Agriculture and Income Distribution in Rural Vietnam under Economic Reforms: A Tale of Two Regions

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Abstract

This paper exploits the panel dimension of the Vietnam Living Standards Survey (VLSS) in order to analyze the main changes occurring in agriculture in Vietnam over the period 1993-1998. This period was marked by a continuation of the reforms that began in 1988 with the implementation of Resolution 10, Vietnam's own version of the Chinese Household Responsibility System. We focus on the impact of two main policy changes: first, the increase in the rice export quota and the significant increase in the price of rice, especially in the south; second, liberalization of the fertilizer market and the sharp drop in the price of fertilizer. To this end, we document changes in the empirically observable "institutional environment," exploring changes in rice and other crop prices as well as fertilizer prices. With this as background, we explore changes in rice production, consumption and marketing, and their links to changes in prices and incomes. We also estimate the degree to which these increases can be "explained" by increased use of inputs like fertilizer, cropping intensity, and increased yields. Finally, we investigate the distributional impacts of these changes, including a detailed examination of the linkages between rice marketing and income distribution using nonparametric econometric techniques. We find that the agricultural reforms had a largely beneficial impact on the well being of rural households throughout Vietnam, but that farmers in the south gained most, consistent with expectations given the policy changes. More generally, our conclusions suggest that market reforms can have a significant impact on incentives, without adverse consequences for income distribution.

JEL Classification: P3, Q12, Q17, Q18

Keywords: economic reforms in Vietnam; trade liberalization; agricultural productivity; welfare distribution

Introduction

The period between 1993-1998 marked a continuation of the reforms of Vietnam's rural sector that began in earnest in 1988 with the implementation of Resolution 10, Vietnam's own version of the Chinese Household Responsibility System. Over this five-year period, new policies were implemented that provided households with better and more secure land use rights, expanded domestic and international marketing opportunities, and relaxed input supply constraints. These reforms, especially the relaxation of trade restrictions on rice and fertilizer, reinforced the incentive-enhancing effects of the earlier decentralization of decision-making in 1988 to farm households, and in the process, influenced supply and marketing decisions in agriculture, incomes and welfare

Our purpose in this paper is to provide a description of the main changes occurring in agriculture in Vietnam over this five-year window, especially as they pertain to the distribution of incomes in the countryside. In particular, we exploit the panel dimension of the Vietnam Living Standard Survey (VLSS, hereafter) in order to track households as they adjusted to the changes in the agricultural sector precipitated by ongoing economic reforms. This includes an assortment of adjustments in agricultural production and marketing, as well as in consumption.

In our analysis, we are especially interested in the regional dimensions of these changes, and the differential effect of these reforms on growth and distribution on north and south Vietnam. We focus on the impact of two main policy changes: first, the increase in the rice export quota and the significant increase in the price of rice, especially in the south; second, liberalization of the fertilizer market and the sharp drop in the price of fertilizer. We expect most of the changes in agriculture to center on rice production, and for the south to gain more than the north. Differences between north and south in terms of their historical comparative advantage in rice production, suggest that these marketing reforms may have accelerated a return to earlier production patterns. Beyond the differences across regions, we are also interested in the possibly uneven impact of the reforms on households within regions. In short, our paper investigates the linkages between the price-policy changes, and the associated (possible) efficiency and equity consequences in the countryside.

The paper is organized as follows. In section 1, we begin by highlighting the major institutional reforms affecting the rural sector over this period, and then discussing their potential implications for agriculture and incomes. This is followed in section 2 by a brief look at the

changing structure of household incomes, and changes in income inequality over this period. Our discussion documents the continuing important role of agriculture in rural incomes, and important changes in income distribution, as well as contrasts between the north and south. In section 3, we turn to the empirically observable "institutional environment," exploring changes in rice and other crop prices as well as fertilizer prices, that we believe to be at the center of the changes in Vietnam's rural sector. With this as background, in section 4 we explore changes in rice production, consumption and marketing: Which regions saw increases in the production and consumption of rice? Were there declines? Moreover, do these changes "line up" with the patterns of price adjustment? We also provide a detailed look at the impact of rising household incomes on the level and pattern of food demand. Next, these changes in rice farming are placed in the broader context of agricultural production, and we describe changes in cropping patterns across Vietnam. Given the significant increase in rice production and farm output, more generally, in this section we also investigate the extent to which these increases can be "explained" by increases inputs like fertilizer, cropping intensity, and increased yields. Finally, in section 5 we focus on the distributional impacts of these changes, including a detailed examination of the linkages between rice marketing and income distribution, as well as a summary of the role of agricultural incomes more generally as they pertain to income inequality.

Throughout the paper, we provide regional breakdowns in the north-south dimension.[1] We also show differences between urban and rural Vietnamese households. Urban households are of some interest because a small fraction is farmers, but also because the welfare consequences of changes in agriculture may have opposite implications for urban and rural households. That said, in order to keep the dimension of the tables to a reasonable level, we focus primarily on those households classified as rural.

[1] In the 1992-93 survey, the country was divided into 7 administrative regions for the purpose of sampling. We define the north to include the Northern Mountains and Midlands, the Red River Delta, and the North Central Coast. The south consists of the South Central Coast, the Central Highlands, the Southeast and the Mekong River Delta. In the 1997-98 survey, 8 administrative regions were used, with the Northern Mountains and Midlands subdivided into the Northeast and Northwest.

1.0 Institutional Changes and Potential Implications

Several important institutional changes occurred between 1993 and 1998 that we would expect to affect agricultural incomes.[2] Some of these changes represented a continuation of the move towards market-based production, while others concerned (implicit) taxes and rice marketing policy:

- Between 1992-1998, key agricultural markets were gradually liberalized. Most important was the relaxation of restrictions on rice exports. The export quota was increased from less than a million metric ton in 1992 to 4.5 million by 1998. Similarly, there was a relaxation of internal barriers to trade in rice that had restricted the flow of rice from the south to north. Especially important in this regard was Decree No. 140/TTg, implemented in March of 1997, which lifted internal trade restrictions on rice, and eliminated some licenses and controls on transports. The combination of export quotas and internal trade restrictions, which restricted the movement of rice from south to north, had severely depressed the price of rice in the south. For example, in 1995 the export value of a ton of rice was US$269, but farmers in the Mekong River Delta received only US$205 per ton, yielding an implicit tax of over 30 percent.[3] Quite clearly, we expect an increase in the rice export quota to increase the price of rice, especially in the south.
- Fertilizer supply constraints were reduced, with new freedoms to import fertilizer. In 1991, central and provincial State Owned Enterprises that earned foreign exchange were allowed to import fertilizer directly. Vietnam does not have much of a domestic fertilizer industry, and therefore is heavily dependent on imports. Over this period, fertilizer imports tripled in quantity terms. While there are no tariffs on imports, there may still be a wedge between the domestic and international prices of fertilizer. Still, we expect a sharp drop in fertilizer prices as a result of the liberalization of this key input market.
- Resolution 5, passed in 1993, aimed to enhance household use-rights in land. Tenure security was extended to 20 years for annual cropland, and 50 years for perennials. Households were extended rights to exchange, transfer, lease, inherit as well as mortgage land. A land titling process was also begun. In the long run, these changes can be expected to impact investment

[2] See the reports done for the Asian Development Bank (1996) and (2000), by Goletti and Minot (1997a and 1997b), and by Goletti (1998) for a more detailed overview of changes in rice policy, as well as a comprehensive review of the performance of the agricultural sector in Vietnam. Timmer (1996) discusses some of the general issues concerning economic transition and the role agriculture in economic development as they may pertain to Vietnam.
[3] Minot and Goletti (1998), page 739.

incentives in agriculture, e.g. irrigation, drainage, perennials, etc. and also affect the efficiency with which land is allocated across households. Although it encountered a variety of administrative difficulty, by 1997 half of all land had been titled, affecting two-thirds of all households. As most of the changes occurred towards the end of our time period, we doubt that this increase in property rights security will have had enough time to be reflected in production behavior and output.

- Improved development of market infrastructure and the continued integration of Vietnam with world agricultural markets would possibly have made it easier for households to start growing exportable cash crops.

In summary, the most important changes in farmers' economic environment concerned prices: increases in crop prices, and reduction of fertilizer prices. Changes in these markets are likely to have affected households in a variety of ways. First, ignoring production adjustments, changes in the price of rice (and fertilizer) will have direct effects on the well-being of rice producers and consumers through their farm balance sheets. Quite likely, we expect this impact to vary across the different regions of Vietnam (urban versus rural; north versus south; rice surplus versus deficit), and also across different parts of the income distribution. Second, we expect households to make production adjustments. For some households, it may no longer be worth growing rice, or it may be more profitable to move into the production of cash crops. For others, rice may be more lucrative, and merit even deeper investments and specialization. Indeed, one of the most interesting questions pertaining to rice-market liberalization concerns the extent to which crop production adjusts across regions. Through trade, rice-deficit regions move into other crops where farmers have a comparative advantage, while rice surplus areas cultivate rice more intensively. The reduced cost of fertilizer may induce farmers to substitute from organic to chemical fertilizer, possibly increasing yields. At the household level, increased commercialization means that households are more engaged in, and affected by markets. An important question is how this increase in market development affects household welfare and efficiency.

In addition to responding to the specific price changes that resulted from government policy in the 1993-1998 period, we expect other factors to affect agriculture. First, we expect a continued adjustment to the market reforms begun in the late 1980s. The decentralization of household decision making, which was at the center of the reforms, is expected to improve farm

efficiencies, and also (possibly) permit greater specialization within farming. An important question concerns whether some of the initial success of the market reforms could be maintained through the 1990s.[4] Second, increases in urban and rural incomes can be expected to increase the demand for food, especially for crops besides rice. This may have encouraged farmers to diversify their crop portfolios, especially moving into more lucrative perennials. The movement of farmers out of rice also suggests the importance of the co-development of rice markets and commercialization, which permits farmers to stop growing their own food. Finally, combined with economic development, economic reforms may have permitted a diminished role for agriculture, as households increasingly participate in non-agricultural pursuits.[5] In assessing the impact of changes in agriculture, it is important to see how non-agricultural pursuits may off-set the impact on household welfare of changes in agricultural income.

While our focus will be on agricultural income -- crop revenue minus expenses—and its place in the context of overall household income, preliminary evidence on the "bottom line" of the possible impact of these changes is provided by Glewwe, Gragnolati, and Zaman (2001). They look at changes in consumption levels between the two years. First, they document a sharp drop in poverty, from 58.2% to 38.4%, suggestive that incomes rose significantly. Most of the decline in poverty that they find is concentrated in urban areas. However, among rural households, they find the most pronounced drops in poverty for households that: i) lived in the south; ii) had more irrigated land, and experienced greater increases in rice productivity. This at least suggests that changes in rice and fertilizer prices, or at least increases in the returns to rice farming, may have been responsible for improved living standards. In order to answer this question, we need look directly at agricultural incomes.

[4] See Tran Thi Que (1998), and Bautista (1999) for preliminary discussion of the impact of Vietnamese agricultural policy changes, and farmer productivity.

[5] If Engel's Law holds, i.e. the income elasticity for food is less then one, we expect the overall increase in the demand for food to be less than proportional to the increase in incomes, and the food share of expenditures to fall. This would correspond to a diminished share of agriculture in economic activity. Of course, the demand for individual agricultural commodities can be considerably more income elastic, and we expect the composition of agricultural output to shift towards these "luxuries".

2.0 Agriculture and the Structure of Income

In this section we document changes in the structure of household income and consumption across the two years of the survey. This serves two purposes. First, it enables us to see any changes in the role of agriculture in the portfolio of household income; and second, it provides us useful background information on patterns of changes in living standards. As households get richer, we expect their demand for agricultural goods to change, with implications for agricultural prices and, possibly, cropping patterns.

Throughout the paper we focus only on the panel households, that is, those households that can be tracked across the two survey years.[6] The VLSS survey in 1998 was intended to include a total of 6000 households, including a re-survey of the 4800 households originally surveyed in 1993. As typically happens, some of the original households could not be re-contacted, so that only 4306 households can be precisely followed between the two surveys. We base our analysis on the 3496 rural and 810 urban households panel (or longitudinal) households that could be accurately matched across the 1993 and 1998 surveys.

To the extent that these households are not representative of the entire population, there may be some limitations on applying conclusions from our analysis to the entire country. However, we have also calculated similar tables over the entire set of non-panel households, and obtain basically the same results. By focusing on the panel, we can track the changes in outcomes for a specific group of households, with some confidence that we are holding "initial conditions" constant. This will be particularly helpful when we look at changes (as opposed to levels) of outcomes. One caveat worth bearing in mind, however, is that the members of any panel data set get older with time in the panel, so some of the changes we observe may be a function of age, in addition to changes in aggregate economic conditions.

2.1 Levels of Income

Table 1 shows mean incomes for households by various sources, partitioned into a variety of sub-samples.[7] A few conventions are worth noting. First, we express all values in terms of 1998 prices, using the recommended 1.456 "deflator." Second, when discussing incomes for use

[6] See World Bank (2000) for more details concerning the VLSS, in particular the sampling frame of 1998 compared to 1993.

[7] See Wiens (1998) for additional discussion of the role of agriculture in household incomes, based on the 1993 survey.

in welfare analysis (as we are in Table1), we also use the monthly and regional consumer price deflators, so that regional incomes are adjusted for regional differences in purchasing power.[8] Third, we present two measures of income (and consumption), with and without the imputed value of capital services. Imputed capital services, which measure the flow of services from durables and owner-occupied housing, are very difficult to estimate, and we want to evaluate the robustness of our conclusions to this "made-up", but important, component of income. Finally, we also weight the per capita household-level variables by household size, so as to reflect "individual level" averages. Two main conclusions follow from Table 1. First, average incomes increased dramatically over this period; and second, income growth was highest in the rural south, and lowest in the rural north.

We begin with overall household incomes from all sources (including capital services). While urban households are not the focus of our paper, it is still informative to examine urban income levels and growth rates, if only as a benchmark for the rural households. In 1993, urban households in the north had average income of 12,802 (thousand dong) compared to 17,994 (thousand dong) in the south, implying a ratio of 0.71 for north to south.[9] Urban households in the north experienced income growth of 84 percent between 1993 and 1998, corresponding to average annual (compounded) growth of 13 percent. Urban household income growth was lower in the south, at 65 percent (10.5 percent per year) for this period. By comparison, rural households in the north had average income of 7,613 in 1993. This was 59 percent as high as urban households in the north, and 87 percent as high as rural dwellers in the south. Rural household incomes grew by 55 percent (9.2 percent per year) in the north and by an astounding 95 percent (14.3 percent per year) in the south. By 1998, the north-south rural income ratio had

[8] The monthly price changes are from the Vietnamese CPI, which is constructed on the basis of a basket of food and non-food items. The regional price indices were constructed by the General Statistical Office (GSO) and are for 1998. These indices are discussed in more detail in "Vietnam Living Standards Survey (VLSS), 1997-98: Basic Information", 2000.

[9] This is a useful point at which to provide a comparison of the panel households to the two cross sections (1993 and 1998). The panel households are virtually indistinguishable from the full cross-section in 1993: the ratio of cross-section to panel household incomes is 1.02 in urban areas, and 1.00 in rural areas. Some differences emerge for the urban households in 1998. The ratio of cross-section to panel household incomes is 1.11 in the south (urban) and 0.95 in the north (urban). Thus, the cross-section would yield a slightly greater widening of the north-south differential for urban areas. The rural samples are closer: the ratio of cross-section to panel household income in 1998 is 0.98 in the north, and 0.94 in the south. The cross-section data thus imply slightly less widening of rural incomes between north and south (by 4 percentage points). However, these differences are very small. The overall story is not sensitive to whether the analysis is restricted to the panel households. Also note that some of the divergence may be driven by the change in the national sampling frame in 1998, as opposed to sample attrition from the 1993 survey. That this may be the case is underlined by the similarity between the panel and non-panel households in 1993.

fallen to 0.69. This pattern of growth is basically the same using Total Income (2), which excludes housing and durables services. The main difference that emerges in using this alternative income measure is that the rural-urban gap is slightly attenuated, reflecting the higher value of housing services in cities.

These numbers do not take into account the differences in household sizes across regions and time periods. In addition, household size fell in all regions, but non-uniformly. For example, household size fell from 4.2 to 4.0 in the urban north, but from 5.7 to 4.9 in the urban south; from 4.8 to 4.6 in the rural north; and from 5.5 to 5.2 in the rural south. These differences and changes in household size are reflected in the per capita income figures, and generate important nuances to the conclusions based on household income. First, per capita income differences are much smaller across regions. The ratio of northern to southern urban incomes is 0.95 in 1993, and 0.96 in 1998. Per capita income growth in the north and south is 92 percent (13.9 percent per year) and 89 percent (13.6 percent per year) respectively. At the same time, however, the gap between north and south is more pronounced in rural areas, as growth was 62 percent (10.1 percent per year) in the north, and 103 percent (15.2 percent per year) in the south. The ratio of north to southern rural per capita incomes fell from 0.99 in 1993 to 0.79 in 1998. Finally, adjustments for household size widen slightly the urban-rural gap.

In addition to changes in levels, there were changes in the composition of incomes over this period. This can be seen directly in the numbers reported in Table 1, as well as in the implied income shares illustrated in Figure 1. Clearly, the levels of all types of income rose in all regions. In urban areas, wages and family run businesses contribute the most income, together accounting for almost 45 percent of incomes in the north in 1993, and 50 percent of incomes in the south. In the south, this rises to 60 percent in 1998. Agriculture is not a very important income source in urban areas, though the category "other income" is especially important. This category is comprised of remittances, government transfers, interest, and rental income. Government transfers, such as military pensions, are higher in the north. Turning to rural areas, agriculture is clearly the most important category. In the north, the share of agriculture falls from 46 percent in 1993 to 33 percent in 1998, while in the south, the share of agriculture falls from 43 to 38 percent. Animal husbandry grew slightly in importance, and is a higher share of income in the north. Finally, income from wages and family-run businesses increased in importance in both the south and north, where they now comprise about one-third of household income. In summary,

broadly defined agricultural sources of income remain very important in the Vietnamese countryside, though agriculture is a slightly smaller share of income in 1998 than in 1993.

Finally, we show mean per capita consumption levels for each region. The consumption numbers paint a slightly different picture than income. Certainly, they indicate significant improvements in living standards, especially in the cities, and suggest a sharp drop in poverty.[10] The ratios of 1998 to 1993 consumption range from 1.57 in the rural south, to 1.74 in the urban north. But unlike the income figures, the consumption numbers do not suggest a widening gap between regions: consumption in urban areas in the north increased from 90 percent to 93 percent of the levels in the south (similar to the per capita income figures), while consumption in the rural north was 83 percent of that in south in both years (in contrast to the income results). One possibility is that the income numbers are "noisier", and are more sensitive to year-to-year variation. In fact, we present evidence later on that suggests that incomes were unusually high in the north in 1993, which would yield lower growth rates in subsequent years (mean reversion). However, it is also possible that consumption responds more slowly than income to changes in "economic fundamentals," and that increased savings, not consumption, is the response to higher incomes. If this is the case, then the income numbers may point accurately to long run trends in living standards that are not yet reflected in annual consumption.[11]

2.2 Income Inequality

Related to the mean levels of per capita income and consumption, we present the Gini coefficients for the same sub-samples. The income-based Gini's suggest that income inequality dropped significantly in urban areas, declining from 0.50 to 0.43. This decline mostly arises from reductions in income inequality within the north and south, since there was only a small closing of the gap between regions (which was small to begin with). The consumption-based Gini's paint a slightly different picture, as they suggest that there has been no change in urban inequality. The income and consumption based Gini's could both be "right," if savings differences between rich

[10] Our results broadly corroborate those in Glewwe, Gragnolati, and Zaman (2001).

[11] We identify a similar possibility in data drawn from a household survey conducted in north China in 1995. In Benjamin, Brandt, Glewwe, and Guo (2002), we find evidence that higher income households save higher fractions of their incomes, and thus that consumption-based measures of inequality may understate true differences in income earning potential.

and poor households are narrowing. Alternatively, the different picture could arise from some differential degree of measurement error in the income and consumption data.

The rural Gini's also show differences in the income and consumption-based measures. The income-based Gini's show no change in overall inequality, with a Gini of 0.41 in both years, but this hides a steep drop in income inequality in the south (0.46 to 0.42), and a slight increase in the north (from 0.37 to 0.39), as well as the higher between-region gap in 1998. Clearly, pooling rural households from the north and south hides considerable variation in the evolution of the income distribution. The consumption-based inequality measures, on the other hand, suggest slight increases in inequality, both within and between the north and south.

3.0 Agricultural Prices

One of the primary avenues by which we expect changes in agricultural policy to affect household behaviour and welfare is through changes in agricultural prices. Probably the most important set of policy changes concerns rice pricing. During most of the early reform period (including 1992-93), rice prices were not directly set by the government, but there were many marketing restrictions. In particular, as part of a broader policy of promoting rice self-sufficiency and possibly protecting northern farmers, there were strongly binding restrictions on the export of rice, and the movement of rice from south to north was impeded. These restrictions had the effect of severely distorting producer and consumer rice prices. More recently (including prior to 1997), the export quota was increased, and thus the implicit export tax reduced. Furthermore, internal trade restrictions have been reduced, especially since 1996, and private traders have become a more important part of the rice marketing system. Non-rice prices are also expected to have changed over this period, as a possible consequence of changing food demand patterns (which we look at later), and increased integration of the Vietnamese economy into world agricultural markets.

The VLSS surveys can be used—albeit indirectly—to explore the impact of liberalization on prices. We explore two dimensions. First, we present evidence on the broad changes in crop prices, looking separately at the north and south. For this exercise we use the household and community parts of the VLSS. In the second exercise, we focus on rice prices (unit values), and explore the extent to which rice prices have converged across the regions of Vietnam, and also look at how rice producer and consumer rice prices changed over the 1993-1998 period.

3.1 An Overview of Price Indices for 1993 and 1998

Table 2 shows the results of the "big picture" of crop prices. In the first panel we use crop prices (unit values) estimated from the cropping section of the household survey. We calculate prices on the basis of the revenue and quantity of each crop sold by households, and create a 1998/1993 price index using the crop shares (of sales) from 1993 as base weights. In reading the numbers, recall that the overall CPI for this time period is 1.46, which serves as a useful benchmark. We look separately at the north and south, since we are interested in the degree of market integration between the regions, and also the possibly different price signals being sent to farmers. Looking first at rice, we see that producer prices rose by factors of 1.62 and 1.83 in the north and south, respectively. Thus, the real price of rice (relative to the CPI) rose in both areas, with prices increasing more in the south. Non-rice crop prices increased even more, especially in the south. While almost all types of crop prices increased, the increase was most pronounced for the exportable perennial industrial crops, especially in the south.

The next panel of Table 2 corroborates these numbers with a selection of food prices drawn from the community questionnaires. Note that these are "theoretical" consumer prices, not realized producer prices (unit values) as in the first panel.[12] Here, we see that consumer rice prices rose faster than the CPI, and at least with these numbers, also faster than producer prices. Consistent with the results for producer prices, rice prices also increased more in the south. The prices across the various goods confirm that food prices (and thus probably agricultural prices) have generally risen faster than the CPI.

In the last panel, we show fertilizer prices, again drawn from the community questionnaire. Fertilizer represents the largest component of farm input cash expenses, especially for rice. The fertilizer market, especially as it relates to imports, was increasingly liberalized over this period, and we would expect to see declines in fertilizer prices with the increase in supply. Even if farmers had no response to fertilizer price changes, lower fertilizer costs would directly increase farm incomes. To the extent that lower prices also encouraged more use of fertilizer, and enabled higher yields, we expect the lower prices to lead to higher crop output and revenues as well. The results strongly show declining real prices of fertilizer. For Urea, Potassium Sulfate,

[12] By "theoretical" we mean that, in contrast to unit values, these prices are based on a price survey with "unconsummated" transactions, as opposed to prices based on realized transactions.

and Phosphate-based fertilizers, prices rose by less than the CPI (i.e., real prices fell), especially in the south. Most dramatically, the nominal price of NPK fertilizer fell by half in both the north and south. Later in the paper, we explore the possible impact of these price changes on fertilizer use.

3.2 Rice Prices

In Table 3, we turn to rice prices more specifically, looking at the degree of market integration between north and south. We calculate the unit values of rice, both purchased and sold, as estimates of the prices paid to farmers and by consumers. In Table 3 we document consumer and producer prices of rice by region for 1993 and 1998. The prices are adjusted for overall changes in the CPI (i.e., the 1993 prices are converted to 1998 currency by the factor 1.456). We also convert the paddy to rice prices (by a factor of 0.66). The first column shows mean consumer prices by region in 1993. Urban prices are (not surprisingly) higher than rural prices, and are slightly higher in the north. Consumer prices also display some variation across regions.

We performed an analysis of variance of these prices, in order to see how much of the total variation can be accounted for by region. The total variation in log consumer prices is 48.40. Of this variation, 7.09 is explained by region (controlling for the month of survey). The F-statistic on region is 80.5, so region is an undeniably important predictor of rice consumer prices in 1993. The fraction of total variation in log prices explained by region (and month) in 1993 is 22 percent. If rice markets become more integrated across regions, we expect to see a reduction in price variability across regions in 1998. In fact, this is what we see. First, real rice prices are significantly higher in 1998, being 30 percent higher in rural, and 23 percent higher in urban areas. There is only a small gap between north and south (the south being higher), and urban prices remain slightly higher. As far as explaining price variation, while the total variation in log prices increased, both the absolute and relative variation explained by region declined, as one expects as rice markets become more integrated across regions.

But changes in the regional price structure are more dramatic for producer prices. First, note the north-south price divide in 1993: prices are 2.55 (thousand dong) per Kg in the north, versus 1.92 in the south. Producer prices are especially low in the Mekong River Delta (MRD), at 1.86. This is exactly what we would expect given the trading restrictions, which primarily

affected MRD rice farmers. In 1993, they were receiving only seventy percent of the price for the same Kg of rice as a farmer in the Red River Delta (in the north). In the ANOVA exercise, we see that 39% of the total variation in log producer prices is explained by region (and month). Thus, producer prices vary much more across regions than do consumer prices. By 1998, most of this regional dimension disappears. Rice prices are still higher in the north (2.83 versus 2.43), but the percentage gap is much smaller. Furthermore, the real price of rice rose across Vietnam, especially in the south, and in particular in the MRD. As the ANOVA shows, total variation in rice producer prices declined (from 108.83 to 52.29), and that portion explained by region falls from 28.78 to 5.19. Thus, producer price dispersion has decreased, and region is a poorer predictor of rice prices, both of which we expect with improving market integration. It thus appears that the marketing reforms, which allowed increased exports internationally as well as domestically, have led to increases in rice prices, especially in the main rice-producing region of the MRD. An obvious set of questions then follows as to who benefited or was hurt most by these price changes.

Finally, a note of caution in interpreting unit values as "prices," especially for consumers. Consumers can choose to some extent how much to pay for their food, and as incomes rise they tend to substitute towards higher qualities, even for goods as homogeneous as rice. So, as incomes rise, some of the extra income is spent on more expensive rice, and this explains some of the increased dispersion in rice consumer prices. In the bottom part of Table 3, we show estimates of the price-expenditure elasticities for ordinary rice by region and survey year. These are estimated by the coefficients from a regression of the log unit values on log per capita household expenditures, with controls for the month of the survey. We see that the higher the average income levels, the more income elastic is the unit value of rice. For example, in 1993 southern urban-dwellers had the highest elasticity of 0.08. By 1998, the urban elasticities had risen to 0.14 in the south, and 0.10 in the north. Even in rural areas in the south, the expenditure elasticity is 0.10. This correlation between consumer rice prices and household income must be kept in mind when we look at the welfare consequences of higher consumer prices.

4.0 Changes in Agriculture

4.1 Food Demand Patterns

We expect the various economic reforms and increased liberalization to impact directly agricultural activity through the prices described in Tables 2 and 3. Similarly, increased integration of the Vietnamese economy into world agricultural markets, and the corresponding evolution of market infrastructure, should make it easier for farmers to move into exportable cash crops, and away from rice. But probably the most important catalyst for change in agricultural production comes from an increased and changing domestic food demand. For example, an increase in incomes of 50 to 80 percent (as reported in Table 1) will typically lead to increased food demand, and movement along Engel curves towards more "luxurious" foods.[13] However, we also know that relative food prices changed over the 5 year period—perhaps as a consequence of shifting demand in the face of relatively inelastic supply—and certainly, some of these price changes also affected the food demand patterns. In this section, rather than focus on links from agriculture to income, we explore the reverse causality, describing the changing demand patterns, and evaluating to what extent they are driven by increased affluence. To the extent that income growth is driving food demand changes, we may extrapolate the impact of rising incomes on future demand for agricultural output.[14]

In Table 4 we report the estimated food expenditures and food shares for ten types of food, for north and south, divided by urban and rural (Tables 4A and 4B). As elsewhere, our calculations are only over the panel households. The first two columns list the levels of household per capita expenditures for each food group, plus total food and non-durables consumption. All values are reported in thousands of dong, in 1998 values (deflated by the CPI). The next two columns show the corresponding budget shares: for total food, we report the share of the budget devoted to food, while for each food group, we report the share of the food budget. We are interested in the extent to which the observed changes lie on a simple Engel curve, i.e., whether the change in demand from 1993 to 1998 can be explained by the increase in incomes from 1993 to 1998.

[13] Of course, this ignores general equilibrium considerations like price changes, and other factors,
[14] In rural China, increasing incomes has helped spur rapid investment in greenhouses and other more capital intensive (and lucrative) forms of agriculture.

In order to do this formally, we exploit the panel structure of the data, and estimate a standard Engel curve of the form:

$$w_{ijt} = b_{j0} + b_{j1}\ln(pcx_{it}) + b_{j2}\ln n_{it} + \sum_{d=1}^{D-1} b_{j2+d}\frac{n_{dit}}{n_{it}} + b_{j3}'C_{it} + e_{ijt}$$

where w_{ijt} is the food share of food type j, for household i, in year t (1993 or 1998). The control variables are $\ln(pcx)$, or log per capita expenditures, household demographic variables (household size, plus the ratios of each of D demographic groups), and commune indicators, C_{it}, which should account for spatial differences in preferences and "long run" prices. In order to test whether the 1998 food share is statistically higher or lower than expected, given the control variables (especially $\ln(pcx)$), we include a dummy variable for 1998. In the fifth column of the table, we report the estimated expenditure elasticity (b_{j1}) from this exercise, while in the sixth column we report the result of the hypothesis test of whether the 1998 budget share is "out of line" with the estimated Engel curve. We report a "+" if the 1998 share is statistically significantly higher than predicted, and a "-" if the share is significantly lower.

The results for urban areas are reported in Table 4A. Expenditures on virtually every food group increased, and total per capita food expenditures increased in the north by 38 percent, and in the south, by 51 percent. In terms of shares, the food share declined from 67 percent to 62 percent in the south, and from 59 to 57 percent in the richer south. The food expenditure elasticities were estimated at 0.82 for both north and south (consistent with Engel's Law). For the north, the increased level of food expenditures and corresponding declines in the food budget share are estimated to be fully in line with the estimated Engel curve and the given income changes: this is one of those rare instances where the cross-section parameters explain changes over time! These results confirm that rising urban incomes alone have important ramifications for agricultural income. In the north, the food budget itself shifted away from rice (0.32 to 0.25) and towards other foods, notably meat, oils, and food away from home. Expenditure on oils and vegetables increased more than predicted given the increases in income, while meat and other foods demand increased less. In the south, the rice share declines from 0.25 to 0.23, but the decline is significantly smaller than predicted given the increase in incomes. Possibly, this is due to the higher relative increase in the price of rice, combined with a relatively low price elasticity

of demand. Alternatively, some of this may represent a substitution towards higher quality, more expensive rice, as suggested in Table 3. Whatever the explanation, these households are spending more on rice than we would predict. The tilt towards rice spills over to other food demands: we observe a smaller shift towards meat, other grains, and fruit, than we expect. On the other hand, vegetable demand is higher than expected.

In Table 4B, we report the corresponding rural results. In the north, real per capita food expenditures increased by 46.4 percent, while they increased a similar amount (44.6 percent) in the south. The matching food shares declined from 0.73 to 0.68 in the north, and 0.63 to 0.62 in the south. Both declines are less than what we expect given the expenditure elasticities, estimated to be 0.78 and 0.80 for north and south. In fact, while the demand patterns shift in the direction expected given the income increases, most are "out of line" with the Engel curve. As before, much of this is driven by rice. The rice share of food declines from 0.51 to 0.44 in the north, and from 0.43 to 0.40 in the south. Given the increase in income, both shares should have been lower in 1998 (assuming the estimated rice expenditure elasticity of 0.6 is not too high). As was the case in the urban south, the explanation is not obvious, but increasing rice prices may have played a role in tilting expenditures towards rice. That said, demand shifted towards meat, oils, fish, fruit, and vegetables, even if less than expected given the increase in incomes.

In summary, increased incomes have generated significant increase in the demand for all types of food, including rice. But, there has still been a significant shift towards non-rice foods as well, which we expect to see reflected in cropping patterns, to which we now turn.

4.2 Cropping Patterns

The broad changes occurring in agriculture discussed above are more directly illustrated in Tables 5 and 6, where we focus on production. In Table 5, we report summary data for all of Vietnam, and for the north and south separately on the composition of output (value of production, deflated by a crop price index), sales, and acreage for the two panel years, 1993 and 1998. For Vietnam as a whole, we observe fairly rapid growth in agriculture, averaging over 6 percent per annum. Rice production grew at a rate of slightly more than 5 percent per year; while non-rice crops (including annual industrial crops and perennials) grew in excess of 8 percent. There are stark regional differences in the performance of the agricultural sector. Household production in the south grew faster than in the north for both rice and non-rice production, with

growth rates almost three times that observed in the north.[15] Overall, the more rapid growth in cash crop production, combined with a decline in the price of rice relative to cash crops, contributed to a marked decline in the role of rice, as rice production fell from 64.3 to 53.3% of crop output. This is not to diminish the still important role of rice, as it is more than half of farm output, and represents 40 percent of net farm income for rural households.

Note that the reduction in rice's share of total output is much steeper than the reduction in acreage, which only fell from 67.5 to 64.1 percent. The much sharper decline in output reflects differences in the value of output per unit of land, which is much higher for cash crops, and the decline in the price of rice relative to cash crops between 1993 and 1998. Coffee, a key component of "non-food crops" provides a useful illustration. Coffee is grown almost entirely in the south, representing less than one percent of the value of output in the north. For the south, it accounted for 5.7 percent of the value of output, and 10.4 percent of sales in 1993. By 1998, these figures had risen to 16.2 percent and 21.1 percent. Over the five year period, coffee nearly tripled as a share of agricultural production in the south. The increase in share was driven by the combination of a three-fold increase in output and a sharp rise in the price of coffee. The nominal value of coffee output increased by a factor of eight! Virtually all of this is exported, so increased involvement of Vietnam in world coffee markets has had a significant impact on cropping patterns and incomes in the south.[16]

The high growth in output for all crops was accompanied by even more rapid commercialization of the farm sector. The percentage of output that was sold increased from 41 percent to 60 percent over the period. This increase is a product both of the increase in cash cropping (for which marketing ratios are higher), but also an increase in the marketing of rice, which increased significantly over this period. Although the percentage of total farm sales comprised of rice declined, it still accounted for 41 percent of sales revenue in 1998. Furthermore, while the south was more commercialized at the outset, this period still saw bigger gains in commercialization in the south. By 1998, more than 75 percent of all farm output in the south was being marketed; by comparison, in the north, only one-third was marketed.

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[15] In 1993, land productivity, measured in terms of either rice yields or the gross value of agricultural output per unit of land, was significantly lower in the south than the north. As a result of the more rapid growth in the south between 1993-1998, the gap largely disappeared. Professor Jean-Pascal Bassimo (personal correspondence) informs us that in the 1920s, rice yields in the north and south were actually similar.

[16] An important avenue of future research is to evaluate the distributional consequences of this striking increase in income from perennials, and furthermore, to evaluate the possible role played by land security in encouraging investment in trees.

How do these results, based on VLSS household survey data, compare to aggregate administrative statistics? Actually, quite well. In Figure 2 we plot indices of the real value of agricultural output, as well as rice, based on data reported in the agricultural yearbooks. We also superimpose the corresponding indices based on the VLSS data. A few methodological points are worth underlining before discussing the comparison, since the data sources are not perfectly comparable. First, the reported VLSS indices are re-calculated on the basis of all households in north and south (including urban and rural, as opposed to rural only, as reported in Table 5). Second, the rice output index (from both data sources) is based on physical output of paddy, as opposed to the value of rice deflated by the rice-price index (as in Table 5). Third, the real value of agricultural output reported in the yearbook includes animal husbandry, whereas our index is based only on crop output. This does not make much difference, given the trends in animal husbandry income reported in Table 1, plus its small share in output.[17] Finally, the most difficult issue in comparing the data concerns the timing of the VLSS survey and the corresponding crop year in the yearbook. Households report output over the past 365 days (year). Given that interviews were spread (approximately) evenly over the survey year, most households report output from crops harvested in two calendar years. As an approximation, we thus "convert" the yearbook data to a typical VLSS household "reporting horizon," by averaging output between the current and past year. For example, 1993 output equals the average of 1993 and 1992 output. The plotted yearbook data are thus a moving average.

As shown in Figure 2, the two data sources line up remarkably well, especially if north and south are pooled. The growth rates by region (north and south) are also similar, however, the VLSS shows slightly more divergence between north and south. More specifically, for rice the yearbook data imply a 1998/1993 index of 122 for north, and 131 for south. This compares to 114 for north, and 135 for south based on the VLSS data. The indices for total output (dominated by rice) are 122 for north, and 140 for south, based on the yearbook, compared to 113 and 147 in the VLSS. Especially given the different sampling frames for these data, the series paint similar pictures: (1) growth is significantly higher in the south; and (2) growth in total output is higher than rice alone, especially in the south.

[17] The national data suggest that income from animal husbandry grew at roughly the same rate as that from crop production.

While Figure 2 provides strong corroboration for the agricultural data in the VLSS, it also provides a strong source of caution about the representativeness of the two sample years, 1993 and 1998. 1993 was an especially good year for agriculture in the north, and a slightly off-year in the south. This means that mean-reversion alone would generate higher growth rates in the south than the north. While the yearbook data do imply a divergence of north-south agricultural output, especially in non-rice, focusing on 1993-98 alone will exaggerate the trends.[18] Of course, we only have VLSS data from 1993 and 1998, so we cannot fully evaluate the robustness of our conclusions to the choice of survey years. That said, our conclusions that follow, based on the VLSS, must be placed in the broader context of the trends shown in Figure 2.

While we can only be suggestive about causal relationships, the growth in output and farm sales appears correlated with the reform and liberalization of both input and output markets. As reported in Table 2, over this short five-year period, we observed a marked increase (decrease) in the relative price of farm output (farm inputs). Overall, agricultural prices rose by 80 to 90 percent, compared to an increase of 45.6 percent in the CPI; fertilizer prices, on the other hand, rose only 10 percent. The behavior of these prices increased the returns to farming, and provided farmers powerful incentives for increasing output and sales. The more rapid growth in output in the south appears partially tied to more favorable movement in prices, as farm prices rose by more, and fertilizer prices rose by less than in the north.

4.3 Rice Output, Land, and Fertilizer Inputs

In Table 6, we provide a breakdown for all of Vietnam, and by north and south, of the growth in crop output and inputs, notably, land and fertilizers. Our eventual objective is to see to what extent changes in output can be explained by changes in inputs. The estimates in this table are based on the panel of households, restricted to those who farmed in both 1993 and 1998. Some of these numbers are not exactly comparable to those in Table 5 because of a reduction in the number of households that were farming between 1993 and 1998. Altogether, we see a

[18] Note that the 1986-1998 period shows a marked divergence between north and south: The index of 1998 total agricultural output relative to 1986 is 1.96 for the south, compared to 1.56 for the north. For rice, the corresponding 1998/1986 output indices are 1.87 for the south, and 1.64 for the north.

reduction of nearly 10 percent in the number of households farming over this five-year period.[19] Differences in samples give rise to modest differences between the two tables.

We focus on rice production and total crop production, highlighting the differences between the north and the south. In the north, rice production measured in physical terms grew 2.8 percent per year. This is less than half the rate of growth of rice production in the south, which was nearly 7 percent. The overall rate of growth of crop production was 8.9 percent per annum in the south, compared to 2.7 percent in the north. A likely explanation for these patterns is the differential effect of liberalization of rice marketing on the two regions, with the low-cost south taking advantage of the expanded export and domestic marketing opportunities for rice. The increase in rice production in the south did not seriously handicap the production of cash crops, however, which grew nearly seventy-five percent faster than rice output. In the north, relative price shifts also affected cropping decisions (see Table 5), but output growth of non-rice production was actually slightly lower than that for rice. One potential explanation is that in the north much of the shift was into perennials and fruits, both of which have 3-5 year lags in revenue generation.

Data on acreage and fertilizer input provide important initial clues as to the margins on which output in agriculture was able to expand. Over this five-year period, cultivated area increased slightly, averaging less than one-half of one percent per annum. This occurred largely in the south, and in the north cultivated area actually declined, largely from the decision of households to take swidden land out of production. Sown area also increased slightly—2 percent per annum nationwide—again largely because of increases in the south. In both regions we see a modest increase in the cropping intensity as measured by the multiple cropping index (MCI). In the north, however, this occurred largely because of a slight increase in sown area and larger reduction in cultivated area; in the south, on the other hand, it occurred because of growth in sown area more than double that in cultivated area.

With output in the aggregate growing at a rate in excess of 6 percent and sown area only 2 percent, it would appear that much of the increase in output is coming from increases in cropping intensity and higher yields. In this regard, the panel provides some insight into the role of increases in fertilizer inputs. The general tendency in both the north and south was for a

[19] Although some households that were not farming in 1993, farm in 1998, this increase is more than offset by the decision of a significant number of households to exit agriculture

reduction in the role of organic fertilizers in rice, and an increase in the use of commercial chemical fertilizers, largely consisting of urea, potassium sulphate, phosphates, and NPK. In real terms, commercial fertilizer use by these households increased slightly less than 10 percent per annum. For non-rice crops, we see some increase in the use of organic fertilizers, especially in the south, and even larger increases in the growth rate in chemical fertilizer use, as we would expect given the liberalization of the fertilizer market. For the entire sample, the application of commercial fertilizers on non-rice production grew nearly thirty percent per annum, with the annual growth in the south almost twice as high as in the north (34.1 percent versus 18.3 percent). As long as the increases in chemical fertilizer use are not being offset by the reduction in the application of organic fertilizers, real increases in the north and south in chemical fertilizer use are an important source of sown area yields.

4.4 Decomposition of Output Growth

In order to analyze the sources of output growth between 1993 and 1998, in Table 7 we report the results of a more formal decomposition exercise. Our primary objective is to estimate the contribution to the output growth of increases in input use versus increases in "total factor productivity." Estimating production functions for agriculture and dealing with a host of econometric issues, including the endogeneity and measurement error of inputs, is a paper in itself. We stop short of carrying out this full-blown exercise, but believe the results are still highly informative.

The basic idea of the exercise is straightforward. Assume that we know the production function for agricultural output, Y_{it}, for household i in year t:

$$\ln Y_{it} \equiv y_{it} = X_{it} b + u_{it}$$

where X_{it} is a vector of inputs, b is a vector of production function parameters, and u_{it} captures the impact of unobservables. We can decompose the change in output between two time periods as:

$$\overline{g} \equiv \Delta \overline{y}_{it} = b \Delta \overline{X}_{it} + \Delta \overline{u}_{it}$$

where $\bar{g}$ is the "growth rate", defined as the difference in log output between the two years, $\Delta y_{it} = \ln Y_{1998} - \ln Y_{1993}$. In order to execute this decomposition, we need estimates of the change in input use, ΔX_{it}, as well as the parameters of the production function. We also need to make some assumptions regarding the unobservables, u_{it}. For example, we could assume that the unobservables are the same (on average) each year, and so force the $\Delta \bar{u}_{it}$ term to equal zero. More plausibly, we could imagine that u_{it} has the following structure:

$$u_{it} = q_t + e_{it}$$

where q_t is a time effect, and e_{it} represents a mean-zero error term. The time effect q_t will capture improvements in productivity that allow all farmers (on average) to obtain more output from their inputs in time period t. This is commonly labeled "total factor productivity." Of course, the source of the time effect is not directly observable, and it could as easily reflect differences in "luck" between time periods. For example, we know from Figure 2 that output in the north was unusually high in 1993, and that this "blip" was unlikely due entirely to productivity differences in 1993.

We choose the following functional form for the production function:

$$\begin{aligned} y_{it} = {} & b_0 + b_1 SA_{it} + b_2 IRR_{it} + b_3 L_{it} + b_4 DK_{it} + b_5 K_{it} + \\ & + b_6 DOF_{it} + b_7 OF_{it} + \sum_{f=1}^{4} b_{8f} DCFERT_{fit} + \sum_{f=1}^{4} b_{9f} CFERT_{fit} + b_{10} Y98_{it} + e_{it} \end{aligned}$$

Essentially, this functional form specifies (log) output (y_{it}) as a function of log inputs, dummy variables (*D*) of whether the farmer uses the input, a time dummy to capture q_t ($Y98_{it}$), and the error term, e_{it}.[20] The inputs that we include are sown acreage (SA_{it}); the percentage of land that

[20] In order to get around the "log of zero" problem for input use, we specify log of input use as $\ln(1+X_{it})$. In general, this would not be the right approach, but our inclusion of the dummy variables for whether input use is non-zero tidies up the impact of this otherwise arbitrary transformation.

is irrigated (IRR_{it}); labor (L_{it}); the real value of farm capital (K_{it}); and the quantities of various types of fertilizer: organic (OF_{it}) plus the four chemical fertilizers, $CFERT_{fit}$ (urea, potassium sulphate, phosphorous, and NPK). This particular functional form enables us to deal with the fact that there are households for whom either farm capital (machinery and draft animal) or fertilizer use is zero.

In order to estimate the parameters of this production function, we pool the data for our panel of households that farmed in both years. We estimate production functions separately for rice, and for the gross value of crop output, measured in constant 1998 *dong*. We also estimate separate production functions for north and south Vietnam in order to allow for potential differences in technology and the productivity of the individual factors of production. Finally, we report two sets of results: OLS and Fixed Effects (OLS-FE). The motivation for using fixed effects is standard: unobserved farmer managerial ability, l_i, may be correlated with input use.[21] In this case, the error term $e_{it} = l_i + v_{it}$, and OLS will yield inconsistent estimates of b. This is a distinct possibility in our application, and may affect our attribution of increases in output to increased fertilizer use. For example, if only the best farmers use chemical fertilizers, then we will get an overstated estimate of the coefficient on chemical fertilizer. In that case, it will appear in the decompositions that the increased use of fertilizer explains most of the increase in output. The fixed effect specification has its own possible problems, especially in exaggerating measurement error in inputs. For this reason, we report both the OLS and OLS-FE results.

In the first half of Table 7 we report the results for rice. On the basis of the OLS parameters for the pooled sample, sown area, land quality, and chemical fertilizer use explain nearly 60 percent of the growth in rice output; the residual (time effect) represents the remaining forty percent. The latter includes the effect of new seed varieties as well as unmeasured labor effort, as well as improvements in productivity or better luck (e.g. rainfall). Decompositions based on separate parameter estimates for the north and south reveal a much larger role of the unexplained component for the south than the north. In the north, increased chemical fertilizer use explains more than two-thirds of the growth in paddy production, with the residual the source of twenty percent of the growth. By contrast, in the south, increased fertilizer use explains only twenty percent, and the residual (time effect) is almost one-half. This sharp contrast between

[21] This corresponds to Mundlak's original motivation for using a fixed effects specification for the estimation of farm production functions.

north and south disappears with the use of household fixed effects: In both regions, more than two-thirds of the increase in output can now be attributed to the residual. As suspected, the use of household fixed effects especially affects the estimated coefficients on chemical fertilizer, and thus the role of fertilizer in explaining growth. In general the parameter estimates for fertilizer are smaller using OLS-FE, with the difference with the OLS parameters greatest in the case of the north.[22]

In the bottom half of the table, we perform a similar exercise for the gross value of crop output. The only difference with the decomposition for rice is that we are now able to include labor as an input (which turns out to be a minor factor).[23] The OLS estimates suggest that almost all of the growth in output is coming from the tremendous increase in fertilizer use. The increase in total input use actually "over-explains" output growth, generating a negative residual. The contrast between the north and south here is particularly stark. In the north, there is a huge negative residual, while in the south slightly more than one-fifth of the increase can still be attributed to the residual. As we saw in the case of rice, using parameters from OLS-FE reduces the contribution of increases in input use (largely fertilizer) in explaining growth, and increases the size of the residual. However, there remains a significant negative residual in the case of the north, while in the south the residual is equal to nearly half of output growth over the period. For the north, some of this "negative" residual may be coming from the shift into perennials and tree crops observed in Table 5, which will not generate income for several more years. That would explain why inputs went up proportionately more than output. Some of the difference in relative performance in north and south may be due to "mean reversion" as suggested by Figure 2.

In summary, our main conclusions from this exercise are that (1) For rice, most of the increase in output cannot be explained by increased inputs. Of that part we can explain, increased use of chemical fertilizer was important; (2) For total output, more of the increase in output can be explained by increased inputs. Non-rice output increased significantly because of increased acreage (sown area), and especially the increase in chemical fertilizers. The unexplained component (productivity?) is positive in the south, and negative in the north. While this pattern is suggestive, and could reflect differences in incentives generated by liberalization and the returns

[22] Although the contribution of productivity growth measured in percentage terms is the same in north and south, the much higher growth in the south implies a much larger role of increases in productivity.
[23] Labour input is not broken down by crop in the survey.

to increasing specialization, there is no way these data alone can be used to confirm this hypothesis.

5.0 Agriculture and Inequality

In this section we explore some of changes in income distribution over the 1993-1998 period, with a focus on the potential impact of changing rice prices. Clearly, increased rice prices will benefit rice producers while hurting consumers. On a regional level, rice surplus regions will gain, while rice deficit regions lose. Moreover, to the extent there are supply and demand responses to the price changes, there may be changes in the pattern of rice marketing.

5.1 Rice Marketing

We begin with an exploration of the impact of rice-price changes on regional rice marketing and cropping patterns. A variety of indicators of rice production, sales, and consumption indicators are presented in Table 8. We divide the table into two parts. In Table 8A, we show the breakdown by urban and rural; north and south. In Table 8B, we provide a more detailed regional breakdown for rural areas.

We can quickly summarize the urban patterns. First, there are very few producers in urban areas. In 1998, 10 percent of urban households grew rice, a decline of 3 percentage points from 1993. Thus, slightly less than a quarter of the urban rice growers in 1993 stopped farming rice (even more in the north). Deflating by the CPI, real consumption expenditures on rice increased from 1602 to 1868 (thousand dong) per household. Most of the increased expenditure comes from the higher relative rice prices, as household physical consumption of rice declined slightly, from 568 to 537 Kg per household. Recall, however, that household size fell, so per capita rice consumption actually increased slightly in urban areas. Finally, the share of rice in non-durable expenditures declined from 0.18 to 0.14. This decline is in line with what we expect from the Engel curve for rice, given that incomes almost doubled in urban areas (See Table 4).

Looking at the combined rural areas for north and south, the value of rice produced increased by almost one-third. While this is due partially to the increase in relative rice prices, it also reflects an increase in rice production from 1119 to 1505 Kg per household. Given that the percentage of households growing rice declined from 85 to 79, this means that rice farmers were

producing about 35 percent more rice per producing household. In comparing north and south, both areas experienced increases in output, but the largest increase by far was in the south where prices increased the most. Most of the extra rice produced was sold to the market, as household rice consumption stayed the same in both north and south. In the two regions combined, 46 percent of farmers sold rice in 1998, compared to 42 percent in 1993. At the same time, farmers in the south also purchased more rice in 1998 than 1993, so that commercial involvement in rice markets was more important from both the production and consumption sides of the market, at least in the south. Rice expenditure shares remain much higher than in urban areas, but they did decline from 0.33 to 0.28 over the 5-year period.

Interesting regional patterns emerge as we look at changes in the rice surpluses. Looking at Rural north and south alone, the northern surplus rose only slightly, from 228 to 302 (thousand dong), where surplus is defined as the per-household difference in value of production and consumption. While households produced more rice in the north, they increased their purchases just as much. The rice surplus position of southern households increased dramatically, from 1738 (thousand dong) in 1993 to 2901 in 1998. The extra production went to exports, as well as increased purchases by households in the north and in urban areas. Thus, at least at this coarse level, changes in marketing patterns match up with our expectations given the changes in relative producer prices.[24]

Table 8B shows detail by sub-regions. Here, we see even stronger patterns of specialization in rice. The northern Uplands goes from a rice deficit of 234 (thousand dong) in 1993 to a deficit of 384 (per household) in 1998. The Red River Delta, the main rice-growing region of the north saw its surplus increase from 678 to 1090, while the northern Coastal region went from small surplus to small deficit. Notice, however, that the apparent lack of change in this region hides largely offsetting increases in production and consumption.

In the southern regions, we see more pronounced specialization. In the Central Highlands, the rice deficit increases from 1307 (thousand dong) to 2070 per household. On the other hand, there are sizable increases in the surplus produced in Central Coastal (49 to 535) and southeast (308 to 853) regions. But the most dramatic change is in the Mekong River Delta, where the household surplus goes from 3011 to 5200, despite an increase in rice consumption of

[24] In physical terms, the north goes from a slight per household deficit of 138.4 kg to a surplus of 116.3, while in the south, the surplus per household goes from 632.4 kg to 2009.1 kg. Differences in producer and consumer prices explain the fact that in value terms the north was in surplus in 1993.

almost 500 (thousand dong). It appears that at the household level, more households are relying on the market for their rice, while at the national level more regions are becoming "rice importers," with the Mekong River Delta producing a growing share of national rice output.

5.2 Changing Rice Prices and Inequality

We know that in total, rural income inequality declined in the south, while income differences widened between north and south. Is this linked to rice? To address this question, we need to know within each region where the winners and losers from rice-price changes are in the income distribution. If rice farmers were concentrated at the bottom or middle of the income distribution in the south, reported price changes could lead to changes in line with those just described. Alternatively, the changes in income inequality may have nothing to do with rice. Many factors were changing besides increases in rice prices.

In this section we employ the methodology outlined by Deaton (1989 and 1997) to explore the association between benefits of rice price changes and a household's position in the income distribution. It is worth a brief review of the theoretical motivation underlying the empirical analysis, even though the intuition is straightforward. Following Deaton's notation, household welfare can be summarized by the indirect utility function:

$$u_h = y\,(wT + b + p\,,\,\vec{p})$$

where household "full income" is the sum of the value of the labour endowment, wT, unearned income, b, and farm profits, p; and $\vec{p}$ is a vector of consumption prices. If we assume that the producer and consumer price of rice is the same (which it isn't), then the change in household welfare associated with change in rice prices is:

$$\frac{\partial u_h}{\partial p} = \frac{\partial y}{\partial b} \bullet \frac{\partial p}{\partial p} + \frac{\partial y}{\partial p} = \frac{\partial y}{\partial b} \bullet (y - q)$$

i.e., the effect of a change in income on household welfare, scaled by the difference between production (y) and consumption (q) of rice. Not surprisingly, welfare increases for those households that are in a surplus position, and decreases for net consumers of rice. Note that the assumption in this formula (as simplified here) is that there is no supply or demand response: This gives us a first-order approximation of the welfare change associated with a small price

change. Clearly, households adjust their behaviour to larger price changes, and this will add additional terms to the formula as producers produce more rice, and consumers reduce rice consumption. These changes will attenuate the potentially adverse impact of an increase in producer prices, while compounding the benefits.

Utilizing the equation above, we ask how much income we have to give households in order to restore them to the original level of welfare:

$$dB = (q - y)dp = p(q - y)d\ln p$$

so that the amount of compensation depends on the net consumption position of the household, scaled by the price change. We express the marginal compensation, dB, as a share of household expenditures:

$$\frac{dB}{x} = \left(\frac{pq - py}{x} \right) d\ln p$$

which Deaton calls the "net consumption ratio." Our focus is on the negative of this expression, the net benefit ratio: The value of production minus the value of consumption, relative to household expenditures. Clearly, we expect households to be relatively better off with an increase in rice prices if they are net sellers of rice. Because of the divergence between producer and consumer rice prices, however, it also makes sense to look at the components of this expression separately. We define the "production ratio" to be the ratio of the value of rice production to total expenditures, and the "consumption ratio" to be the ratio of the value of rice consumption to total expenditures (which is just the rice budget share).

Our specific interest is in the correlation of the benefit ratio with the position of the household in the income distribution, as summarized by log of household per capita expenditures ($\ln pcx$). A useful starting point for our discussion is the results reported by Minot and Goletti (1998). They use the 1993 VLSS to calibrate a structural spatial model of rice markets in Vietnam, in order to simulate the distributional impact of a relaxation of the rice export quota. Their focus, as ours, is on the impact of the change in rice prices on household welfare, as summarized by the net benefit ratio. Their main conclusions are: (1) Higher rice prices will exacerbate regional income inequality; (2) Higher rice prices will worsen the within-region inequality, because rural poor would be hurt more than urban poor; and (3) Higher rice prices will still yield net benefits to the poor, through higher incomes, and therefore reduce poverty. We

do not directly address their second point, since we prefer not to pool urban and rural households in the welfare analysis. However, our results using the 1998 data directly address their other predictions.

In addition to the benefit of having more data, which allows us to estimate rather than simulate the impact of the price increase, we also note that some of the assumptions in their analysis do not ultimately hold. For example, consumer prices actually rose more than producer prices (they assume the reverse). The divergence of consumer and producer prices provides an "interpretation challenge" to both their conclusions, and our approach. Most importantly, and perhaps not surprisingly, many other factors that Minot and Goletti hold constant changed, notably the increase in incomes, and the decrease in fertilizer prices. Both of these factors lead to rice supply and demand responses that are not easily anticipated.

Following Deaton, we estimate nonparametric regressions of the association between rice benefit ratios and income ln*pcx*.[25] The resulting graphs provide a clear picture of who the relative winners and losers from price changes are. As there are very few rice producers in urban areas, these households' net benefit ratios are essentially their rice budget shares. The welfare losses associated with rice price increases will thus be in direct proportion to rice consumption. Since rice expenditure shares are higher for lower income households (as the Engel curve clearly shows), then in relative terms the poor will be most adversely affected by the price increase, and the price increase will worsen inequality of welfare (all else equal). We do not show the results of this exercise, but focus instead on the rural households, where the story is more complicated.

The results are presented in Figure 3 (Rural north) and Figure 4 (Rural south). We show three sets of graphs: the net benefit ratio, the production ratio, and the consumption ratio. We show these variables separately for 1993 and 1998, since it is unrealistic to imagine that the results from a single point in time will apply over the entire 5 year period, given all of the other changes in rice production, consumption, and household incomes. Indeed, the theory outlined above refers to the impact of marginal changes in prices on household welfare, holding everything constant. Over the five-year period, the rice price changes were far from marginal, and little was constant. We also show changes in the rice variables over the 5-year period, and how these changes relate to a household's position in the original 1993 income distribution. With this set of graphs, we can look at relative improvements in living standards associated with

[25] Specifically, we employ the Fan non-parametric regression estimator, as described in Deaton (1997), Chapter 4.

changes in rice marketing. On each figure, we present two reference bars, corresponding to the 25th and 75th percentiles of the ln*pcx* distribution. Note that while the domain of ln*pcx* includes all of ln*pcx*-axis, most of the observations are concentrated in the middle of the figures, so most inferences should be drawn from the shapes of the estimated functions in the middle of the graphs. Finally, the dashed lines represent the bootstrapped 95% confidence intervals for the regression line.

First consider results from the north. The first panel (Panel A) shows the net benefit ratio for 1993, alongside which we present (in Panel B) the corresponding figure for 1998. Panel A shows that the net benefit of a rice price increase (given the values of variables in 1993) was positive, in the 0.10 range. This means (approximately) that the difference in value between rice production and consumption is 10 percent of income. The net benefits declined slightly with lnpcx, suggesting that the benefits were proportionately concentrated among lower income households. By 1998, panel B suggest that the net benefits are lower, especially at the lower end of the income distribution. In fact, the net benefits are negative for the poorest households. This can arise, for example, because consumption prices have risen faster than producer prices, and rice consumption remains especially important in the consumption basket of the poor. In Panel C, we look at the change in the net benefit ratio. This is the change in the household rice surplus, as a percentage of 1993 income (consumption). Clearly, households in the bottom 25 percent saw declines in their rice surplus position. For the majority of households in the north, the change in rice surplus was barely positive, slightly more so for richer households.

We get a slightly clearer understanding of what was happening by splitting the net benefit ratio into its production and consumption components. In Panels D, E, and F we see that revenue from rice production represents a significant fraction of household income, and that the importance of rice declines with household income (lnpcx). So on the income side, increases in rice prices are strongly pro-poor. This relationship shifts down somewhat between 1993 and 1998. Still, as we can see in Panel F, the combined impact of higher rice prices and greater rice output yielded benefits that were concentrated among lower income households. Whatever else was going on in terms of income generation, the liberalization of rice markets seems to have unambiguously served to reduce income inequality. But income does not translate directly into welfare (as the net benefit ratios show). In panels G, H, F we see that higher rice prices for consumers offset most of the gains to income. The consumption ratios are essentially Engel

curves, and they have the expected negative slope (as we saw in the regressions reported in Table 4). In Panel I, we can see the very steep relationship between changes in rice expenditures and a household's lnpcx. Poor households increased their rice expenditures significantly more (as a percentage of consumption) than rich households. As a result, the burden of the consumer rice price increases fell disproportionately on them. As we saw in Panel C, for the poorest households, the increase in consumer prices far outweighed the gains from higher producer prices.

In Figure 4 we report the results for the south. The patterns are similar to those in Figure 3 with one main exception: the net benefits are much higher in the south. Looking across Panels A to C, we see that the net benefits are higher each year than in the north, and are also positive for most households in the income distribution. In fact, Panel C shows that there were many more winners from liberalization in the south, as most households saw an increase in their rice surpluses. Furthermore, if anything, these net benefits were concentrated in the middle of the distribution. Whether this reduced the inequality of welfare depends on the social welfare function used to weigh the social benefits of income to rich and poor households, and associated inequality index. Still, it does not appear that benefits accrued disproportionately to the better off, which would have unambiguously increased inequality.

The disaggregated figures are also informative. The consumption pictures are similar to those for the north, but the production figures are striking, and tell most of the story. While the benefits to rice revenue of higher rice prices are more evenly spread out in 1993, in 1998, the distributional impact of higher prices may still have served to equalize incomes, especially increasing incomes in the middle of the lnpcx distribution. In general, the change in the rice production ratio shows that households in the south benefited proportionately more than those in the north, and that the increases in income from higher rice output and higher prices were shared relatively equally. This goes some way towards explaining why income inequality fell in the rural south.

In summary, liberalization of rice prices has been a double-edged sword, increasing the incomes of the poor, especially in the south; but also increasing the cost of food, which falls most heavily on the poor. On balance, except for the very poorest farmers, southern farmers across the income distribution benefited from the changes, while most northern households are slightly better off, except at the bottom of the income distribution. Note, however, that these

conclusions ignore the fact that overall incomes in both the north and south have increased, and that rice price liberalization may have facilitated the movement of northern farmers out of rice and into other crops. It is also not obvious why such a gap has emerged between the producer and consumer prices. If people are voluntarily choosing to buy better quality rice, for example, some of the adverse impact of the increase in rice consumer prices will be overstated. Our results suggest, however, that in terms of rural welfare, there remains room for further liberalization in rice marketing.

5.3 The Contribution of Agriculture to Income Inequality

In our final exercise, we examine the degree to which agriculture, and possibly increasing inequality of agricultural income, contributes to overall inequality. We do so by decomposing total income inequality by income-source using a method developed by Shorrocks (1982, 1983), and applied by Benjamin, Brandt, Glewwe, and Guo (2002). Shorrocks shows that under reasonable assumptions, a decomposition of total inequality by source of income can be calculated, whereby the decomposition applies to any inequality index. Basically, the decomposition allows us to answer the question: "what fraction of total income inequality is generated by inequality of income from income source, *k*?" Assuming that there are *k* sources of income, e.g. income from farming, wages, etc., the proportion of total inequality in, S_k, deriving from y_k is given by:

$$S_k = \frac{\text{cov}(y_k, y)}{\text{var}(y)}$$

where y_k is the income derived from source *k*, and *y* is total household income. We can easily estimate S_k by the following regression:

$$y_{kh} = b_0 + b_k y_h + e_h$$

The coefficient b_k yields our estimate of S_k.

The key question is how we interpret S_k (i.e., when is it "big" or "small"?). One benchmark is to compare S_k to zero. If S_k is negative, increases in the inequality of income source *k* will actually reduce inequality, reflecting the fact that y_k is an income source earned primarily by the poor. Alternatively, we can compare S_k to W_k, where W_k is the share of income

derived from source k. Since the rich tend to earn more income from all sources, increases in inequality of any type of income will increase overall income inequality. However, some sources will be relatively less disequalizing, and W_k is a useful benchmark. If S_k is greater than W_k, increases in the inequality of the distribution of y_k can viewed as disproportionately increasing income inequality, whereas if $S_k < W_k$, the income source is relatively less disequalizing.

We also consider two statistical issues that may affect the interpretation of the decomposition. First, we may want to "net out" the spatial contributions to inequality. For example, it may be that non-farm income generates most inequality. However, this may simply reflect the possibility that areas with greater non-farm incomes are richer. While the decomposition would correctly attribute total inequality to non-farm incomes, the results would not imply that increases in non-farm income in poorer areas would increase inequality. We can evaluate the sensitivity of our conclusions to spatial variation in the composition of income by allowing for cluster fixed effects, and identifying b_k from the within-cluster variation in incomes. A second issue in the decomposition is measurement error. Any mis-measurement of an income source will lead to a spurious positive relationship between y_k and y. Again, the OLS decomposition is mechanically correct, but interpretation is difficult. Essentially, we are trying to estimate the correlation between a given income source, and a household's position in the income distribution. The measurement error in this case could either lead to an overstatement of this relationship, or an understatement (through conventional attenuation bias). A standard fix-up for this type of measurement error would be to use an alternative estimate of the household's position in the income distribution as an instrument. In this case, we use household per-capita consumption as an instrument for per-capita income.

In Table 9, we report the results of the decompositions separately for 1993 and 1998. Our sample here, as before, is the panel of households for which we have data for both 1993 and 1998. We report three alternative estimates: OLS, OLS with cluster fixed effects, and 2SLS with cluster fixed effects, where we instrument total income by consumption in order to adjust for possible measurement error in living standards.

Our focus here is on the changing role of agriculture in inequality. We begin with rural Vietnam (north and south combined). As we've seen before, farming represents a significant portion of rural household income. In 1993, its share was 42.3 percent and in 1998 it was only

slightly lower at 34.7. All but a small percentage of this is income from crop production. (The rest is the value of crop by-products.) For 1993, our OLS estimate for S_k is 0.141, which is considerably less than that of farming's share. Adding cluster effects has no impact on this estimate, while the 2SLS estimate is 0.290, which is larger than OLS. To a large extent, this arises because of the spillovers from correcting the measurement error in income from family run businesses. Family business income is notoriously difficult to measure, and this almost certainly contaminates the OLS estimates of the decomposition. Even after instrumenting, the contribution of family business income to total inequality significantly exceeds its income share. However, the OLS estimates are even higher, which (because of adding up) leads to an under-estimate of the impact of agricultural income on overall inequality. Throughout our remaining discussion, we will focus on the 2SLS estimates.

Turning to the 1998 figures, the contribution of agriculture to inequality has risen to 0.229, but it is still lower than agricultures share of income (0.347). The next two panels of the table provide the breakdowns by north and south. One finding worth noting is the strongly equalizing impact of wage income: clearly, it appears that the development of off-farm labour markets will improve income inequality. Another finding common to both regions is that inequality of income from family businesses is the largest contributor to overall income inequality. In the north, the impact of farming on income inequality fell from 1993 to 1998 (as did the share of income from farming) while it rose slightly in the south (with only a slight decline in its importance). Given the results from the previous section, it appears that inequality of non-rice farm income may be generating some income inequality. However, the overall conclusion that we draw from this exercise is that inequality of farm income is *not* the primary source of inequality in rural areas. Concern that agricultural reforms may have adverse distributional consequences, because of increasing inequality in farm incomes, seems unwarranted.

6.0 Conclusions

While there have undoubtedly been continuous changes—both subtle and not-so-subtle—in the institutional environment in which farmers make decisions, the most dramatic and observable changes over the 1993-1998 period involved liberalization of the rice market. We exploit the panel dimension of the rich VLSS in order to document changes in prices, and explore the possible impact of these changes on efficiency and equity in rural Vietnam. Using these data, we draw the following conclusions:

1) Prices in the VLSS data reflect the main policy changes: (i) rice producer prices rose in all regions, but especially the south, where the implicit tax of the export quota had most depressed prices; (ii) fertilizer prices declined dramatically in all regions. It also appears that the rice market became more integrated, as the variation in rice producer prices fell between 1993 and 1998, and the correlation of price with region also declined.

2) Rural households experienced rapidly rising incomes over this period, and some of this increase can be directly (and indirectly) linked to rice market liberalization. First, even if there was no behavioral response by farmers, the higher rice prices that arose from the reforms significantly increased the value of rice output, while the sharp drop in fertilizer prices cut farm costs. Second, the increased incentives in rice farming "line up" with the anticipated behavioural response: Rice output increased, especially in the south where prices rose the most, and farmers made considerable increases in their use of fertilizer, further improving yields.

3) Despite the direct linkages between rice market liberalization and income, however, we find the greatest increases in agricultural output occurred in non-rice crops. While cheaper fertilizer may have facilitated this expansion, the primary driving forces appear to have been changes in local food demand patterns, combined with broadening export opportunities, that provided incentives for farmers to expand their non-rice production, especially of perennials.

4) The changing patterns of returns to various agricultural activities also appears to have shifted geographic patterns of production and marketing, with rice production shifting to the south, and the north moving towards non-rice crops. At the same time, there were significant increases in the amount of domestic trade in rice, both at the national and household levels: Vietnamese households are increasingly reliant on markets for obtaining rice.

5) Not surprisingly, given that the burden of the export quota fell most heavily on the south, especially farmers in the Mekong River Delta, a relaxation of the quota yielded disproportionate benefits for southern farmers. This served to widen regional income differences, as relative rice production and incomes returned to historical patterns of specialization.

6) However, total rural income inequality did not increase, despite the increased regional inequality. This occurred because of significant reductions of inequality among southern households. We showed that in both the north and south, increased producer prices for rice primarily benefit poorer and middle-income farmers. The increases in incomes from rice thus tended to equalize household incomes. To some extent, the corresponding increases in consumer prices "undid" these benefits, especially for the urban poor. However, we do not find that among rural households, taking into account the increases in rice consumer prices, the overall (net) impact of the increase in rice prices had an adverse impact on inequality.

7) We do not find evidence of increasing income inequality within regions, and moreover, we find that, compared to other sources of income (like family run businesses), inequality of agricultural incomes contributes less than its share to total inequality. This suggests that policy makers need not be concerned about adverse linkages between further agricultural liberalization, and income inequality.

In summary, we find that the agricultural reforms had a largely beneficial impact on the well-being of rural households throughout Vietnam. An important next question is whether we can expect these benefits to continue. There are certainly reasons to be cautious in extrapolating results from the 1993-1998 period to the next five years. First of all, to the extent that increased

use of fertilizer is driving improved yields, there are technological limits as to the extent that additional fertilizer can further increase yields. Second, if the incentives to cultivate rice more intensively or more efficiently are driven by increased rice prices—or a continuation of other institutional reforms—again, we expect a limit to the opportunities for this type of growth as prices converge to international levels. Again, technological constraints eventually dominate improvements in incentives. Finally, one has to be careful in extrapolating time trends from any two years of data. As we saw when comparing the VLSS data to aggregate data, the overall trends we observed from 1993-1998 are consistent with aggregate trends. However, the relative performance of south and north that we observe may, in part, reflect "mean reversion," in that 1993 was a relatively good year for the north, compared to 1998 for the south. There may also be lags in the realization of output of perennials, especially in the north, so that the observed divergence is transitory. That said, the broad picture provided by the VLSS suggests that even over the brief span of five years, farmers responded to the changes in their economic environment generated by the reforms, and that these responses are not likely to be reversed in the years ahead.

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Table 1
Household Incomes by Source

	1993					
	Urban			Rural		
	North	South	Total	North	South	Total
Total Income (1)	12801.5	17993.6	15852.7	7613.0	8779.3	8110.8
Total Income (2)	10625.1	14021.8	12621.2	6914.3	7782.1	7284.7
By components:						
Wages	2456.5	4261.8	3517.4	475.1	1355.7	850.9
Family Business	3163.8	4876.4	4170.3	1081.1	1548.2	1280.4
Farming	733.5	414.8	546.2	3529.1	3779.7	3636.0
Livestock	221.7	-29.2	74.3	807.8	246.8	568.3
Other	4049.6	4497.9	4313.1	1021.2	851.8	948.9
Services, Durables	2176.3	3971.8	3231.5	698.7	997.2	826.1
Household Size	4.2	5.7	5.1	4.8	5.5	5.1
Per Capita Income (1)	3062.9	3234.0	3174.8	1604.9	1629.7	1616.3
Per Capita Income (2)	2547.9	2533.4	2538.4	1458.3	1449.7	1454.3
Per Capita Consumption (1)	2503.5	2789.0	2690.2	1387.2	1612.0	1490.3
Per Capita Consumption (2)	1988.6	2088.4	2053.8	1240.6	1432.0	1328.4
Gini, PC Income (1)	0.49	0.50	0.50	0.37	0.46	0.41
Gini, PC Income (2)	0.51	0.52	0.52	0.37	0.48	0.42
Gini, PC Consumption (1)	0.32	0.34	0.34	0.24	0.29	0.27
Gini, PC Consumption (2)	0.29	0.29	0.29	0.22	0.27	0.25
	1998					
	Urban			Rural		
	North	South	Total	North	South	Total
Total Income (1)	23505.3	29598.6	27086.1	11798.4	17092.1	14057.6
Total Income (2)	19314.9	23845.0	21977.0	10244.7	15186.6	12353.8
By components:						
Wages	5058.5	6759.5	6058.1	1057.2	2784.3	1794.3
Family Business	5607.5	11055.1	8808.8	2103.4	3453.7	2679.7
Farming	1052.9	654.3	818.7	3924.6	6425.1	4991.8
Livestock	453.3	136.3	267.0	1433.2	1032.4	1262.1
Other	7142.6	5239.9	6024.5	1726.4	1491.1	1625.9
Services, Durables	4190.4	5753.6	5109.0	1553.6	1905.5	1703.8
Household Size	4.0	4.9	4.5	4.6	5.2	4.8
Per Capita Income (1)	5871.9	6115.5	6026.1	2597.1	3305.7	2922.0
Per Capita Income (2)	4825.1	4931.5	4892.5	2256.5	2939.1	2569.5
Per Capita Consumption (1)	4360.3	4685.6	4566.2	2219.1	2530.0	2361.6
Per Capita Consumption (2)	3313.5	3501.5	3432.5	1878.5	2163.4	2009.1
Gini, PC Income (1)	0.42	0.44	0.43	0.39	0.42	0.41
Gini, PC Income (2)	0.44	0.43	0.44	0.39	0.42	0.41
Gini, PC Consumption (1)	0.32	0.35	0.34	0.27	0.29	0.28
Gini, PC Consumption (2)	0.30	0.29	0.30	0.25	0.27	0.26

Notes:
1/ All values are presented in 1998 currency, and are also deflated by regional and monthly price indices.
2/ Income (1) is total income from all components listed in the table, while Income (2) is the same measure, but excluding imputed income from durables and owner-occupied housing. The same distinction holds for consumption(1) and (2).
3/ Means are calculated over the panel households.
4/ The means for the per capita variables (consumption and income) are weighted by household size.
5/ Gini's are calculated over those households with positive income, and are weighted by household size.

Table 2
Selected Price Indices for 1998/1993, Rural Vietnam

	North	South
Crop Producer Prices		
Rice	1.62	1.83
Non-rice	1.97	2.26
All crops	1.83	2.05
Other Staples	2.07	1.73
Vegetables	2.36	1.86
Annual Industrial Crops	1.45	1.74
Perennial Industrial	2.63	3.19
Fruit	1.93	1.88
Selected Foods (Consumer)		
Rice	1.85	2.13
Pork	1.54	1.54
Beef	2.06	1.73
Chicken	1.61	1.60
Tofu	1.46	1.35
Cabbage	2.33	1.76
Tomatoes	2.94	1.73
Oranges	1.80	1.63
Bananas	1.74	1.66
Fertilizer		
Urea	1.13	1.14
Potassium Sulfate	1.62	1.12
Phosphates	1.41	1.13
NPK	0.48	0.51

Notes:
1/ Each index represents the relative price in the 1998 sample to the 1993 sample.
2/ The crop prices are calculated from unit values in the crop sales part of the household surveys. The indices are based on weighted averages of price changes for the commodity group, where the base year weights are calculated in 1993. The crop unit values are calculated for all panel households. The constituent price ratios are calculated on the basis of sales-weighted average prices.
3/ The "Selected Foods" and Fertilizer prices are taken from the Community Price surveys, and are the simple ratio of average prices in the two surveys.

Table 3
Rice "Prices" Across Time and Over Space

	Consumer Prices		Producer Prices	
	1993	**1998**	**1993**	**1998**
Prices in 1998 (1000 Dong)				
Rural North	2.71	3.35	2.55	2.83
Rural South	2.58	3.45	1.92	2.43
Rural Vietnam	2.63	3.42	2.03	2.50
Urban North	2.91	3.29		
Urban South	2.81	3.65		
Urban Vietnam	2.85	3.50		
ANOVA				
Variation of Logs	48.40	78.42	108.83	52.29
Explained by Region	7.09	4.43	28.78	5.19
(F-statistic)	(80.5)	(30.2)	(105.4)	(41.01)
R-squared	0.22	0.25	0.39	0.36
Unit Value Income Elasticities:				
Urban North	0.03 (3.5)	0.10 (6.0)		
Urban South	0.08 (8.8)	0.14 (11.1)		
Rural North	0.02 (2.0)	0.04 (3.4)		
Rural South	0.05 (6.0)	0.10 (10.9)		

Notes:
1/ All "prices" are really unit values, taken as the ratio of the value of rice purchased or sold, to the quantity.
2/ Consumer prices are expressed as 1000 Dong per kilogram of purchased rice. The average unit values (prices) are weighted by the value of purchases. 1993 prices are expressed in 1998 values, inflated by 1.456.
3/ Producer prices are expressed as 1000 Dong per kilogram of sold rice (paddy converted to rice by a factor of 0.66). The average unit values (prices) are weighted by the value of sales. 1993 prices are expressed in 1998 values, inflated by 1.456.
4/ The variation of logs is the total variation of log prices. The variation explained by region is the total explained variation (by region) in an ANOVA decomposition, including monthly dummies. The F-statistic is the F-statistic for the significance of the Region effects, while the R-squared is the fraction of total variation explained by month and region.
5/ Income elasticities are the estimated coefficients from a regression of log unit value on log per capita total expenditures and month dummies for each year and region. t-values are in parentheses.

Table 4A
Food Demand Patterns and Expenditure Elasticities (Urban)

	Per Capita Real Expenditures (1000 Dong)		Shares			
	1993	**1998**	**1993**	**1998**	**Expenditure Elasticity**	**Unexplained (1998-1992)**
Urban North						
Per Capita Consumption	2279.1	3587.3				
Food Expenditures	1490.9	2050.5	0.67	0.62	0.82	
Rice	380.6	433.3	0.32	0.25	0.49	
Other Grains	69.5	98.1	0.04	0.05	0.96	
Meat	352.9	473.5	0.22	0.23	1.27	-
Oils	20.7	47.3	0.01	0.03	0.83	+
Fish	100.5	141.6	0.07	0.07	1.00	
Other Protein	72.7	88.3	0.05	0.05	0.85	
Vegetables	70.0	96.1	0.05	0.05	0.56	+
Fruit	68.5	97.6	0.04	0.04	1.32	
Other Foods	208.2	314.9	0.13	0.14	1.28	-
Food Away from Home	144.9	254.5	0.06	0.10	1.86	
Urban South						
Per Capita Consumption	2605.7	4248.0				
Food Expenditures	1503.0	2264.6	0.59	0.57	0.82	+
Rice	294.8	421.9	0.25	0.23	0.41	+
Other Grains	93.9	83.7	0.06	0.04	1.11	-
Meat	286.1	409.3	0.17	0.17	1.41	-
Oils	36.5	46.3	0.03	0.02	0.75	-
Fish	166.0	248.9	0.11	0.11	0.94	
Other Protein	58.2	60.2	0.04	0.03	0.64	-
Vegetables	75.3	121.0	0.05	0.06	0.63	+
Fruit	68.8	101.4	0.05	0.04	1.16	-
Other Foods	202.3	265.5	0.13	0.12	1.15	-
Food Away from Home	221.1	504.7	0.10	0.19	1.59	+

Notes:

1/ The first two columns show the average household per capita expenditures on a specific food group, expressed in 1998 prices. The third and fourth columns give the budget shares of each food group, as a share of total food expenditures.

2/ Total per capita expenditure is total non-durable expenditures.

3/ The fifth column reports the estimated expenditure elasticity, estimated at the average budget share, from a regression of the budget share on the log per capita expenditure, demographic controls, and commune fixed effects. The regression is estimated over all panel households, pooled over the two sample years, and includes a year dummy.

4/ The last column reports the result of a test of whether the food share in 1998 is statistically significantly higher than predicted from the Engel curve (i.e., the t-statistic on a year dummy in the Engel curve regression). If the food share in 1998 is higher than predicted by income and demographics, we report "+", while if the food share in 1998 is less than predicted, we report a "-".

Table 4B
Food Demand Patterns and Expenditure Elasticities (Rural)

	Per Capita Real Expenditures (1000 Dong)		Shares			
	1993	**1998**	**1993**	**1998**	**Expenditure Elasticity**	**Unexplained (1998-1992)**
Rural North						
Per Capita Consumption	1225.6	2001.1				
Food Expenditures	872.8	1277.3	0.73	0.68	0.78	+
Rice	421.9	518.1	0.51	0.44	0.64	
Other Grains	42.7	50.6	0.05	0.04	1.00	-
Meat	139.8	245.0	0.15	0.18	1.48	-
Oils	8.5	32.1	0.01	0.03	1.12	+
Fish	56.8	92.1	0.06	0.07	1.25	
Other Protein	24.4	43.6	0.02	0.03	1.48	+
Vegetables	43.0	58.1	0.05	0.05	0.87	
Fruit	17.9	37.5	0.02	0.03	1.59	+
Other Foods	104.0	157.5	0.12	0.12	1.24	-
Food Away from Home	9.1	36.0	0.01	0.02	2.71	
Rural South						
Per Capita Consumption	1605.0	2396.8				
Food Expenditures	971.0	1405.5	0.63	0.62	0.80	+
Rice	374.6	500.9	0.43	0.40	0.63	+
Other Grains	45.0	40.5	0.04	0.03	1.35	-
Meat	143.1	240.5	0.13	0.16	1.50	
Oils	23.8	34.2	0.03	0.02	0.80	
Fish	113.9	161.4	0.11	0.11	0.99	
Other Protein	20.1	31.3	0.02	0.02	1.19	
Vegetables	44.3	80.1	0.05	0.06	0.85	+
Fruit	35.3	48.9	0.03	0.03	1.40	-
Other Foods	137.9	172.4	0.13	0.12	1.15	-
Food Away from Home	32.0	94.4	0.02	0.05	2.35	+

Notes:

1/ The first two columns show the average household per capita expenditures on a specific food group, expressed in 1998 prices. The third and fourth columns give the budget shares of each food group, as a share of total food expenditures.

2/ Total per capita expenditure is total non-durable expenditures.

3/ The fifth column reports the estimated expenditure elasticity, estimated at the average budget share, from a regression of the budget share on the log per capita expenditure, demographic controls, and commune fixed effects. The regression is estimated over all panel households, pooled over the two sample years, and includes a year dummy.

4/ The last column reports the result of a test of whether the food share in 1998 is statistically significantly higher than predicted from the Engel curve (i.e., the t-statistic on a year dummy in the Engel curve regression). If the food share in 1998 is higher than predicted by income and demographics, we report "+", while if the food share in 1998 is less than predicted, we report a "-".

Table 5
Crop Output, Acreage, and Sales: Shares, 1993 and 1998

	Output		Acreage		Sales	
Vietnam	**1993**	**1998**	**1993**	**1998**	**1993**	**1998**
Rice	0.643	0.533	0.665	0.641	0.464	0.409
Other Staples	0.055	0.044	0.098	0.068	0.039	0.019
Vegetables	0.066	0.064	0.045	0.039	0.095	0.067
Non-food crops	0.149	0.239	0.099	0.145	0.260	0.342
Fruits and Perennials	0.087	0.120	0.093	0.107	0.142	0.163
Totals	3143.9	4421.1	9622.9	10951.4	1275.3	2654.5
Percentage Output Sold					0.406	0.596
North	**1993**	**1998**	**1993**	**1998**	**1993**	**1998**
Rice	0.653	0.576	0.591	0.576	0.383	0.379
Other Staples	0.097	0.093	0.184	0.132	0.106	0.054
Vegetables	0.080	0.101	0.053	0.048	0.155	0.153
Non-food crops	0.107	0.135	0.088	0.106	0.211	0.232
Fruits and Perennials	0.063	0.095	0.084	0.138	0.145	0.182
Totals:	2418.0	2857.6	7025.0	7499.6	544.9	949.9
Percentage Output Sold					0.225	0.332
South	**1993**	**1998**	**1993**	**1998**	**1993**	**1998**
Rice	0.635	0.508	0.722	0.684	0.492	0.417
Other Staples	0.020	0.016	0.030	0.026	0.016	0.011
Vegetables	0.053	0.043	0.040	0.033	0.074	0.045
Non-food crops	0.185	0.300	0.108	0.171	0.276	0.369
Fruits and Perennials	0.108	0.134	0.100	0.086	0.142	0.158
Totals:	4229.2	6625.8	13507.2	15885.5	2367.2	4979.1
Percentage Output Sold					0.560	0.751

Notes:
1/ Based on rural panel households in the 1993 and 1998 survey.
2/ We express the value of crop output in both years in terms of 1998 *dong*, using regional price deflators based on prices received by farming households as reported in the VLSS.
3/ We express the value of crop sales in both years in 1998 dong, using the same regional prices deflators as used to deflate the value of crop output.

Table 6
Changes in Crop Output, Land and Fertilizer Use per Household, 1993 and 1998

	Vietnam			North			South		
	1993	1998	Annual Growth	1993	1998	Annual Growth	1993	1998	Annual Growth
Agricultural Output:									
Crop Production (*dong*)	3317.9	4502.0	6.29	2518.1	2871.4	2.66	4512.4	6912.6	8.90
Paddy (kg)	2033.5	2633.4	5.28	1436.3	1646.4	2.71	2931.0	4108.4	6.99
Non-rice production			8.16			2.44			14.60
Land:									
Cultivated Area (m^2):									
Total	5890.0	6048.7	0.53	3878.5	3710.3	-0.89	8896.5	9543.6	1.42
Paddy		3841.5			2540.3			5786.3	
Irrigated	2207.1	3264.8	8.15	1654.1	1960.7	3.46	3033.5	5213.8	11.4
Sown Area:									
Total	10021.8	11058.9	1.99	7224.4	7440.1	0.59	14202.6	16466.4	3.46
Rice	6722.6	7126.0	1.15	4381.5	4345.6	-0.16	10221.5	11263.6	1.96
MCI:									
Total	1.70	1.83		1.86	2.00		1.60	1.73	
Fertilizer Input:									
In Rice Production:									
Organic (kg)	1510.4	1297.9	-3.07	1996.4	1808.7	-1.99	742.1	514.7	-7.59
Expenditure (dong)	380.1	597.5	9.47	220.6	310.8	7.14	632.3	1043.6	10.54
Nitrogen (kg)	119.8	131.2		75.8	86.0		189.3	200.1	
Phosphates (kg)	64.9	86.2		79.8	107.8		41.3	53.0	
Potassium (kg)	7.8	22.4		3.9	20.4		14.1	25.5	
NPK (kg)	22.1	52.1		4.8	13.0		49.4	112.0	
In Non-rice Production:									
Organic (kg)	494.6	569.1	2.85	696.5	744.7	1.35	175.3	300.9	11.33
Expenditure (dong)	109.0	402.7	29.9	52.6	121.7	18.31	198.1	858.3	34.08
Nitrogen (kg)	34.8	66.0		18.7	34.4		60.3	114.3	
Phosphates (kg)	13.8	42.4		13.7	34.0		14.0	55.4	
Potassium (kg)	8.4	13.5		0.5	4.1		20.8	27.8	
NPK (kg)	6.2	63.6		1.0	9.5		14.4	146.3	

Notes:
1/ Based on panel households in the 1993 and 1998 survey that farm in both years.
2/ We express the value of crop output in both years in terms of 1998 *dong*, using regional price deflators based on prices received by farming households as reported in the VLSS.
3/ Fertilizer expenditure in 1998 is deflated using separate fertilizer price indices for North and South Vietnam.
4/ Growth rates are calculated as the implied annual average compounded growth rate between 1993 and 1998.
5/ MCI is the multiple cropping index, calculated as the average number of crops per unit of land.

Table 7
Decompositions of Output Growth, 1993 to 1998

	Rice Production					
	Vietnam		North		South	
	OLS	OLS-FE	OLS	OLS-FE	OLS	OLS-FE
Output Growth :	21.00	21.00	15.70	15.70	30.90	30.90
Contribution to output growth: (%)						
Sown Area	8.86	8.38	-0.83	-.89	17.57	15.53
Labor						
Capital	0.09	2.10	-0.47	2.80	3.53	.97
Fertilizers	40.15	17.33	65.41	32.17	22.04	12.56
Chemical	43.67	21.62	70.70	36.31	22.20	15.21
Organic	-3.52	-4.29	-5.29	-4.14	-0.16	-2.65
Land Quality	12.27	1.40	16.37	-1.53	6.95	1.60
Residual	38.63	70.79	19.52	67.45	49.94	69.34
	Total Crop Output					
	Vietnam		North		South	
	OLS	OLS-FE	OLS	OLS-FE	OLS	OLS-FE
Output Growth:	17.1	17.1	8.00	8.00	32.40	32.40
Contribution to output growth: (%)						
Sown Area	16.37	16.78	20.13	17.25	14.78	16.98
Labor	1.11	.47	6.5	8.75	-5.03	-1.26
Capital	7.60	5.56	4.75	4.54	10.49	3.86
Fertilizers	92.08	49.82	155.25	120.88	58.74	34.65
Chemical	93.57	52.39	163.38	103.63	57.72	34.57
Organic	-1.49	-2.57	-8.13	-9.75	1.02	.08
Land Quality	3.00	-.78	4.75	-6.25	-1.85	-.20
Residual	-20.16	28.15	-98.64	-45.17	22.87	45.97

Notes:
1/ These decompositions estimate the fraction of output growth "explained" or accounted for by changes in input use, based on production functions estimated for each sub-sample, pooled across years, and based on the panel households in 1993 and 1998 that farm in both years.. The residual is the coefficient on an indicator variable for 1998.
2/ The OLS-FE decompositions are based on production functions estimated with household fixed-effects.
3/ For rice, output is measured in physical units (Kg.), while "Total Crop Output" is the value of crop output expressed in terms of 1998 *dong*, using regional price deflators based on prices received by farming households as reported in the VLSS
4/ The output growth rates used in the decomposition and reported are computed by taking the difference $\text{mean}(\log Y_{98}) - \text{mean}(\log Y_{93})$, where Y is either rice output, measure in physical terms, or the deflated value of crop output.
5/ Labor input is not provided separately for rice production, and so is not included in the rice decomposition.
6/ The capital stock in agriculture is measured by the deflated current market value of farm machinery and draft animal. We deflate the capital stock by a national deflator constructed on the basis of prices paid for capital machinery and draft animal in 1993 and 1998 as reported in the VLSS.
7/ The contribution of fertilizer is the sum of the contribution of urea, phosphates, potassium sulphate and NPK.
8/ Land quality is measured by the percentage of land irrigated.

Table 8A
Rice Marketing

	Urban North		Urban South		Urban Vietnam	
	1993	**1998**	**1993**	**1998**	**1993**	**1998**
Value of Rice Produced	132.63	97.07	406.61	734.82	293.64	471.85
Produced Rice?	0.12	0.07	0.13	0.12	0.13	0.10
Quantity of Rice Produced	58.08	40.49	194.11	312.47	138.02	200.32
Value of Rice Sold	11.36	3.65	161.68	508.15	99.69	300.12
Sold Rice?	0.03	0.01	0.08	0.09	0.06	0.06
Value of Rice Consumed	1591.94	1683.72	1609.15	1998.98	1602.05	1868.98
Quantity of Rice Consumed	552.13	519.57	579.59	549.58	568.27	537.21
Value of Rice Purchased	1469.00	1576.60	1374.21	1788.07	1413.29	1700.87
Purchased Rice?	0.99	0.99	0.97	0.97	0.98	0.98
Quantity of Rice Purchased	504.71	479.66	489.33	489.62	495.67	485.51
Value of Home Prod Rice	122.94	107.12	234.94	210.90	188.76	168.11
Consumed Home Prod Rice?	0.17	0.25	0.16	0.20	0.17	0.22
Quantity of Home Prod Rice	47.42	39.91	90.27	59.96	72.60	51.69
Rice Budget Share	0.22	0.16	0.15	0.13	0.18	0.14
Net Rice Sales	-1457.64	-1572.95	-1212.53	-1279.93	-1313.60	-1400.75
Net Seller?	0.02	0.01	0.06	0.08	0.05	0.05
Value of Rice Surplus	-1459.31	-1586.65	-1202.54	-1264.16	-1308.42	-1397.13
Surplus?	0.04	0.04	0.07	0.08	0.06	0.06
	Rural North		**Rural South**		**Rural Vietnam**	
	1993	**1998**	**1993**	**1998**	**1993**	**1998**
Value of Rice Produced	2225.64	2643.49	3389.70	5171.44	2722.43	3722.35
Produced Rice?	0.93	0.89	0.75	0.64	0.85	0.79
Quantity of Rice Produced	895.24	1021.22	1605.90	2154.24	1198.53	1504.76
Value of Rice Sold	305.58	569.40	1365.79	3162.05	758.05	1675.87
Sold Rice?	0.42	0.45	0.42	0.47	0.42	0.46
Value of Rice Consumed	1998.07	2341.61	1991.67	2576.40	1995.34	2441.82
Quantity of Rice Consumed	743.55	742.19	789.20	793.23	763.04	763.97
Value of Rice Purchased	443.97	453.06	733.44	1152.97	567.51	751.76
Purchased Rice?	0.65	0.56	0.85	0.88	0.74	0.70
Quantity of Rice Purchased	163.89	135.29	284.64	333.80	215.43	220.01
Value of Home Prod Rice	1554.10	1888.56	1258.23	1423.43	1427.83	1690.05
Consumed Home Prod Rice?	0.93	0.91	0.76	0.66	0.86	0.81
Quantity of Home Prod Rice	579.66	606.90	504.56	459.43	547.61	543.96
Rice Budget Share	0.38	0.30	0.28	0.25	0.33	0.28
Net Rice Sales	-138.39	116.34	632.35	2009.08	190.54	924.11
Net Seller?	0.36	0.40	0.36	0.44	0.36	0.42
Value of Rice Surplus	227.57	301.87	1398.03	2595.04	727.09	1280.53
Surplus?	0.54	0.48	0.47	0.45	0.51	0.47

Notes:

1/ All calculations are based on panel households.

2/ Value of rice produced is valued at producer prices, either that reported by the household on the basis of its sales, or the "nearest" estimate (cluster, or region). Value of consumed rice is valued at consumer "unit values" in the same way.

3/ The value of home produced/consumed rice is valued is self-reported by the household.

4/ The rice budget share is the share of non-durable consumption.

5/ The rice surplus is the difference in the value of rice produced and consumed (valued at the respective producer and consumer prices.

6/ Paddy is converted to rice by the usual factor of 0.66, while 1993 prices are converted to 1998 by 1.456. All values are expressed in 1000 Dong (1998 currency).

Table 8B
Rice Marketing By Region (Rural Only)

	Northern Uplands		Red River Delta		Northern Coastal	
	1993	**1998**	**1993**	**1998**	**1993**	**1998**
Value of Rice Produced	1962.93	2386.22	2648.45	3137.01	1900.69	2207.29
Produced Rice?	0.93	0.91	0.96	0.93	0.87	0.83
Quantity of Rice Produced	767.91	975.78	1037.63	1124.00	830.58	921.01
Value of Rice Sold	204.38	320.61	425.17	809.70	244.66	499.36
Sold Rice?	0.31	0.36	0.56	0.56	0.36	0.37
Value of Rice Consumed	2197.18	2770.22	1969.90	2047.14	1810.42	2284.83
Quantity of Rice Consumed	784.56	856.39	730.28	672.28	716.01	714.35
Value of Rice Purchased	485.57	533.56	287.42	274.90	628.43	624.78
Purchased Rice?	0.67	0.59	0.56	0.47	0.76	0.66
Quantity of Rice Purchased	176.43	158.11	104.66	85.24	237.38	183.30
Value of Home Prod Rice	1711.61	2236.66	1682.49	1772.24	1181.99	1660.06
Consumed Home Prod Rice?	0.94	0.93	0.96	0.95	0.87	0.85
Quantity of Home Prod Rice	608.13	698.28	625.61	587.05	478.63	531.05
Rice Budget Share	0.37	0.35	0.40	0.27	0.35	0.29
Net Rice Sales	-281.19	-212.94	137.75	534.80	-383.77	-125.41
Net Seller?	0.25	0.28	0.50	0.54	0.28	0.34
Value of Rice Surplus	-234.25	-383.99	678.55	1089.87	90.27	-77.54
Surplus?	0.39	0.30	0.69	0.68	0.48	0.38

	Central Coastal		Central Highlands		Southeast		Mekong River Delta	
	1993	**1998**	**1993**	**1998**	**1993**	**1998**	**1993**	**1998**
Value of Rice Produced	1953.54	2857.84	1030.89	1115.41	2199.23	3569.37	5035.53	7731.70
Produced Rice?	0.83	0.84	0.83	0.43	0.59	0.46	0.76	0.64
Quantity of Rice Produced	893.47	1100.12	525.18	396.43	928.98	1347.19	2444.10	3338.49
Value of Rice Sold	205.51	848.84	56.40	107.33	877.24	2163.35	2399.26	5305.18
Sold Rice?	0.28	0.50	0.12	0.12	0.35	0.34	0.58	0.56
Value of Rice Consumed	1904.44	2322.43	2337.84	3185.89	1891.02	2715.72	2023.84	2553.06
Quantity of Rice Consumed	702.83	713.14	841.83	994.29	723.49	766.40	854.04	814.18
Value of Rice Purchased	539.34	536.29	981.10	2174.82	864.15	1637.76	740.95	1109.27
Purchased Rice?	0.81	0.85	0.85	0.90	0.84	0.87	0.88	0.89
Quantity of Rice Purchased	191.65	157.68	355.11	675.79	328.04	433.28	304.17	329.53
Value of Home Prod Rice	1365.10	1786.14	1356.75	1011.07	1026.87	1077.96	1282.90	1443.79
Consumed Home Prod Rice?	0.84	0.85	0.83	0.49	0.59	0.52	0.78	0.65
Quantity of Home Prod Rice	511.18	555.47	486.72	318.50	395.45	333.12	549.87	484.65
Rice Budget Share	0.31	0.27	0.35	0.30	0.24	0.20	0.26	0.25
Net Rice Sales	-333.83	312.56	-924.70	-2067.49	13.09	525.59	1658.31	4195.91
Net Seller?	0.22	0.48	0.10	0.07	0.28	0.31	0.51	0.53
Value of Rice Surplus	49.10	535.41	-1306.95	-2070.48	308.21	853.64	3011.69	5178.64
Surplus?	0.42	0.47	0.10	0.09	0.37	0.34	0.60	0.55

Notes:
1/ All calculations are based on panel households.
2/ Value of rice produced is valued at producer prices, either that reported by the household on the basis of its sales, or the "nearest" estimate (cluster, or region). Value of consumed rice is valued at consumer "unit values" in the same way.
3/ The value of home produced/consumed rice is valued is self-reported by the household.
4/ The rice budget share is the share of non-durable consumption.
5/ The rice surplus is the difference in the value of rice produced and consumed (valued at the respective producer and consumer prices.
6/ Paddy is converted to rice by the usual factor of 0.66, while 1993 prices are converted to 1998 by 1.456. All values are expressed in 1000 Dong (1998 currency).

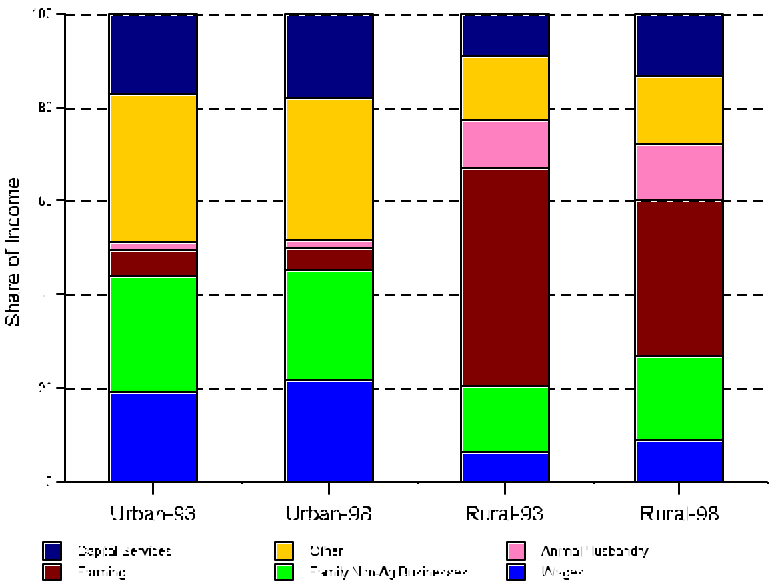
Table 9
Decompositions of Rural Income Inequality by Source of Income, 1993 and 1998

	1993				1998			
		Coefficient on per capita Income				Coefficient on per capita Income		
			Cluster	Effects			Cluster	Effects
	Share	OLS	OLS	2SLS	Share	OLS	OLS	2SLS
Rural Vietnam								
Source of Income								
1. Wages	0.110	0.041	0.022	0.002	0.120	0.048	0.023	0.024
2. Family Business	0.152	0.534	0.552	0.252	0.177	0.404	0.429	0.307
3. Farming	0.423	0.141	0.138	0.290	0.347	0.268	0.262	0.229
4. Animal Husbandry	0.069	0.034	0.040	0.048	0.087	0.029	0.041	0.045
5. Services, Durables	0.109	0.061	0.054	0.165	0.131	0.104	0.089	0.155
6. Other	0.137	0.187	0.194	0.243	0.137	0.147	0.157	0.240
Rural North								
1. Wages	0.062	0.027	0.013	0.046	0.087	0.062	0.044	-0.072
2. Family Business	0.133	0.519	0.530	0.125	0.165	0.397	0.409	0.308
3. Farming	0.466	0.075	0.071	0.219	0.316	0.141	0.167	0.089
4. Animal Husbandry	0.105	0.042	0.046	0.131	0.116	0.058	0.041	0.065
5. Services, Durables	0.097	0.054	0.045	0.120	0.146	0.127	0.094	0.146
6. Other	0.167	0.282	0.295	0.358	0.170	0.215	0.218	0.320
Rural South								
1. Wages	0.162	0.044	0.027	-0.013	0.153	0.028	0.011	-0.007
2. Family Business	0.174	0.545	0.563	0.296	0.189	0.414	0.440	0.307
3. Farming	0.411	0.176	0.174	0.314	0.379	0.332	0.315	0.319
4. Animal Husbandry	0.029	0.034	0.037	0.020	0.058	0.017	0.041	0.031
5. Services, Durables	0.121	0.064	0.058	0.180	0.117	0.092	0.085	0.161
6. Other	0.104	0.137	0.140	0.203	0.105	0.116	0.123	0.190

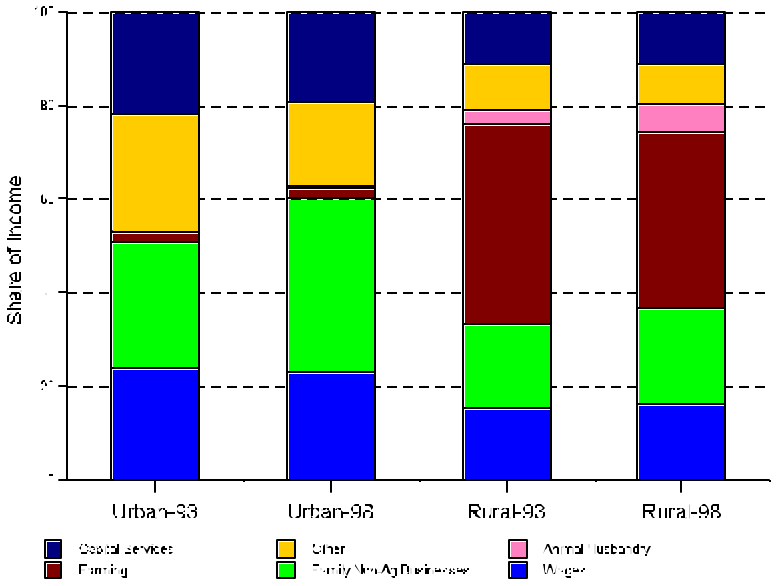
Notes:
1/ Based on the panel of rural households in the 1993 and 1998 surveys.
2/ Value of the services obtained from household durables, including housing.
3/ Fixed-effects specification includes controls for cluster fixed effects.
4/ 2SLS specification instruments total income by household total consumption.

Figure 1

Composition of Income: North Vietnam



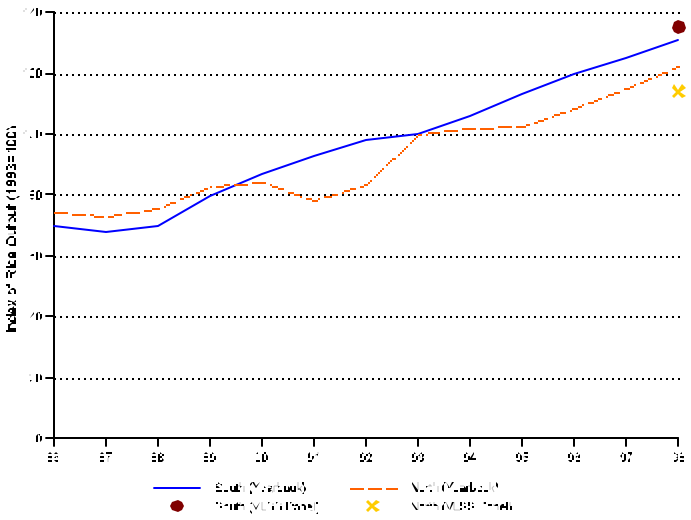
Composition of Income: South Vietnam



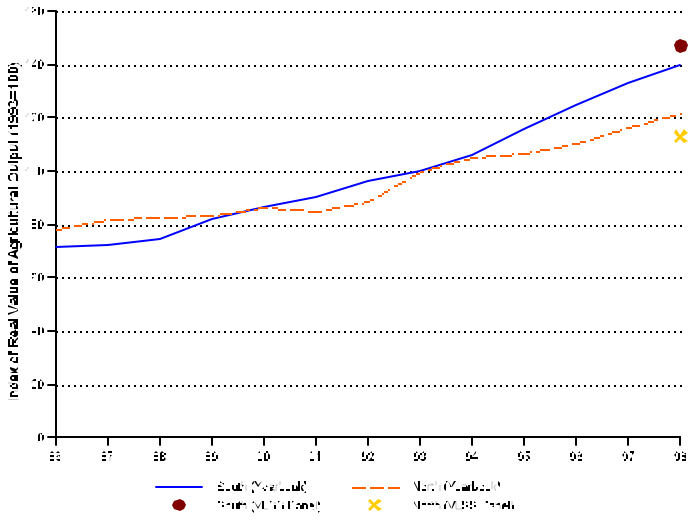
Notes: Based on data reported in Table 1.

Figure 2

Trends in Rice Production

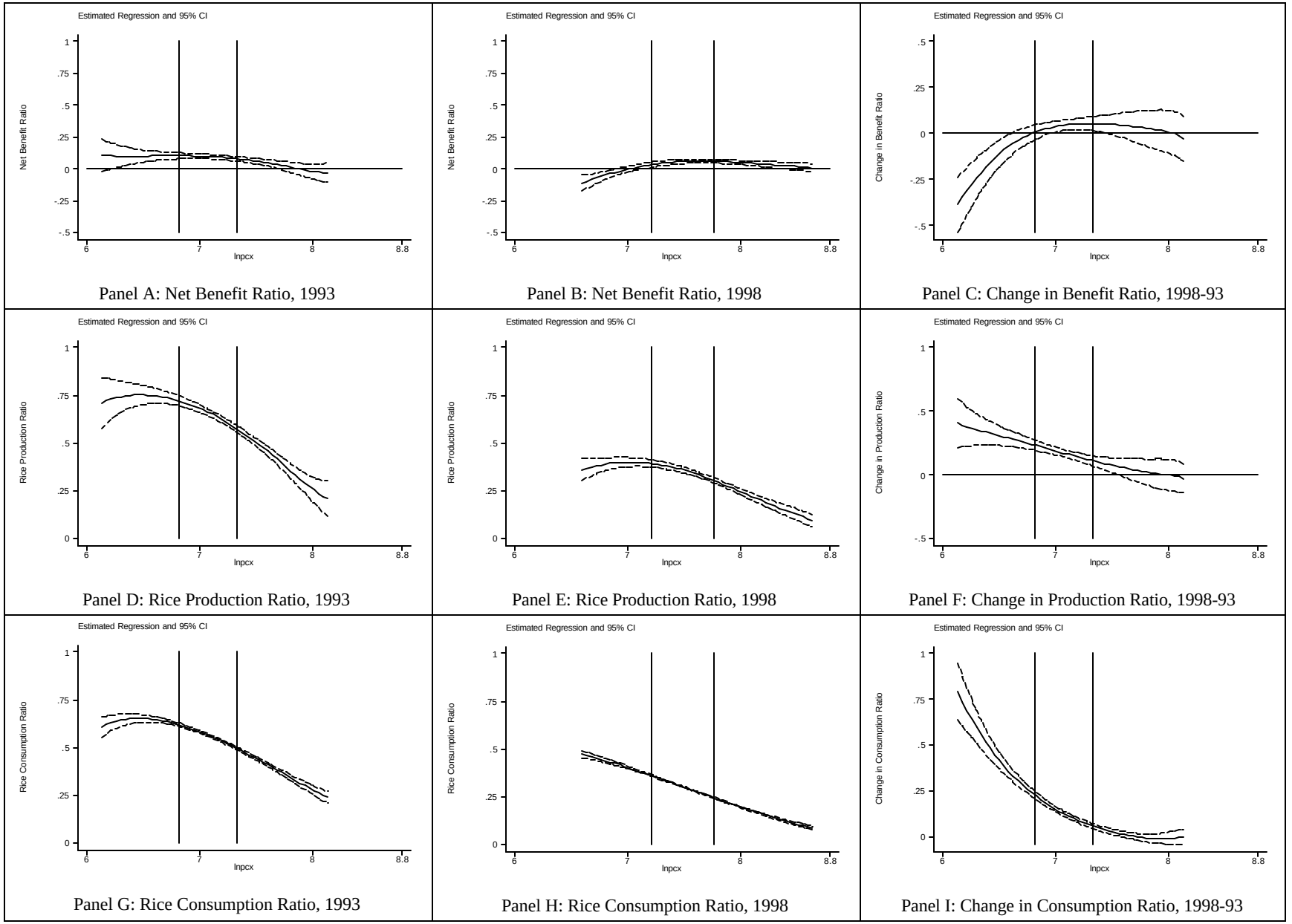


Trends in Total Agricultural Output



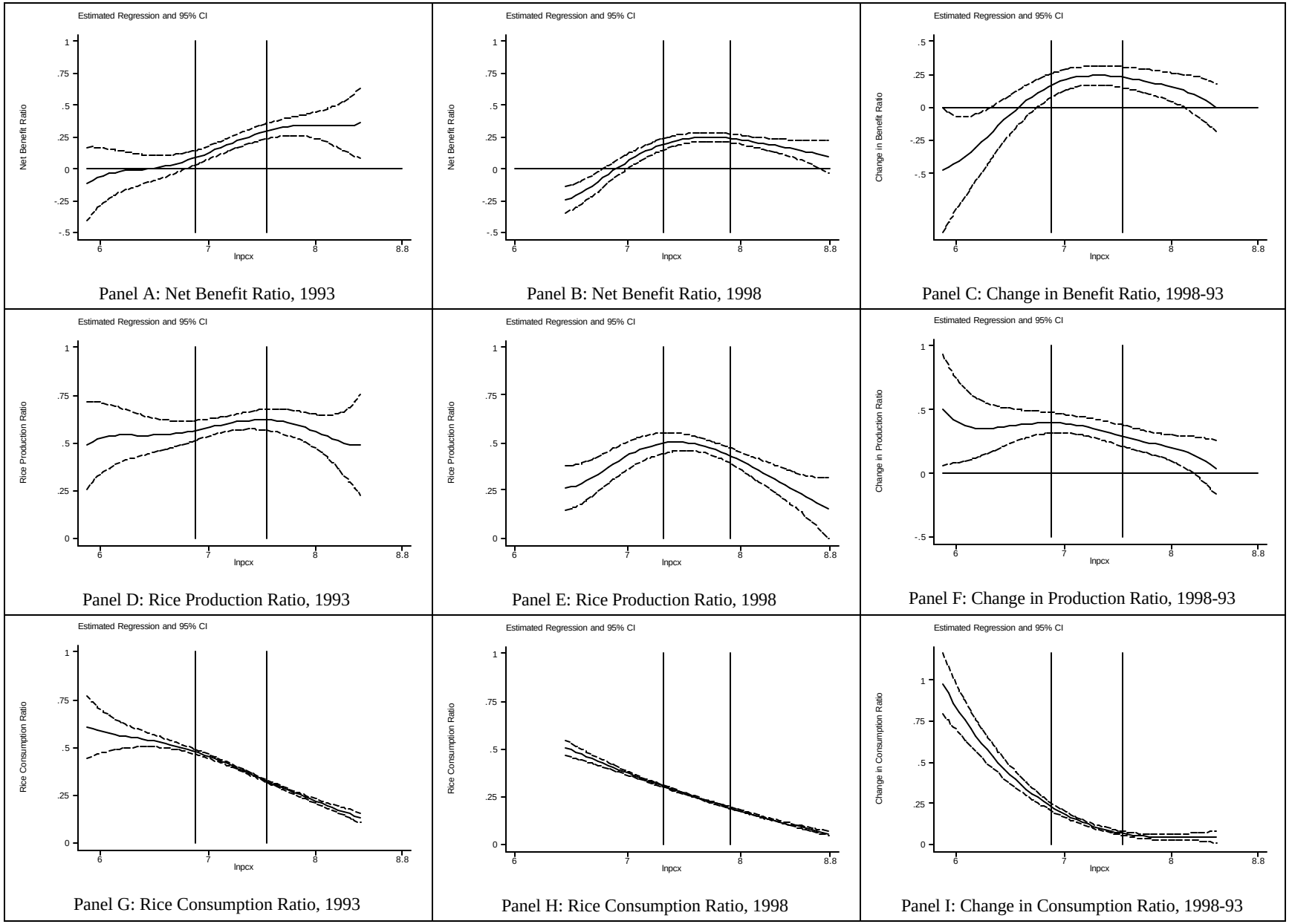
Notes: Each figure shows an index for agricultural output in the given crop year, relative to the base year of 1993. Each crop year's output is based on a moving average of output in that year and the previous one (analogous to the VLSS). These aggregate data are drawn from the yearbook (GSO, 2000). Superimposed on each graph is relative output in 1998 versus 1993, based on the VLSS panel households.

Figure 3– The Distributional Impact Of Changes in Rice Prices: Rural North



Notes: (1) Each graph illustrates the estimated non-parametric regression, plus 95% confidence interval, based on bootstrapped standard errors. (2) Vertical bars are provided for reference, at the 25th and 75th percentiles of the ln*pcx* distribution. (3) The benefit ratio is plotted for each of 1993 and 1998 (relative to each year's lnpcx), while the change in benefit ratio is defined as the difference in surplus (production minus consumption) between 1998 and 1993, relative to 1992 consumption. (4) The production and consumption ratios, as well as their changes, are analogously defined. For example, the production ratio is the ratio of rice production to total consumption. (5) All of the "changes" are relative to 1993 consumption.

Figure 4– The Distributional Impact Of Changes in Rice Prices: Rural South



Notes: (1) Each graph illustrates the estimated non-parametric regression, plus 95% confidence interval, based on bootstrapped standard errors. (2) Vertical bars are provided for reference, at the 25th and 75th percentiles of the ln*pcx* distribution. (3) The benefit ratio is plotted for each of 1993 and 1998 (relative to each year's lnpcx), while the change in benefit ratio is defined as the difference in surplus (production minus consumption) between 1998 and 1993, relative to 1992 consumption. (4) The production and consumption ratios, as well as their changes, are analogously defined. For example, the production ratio is the ratio of rice production to total consumption. (5) All of the "changes" are relative to 1993 consumption.