \sum_{r'h} gh_{r'h} \cdot CPI_{r'} \cdot \sum_{l} hpop_{r'hl} \right)$
Investment demand	$PQ_{rc} \cdot QI_{rc} = \beta_{rc}^{i} \cdot \left(\alpha_{r}^{k} + \sum_{ka} K_{rka} \right) \cdot \left(\sum_{r'h} sh_{r'h} \cdot \left(1 - th_{r'h}\right) \cdot YH_{r'h} + sg \cdot YG + sf \cdot X \right)$
Sectoral & regional capital allocation	$K_{rka} = \beta^{k} \cdot \lambda_{rka}^{k} \cdot \left(WF_{rk} \cdot WD_{rka} \cdot CPI_{r} \big/ cpi_{r}^{0} - AR \right) \cdot AR^{-1}$

Table A2 continued. CGE model equations

National average capital returns	$AR \cdot \sum_{rka} QF_{rka} = \sum_{rka} WF_{rk} \cdot WD_{rka} \cdot QF_{rka} \cdot CPI_r \big/ cpi_r^0$
Within-period system constraints	
Factor market equilibrium	$\sum_{a} QF_{rfa} = qfs_{rf}$ where $qfs_{rl} = \sum_{h} hlab_{rhl}$
Commodity market equilibrium	$QQ_{rc} = \sum_{a} QN_{rca} + \sum_{h} QH_{rch} \cdot \sum_{l} hpop_{rhl} + QG_{rc} + QI_{rc} + QT_{rc}$
Current account balance	$\sum_{wrc} \left(pwm_{rc} \cdot QR_{wrc} - pwe_{rc} \cdot QR_{rwc} \right) + \sum_{rf} rw_{rf} \cdot \left(1 - tf_{rf}\right) \cdot YF_{rf} \cdot X^{-1} = sf$
Between-period capital accumulation	
Conversion & allocation of past investment into new capital stocks	$QF^{y}_{rka} = QF^{y-1}_{rka} \cdot \left(1 - d\right) + \frac{\lambda^{k}_{rka} \cdot K^{y-1}_{rka}}{\sum_{k'a'} \lambda^{k}_{rk'a'} \cdot K^{y-1}_{rk'a'}} \cdot \frac{\sum_{c} PQ^{y-1}_{rc} \cdot QI^{y-1}_{rc}}{\alpha^{i}_{r} \cdot \sum_{c} iwts_{rc} \cdot PQ^{y-1}_{rc}}$
Between-period labor migration	
Labor migration function	$lm^{y}_{'coast'l} = \beta^{l}_{l} \cdot \left(\frac{WF^{y-1}_{'coast'l}}{WF^{y-1}_{'sierra'l}} \cdot \frac{RCPI^{y-1}_{'sierra'}}{RCPI^{y-1}_{'coast'}} - \alpha^{l}_{l} \right) \cdot QFS^{y-1}_{'sierra'l}$ and $lm^{y}_{'sierra'l} = -lm^{y}_{'coast'l}$
Labor supply growth	$QFS^{y}_{rl} = \left(QFS^{y-1}_{rl} + lm^{y}_{rl} \right) \cdot \left(1 + gl^{y}_{rl} \right)$
Between-period population growth	
Household labor endowment	$hlab^{y}_{rhl} = \left(hlab^{y-1}_{rhl} \Big/ \sum_{hi} hlab^{y-1}_{rh'l} \right) \cdot lm^{y}_{rl}$
Household population growth	$hpop^{y}_{rhl} = \left(hpop^{y-1}_{rhl} + \left(1 + drm \cdot \left(hpop^{y-1}_{rhl} \big/ hlab^{y-1}_{rhl} \right) \right) \cdot lm^{y}_{rl} \right) \cdot \left(1 + gl^{y}_{rl} \right)$
Between-period total factor productivity growth	
Productivity growth	$\alpha^{v\,y}_{ra} = \alpha^{v\,y-1}_{ra} \cdot \left(1 + gp^{y} \right)$

Table A3. Regional and international trade elasticities in the model

Maize	4.45	Clothing and footwear	3.70
Other cereals	4.45	Wood products	3.40
Potatoes	3.25	Paper products	2.95
Roots and tubers	3.25	Chemicals	2.10
Fruits	1.35	Non-metallic minerals	2.90
Vegetables	1.35	Ferrous metals	2.95
Cotton	2.50	Non-ferrous metals	4.20
Coffee	1.15	Metal products	3.75
Sugar	2.70	Machinery and vehicles	4.05
Other cash crops	3.25	Other manufacturing	3.75
Cattle	2.00	Construction	1.90
Poultry	0.90	Electricity and water	2.80
Other livestock	2.00	Trade services	1.50
Forestry	2.50	Hotel and catering	0.50
Fishing	1.25	Transport and communication services	0.50
Mining	0.90	Business and real estate services	0.50
Food processing	3.50	Community and other services	0.50
Textiles	3.75	Government services	0.50

Source: Dimaranan et al. 2006.

REFERENCES

Dimaranan, B.V., R.A. McDougall, and T.W. Hertel. 2006. Behavioral parameters. In *Global trade, assistance, and production: The GTAP 6 data base*, ed. B.V. Dimaranan. Center for Global Trade Analysis. West Lafayette, Ind.: Purdue University.

Escobal, J. and M. Valdivia. 2004. *Peru: Hacia una estrategia de desarrollo para la Sierra rural*. Lima, Peru: GRADE.

Fan, S., X. Zhang, and N. Rao. 2004. *Public expenditure, growth, and poverty reduction in rural Uganda.* Development Strategy and Governance Division Discussion Paper No. 4. Washington, D.C.: International Food Policy Research Institute.

INEI. (Informe Técnico, Instituto Nacional de Estadistica e Informatica). 2006. *Encuesta Nacional de Hogares: 2004*. Lima, Peru: INEI.

INEI. 2008. *Sistema de cuentas nacionales,* Lima, Peru: INEI. <http://www.inei.gob.pe>, accessed January 15, 2008.

INEI. 2009. *La pobreza en el Perú en el año 2007*. Lima, Peru: INEI.

Laszlo, S., and E. Santor. 2004. *Internal migration and borrowing constraints: Evidence from Peru.* Development and Comp Systems 0411022, EconWPA. St. Louis, Mo.: Washington University. <http://129.3.20.41/eps/dev/papers/0411/0411022.pdf>, accessed January 2008.

Morley, S., A. Nin-Pratt and J. Thurlow. 2008. *A 2002 social accounting matrix for Peru with provisional matrices for the Coastal, Sierra and Selva regions.* Washington, D.C.: International Food Policy Research Institute.

World Bank. 2005. *Opportunities for all: Peru poverty assessment*. Report No. 29825-PE. Washington D.C.: World Bank.

RECENT IFPRI DISCUSSION PAPERS

For earlier discussion papers, please go to www.ifpri.org/pubs/pubs.htm#dp.
All discussion papers can be downloaded free of charge.

897. *Spatial networks, labor supply, and income dynamics: Evidence from Indonesian villages*. Futoshi Yamauchi, Megumi Muto, Shyamal Chowdhury, Reno Dewina, and Sony Sumaryanto, 2009.

896. *The evolution of an industrial cluster in China.* Belton Fleisher, Dinghuan Hu, William McGuire, and Xiaobo Zhang, 2009.

895. *Commodity price volatility and nutrition vulnerability.* Monika Verma and Thomas W. Hertel, 2009

894. *Measuring irrigation performance in Africa*. Mark Svendsen, Mandy Ewing, and Siwa Msangi, 2009

893. *Managing future oil revenues in Ghana: An assessment of alternative allocation options.* Clemens Breisinger, Xinshen Diao, Rainer Schweickert, and Manfred Wiebelt, 2009.

892. *Impact of water user associations on agricultural productivity in Chile.* Nancy McCarthy and Tim Essam, 2009.

891. *China's growth and the agricultural exports of southern Africa.* Nelson Villoria, Thomas Hertel, and Alejandro Nin-Pratt, 2009.

890. *The impact of climate variability and change on economic growth and poverty in Zambia.* James Thurlow, Tingju Zhu, and Xinshen Diao, 2009.

889. *Navigating the perfect storm: Reflections on the food, energy, and financial crises.* Derek Headey, Sangeetha Malaiyandi, and Shenggen Fan, 2009.

888. *How important is a regional free trade area for southern Africa? Potential impacts and structural constraints.* Alejandro Nin Pratt, Xinshen Diao, and Yonas Bahta, 2009.

887. *Determinant of smallholder farmer labor allocation decisions in Uganda.* Fred Bagamba, Kees Burger, and Arie Kuyvenhoven, 2009.

886. *The potential cost of a failed Doha Round.* Antoine Bouët and David Laborde, 2009.

885. *Mapping South African farming sector vulnerability to climate change and variability: A subnational assessment.* Glwadys Aymone Gbetibouo and Claudia Ringler, 2009.

884. *How does food price increase affect Ugandan households? An augmented multimarket approach.* John M. Ulimwengu and Racha Ramadan, 2009.

883. *Linking urban consumers and rural farmers in India: A comparison of traditional and modern food supply chains.* Bart Minten, Thomas Reardon, and Anneleen Vandeplas, 2009.

882. *Promising Approaches to Address the Needs of Poor Female Farmers: Resources, Constraints, and Interventions.* Agnes R. Quisumbing and Lauren Pandolfelli, 2009.

881. *Natural Disasters, Self-Insurance, and Human Capital Investment: Evidence from Bangladesh, Ethiopia, and Malawi.* Futoshi Yamauchi, Yisehac Yohannes, and Agnes Quisumbing, 2009.

880. *Risks, ex-ante actions, and public assistance: Impacts of natural disasters on child schooling in Bangladesh, Ethiopia, and Malawi.* Futoshi Yamauchi, Yisehac Yohannes, and Agnes Quisumbing, 2009.

879. *Measuring child labor: Comparisons between hours data and subjective measures.* Andrew Dillon, 2009.

878. *The effects of political reservations for women on local governance and rural service provision: Survey evidence from Karnataka.* Katharina Raabe, Madhushree Sekher, and Regina Birner, 2009.

877. *Why is the Doha development agenda failing? And what can be Done? A computable general equilibrium-game theoretical approach.* Antoine Bouët and David Laborde, 2009.

876. *Priorities for realizing the potential to increase agricultural productivity and growth in Western and Central Africa.* Alejandro Nin-Pratt, Michael Johnson, Eduardo Magalhaes, Xinshen Diao, Liang You, and Jordan Chamberlin, 2009.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org