Crop Output in Vietnam, 1992 to 2006: An Analysis of the Patterns and Sources of Growth

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1. Motivation and Background

The purpose of this report is to provide a detailed analysis of the behaviour of cropping output in agriculture between 1992 and 2006 in Vietnam at both the national and regional level. There are several motivations.

First, the cropping sector is important. Output from the cropping sector represents between 75-80 percent of the total value of output produced in agriculture; output from animal husbandry and farm services makes up the rest. Agriculture, in turns, represents 75-80 percent of the total value of output produced by the primary sector, which consists of agriculture, forestry and fisheries. Similar percentages apply to value-added. Thus, half of output or income generated in the primary sector is tied to cropping output. Given the role of the primary sector in Vietnam's economy, and the percentage of households that derive income from the primary sector, behaviour in the cropping sector has important implications for the evolution of both growth and inequality.

Second, Vietnam's General Statistical Office reports annually estimates of cropping output at the national level in current (i.e., nominal) prices. They also report estimates in constant 1994 (i.e., real) prices. As far as we know however, they do not report similar estimates of nominal and real crop output disaggregated at either the provincial or regional level. Moreover, little is known about the construction of these estimates, especially details concerning the deflator used to convert measures of crop output from current to real values.

Third, the period 1992 through 2006 has been one of considerable change in the economic and policy environment that might affect the growth of agriculture. Most obviously, the beginning of this time period corresponded to the main economic reforms that affected farm

incentives. In addition, there have been a series of important measures of trade liberalization, both within Vietnam and between Vietnam and international markets. Combined, these factors have more closely tied farmer incentives and outcomes to fluctuations in world crop prices. These price (and policy) changes may also have induced farmers to shift dramatically cropping patterns, and to improve productivity (yields). Irrespective of responses to incentives, the integration of Vietnamese agriculture to international markets (and pricing) has made the valuation of agricultural output more complicated, especially in permitting policy makers to distinguish real increases in crop output from possibly transitory increases in nominal output driven by international trends in crop prices.

Our primary objective is to provide a series of first-order "facts" concerning trends in real crop output in Vietnam. This principally entails combining nominal crop output and acreage data provided by the GSO, with price indices that we construct ourselves using detailed micro-level data from the Vietnam Living Standards Surveys (VLSS). We use information on prices extracted from the VLSS in order to construct a set of consistent estimates of the current value of crop output at the regional and national level for five benchmark years: 1992/1993, 1997/1998, 2002, 2004 and 2006. We use the same price information to construct a set of chain-linked Laspeyres price deflators at both the national and regional level in order to examine the behaviour of the real value of crop output over time.

We examine key trends in the value of aggregate crop output, and major sub-aggregates at both the national and regional level over the period between 1992 and 2006. We also examine trends with respect to acreage. Our estimates of the value of real output and acreage data further allow us to carry out simple decomposition exercises examining the contributions of the extensive and intensive margins to output growth over time. The extensive margin reflects

increases in crop output related to increases in acreage; the intensive margin, on the other hand, reflects increases arising from increases in crop output produced per unit of land (i.e., yields).

We supplement our analysis at the national and regional level with a modest examination of trends at the household level. We are especially interested in the heterogeneity in the behaviour of the growth of crop output across households. The two dimensions of household heterogeneity that we concern ourselves with are farm size (measured in terms of cultivated area), and household income.

We focus our analysis on trends with respect to how rapidly output was growing in real terms. The next parts of the chain would link output to farm incomes more directly. First this requires information on the value-added from crop production (gross output value less the cost of intermediate inputs) in order to convert gross revenue into real net income. Second, we would have to convert "real farm profits" measured in producer prices, to "real incomes" that link to farmer welfare, utilizing the Consumer Price Index (CPI) for rural households. In this report, we focus only on the trends in real output at the national and sub-regional level, and save the latter two links of the chain for future work.

2. Our Strategy

Vietnam's General Statistical Office (GSO) reports annually provincial-level data on acreage and physical output for 20 key crops. These crops fall into five main categories: cereals, annual industrial crops, perennials, fruits, and vegetables. Our strategy is to use the GSO physical output data, along with information on "unit values" ("prices") from the VLSS in each of five benchmark years (1992, 1997, 2002, 2004 and 2006) to value output in order to produce a "consistent" set of estimates of the value of crop output. In an appendix, we describe in more

detail the procedures used to overcome some of the shortcomings in the GSO aggregate crop data.

While for expositional simplicity we will refer to them as such, unit values are not actual market prices. Rather, they are the ratio of sales revenue to output sold for each crop by farm households. Using the household survey data on crop sales, we calculate unit values for each household for each crop sold, and use them as estimates of farm-gate prices. Based on the sample of unit values, we then estimate the median unit value in each region for the purpose of valuing crop output in that region.[1] At the national level, we use the median calculated over all households in the country.

The unit values are then treated the same as prices, and used to construct separate chain-linked Laspeyres price indices for each region, and then for all of Vietnam. Each regional index is based only on price information for that region. The national index uses price information for the entire country. Differences in the composition of crop output across regions and differences in the behaviour of prices among major crop groups, e.g. cereals versus perennials, etc., point to potential problems in using a simple "national" price index to deflate regional nominal totals. The chain-linked index has the added advantage of factoring in changes over time in crop composition, and thus the weight of various crops in the price index. As we show below, there have been important changes in the composition of crop output.

[1] We also experimented with using alternative summary measures such as the mean unit value, and the differences are marginal. The value of the median is that it is slightly less sensitive to extreme outliers in the data.

3. Nominal rates of total crop output between 1992 and 2006, and select sub-periods

In the next few tables we document total crop output, first in nominal, then in real terms. In order to do so, we also discuss the price index used to covert nominal to real output. In the top panel of Table 1, we report our estimates of the nominal value of crop out for all of Vietnam and by region for our five benchmark years. The top panel of Table 2 provides corresponding estimates of rates of nominal growth. In nominal terms, the value of crop output in current prices increased from 33.6 trillion VND to 182.8 trillion VND. This implies an average annual rate of growth of 12.9 percent over the entire period. The most rapid growth occurred between 1992 and 1997. This was followed by a sharp reduction in growth rates between 1997 and 2002 during which the nominal value of crop output only grew 3.9 percent annually. Nominal output growth accelerated the next four years, and has averaged more than 16 percent per annum.

There are significant differences across the regions, with the growth in the Central Highlands (CH) the most rapid. Between 1992 and 2006, the nominal value of crop output increased at an annual rate of 22.3 percent in the CH. By comparison, the next most rapidly growing regions were the North West (NW) at 15.3 percent, and the South East (SE) at 14.1 Percent. Growth in crop output for both of the deltas lagged noticeably: it increased only 11.9 percent in the Mekong River Delta (MRD) and 8.6 percent in the Red River Delta (RRD).

4. Price Indices

We are interested in real growth, which requires the construction of a set of crop price deflators in order to deflate nominal output into "real output." "Real Output" corresponds to a constant composite of agricultural commodities. The distinction between nominal and real output is especially important if we want to evaluate overall trends in agricultural productivity. If there

was only one crop (e.g., rice), this might be very easy. If prices were constant across the country, then increases in the value of rice output could be converted to "Kilograms" of rice using the price of rice. We would only need to track the national price of rice over time (e.g., from 1992 to 2006). If the price of rice varied across regions, then if we wanted to convert the values produced in each region to quantities, we would simply need regional price series. The calculation is more complicated once there are many crops, especially as all prices do not move in tandem. By its very nature, exercises like ours entail significant distillation and simplification.

Our objective is to construct a deflator that corresponds to tracking the price of composite crop output over time. The focus is on permitting inter-temporal comparisons, so that we can summarize growth patterns. For any two years, we wish to calculate the "average" ratio of prices in the second period to the first, where the weights in the average depend on the relative importance of the crop in the base year. From this exercise, we can adjust nominal growth rates for the general tendency of crop prices to rise between the two time periods.

The GSO itself conducts this exercise, reporting the value of crop production in both current prices and also in 1994 prices. These two series can be used to "back-out" their deflator with 1994 as the base year. There are number of potential problems with their deflator however. First, it uses as weights crop composition in 1994. As we show below, there has been an important shift in the composition of crop output. In particular, cereals (and especially paddy) have become less important, as the contribution of fruits, perennials and vegetables have increased. Insofar as there are differences across crops in terms of the behaviour of prices, changes in crop composition will introduce biases into the deflator, and ultimately, estimates of real output. Second, regions differ significantly in terms of the composition of crop output.

Using a "national" deflator to convert regional nominal totals into real output will thus also introduce a bias into our estimates of regional growth rates.

In Table 3, we report both the Laspeyres index between years, e.g. 1992-1997, 1997-2002, etc, and then the chain-linked index with 1992 as 100. In the second panel of Table 2 we report the rate of annual price inflation (or deflation) implied by each of the indices between our benchmark years. In the appendix, we carry out a comparison of our index with the official GSO price deflator. Over the entire period, farm-gate prices rose slightly more than 6.5 percent per year, but this ignores volatility over the period. Prices rose nearly 12 percent or so per annum between 1992 and 1997, were modestly lower in 2002 compared to 1997, and then began to rise again, and between 2004 and 2006, rose at more than 11 percent per annum.

Some of this variation in prices reflects fluctuations and trends in international crop prices. In Appendix Table A4, we report some of these main patterns for crops grown in Vietnam. The decline in Vietnamese prices between 1997 and 2002 matches global declines in crop prices almost across the board, but notably in rice and key perennials like coffee and rubber. The sharp increases between 2002, 2004, and 2006 for the price indices also correspond to significant increases in the world price of grain, and especially perennials.

Note also the heterogeneity in the behaviour of crop prices across regions over our benchmark years. Over the entire period, the difference in the rate of inflation in crop prices between the region with the most rapidly rising and least rapidly rising prices is a fairly modest 1.5 percent per annum (see Table 2). But, even this amounts to an accumulated difference of 20 percent over a 14 year period. Since the real rate of crop output is simply the nominal rate less the rate of inflation, a small difference of 1.5 percent per annum can amount to a significant

"real" difference over a longer period of time. Also, over much shorter periods, the differences in behaviour are significantly larger. The behaviour of crop prices in the Central Highlands between 1997 and 2002 is a good example. Prices fell back to 1992 levels there, largely due to the sharp drop in prices of perennials such as coffee and rubber, while prices in the seven other regions more or less remained constant. Prices recovered in the region rapidly after 2002, increasing at rates nearly twice that experienced nationally.

5. Real Output Growth

In the bottom panel of Table 1 we report the levels of real output by region, and for Vietnam as whole. To present the numbers more clearly, we plot the logarithms of output over time in Figure 1. The slopes of the lines represent the growth rates of output, while the relative positions show the rankings of output by region. The most striking aspect of the figure is the rapid rate of growth in the Central Highlands, such that it has become the second most important region for crop output, passing the almost stagnant RRD, though still well behind the MRD (in levels).

The growth rates themselves are reported in the bottom panel of Table 2. In this table, one can see the accounting identity that real growth equals nominal growth minus inflation. The resulting growth rates are also plotted in Figure 2. In calculating real rates of growth, we use separately the national and regional price deflators for deflating national and regional output. Over the entire period, growth of real crop output at the national level averaged an impressive 6.3 percent per annum. Over the 14 year period, however, there has been a slow secular decline in the rate of growth of crop production, falling from a high of nearly 8 percent between 1992-1997, to 5.7 percent between 1997 and 2002, 5.4 percent between 2002 and 2004, and then 4.40

percent between 2004 and 2006. This decline is partially expected; the high growth in the early 1990s reflects the one-time gains that Vietnam agriculture enjoyed as part of the reintroduction of family farming in the late 1980s, and price and trade liberalization, especially with respect to rice (Benjamin and Brandt, 2002).

There are significant differences across the regions. The fastest growth (as observed already) has been in the Central Highlands, which at 16.0 percent per annum is almost two and a half times the national average. Although growth dropped between 1997 and 2004 from the exceptional highs of the period 1992-1997, growth continued to be well above the national average, and between 2004 and 2006 growth exceeded 12 percent. In contrast, growth in the RRD has lagged significantly behind, and between 1992 and 2006 averaged only 2.5 percent, less than half the national average. The very slow growth in the RRD between 2004 and 2006 of 1.3 percent is particularly noticeable, behaviour that it shares with MRD, where growth was only 0.3 percent. In contrast, however, over the entire period, the MRD has done reasonably well, with output growing at an annual real rate of nearly 5 percent. In four of the other regions, namely, NE, NW, NCC and SE, growth between 1992 and 2006 has averaged 6 percent or more per annum, implying a near doubling of output. Next to the RRD, growth has been slowest in the SCC.

In short, despite some significant regional differences, crop production has experienced very robust growth throughout much of Vietnam over this 14 year period, a development that likely has important distributive consequences.

6. Real Output Growth by Crop Group

Table 4 provides estimates of the rate of growth of real output at both the regional and national level over the same benchmark years for the five crop sub-aggregates. In each case, nominal crop output is being deflated by unique regional (national) price deflators that we constructed for each sub-aggregate. For example, the nominal value of cereal output in the RRD is deflated using a price index that utilizes information on prices in the RRD on paddy, corn, cassava, and sweet potatoes. There are lots of numbers to digest, but several things stick out:

1. In Figure 3, we plot the growth rates by region and crop for the full time span (1992-2006). As noted before, the most remarkable feature is the rapid rate of growth in the Central Highlands. As can be seen here, however, output in the Central Highlands grew across the board, in all crop groups: perennials most obviously, but also cereals, fruit, and annual industrials. Nationally, expansion of perennials is most notable, as is the almost 10 percent annual rate of growth in fruit and vegetables.

2. Turning to Table 4 itself, we can see variation of these patterns across time periods. Between 1992 and 2002, cereal production grew a very robust 5 percent per annum, but fell off sharply the next four years. Between 2004 and 2006, output increased at less than one-half of one percent per annum, and actually contracted in both of the deltas regions. An important question is the reasons for the sharp drop off, and the extent to which cereal production has started to increase again in light of the sharp rise in grain prices the last year or so.

3. The slack in cereals has been picked up by the rapid growth in the other crops, especially perennials and fruits. Perennials and fruits have grown at average rates of 15.4 and 9.3

percent per annum, respectively. Although annual growth in both groups has declined over time, growth between 2004 and 2006 still averaged more than 10 percent in both.

4. The rapid growth in perennial production has not been limited to the CH. Both the SE and NW have enjoyed expansion in perennial crop output.

5. The rate of growth of vegetable output over the 14 year period has been the most constant among the sub-aggregates. This is true at both the national as well as regional level. We do not know if this accurately reflects trends, or is a product of the way that GSO measures vegetable output.

7. Composition of Crop Output

Table 5 provides summary information at the regional and national level on the composition of crop output. In each of the five benchmark years, we report the percentage of nominal output made up of cereals, vegetables, annual industrial crops, perennials and fruit. In the early 1990s, cereals made up the bulk of crop output, representing nearly 75 percent of the value of crop output. Within cereals, rice was dominant, and itself represented more than 80 percent of output. In most regions, the percentage for cereals was between 70 and 80 percent, but in both the Central Highlands and the Southeast the percentage was less than 40 percent. Nationally, the rest of crop output was divided among annual industrial crops (8.40 percent), vegetables (5.95), perennials (5.51), and fruits (5.52). The much smaller role for cereals in the CH and SE was offset by much larger shares for annual industrial and perennials, which combined represented between 40-50 percent of gross crop output. These two regions were likely dependent on imports of rice from other parts of the country.

The national numbers are also arrayed in Figure 4. The most significant trend at the national level is the reduction in the share of cereals, which fell to 56.90 percent by 2006, and the shift to cash crops. Most of this occurred between 1992 and 1997, and 2004-2006.[2] Perennials almost tripled as a share of the value of crop output, from 5.51 percent in 1992 to 15.36 percent in 2006. Much of this can be attributed to the increases in CH and SE. Vegetables' share has doubled.

Table 6 complements Table 5, and for each of the 5 major crop groups (as well as for total crop output) we provide each region's share of the national total. The prominent role of the two deltas in cereal production sticks out, as does the expanding role of the CH and SE in perennial production. The NE has also become a more important producer of fruits. Reflecting the significantly lower growth of crop output in the RRD relative to the rest of Vietnam, the region's overall share of total crop output fell from 22.7 percent to 15.9. Figure 5 provides a further summary of the patterns for total crop output. The most obvious patterns are the decline in the share of output produced in the two deltas: the Red River Delta declining more than the Mekong River Delta, and the corresponding increase in the share produced in the Central Highlands and Southeast.

8. Acreage

Changes in the amount of land under cultivation, and shifts in acreage among the major crop groups play an important role in explaining the output trends described above. In Table 7 we report for each of the 8 regions and for each of our 5 benchmark years, total sown area for each of the five crop groups. It is important to note here that these data are for *sown area* as

[2] With the sharp rise in cereal prices the last year, cereals' share of total crop output has probably risen.

opposed to cultivated land, and thus reflect changes in both cultivated area, as well as changes in the intensity with which land is farmed. Unfortunately, we do not have estimates for cultivated area which would allow us to sort out the two.

For all of Vietnam, sown area increased by 40 percent over the 14 year period, with most of this occurring in the years up to 2002. This works out to an increase of 2.4 percent annually over the 14 year period. Room for expansion on this margin differed enormously across the regions. In the highly densely-populated RRD, for example, sown area remained more or less the same. In contrast, sown area increased more than three-fold in the CH. In between these two extremes are regions such as the SE and NW, both of which experienced increases in sown area of two-thirds. In the NE and MRD, on the other hand, sown area increased by slightly more than a third. Figure 6 reports the corresponding national totals by crop type. This clearly shows that growth in sown area has halted since 2002, except for perennials. Looking forward, there does not appear to be much room for further increases in sown area, and in all likelihood, it will contract.

Table 8 reports the percentage of sown area in each region and in all of Vietnam in each of the five crop categories. This is complemented by Table 9 that reports each region's share of total sown area in Vietnam in each of the five crop groups. Figures 7 and 8 plot the national numbers from these tables, illustrating the shifting crop composition and geographic distribution of sown area. In the aggregate, cereals dominate, and in 1992, 82.45 percent of sown area was in cereals. This declined appreciably between 1992 and 2002, with smaller reductions occurring between 2002 and 2006. Overall, the percentage of sown area in cereals fell by 13 percentage points, offset by increases (in order of magnitude) in perennials, fruits and vegetables. Only in the MRD, Vietnam's major rice growing region, do we not observe a reduction in area in cereals

of 10 percentage points or more. Most of the increase in sown area in perennials is a product of the rapid expansion in the CH and SE, however increases in fruits and vegetables are more broadly observed across the 8 regions.

It is important to remember that even with the decline in the share of sown area in cereals, total sown area in cereals actually increased. This reflects the fact that total sown area itself rose by 40 percent. Between 1992 and 2006, total sown area in cereals increased from 7.642 million hectares to 9.012 million, or an increase of slightly less than 20 percent. By comparison, sown area in perennials increased by 228 percent; fruits rose by 196 percent; vegetables by 123 percent; and by 53 percent in annual industrial crops.

9. Decomposition

The growth in real crop output that we documented in Section 5 occurred at both the extensive and intensive margins. The extensive margin here is the amount of land under cultivation (sown), while the intensive margin captures the contribution to output growth arising from changes in output per unit of land. Output per unit of land can increase because of higher yields or a shift to higher-valued crops. Increases in crop output resulting from an increase in the intensity with which land is used (i.e., the degree of double cropping) are also part of the intensive margin.

Unfortunately, we do not have data on cultivated area, and only have data on sown area. Changes in sown area are a product of both changes in cultivated area, and changes in the multiple-cropping intensity. Nonetheless, we are able to carry out simple decompositions for changes in real crop output over time using sown area. In this simple decomposition, there are actually three contributing factors to output change:

- Increases in yields on existing land;
- Increases in land evaluated at existing yields;
- Increases on new land related to an increase in yields.

In this decomposition, we define yields to be the value of output per unit of sown land. Thus, changes in yield will be a product of both increases in physical yields, e.g. kilograms of paddy per hectare, and a shift to crops with a higher value of output per unit of land. There is also a third "interaction" factor, which represents the increase in output related to an increase in yields on new land. In principle, we could extend our decomposition to allow for this further breakdown, but will not do so at this point

In Table 10, we provide the results of this simple decomposition for each of the 8 regions and for all of Vietnam for key sub-periods and for the entire period: 1992-1997, 1997-2002, 2002-2004, 2004-2006, and 1992-2006. We report the contributions in terms of proportions, with the sum of the 3 contributions totalling one. In principle, the contributions can be either positive or negative. For example, a reduction in sown area between periods would contribute negatively to growth.

Over the entire period from 1992 to 2006 fully half of the increase in real output can be attributed to an increase in output on existing land. The increase in sown area is the source of 30 percent of the increase, while 20 percent of the growth can be attributed to the increase on new land related to an increase in yields. Especially revealing is the trend in the contribution of these factors. Increases in sown area are very important up through 2002, but over the last 4 years contributed much less as room to expand sown area was exhausted in most regions. The

slack is filled by the contribution of rising yields, which between 2002-2004, and 2004-2006 were the source of 80 and 70 percent of the growth in real crop output, respectively.

Analysis at the national level conceals important regional differences reflecting differences in the ability to expand output along the extensive margin. In the RRD, for example, there was simply no room, and in fact sown area declined slightly. As a result, all of the increase in real output came from either increases in physical yields, or a shift to higher value-added crops on existing land. The North Central and South Central were also more constrained in this regard. In the MRD and the SE, on the other hand, there was much more room to increase output through increases in sown area, especially during the period up to 2002. However, since 2002 these opportunities have largely disappeared, and increases in yields underlie the continued expansion of real output. Only in the NE, NW and the CH are increases in sown area continuing to play a role in real output growth, and between 2004 and 2006 were the source of roughly forty percent of output growth. Much of this is likely in the form of newly reclaimed land.

10. The Behavior of CropYields

In our decompositions, the contribution of increases in yields is actually the product of two factors: 1. increases in physical yields; and 2. a shift to higher-valued crops. We intend to extend our decomposition for these two factors in future work, but for the moment, provide summary data on the behaviour of physical yields for our key crops. Table 11 presents yields for major crops by region and nationally for each of the 5 benchmark yields, while Table 12 provides rates of growth in yields over select periods.

There are a number of caveats in interpreting these data. First, yield figures for both fruits and vegetables are aggregates constructed separately over all fruits and vegetables, respectively.

Within each of these sub-aggregates, we are not able to differentiate the contribution to total yields of yield growth of individual crops versus a shift to crops with higher yields. Second, in the case of perennials it take several years after planting before the trees actually begin to bear output. Once this occurs, output will typically rise the first few years, and then level off. Thus, during periods of rapid expansion in acreage, and depending on how acreage in these crops is recorded, yield growth may be dampened. This will be less of a problem over longer periods of time.

Turning to the growth rates in the last panel of Table 12, between 1992 and 2006, an unweighted average of physical yields for the major crops increased at an annual rate of slightly more than 4 percent. There are important differences across the crop groups. Perennials grew the fastest. Excluding perennials, yield growth still averaged a very respectable 3.3 percent, and for paddy, yields grew 2.8 percent per annum. Paddy yields rose through 2002, but have fallen subsequently, and between 2004 and 2006 were especially low. The driving factor in the fall in paddy yield growth is the behaviour in the two deltas, which combined represent 60 percent of paddy acreage. For cereals as a group, this has been partially offset by the more rapid increases in yield growth in both maize and cassava.

There is a marked cyclical dimension to yield behavior: After rising between 1992 and 1997, yield growth fell over the next five years, but then rose sharply after 2002. In fact, growth after 2002 is more than double that between 1993 and 2002. However, a healthy portion of this is the product of rising yields in perennials, the calculation of which may be sensitive to the caveat raised above. Nonetheless, in the face of limited opportunities to expand acreage, it is this increase in yield growth that has helped to sustain reasonably high rates of growth of crop output over the last half of the period between 1992 and 2006.

11. A Brief Look at Distributive Dimensions of Crop Output Growth

Income from cropping represents an important source of rural household income. On the basis of estimates we have constructed of household income using the VLSS, in 1993 income from cropping represented 43.9 percent of total rural household income. This has declined over time with the emergence of new farm sidelines, e.g. animal husbandry and aquaculture, off-farm wage opportunities, and the development of family-run businesses, but even as late as 2006 income from cropping was the source of 26.9 percent of total rural income. Farming income may be especially important for households in the lower end of the income distribution for whom farming is the major source of income.

Drawing on data from the VLSS, we examine the behaviour of the growth of crop output by household "type". We divide rural households into quintiles on the basis of two criteria: cultivated landholdings, and per capita household incomes. We next compute for each of the five VLSS years, namely, 1992, 1997, 2002, 2004 and 2006, the value of real output per household in the quintile, and then rates of growth of real output over the entire period. Table 13 (and Figures 9 and 10) reports the breakdown on the basis of cultivated landholdings, while Table 14 (and Figures 11 and 12) does the same thing on basis of per capita household incomes.

At the bottom of both of these tables are the rates of growth of real crop output over the period between 1992 and 2006 that are implied by the VLSS data. On average, between 1992 and 2006, average farm household real crop output grew 6.60 percent per annum, or slightly higher than our estimate of aggregate real crop output using the GSO data. In principle, the two numbers need not line up, especially if there is a sharp reduction in the percentage of households in the economy that are farming. This does not appear to be the case, and it is reassuring that the

rates of growth in real crop output implied by the aggregate and household level data line up as well as they do.[3]

Across cultivated holdings, we observe relatively modest differences in the rate of growth of real crop output. It is lowest for the smallest of farms, rises through the third quintile, and then levels off. Output growth in the smallest quintiles is about half of the average (3.4 versus 6.6), but for the second quintile the difference is significantly less (5.6 versus 6.6). "Farm Size" is only modestly related to agricultural growth. We observe slightly smaller differences when households are sorted on the basis of income, but in the opposite direction. Real crop output grows at a fairly similar rate for households in the lower three quintiles, and then falls slowly through next two quintiles. More pronounced differences in growth rates throughout the income distribution are observed for the period between 1997 and 2006, which we also report at the bottom of Table 14. The rate of growth of crop output for households in the bottom quintile was almost twice that of households in the top quintile (8.1 versus 4.2 percent), and a third higher than households in the fourth quintile (8.1 versus 5.8). This behaviour represents an important reversal of the pattern observed between 1992 and 1997, and much higher rates of growth among higher income households.

The results of these growth rates are reflected in Figure 13. In 1992, crop output is highly correlated with income quintile: richer households produce more crop output. By 2006, however, the relationship between income and crop output has flattened out significantly, and there is not much to differentiate the top three (or even four) quintiles from each other. Clearly, farming is

[3] Between 1992 and 2006, the percentage of "rural" households that report income from cropping declines slightly from 94 percent to 84 percent. The percentage of "urban" households with cropping income remains constant at 22 percent. The other potential source of differences in rates of growth between the aggregate figures and the household-based ones is the behaviour of crop output on state farms and plantations.

not the route to the top of the economic pyramid in rural Vietnam. One other notable feature from Figure 15 is that while crop output is similar across the top three quintiles, the richest households are distinguished by heavier involvement in perennials. Especially if the trees have not fully matured, we may see crop output (and income) increase sharply for the richest households. Of course, for this to translate into incomes requires correspondingly high commodity prices, which may not persist during a global economic downturn.

Over the period between 1992 and 2006, income inequality in rural Vietnam, as measured by the Gini coefficient for per capita household incomes falls slightly, and at a minimum, probably remains the same. In fact, our own estimates suggest that inequality in 1992 and 1997 is nearly identical, but then significantly lower in 2002, 2004 and 2006. With income from the cropping sector much more important for those households in the bottom of the income distribution, the much more rapid growth of crop output (and incomes from cropping activity) by these households after 1997 may have played an important role in preventing income differences from widening, though this remains a topic for closer investigation.

12. Summary

We summarize our key findings:

1. Vietnam has enjoyed robust growth in cropping output over the period 1992-2006. Rates of growth have fallen from the highs of the early to mid 1990s, but since 2002 have grown at between 4.5 and 5 percent.

2. There are marked differences among regions, with the growth in the RRD and MRD lagging significantly. The sharp drop in crop output growth after 2002 is particularly noticeable. The most rapid growth has been enjoyed by the CH, SE, and the NE and NW.

3. There are also important differences across crop groups. The most rapid growth has been experienced by perennials, followed by fruits, and then vegetables. Cereal output growth has lagged, but still grew a respectable 4.0 percent annually.

4. Both the extensive and intensive margins have played important roles in this growth, but increases in physical yields and a shift to higher valued crops are especially important. At a minimum, they are the source of half of more of crop output growth over the entire time period, and more than three-quarters or so over the period between 2002 and 2006.

5. Our estimates of the nominal and real crop output line-up reasonably well with the GSO estimates, however, the GSO estimates for 2006 appear low. Underlying this are the prices that GSO has used to value crop output. By comparison to those we estimated using the VLSS household level data and international prices for the same key crops, GSO prices appear low. This has contributed to lower nominal output figures and nominal growth estimates. It may also have affected estimates of real output growth.

6. At the household level, we observe higher rates of growth of crop output among lower income households. The relationship is especially sharp between 1997 and 2006. With income from agriculture more important for these households, the ability of lower income households to benefit significantly from the growth in agriculture likely had positive implications for the trajectory of income inequality in Vietnam.

APPENDIX:

ESTIMATING CROP OUTPUT

The starting point for our estimates is provincial-level data reported by GSO on output and acreage in 20 key crops. The list is not exhaustive, but covers most of the cropping sector. Table A1 provides a list of the crops for which we have information, by major crop group. Aside from dealing with occasional "outliers" in output or acreage that are the result of either data reporting or coding errors, the two main problems we face in our estimation relate to the valuing of output in fruits and vegetables. We discuss each in turn below.

In the construction of regional estimates, we aggregate data at the provincial level. Regional boundaries have changed since 1992 and a number of provinces have been shifted among regions. To ensure consistency in our estimates at the regional level, we define regions on the basis of the definition in 1992. Table A2 in the appendix provides a breakdown of provinces by region.

Estimates of fruit output

Data on the physical outputs of fruits are not available for 1992. We have data for 1997, 2002, 2004 and 2006, but then only for 5 fruits including banana, rambutan, mango, citrus (oranges, limes and mandarins), and pineapple. In order to obtain estimates of the value of output for all fruits in each year, as well as for 1992, we utilize information from the VLSS. First, for each VLSS year, we estimate for each region the portion of the total value of fruit output that is represented by these five crops. We use this ratio to "blow up" our estimate based on the five fruits in order to obtain an estimate for all fruits. On average, these five crops represent xx.x percent of the gross value of fruit output as reported at the household level. Second, we use the

VLSS data to construct estimates of the rate of growth of the nominal value of fruit output between 1992 and 1997. This estimate is then applied to our estimates for 1997 in order to obtain an estimate of the gross value of fruit output in 1992.

The accuracy of our methodology rests on two things: 1.The similarity in the ratio of these five crops to total fruit output in the household sector compared to fruit production outside the household sector; and 2. How well growth in fruit output at the household level captures aggregate trends. This depends on both the similarity between growth in output in the household and non-household sector, and the representative of the households in the 1992 and 1997 VLSS.

Estimates of vegetable output

GSO does not report disaggregated output for vegetables. They only report total physical output of vegetables in kilograms. In order to value output, we use the VLSS to construct an estimate of the "unit value" for vegetables. This represents the average amount households received per kilogram of vegetables sold to the market calculated over all vegetables. As we do for all other crops, we construct estimates at both the regional level and national level. We also experimented with calculating unit values over the 5 vegetable crops that appear in each of the 5 VLSS. The differences are marginal.

Acreage data for fruits

We do not have complete acreage data for fruits. In order to obtain an estimate of total acreage that is comparable to our measure of output, we use information from the VLSS to estimate the percentage of total fruit acreage in the 5 fruits identified above. The chief difficulty here is that in the VLSS, data on fruit are more likely to be reported in terms of the total number of trees rather than the acreage. Households typically reported one way or the other.

Using the VLSS, we estimate for each of the five benchmark years both the percentage of fruit area, and the percentage of fruit trees in the five fruits we have data for. We do this at both the regional and national level. In general, the two estimates are very consistent with each other, and are in the ballpark of 80-85 percent. We use these estimates to "blow-up" our acreage estimates to obtain an estimate of the total acreage in fruits.

A comparison with GSO Estimates

For comparison, in Table A3 we report GSO's estimates of the nominal value of crop output between 1992 and 2006 at the national level, along with our estimates for the 5 VLSS years. (See columns (1) and (2). In making the comparison between our estimates and those of GSO, it is important to keep in mind that the comparison cannot be exact. There are several reasons for this. First, the number of crops used to estimate output may differ. Second, the "price" data from the VLSS that we are using to value physical output in each of the benchmark years is in fact based on sales in the preceding 12 months. This implies for 2006, for example, that we are using prices over a period spanning part of 2005 and 2006. Nonetheless, for 4 of the years, 1992, 1997, 2002 and 2004, our estimates are within 10 percent of GSOs, and for 1992 and 2004 we do especially well. This is reassuring, and gives our regional estimates, for which we have no other basis for comparison, credibility.

Larger differences are observed for 2006: Our estimate of the nominal value of crop output for 2006 is twenty-five percent higher than GSO. This is exceptionally high and worrisome. More forensics work is required, but we believe the primary reason for the difference is too low of crop prices used by GSO to value output in 2006.

In Table A3, we also compare our price deflator for crop output with GSOs for the five benchmark years: 1992, 1997, 2002, 2004 and 2006. We "backed-out" GSO's deflator for the cropping sector using data they report on output in current prices and in 1994 prices. (See column (5). To facilitate the comparison, we "renormalize" GSOs deflator so that either 1992 or 1993 is equal to 100. Although the two deflators differ in construction (the GSO index uses 1994 output weights, and ours is a chain-linked Laspeyres price index in which the weights change over time), they tell a fairly similar story of what happens to crop prices between 1992 and 2006, but GSO's index shows a smaller drop in crop prices in the late 1990s and early 2000s, and then a significantly smaller increase in crop prices after 2002 (xx.x percent versus yy.y percent). Between 2004 and 2006, their index implies an increase of 5.7; by comparison, our index shows an increase of 24.1 percent. Some of this may be attributable to differences in the weighting of crops in the two price indices and differences in the behaviour of prices across these crops, but it appears to more than just a matter of weighting.

A reasonable point of comparison is the behaviour of crop prices internationally. In Table A4, we provide a set of estimates of for the behaviour of world crop prices for a majority of the crops we are using. All prices are expressed relative to the base year, 1992, while the year-to-year change is the percentage change between survey years. Prices were initially calculated on the basis of US $. These data show increases in international prices between 2002 and 2006 on par with those we estimate on the basis of the unit values from the VLSS. The run-up in the price of paddy, which represents slightly less than half of the gross value of crop output in Vietnam, is especially informative. Internationally, the price of paddy rose 28 percent between 2002 and 2004, and an additional 23 percent between 2004 and 2006. Our unit values for paddy show a similar increase.

Table 1: Nominal and Real Crop Output by Region
(in Millions of VND)

	Nominal Crop Output				
Region:	1992	1997	2002	2004	2006
Red River Delta	7,642,952	16,268,997	16,981,900	19,971,046	24,317,746
North East	3,109,436	6,496,276	10,953,713	14,427,437	19,278,402
North West	594,376	1,375,549	2,354,512	3,160,143	4,356,061
North Central Coast	2,819,342	7,060,252	9,398,532	13,462,599	16,447,691
South Central Coast	1,943,748	4,724,820	5,115,895	6,980,863	9,093,037
Central Highlands	1,562,103	8,425,620	8,195,140	13,982,386	26,282,982
South East	3,736,191	9,491,042	11,555,374	16,898,163	23,642,527
Mekong River Delta	12,234,180	28,937,286	35,794,038	47,452,610	59,404,005
National (1)	33,642,328	82,779,842	100,349,103	136,335,246	182,822,451
	Real Crop Output				
	1992	1997	2002	2004	2006
Red River Delta	7,642,952	9,714,997	10,115,962	10,482,492	10,754,261
North East	3,109,436	4,321,643	7,607,469	8,233,096	9,160,115
North West	594,376	848,125	1,361,833	1,539,018	1,729,887
North Central Coast	2,819,342	4,148,509	5,622,665	6,463,503	6,726,238
South Central Coast	1,943,748	2,613,024	2,979,091	3,399,959	3,618,670
Central Highlands	1,562,103	4,338,874	8,095,304	9,763,406	12,425,300
South East	3,736,191	5,071,545	7,497,102	8,725,053	9,792,838
Mekong River Delta	12,234,180	16,948,933	21,608,717	23,571,218	23,734,240
National (1)	33,642,328	48,005,650	64,888,142	72,177,746	77,941,550
National (2)	33,642,328	49,178,169	64,976,877	72,217,352	78,781,609

Notes:

1/ Source: See Appendix;
2/ "Nominal" values are expressed in current VND, while "Real" values are expressed in 1992 constant prices.
2/ National (1): Sum of real crop output in each region using regional deflators to deflate nominal crop output in each region; National (2): Sum of nominal crop output in each region deflated by the same national (non-region-specific) deflator.

Table 2
Average Annual Rates of Growth of Crop Output
Selected Years as Endpoints

	Nominal Growth in Output				
	92-97	**97-02**	**02-04**	**04-06**	**92-06**
Red River Delta	0.163	0.009	0.084	0.103	0.086
North East	0.159	0.110	0.148	0.156	0.139
North West	0.183	0.113	0.159	0.174	0.153
North Central Coast	0.202	0.059	0.197	0.105	0.134
South Central Coast	0.194	0.016	0.168	0.141	0.117
Central Highlands	0.401	-0.006	0.306	0.371	0.223
South East	0.205	0.040	0.209	0.183	0.141
Mekong River Delta	0.188	0.043	0.151	0.119	0.119
National (1)	0.197	0.039	0.166	0.158	0.129
	Annual Change in Crop Price Index				
	92-97	**97-02**	**02-04**	**04-06**	**92-06**
Red River Delta	0.114	0.000	0.066	0.091	0.061
North East	0.091	-0.010	0.107	0.101	0.059
North West	0.109	0.014	0.095	0.114	0.074
North Central Coast	0.121	-0.004	0.125	0.085	0.070
South Central Coast	0.133	-0.011	0.100	0.110	0.071
Central Highlands	0.174	-0.138	0.208	0.243	0.064
South East	0.142	-0.041	0.130	0.123	0.070
Mekong River Delta	0.121	-0.006	0.107	0.115	0.071
National (1)	0.119	-0.018	0.111	0.113	0.066
	Real Growth in Output				
	92-97	**97-02**	**02-04**	**04-06**	**92-06**
Red River Delta	0.049	0.008	0.018	0.013	0.025
North East	0.068	0.120	0.040	0.055	0.080
North West	0.074	0.099	0.063	0.060	0.079
North Central Coast	0.080	0.063	0.072	0.020	0.064
South Central Coast	0.061	0.027	0.068	0.032	0.045
Central Highlands	0.227	0.133	0.098	0.128	0.160
South East	0.063	0.081	0.079	0.059	0.071
Mekong River Delta	0.067	0.050	0.044	0.003	0.048
National (1)	0.074	0.062	0.055	0.039	0.062
National (2)	0.079	0.057	0.054	0.044	0.063

Notes:

1/ Authors calculations based on numbers reported in Tables 1 and 3.

Table 3
Regional Crop Price Indices (Deflators)

	Pairwise Laspeyres Index			
	92-97	**97-02**	**02-04**	**04-06**
Red River Delta	1.67	1.00	1.13	1.19
North East	1.50	0.96	1.22	1.20
North West	1.62	1.07	1.19	1.23
North Central Coast	1.70	0.98	1.25	1.17
South Central Coast	1.81	0.95	1.20	1.22
Central Highlands	1.94	0.52	1.41	1.48
South East	1.87	0.82	1.26	1.25
Mekong River Delta	1.71	0.97	1.22	1.24

	Chain-linked Laspeyre Index, 1992 =100				
	1992	**1997**	**2002**	**2004**	**2006**
Red River Delta	100.00	167.46	167.87	190.52	226.12
North East	100.00	150.32	143.99	175.24	210.46
North West	100.00	162.19	172.89	205.34	251.81
North Central Coast	100.00	170.19	167.15	208.29	244.53
South Central Coast	100.00	180.82	171.73	205.32	251.28
Central Highlands	100.00	194.19	101.23	143.21	211.53
South East	100.00	187.14	154.13	193.67	241.43
Mekong River Delta	100.00	170.73	165.65	201.32	250.29

Notes:

1/ Authors calculations.

Table 4
Real Growth Rates by Crop and Region
Selected Endpoints, Annual Averages

	Beginning and Endpoints				
	92-97	**97-02**	**02-04**	**04-06**	**92-06**
Cereals:					
Red River Delta	0.037	0.004	-0.002	-0.013	0.012
North East	0.049	0.120	0.034	-0.006	0.063
North West	0.049	0.090	0.103	0.051	0.071
North Central Coast	0.065	0.048	0.064	0.017	0.052
South Central Coast	0.033	0.023	0.064	0.024	0.033
Central Highlands	0.050	0.110	0.136	0.158	0.098
South East	0.081	0.083	0.047	0.013	0.067
Mekong River Delta	0.048	0.051	0.024	-0.008	0.037
National	0.048	0.050	0.033	0.005	0.040
Vegetables and Beans:					
Red River Delta	0.092	0.026	0.097	0.022	0.058
North East	0.056	0.143	0.061	0.032	0.084
North West	0.080	0.105	0.108	0.078	0.093
North Central Coast	0.044	0.059	0.093	0.051	0.057
South Central Coast	0.095	0.100	0.095	0.091	0.096
Central Highlands	0.215	0.136	0.085	0.170	0.161
South East	0.079	0.035	-0.049	0.159	0.055
Mekong River Delta	0.076	0.139	0.138	0.087	0.108
National	0.084	0.086	0.089	0.077	0.085
Annual Industrial Crops:					
Red River Delta	0.074	0.067	0.136	0.067	0.079
North East	0.134	0.096	0.034	0.010	0.088
North West	0.174	0.081	0.062	0.017	0.101
North Central Coast	0.220	0.153	0.021	0.002	0.133
South Central Coast	0.160	0.029	0.029	-0.003	0.069
Central Highlands	0.177	0.133	-0.057	0.170	0.124
South East	0.068	0.017	-0.038	0.034	0.029
Mekong River Delta	0.065	0.042	-0.057	0.058	0.037
National	0.111	0.074	0.001	0.040	0.071
Perennials:					
Red River Delta	0.106	0.094	0.022	-0.019	0.071
North East	0.062	0.147	0.059	0.224	0.113
North West	0.124	0.102	0.324	0.201	0.153
North Central Coast	0.244	0.069	0.196	0.087	0.149
South Central Coast	0.152	0.162	0.293	-0.018	0.148
Central Highlands	0.316	0.132	0.114	0.111	0.189
South East	0.059	0.210	0.170	0.079	0.130
Mekong River Delta					

Table 4
Real Growth Rates by Crop and Region
Selected Endpoints, Annual Averages

	Beginning and Endpoints				
	92-97	**97-02**	**02-04**	**04-06**	**92-06**
National	0.184	0.152	0.125	0.114	0.154
Fruit:					
Red River Delta	0.112	-0.002	0.016	0.240	0.073
North East	0.207	0.099	0.065	0.473	0.179
North West	0.127	0.165	-0.223	0.138	0.083
North Central Coast	0.078	0.084	0.295	0.025	0.101
South Central Coast	0.189	-0.079	0.129	0.126	0.069
Central Highlands	0.064	0.341	0.000	0.085	0.149
South East	-0.004	-0.027	0.159	0.124	0.027
Mekong River Delta	0.269	-0.001	0.159	-0.014	0.110
National	0.164	0.015	0.115	0.101	0.093

Notes:

1/ Authors' calculations. See text.

Table 5
Share of Crop Output by Crop Type and Region
Percentages by Year

	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992:									
Cereals	84.12	65.26	73.18	77.96	79.24	37.69	38.31	85.43	74.62
Vegetables & Beans	7.55	7.50	5.26	8.62	6.19	5.70	6.68	3.74	5.95
Annual Industrials	2.95	10.36	12.11	9.83	9.89	10.89	23.79	5.53	8.40
Perennials	0.21	13.44	1.79	0.51	0.83	43.99	18.51	0.01	5.51
Fruits	5.18	3.45	7.66	3.07	3.85	1.72	12.71	5.29	5.52
1997:									
Cereals	76.26	65.36	65.38	72.43	69.19	15.59	36.68	78.40	64.53
Vegetables & Beans	13.58	10.91	7.17	8.41	7.81	5.95	8.39	4.11	7.81
Annual Industrials	2.71	11.26	13.91	13.41	14.82	6.77	24.59	4.59	8.75
Perennials	0.08	4.02	2.07	1.59	0.72	70.85	20.59	0.00	10.11
Fruits	7.37	8.45	11.48	4.15	7.45	0.83	9.75	12.90	8.79
2002:									
Cereals	73.84	70.44	62.45	70.66	64.73	26.19	40.23	75.38	65.22
Vegetables & Beans	14.31	11.07	7.92	8.48	13.28	13.91	9.67	8.28	10.49
Annual Industrials	3.45	7.52	13.57	14.40	16.01	8.71	12.92	4.73	7.78
Perennials	0.18	3.99	1.68	1.25	1.04	46.24	28.90	0.11	7.82
Fruits	8.22	6.98	14.38	5.21	4.94	4.94	8.29	11.50	8.69
2004:									
Cereals	72.76	68.22	65.85	68.35	65.73	23.59	37.00	75.56	62.83
Vegetables & Beans	15.69	12.88	7.84	9.38	14.13	9.72	6.88	9.50	10.65
Annual Industrials	4.31	8.60	15.93	14.48	14.61	7.15	9.91	3.14	7.14
Perennials	0.29	2.94	3.07	1.73	1.81	57.46	38.86	0.08	11.43
Fruits	6.96	7.36	7.31	6.06	3.72	2.07	7.34	11.72	7.96
2006:									
Cereals	69.03	60.08	64.67	66.74	61.95	20.70	32.65	72.42	56.87
Vegetables & Beans	17.90	12.53	9.37	9.92	15.27	9.94	8.34	10.95	11.65
Annual Industrials	4.24	7.23	13.39	13.93	16.84	4.28	11.08	5.06	7.43
Perennials	0.19	4.58	3.68	2.36	1.43	63.54	41.10	0.06	15.35
Fruits	8.64	15.59	8.88	7.04	4.51	1.54	6.83	11.50	8.70

Notes:

1/ Authors' calculations.

Table 6
Regional Contribution to Crop Sub-aggregates and Total Crop Output
Percentages by Region and Year

	RRD	NE	NW	NC	SCC	CH	SE	MRD
1992:								
Cereals	25.6	8.1	1.7	8.8	6.1	2.3	5.7	41.6
Vegetables & Beans	28.8	11.6	1.6	12.1	6.0	4.5	12.5	22.9
Annual Industrials	8.0	11.4	2.5	9.8	6.8	6.0	31.5	24.0
Perennials	0.8	22.5	0.6	0.8	0.9	37.0	37.3	0.1
Fruits	21.3	5.8	2.4	4.7	4.0	1.4	25.6	34.8
Total	22.7	9.2	1.8	8.4	5.8	4.6	11.1	36.4
1997:								
Cereals	23.2	7.9	1.7	9.6	6.1	2.5	6.5	42.5
Vegetables & Beans	34.2	11.0	1.5	9.2	5.7	7.8	12.3	18.4
Annual Industrials	6.1	10.1	2.6	13.1	9.7	7.9	32.2	18.3
Perennials	0.2	3.1	0.3	1.3	0.4	71.3	23.3	0.0
Fruits	16.5	7.5	2.2	4.0	4.8	1.0	12.7	51.3
Total	19.7	7.8	1.7	8.5	5.7	10.2	11.5	35.0
2002:								
Cereals	19.2	11.8	2.2	10.1	5.1	3.3	7.1	41.2
Vegetables & Beans	23.1	11.5	1.8	7.6	6.5	10.8	10.6	28.2
Annual Industrials	7.5	10.6	4.1	17.3	10.5	9.2	19.1	21.7
Perennials	0.4	5.6	0.5	1.5	0.7	48.3	42.6	0.5
Fruits	16.0	8.8	3.9	5.6	2.9	4.6	11.0	47.2
Total	16.9	10.9	2.3	9.4	5.1	8.2	11.5	35.7
2004:								
Cereals	17.0	11.5	2.4	10.7	5.4	3.9	7.3	41.9
Vegetables & Beans	21.6	12.8	1.7	8.7	6.8	9.4	8.0	31.1
Annual Industrials	8.8	12.7	5.2	20.0	10.5	10.3	17.2	15.3
Perennials	0.4	2.7	0.6	1.5	0.8	51.6	42.2	0.3
Fruits	12.8	9.8	2.1	7.5	2.4	2.7	11.4	51.3
Total	14.6	10.6	2.3	9.9	5.1	10.3	12.4	34.8
2006:								
Cereals	16.1	11.1	2.7	10.6	5.4	5.2	7.4	41.4
Vegetables & Beans	20.5	11.3	1.9	7.7	6.5	12.3	9.3	30.6
Annual Industrials	7.6	10.3	4.3	16.9	11.3	8.3	19.3	22.1
Perennials	0.2	3.1	0.6	1.4	0.5	59.5	34.6	0.1
Fruits	13.2	18.9	2.4	7.3	2.6	2.5	10.2	42.9
Total	13.3	10.5	2.4	9.0	5.0	14.4	12.9	32.5

Notes:
1/ Authors' calculations.

Table 7
Regional and National Sown Area by Sub-Aggregates
In Hectares by Crop, Region, and Year

	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992:									
Cereals	1,400,201	779,799	243,000	924,200	539,300	266,000	526,100	2,963,400	7,642,000
Vegetables & Beans	98,196	48,428	6,760	48,000	22,100	26,500	65,200	71,400	386,584
Annual Industrials	43,015	62,955	20,469	64,516	48,318	40,664	136,170	84,687	500,794
Perennials	2,292	33,137	9,936	15,626	6,087	127,397	283,181	1,258	478,914
Fruits	27,400	16,400	4,000	22,800	20,800	9,300	25,200	135,000	260,900
Total	1,571,104	940,719	284,165	1,075,142	636,605	469,861	1,035,851	3,255,745	9,269,192
1997:									
Cereals	1,385,300	795,500	248,800	908,200	516,700	284,100	628,700	3,516,900	8,284,200
Vegetables & Beans	124,600	67,900	11,800	75,000	38,000	61,600	118,300	98,400	595,600
Annual Industrials	55,600	80,200	31,100	88,400	77,200	60,300	151,700	113,100	657,600
Perennials	3,290	40,637	7,765	28,289	16,048	400,045	427,881	0	923,955
Fruits	49,200	50,600	23,500	38,700	15,400	11,900	50,800	186,000	426,100
Total	1,617,990	1,034,837	322,965	1,138,589	663,348	817,945	1,377,381	3,914,400	10,887,455
2002:									
Cereals	1,141,100	1,035,700	304,900	914,100	496,600	445,800	717,400	3,883,200	8,938,800
Vegetables & Beans	131,400	101,800	17,000	91,400	53,100	100,900	122,000	144,900	762,500
Annual Industrials	60,800	107,600	40,900	140,300	84,400	101,600	134,000	102,300	771,900
Perennials	4,100	63,700	11,100	53,500	32,800	614,800	564,900	3,400	1,348,300
Fruits	70,400	128,900	33,400	51,400	26,700	18,000	117,700	231,000	677,500
Total	1,407,800	1,447,300	407,300	1,250,700	693,600	1,281,100	1,656,000	4,364,800	12,499,000
2004:									
Cereals	1,108,827	1,054,505	336,403	942,096	504,171	487,742	726,275	3,866,819	9,026,838
Vegetables & Beans	147,593	114,334	18,045	102,657	58,033	100,266	108,607	167,127	816,662
Annual Industrials	71,000	110,600	45,900	142,300	83,500	94,400	120,900	91,800	760,400
Perennials	3,975	67,693	14,133	59,327	36,454	627,289	594,634	2,924	1,406,429
Fruits	76,756	136,262	35,551	55,411	28,499	22,134	132,937	260,253	747,803
Total	1,376,455	1,483,394	450,032	1,301,791	710,657	1,331,831	1,683,353	4,388,923	12,758,132
2006:									
Cereals	1,068,700	1,042,900	361,600	944,300	508,500	569,600	688,200	3,828,700	9,012,500
Vegetables & Beans	146,100	117,600	20,200	106,300	63,200	103,100	116,000	188,500	861,000
Annual Industrials	88,700	114,600	46,300	140,300	77,600	90,500	115,400	93,400	766,800
Perennials	3,171	73,796	13,092	61,931	43,563	712,201	661,093	3,454	1,572,301
Fruits	69,784	153,324	36,979	56,363	30,481	25,482	120,906	278,005	771,324
Total	1,376,455	1,502,220	478,171	1,309,194	723,344	1,500,883	1,701,599	4,392,059	12,983,925

Notes:

1/ Authors' calculations. See Text.

Table 8
Share of Sown Area by Crop Type and Region
Percentages of Each Region by Year

	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992:									
Cereals	89.12	82.89	85.51	85.96	84.72	56.61	50.79	91.02	82.45
Vegetables & Beans	6.25	5.15	2.38	4.46	3.47	5.64	6.29	2.19	4.17
Annual Industrials	2.74	6.69	7.20	6.00	7.59	8.65	13.15	2.60	5.40
Perennials	0.15	3.52	3.50	1.45	0.96	27.11	27.34	0.04	5.17
Fruits	1.74	1.74	1.41	2.12	3.27	1.98	2.43	4.15	2.81
1997:									
Cereals	85.62	76.87	77.04	79.77	77.89	34.73	45.64	89.85	76.09
Vegetables & Beans	7.70	6.56	3.65	6.59	5.73	7.53	8.59	2.51	5.47
Annual Industrials	3.44	7.75	9.63	7.76	11.64	7.37	11.01	2.89	6.04
Perennials	0.20	3.93	2.40	2.48	2.42	48.91	31.06	0.00	8.49
Fruits	3.04	4.89	7.28	3.40	2.32	1.45	3.69	4.75	3.91
2002:									
Cereals	81.06	72.04	74.86	73.09	71.60	34.80	43.32	88.97	71.52
Vegetables & Beans	9.33	7.08	4.17	7.31	7.66	7.88	7.37	3.32	6.10
Annual Industrials	4.32	7.48	10.04	11.22	12.17	7.93	8.09	2.34	6.18
Perennials	0.29	4.43	2.73	4.28	4.73	47.99	34.11	0.08	10.79
Fruits	5.00	8.97	8.20	4.11	3.85	1.41	7.11	5.29	5.42
2004:									
Cereals	78.74	71.09	74.75	72.37	70.94	36.62	43.14	88.10	70.75
Vegetables & Beans	10.61	7.71	4.01	7.89	8.17	7.53	6.45	3.81	6.40
Annual Industrials	5.04	7.46	10.20	10.93	11.75	7.09	7.18	2.09	5.96
Perennials	0.28	4.56	3.14	4.56	5.13	47.10	35.32	0.07	11.02
Fruits	5.45	9.19	7.90	4.26	4.01	1.66	7.90	5.93	5.86
2006:									
Cereals	77.64	69.42	75.62	72.13	70.30	37.95	40.44	87.17	69.41
Vegetables & Beans	10.61	7.83	4.22	8.12	8.74	6.87	6.82	4.29	6.63
Annual Industrials	6.44	7.63	9.68	10.72	10.73	6.03	6.78	2.13	5.91
Perennials	0.23	4.91	2.74	4.73	6.02	47.45	38.85	0.08	12.11
Fruits	5.07	10.21	7.73	4.31	4.21	1.70	7.11	6.33	5.94

Notes:

1/ Authors' calculations. See Text.

Table 9
Regional Contribution to Total Sown in each Sub-aggregate
Percentages by Region and Year

	RRD	NE	NW	NC	SCC	CH	SE	MRD
1992:								
Cereals	18.32	10.20	3.18	12.09	7.06	3.48	6.88	38.78
Vegetables & Beans	25.40	12.53	1.75	12.42	5.72	6.85	16.87	18.47
Annual Industrials	8.59	12.57	4.09	12.88	9.65	8.12	27.19	16.91
Perennials	0.48	6.92	2.07	3.26	1.27	26.60	59.13	0.26
Fruits	10.50	6.29	1.53	8.74	7.97	3.56	9.66	51.74
Total	16.95	10.15	3.07	11.60	6.87	5.07	11.18	35.12
1997:								
Cereals	16.72	9.60	3.00	10.96	6.24	3.43	7.59	42.45
Vegetables & Beans	20.92	11.40	1.98	12.59	6.38	10.34	19.86	16.52
Annual Industrials	8.45	12.20	4.73	13.44	11.74	9.17	23.07	17.20
Perennials	0.36	4.40	0.84	3.06	1.74	43.30	46.31	0.00
Fruits	11.55	11.98	5.52	9.08	3.61	2.79	11.92	43.65
Total	14.86	9.50	2.97	10.46	6.09	7.51	12.65	35.95
2002:								
Cereals	12.77	11.59	3.41	10.23	5.56	4.99	8.03	43.44
Vegetables & Beans	17.23	13.35	2.23	11.99	6.96	13.23	16.00	19.00
Annual Industrials	7.88	13.94	5.30	18.18	10.93	13.16	17.36	13.25
Perennials	0.30	4.72	0.82	3.97	2.43	45.60	41.90	0.25
Fruits	10.39	19.03	4.93	7.59	3.94	2.66	17.37	34.10
Total	11.26	11.50	3.26	10.01	5.55	10.25	13.25	34.92
2004:								
Cereals	12.28	11.68	3.73	10.44	5.59	5.40	8.05	42.84
Vegetables & Beans	18.07	14.00	2.21	12.57	7.11	12.28	13.30	20.46
Annual Industrials	9.34	14.54	6.04	18.71	10.98	12.41	15.90	12.07
Perennials	0.28	4.81	1.00	4.22	2.59	44.60	42.28	0.21
Fruits	10.26	18.22	4.75	7.41	3.81	2.96	17.78	34.80
Total	11.04	11.63	3.53	10.20	5.57	10.44	13.19	34.40
2006:								
Cereals	11.86	11.57	4.01	10.48	5.64	6.32	7.64	42.48
Vegetables & Beans	16.97	13.66	2.35	12.35	7.34	11.97	13.47	21.89
Annual Industrials	11.57	14.95	6.04	18.30	10.12	11.80	15.05	12.18
Perennials	0.20	4.69	0.83	3.94	2.77	45.30	42.05	0.22
Fruits	9.05	19.88	4.79	7.31	3.95	3.30	15.68	36.04
Total	10.60	11.57	3.68	10.08	5.57	11.56	13.11	33.83

Notes:
1/ Authors' calculations. See Text.

Table 10
Decomposition of the Growth of Real Crop Output
By Region and for Various Endpoints
Proportions

	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992 to 1997:									
Increased Yields	0.86	0.68	0.60	0.83	0.84	0.34	0.06	0.40	0.50
Increased Sown Area	0.11	0.26	0.32	0.13	0.12	0.42	0.92	0.52	0.41
Interaction	0.03	0.07	0.08	0.05	0.04	0.25	0.02	0.08	0.09
1997 to 2002:									
Yields	4.77	0.35	0.45	0.66	0.65	0.22	0.48	0.52	0.50
Sown Area	-3.15	0.51	0.43	0.28	0.33	0.65	0.42	0.42	0.42
Interaction	-0.62	0.14	0.12	0.06	0.03	0.13	0.10	0.06	0.07
2002 to 2004:									
Yields	0.99	0.59	0.18	0.70	0.81	0.78	0.88	0.93	0.80
Sown Area	0.01	0.39	0.81	0.27	0.17	0.19	0.10	0.06	0.18
Interaction	0.00	0.02	0.02	0.03	0.02	0.03	0.01	0.01	0.02
2004 to 2006:									
Yields	1.91	0.88	0.47	0.86	0.71	0.47	0.90	0.90	0.70
Sown Area	-0.87	0.11	0.50	0.14	0.28	0.47	0.09	0.10	0.20
Interaction	-0.04	0.01	0.03	0.00	0.01	0.06	0.01	0.00	0.10
1992 to 2006:									
Yields	1.49	0.43	0.38	0.69	0.74	0.21	0.37	0.47	0.50
Sown Area	-0.30	0.31	0.36	0.16	0.16	0.32	0.40	0.37	0.30
Interaction	-0.18	0.26	0.26	0.15	0.10	0.47	0.24	0.16	0.20

Notes:

1/ Authors' calculations. See Text.

Table 11
Yields (Tons Per Hectare)
By Crop, Region, and Year

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992										
Cereals	Cassava	8.59	9.68	8.42	7.31	8.84	7.69	12.21	8.78	9.05
	Maize	2.16	1.32	1.21	1.32	1.10	1.96	1.46	2.24	1.56
	Rice	3.88	2.48	1.91	2.58	2.98	2.40	2.49	3.74	3.33
	Sweet potatoes	8.72	6.52	3.85	4.63	4.23	6.03	5.15	10.35	6.40
Vegetables & Beans	Beans									
	Vegetable	12.40	9.59	10.00	7.96	11.02	14.32	10.56	13.21	11.23
Annual Industrials	Cotton		0.38	0.37	0.28	0.25	0.73	0.80	0.00	0.67
	Peanuts	0.89	0.80	0.68	0.64	0.71	0.96	1.51	1.80	1.04
	Soybeans	1.04	0.58	0.73	0.67	0.71	0.88	0.69	1.56	0.82
	Sugar cane	49.78	30.45	28.29	42.92	36.56	33.46	44.52	50.29	43.94
	Tobacco	0.31	1.01		0.62	0.82	0.53	2.89	1.48	1.23
Perennials	Black pepper				0.56		0.95	1.30	0.44	1.08
	Cashew									
	Coffee				0.35	0.43	1.14	1.49		1.15
	Rubber						0.15	0.36		0.32
	Tea	2.65	2.63	1.35	2.55	0.15	3.34	2.91		2.56
Fruits	All fruits									
1997										
Cereals	Cassava	8.82	9.52	7.56	6.11	8.82	9.32	15.61	8.73	9.45
	Maize	3.06	2.08	1.54	2.22	1.95	3.05	3.01	3.12	2.49
	Rice	4.71	3.22	2.60	3.61	3.68	2.86	3.04	3.98	3.88
	Sweet potatoes	7.84	5.83	3.82	5.16	5.27	6.49	5.60	13.73	6.33
Vegetables & Beans	Beans	0.79	0.60	0.58	0.56	0.79	0.67	0.52	1.37	0.69
	Vegetable	15.78	10.79	10.20	8.65	11.36	17.23	13.44	13.12	13.18
Annual Industrials	Cotton		0.56	0.33	0.50		1.15	1.11		0.94
	Peanuts	1.44	1.02	1.00	1.23	1.26	1.04	1.79	1.81	1.39
	Soybeans	1.22	0.81	0.83	0.92	1.40	1.11	0.86	2.10	1.06
	Sugar cane	38.98	36.61	45.05	56.23	42.79	41.00	45.08	49.86	46.38
	Tobacco	1.40	1.26		0.80	1.05	0.88	0.93	2.20	1.03
Perennials	Black pepper				0.57	1.14	0.96	2.66		1.75
	Cashew					0.15	0.22	0.36		0.33
	Coffee			0.33	0.63		1.31	1.09		1.26
	Rubber				0.41		0.25	0.59		0.50
	Tea	3.05	2.86	2.21	3.01	1.27	3.56	1.24		2.99
Fruits	All fruits	7.84	3.00	2.40	3.05	9.28	2.20	7.69	6.57	5.85

Table 11
Yields (Tons Per Hectare)
By Crop, Region, and Year

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
2002										
Cereals	Cassava	10.77	10.50	8.33	8.07	11.87	13.09	19.02	13.05	13.17
	Maize	3.52	2.65	2.54	2.98	2.90	3.07	3.49	4.23	3.02
	Rice	5.64	4.22	3.27	4.51	4.28	3.25	3.47	4.62	4.59
	Sweet potatoes	8.56	6.30	4.38	5.89	5.65	7.83	5.55	16.79	7.17
Vegetables & Beans	Beans	1.00	0.80	0.76	0.57	0.88	0.55	0.68	1.35	0.71
	Vegetable	16.27	10.89	10.22	8.87	12.21	17.51	10.00	14.60	13.35
Annual Industrials	Cotton		0.38	0.65		0.00	1.20	0.92		1.05
	Peanuts	1.91	1.25	0.99	1.64	1.46	1.09	2.01	2.32	1.62
	Soybeans	1.48	0.95	1.06	1.33	0.00	1.37	0.81	2.24	1.28
	Sugar cane	51.67	42.72	48.46	54.19	42.39	42.18	52.32	69.23	53.50
	Tobacco	0.00	1.37	0.00	0.67	1.25	1.04	1.28	2.20	1.28
Perennials	Black pepper				0.42	0.40	1.11	0.99	0.63	0.94
	Cashew					0.19	0.38	0.61	0.33	0.54
	Coffee	0.10	0.11	0.55	0.55	0.60	1.41	0.99		1.34
	Rubber				0.23	0.06	0.35	0.87		0.69
	Tea	3.76	3.67	2.34	2.64	2.14	5.30	1.00		3.88
Fruits	All fruits	7.69	1.77	1.87	3.56	5.82	3.69	2.96	6.31	4.49
2004										
Cereals	Cassava	11.64	11.80	9.60	11.74	15.14	15.07	20.14	7.82	14.98
	Maize	4.09	2.90	2.78	3.67	3.51	3.58	3.81	5.30	3.46
	Rice	5.78	4.47	3.63	4.93	4.71	3.95	3.75	4.87	4.86
	Sweet potatoes	8.91	6.39	4.79	6.17	6.09	7.66	5.43	18.34	7.48
Vegetables & Beans	Beans	1.21	0.79	1.64	0.71	0.99	0.67	0.76	1.43	0.83
	Vegetable	17.30	10.92	10.93	9.33	13.31	19.61	10.18	16.03	14.40
Annual Industrials	Cotton		0.38	0.75	0.33	0.00	1.32	1.17		1.15
	Peanuts	2.25	1.65	1.48	1.75	1.58	0.94	2.13	2.65	1.83
	Soybeans	1.65	1.00	1.12	1.39	0.00	0.98	0.85	2.23	1.32
	Sugar cane	52.85	43.72	49.78	56.29	45.66	49.31	54.41	69.39	55.32
	Tobacco		1.49		0.80	1.33	1.57	1.43	2.00	1.44
Perennials	Black pepper				0.72	0.52	1.51	1.50	0.66	1.38
	Cashew				0.10	0.36	0.43	0.85	0.53	0.73
	Coffee	0.36	0.13	0.66	0.74	0.80	1.76	1.11		1.66
	Rubber				0.27	0.00	0.54	1.09		0.89
	Tea	4.03	3.85	3.46	2.72	2.19	5.53			4.11
Fruits	All fruits	7.57	2.61	1.89	5.87	5.17	3.87	3.27	6.27	4.85

Table 11
Yields (Tons Per Hectare)
By Crop, Region, and Year

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
2006										
Cereals	Cassava	11.79	12.55	9.69	14.86	15.65	16.21	25.66	10.52	17.33
	Maize	4.10	2.82	2.90	3.47	3.88	4.40	4.67	5.39	3.72
	Rice	5.81	4.54	3.80	5.10	4.91	4.29	3.99	4.82	4.90
	Sweet potatoes	9.40	6.39	4.71	6.14	5.92	9.77	7.76	19.82	8.04
Vegetables & Beans	Beans	1.52	0.79	0.85	0.72	1.08	0.80	0.87	1.46	0.90
	Vegetable	18.13	11.11	11.29	9.81	14.67	21.12	11.81	16.70	15.22
Annual Industrials	Cotton	0.00	0.67	0.92			1.38	1.20		1.41
	Peanuts	2.33	1.46	1.29	1.76	1.85	1.39	2.17	3.00	1.87
	Soybeans	1.54	1.03	1.20	1.28	1.68	1.59	1.10	2.08	1.40
	Sugar cane	49.32	46.40	53.79	55.11	45.40	54.06	57.78	74.36	58.03
	Tobacco	0.00	1.37	0.00	1.75	1.74	1.73	1.67	2.25	1.60
Perennials	Black pepper				0.72	0.90	2.16	1.59	1.79	1.69
	Cashew				0.84	0.26	0.31	1.22	0.69	0.88
	Coffee	3.80	0.75	1.47	0.80	0.94	2.06	1.57		2.00
	Rubber				0.41	0.04	0.79	1.63		1.32
	Tea	4.61	5.27	4.43	5.24	1.89	6.28			5.39
Fruits	All fruits	7.61	2.13	2.73	5.12	5.63	4.23	4.34	6.71	5.16

Notes:

1/ Authors' calculations. See Text.

Table 12
Annual Rate of Growth in Yields of Key Crops
By Crop, Region, and Various Endpoints

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
1992 to 1997:										
Cereals	Cassava	0.005	-0.003	-0.021	-0.035	0.000	0.039	0.050	-0.001	0.009
	Maize	0.072	0.095	0.049	0.110	0.121	0.092	0.156	0.069	0.097
	Rice	0.040	0.054	0.064	0.070	0.043	0.036	0.041	0.012	0.031
	Sweet potatoes	-0.021	-0.022	-0.002	0.022	0.045	0.015	0.017	0.058	-0.002
Vegetables & Beans	Beans									
	Vegetable	0.049	0.024	0.004	0.017	0.006	0.038	0.049	-0.001	0.033
Annual Industrials	Cotton		0.077	-0.021	0.125		0.094	0.069		0.069
	Peanuts	0.100	0.048	0.080	0.139	0.120	0.017	0.034	0.000	0.059
	Soybeans	0.032	0.068	0.028	0.066	0.144	0.047	0.046	0.062	0.052
	Sugar cane	-0.048	0.038	0.098	0.056	0.032	0.041	0.003	-0.002	0.011
	Tobacco	0.349	0.045		0.052	0.049	0.105	-0.203	0.082	-0.035
Perennials	Black pepper				0.004		0.002	0.155		0.100
	Cashew									
	Coffee				0.123		0.029	-0.060		0.020
	Rubber						0.110	0.101		0.095
	Tea	0.028	0.017	0.103	0.034	0.526	0.013	-0.157		0.032
Fruits	All fruits									NA
Average (all crops)										0.024
Average (ex. Perennials)										0.024
1997 to 2002:										
Cereals	Cassava	8.82	9.52	7.56	6.11	8.82	9.32	15.61	8.73	9.45
	Maize	3.06	2.08	1.54	2.22	1.95	3.05	3.01	3.12	2.49
	Rice	4.71	3.22	2.60	3.61	3.68	2.86	3.04	3.98	3.88
	Sweet potatoes	7.84	5.83	3.82	5.16	5.27	6.49	5.60	13.73	6.33
Vegetables & Beans	Beans	0.79	0.60	0.58	0.56	0.79	0.67	0.52	1.37	0.69
	Vegetable	15.78	10.79	10.20	8.65	11.36	17.23	13.44	13.12	13.18
Annual Industrials	Cotton		0.56	0.33	0.50		1.15	1.11		0.94
	Peanuts	1.44	1.02	1.00	1.23	1.26	1.04	1.79	1.81	1.39
	Soybeans	1.22	0.81	0.83	0.92	1.40	1.11	0.86	2.10	1.06
	Sugar cane	38.98	36.61	45.05	56.23	42.79	41.00	45.08	49.86	46.38
	Tobacco	1.40	1.26		0.80	1.05	0.88	0.93	2.20	1.03
Perennials	Black pepper				0.57	1.14	0.96	2.66		1.75
	Cashew					0.15	0.22	0.36		0.33
	Coffee			0.33	0.63		1.31	1.09		1.26
	Rubber				0.41		0.25	0.59		0.50

Table 12
Annual Rate of Growth in Yields of Key Crops
By Crop, Region, and Various Endpoints

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
	Tea	3.05	2.86	2.21	3.01	1.27	3.56	1.24		2.99
Fruits	All fruits	7.84	3.00	2.40	3.05	9.28	2.20	7.69	6.57	5.85
Average (all crops)										0.024
Average (ex. Perennials)										0.024
2002 to 2004:										
Cereals	Cassava	0.039	0.060	0.073	0.206	0.129	0.073	0.029	-0.226	0.066
	Maize	0.077	0.047	0.047	0.110	0.101	0.080	0.045	0.120	0.071
	Rice	0.012	0.029	0.055	0.046	0.049	0.102	0.039	0.026	0.028
	Sweet potatoes	0.020	0.007	0.046	0.024	0.039	-0.011	-0.011	0.045	0.022
Vegetables & Beans	Beans	0.099	-0.009	0.471	0.121	0.059	0.106	0.052	0.032	0.079
	Vegetable	0.031	0.001	0.034	0.026	0.044	0.058	0.009	0.048	0.038
Annual Industrials	Cotton		0.006	0.072			0.048	0.128		0.046
	Peanuts	0.087	0.147	0.224	0.035	0.041	-0.073	0.027	0.068	0.063
	Soybeans	0.055	0.025	0.029	0.022		-0.155	0.024	-0.002	0.013
	Sugar cane	0.011	0.012	0.014	0.019	0.038	0.081	0.020	0.001	0.017
	Tobacco		0.044		0.095	0.033	0.232	0.054	-0.047	0.061
Perennials	Black pepper				0.301	0.144	0.166	0.233	0.025	0.214
	Cashew					0.359	0.065	0.181	0.264	0.167
	Coffee	0.890	0.095	0.093	0.153	0.153	0.114	0.059		0.113
	Rubber				0.084	-0.737	0.238	0.121		0.132
	Tea	0.035	0.023	0.217	0.015	0.010	0.022			0.028
Fruits	All fruits	-0.008	0.214	0.004	0.284	-0.058	0.025	0.051	-0.003	0.039
Average (all crops)										0.071
Average (ex. Perennials)										0.045
2004 to 2006:										
Cereals	Cassava	0.006	0.032	0.005	0.125	0.017	0.037	0.129	0.160	0.076
	Maize	0.002	-0.015	0.021	-0.028	0.051	0.108	0.107	0.008	0.037
	Rice	0.003	0.007	0.023	0.017	0.021	0.043	0.032	-0.005	0.004
	Sweet potatoes	0.027	-0.001	-0.009	-0.002	-0.014	0.130	0.195	0.039	0.037
Vegetables & Beans	Beans	0.122	0.001	-0.282	0.008	0.042	0.093	0.072	0.008	0.043
	Vegetable	0.024	0.009	0.016	0.025	0.050	0.038	0.077	0.021	0.028
Annual Industrials	Cotton		0.325	0.105			0.019	0.010		0.109
	Peanuts	0.017	-0.058	-0.067	0.003	0.083	0.214	0.010	0.064	0.009
	Soybeans	-0.034	0.015	0.035	-0.039		0.275	0.139	-0.036	0.032
	Sugar cane	-0.034	0.030	0.039	-0.011	-0.003	0.047	0.030	0.035	0.024
	Tobacco		-0.040		0.479	0.141	0.050	0.083	0.061	0.052
Perennials	Black pepper				-0.002	0.313	0.197	0.030	0.647	0.105

Table 12
Annual Rate of Growth in Yields of Key Crops
By Crop, Region, and Various Endpoints

Sub aggregate	Crop	RRD	NE	NW	NC	SCC	CH	SE	MRD	National
	Cashew				1.931	-0.146	-0.155	0.198	0.142	0.099
	Coffee	2.262	1.372	0.499	0.043	0.085	0.083	0.187		0.097
	Rubber				0.223	2.124	0.208	0.220		0.217
	Tea	0.070	0.170	0.131	0.388	-0.071	0.065			0.145
Fruits	All fruits	0.002	-0.096	0.203	-0.066	0.044	0.045	0.152	0.034	0.031
Average (all crops)										0.067
Average (ex. Perennials)										0.040
1992 to 2006:										
Cereals	Cassava	0.023	0.019	0.010	0.052	0.042	0.055	0.054	0.013	0.047
	Maize	0.047	0.055	0.065	0.071	0.094	0.059	0.087	0.065	0.064
	Rice	0.029	0.044	0.051	0.050	0.036	0.043	0.034	0.018	0.028
	Sweet potatoes	0.005	-0.001	0.014	0.020	0.024	0.035	0.030	0.048	0.016
Vegetables & Beans	Beans									
	Vegetable	0.028	0.011	0.009	0.015	0.021	0.028	0.008	0.017	0.022
Annual Industrials	Cotton		0.040	0.067			0.046	0.029		0.054
	Peanuts	0.071	0.044	0.046	0.075	0.071	0.027	0.026	0.037	0.043
	Soybeans	0.029	0.042	0.037	0.048	0.063	0.043	0.034	0.021	0.039
	Sugar cane	-0.001	0.031	0.047	0.018	0.016	0.035	0.019	0.028	0.020
	Tobacco		0.022		0.077	0.055	0.088	-0.038	0.030	0.019
Perennials	Black pepper				0.018		0.061	0.015	0.105	0.032
	Cashew									0.117
	Coffee				0.060	0.057	0.043	0.004		0.041
	Rubber						0.126	0.113		0.107
	Tea	0.040	0.051	0.089	0.053	0.196	0.046	-1.000		0.055
Fruits	All fruits	-0.003	-0.037	0.014	0.059	-0.054	0.076	-0.062	0.002	-0.014
Average (all crops)										0.043
Average (ex. Perennials)										0.033

Notes:

1/ Authors' calculations, based on yield data reported in Table 11.

Table 13
Real Crop Output by Acreage Quintiles
By Year (in Thousands of VND)

	1	2	3	4	5	Overall
1992:						
Cereals	403.4	1,174.7	1,773.2	2,333.7	3,059.2	1,785.9
Vegetables & Beans	47.3	89.5	135.8	148.6	125.8	111.6
Annual Industrials	67.7	103.5	146.3	262.6	508.5	222.2
Perennials	163.6	82.3	90.7	110.3	319.7	155.9
Fruits	199.7	81.6	114.1	164.3	331.2	181.2
Total	881.6	1,531.5	2,260.0	3,019.5	4,344.4	2,456.8
1997						
Cereals	493.0	1,511.1	2,203.2	2,767.4	4,058.7	2,206.1
Vegetables & Beans	76.2	139.0	160.2	154.7	143.0	134.6
Annual Industrials	44.8	146.8	264.7	474.0	887.0	363.3
Perennials	162.3	158.0	240.0	430.4	961.9	390.4
Fruits	205.9	257.3	311.7	307.8	395.9	295.7
Total	982.2	2,212.2	3,179.9	4,134.3	6,446.4	3,390.1
2002						
Cereals	630.5	1,708.5	2,493.1	3,307.6	4,810.1	2,589.4
Vegetables & Beans	106.7	160.7	243.8	268.4	186.2	193.1
Annual Industrials	43.7	107.4	218.8	397.7	588.1	271.1
Perennials	79.8	104.3	237.1	506.8	1,056.0	396.7
Fruits	260.0	300.3	395.9	465.9	552.3	394.8
Total	1,120.8	2,381.2	3,588.7	4,946.3	7,192.6	3,845.2
2004						
Cereals	612.8	1,787.4	2,810.5	3,776.1	5,395.0	2,876.0
Vegetables & Beans	166.5	169.5	237.7	279.4	214.3	213.5
Annual Industrials	39.0	126.7	258.3	400.0	450.5	254.8
Perennials	77.1	115.9	239.2	763.2	989.9	437.0
Fruits	254.9	362.0	462.8	622.5	915.6	523.5
Total	1,150.3	2,561.6	4,008.5	5,841.3	7,965.3	4,304.9
2006:						
Cereals	698.1	2,553.5	4,252.6	6,243.7	8,767.1	4,502.3
Vegetables & Beans	207.4	196.0	275.4	236.1	225.9	228.1
Annual Industrials	61.8	144.4	295.4	406.6	592.5	300.1
Perennials	89.2	230.8	536.3	834.2	1,092.3	556.5
Fruits	344.1	379.8	489.1	523.7	829.9	513.3
Total	1,400.5	3,504.5	5,848.8	8,244.3	11,507.7	6,100.4
Annual Growth (1992-2006)	0.033	0.059	0.067	0.071	0.069	0.064

Notes:
1/ Based on VLSS, 1992, 1998, 2002, 2004, and 2006.

Table 14
Real Crop Output by Income Quintiles
By Year (in Thousands of VND)

	1	2	3	4	5	Overall
1992:						
Cereals	1,281.4	1,700.2	1,938.6	2,062.2	2,103.1	1,785.9
Vegetables & Beans	74.1	84.5	142.6	153.6	117.8	111.6
Annual Industrials	151.8	212.1	196.9	256.1	314.0	222.2
Perennials	157.8	92.6	125.4	146.2	257.2	155.9
Fruits	126.9	126.7	152.8	207.3	308.3	181.2
Total	1,792.1	2,216.2	2,556.3	2,825.4	3,100.4	2,456.8
1997						
Cereals	1,713.5	2,105.2	2,209.0	2,629.1	2,402.9	2,206.1
Vegetables & Beans	59.6	128.2	152.3	157.3	179.2	134.6
Annual Industrials	157.8	308.6	345.9	455.1	550.0	363.3
Perennials	99.2	215.8	316.7	364.5	925.6	390.4
Fruits	150.9	198.3	299.3	339.0	484.6	295.7
Total	2,181.0	2,956.0	3,323.2	3,945.0	4,542.3	3,390.1
2002						
Cereals	2,106.1	2,622.9	2,831.5	2,873.7	2,452.7	2,589.4
Vegetables & Beans	125.2	191.8	203.6	232.8	198.2	193.1
Annual Industrials	219.8	263.4	274.4	296.4	287.8	271.1
Perennials	161.6	292.6	378.4	453.9	604.4	396.7
Fruits	126.3	205.1	299.4	440.7	764.0	394.8
Total	2,739.1	3,575.8	3,987.3	4,297.4	4,307.2	3,845.2
2004						
Cereals	2,567.1	2,892.9	3,340.9	3,043.7	2,553.4	2,876.0
Vegetables & Beans	138.5	185.9	206.9	250.8	269.5	213.5
Annual Industrials	224.2	275.5	254.5	282.3	237.4	254.8
Perennials	146.0	270.9	377.3	502.8	806.5	437.0
Fruits	147.9	335.5	396.7	675.2	960.1	523.5
Total	3,223.8	3,960.7	4,576.2	4,754.9	4,827.0	4,304.9
2006:						
Cereals	3,868.6	4,920.8	5,233.8	4,969.1	3,616.4	4,502.3
Vegetables & Beans	139.5	176.8	181.8	336.4	284.3	228.1
Annual Industrials	135.9	272.0	318.7	378.3	370.0	300.1
Perennials	186.7	203.3	422.6	498.2	1,320.8	556.5
Fruits	209.2	322.4	358.4	525.0	1,041.9	513.3
Total	4,539.9	5,895.3	6,515.4	6,706.9	6,633.5	6,100.4
Annual Growth (1992-2006)	0.066	0.069	0.066	0.061	0.054	0.064

Notes:
1/ Based on VLSS, 1992, 1998, 2002, 2004, and 2006.

Table A1: Crops included in the GSO Provincial Data

Aggregate:	Sub-components (if any):
Cereals	Rice
	Maize
	Cassava
	Sweet Potatoes
Annual Industrial	Peanuts
	Cotton
	Soybeans
	Sugar
	Tobacco
Perennials	Coffee
	Pepper
	Cashews
	Rubber
	Tea
Fruit	Pineapple
	Citrus (oranges, limes and mandarins)
	Banana
	Rambutan
	Mango
Vegetables (Miscellaneous)	
Green Beans	

Table A2: Definitions of the Regions (Provinces assigned by Region)

Region	Included Provinces	
Red River Delta (RRD)	Haiduong	Hungyen
	Haiphong	Namdinh
	Hanam	Ninhbinh
	Hanoi	Thaibinh
	Hatay	
Northeast (NE)	Bacgiang	Phutho
	Backan	Quangninh
	Bacninh	Thainguyen
	Caobang	Tuyenquang
	Hagiang	Vinhphuc
	Langson	Yenbai
	Laocai	
Northwest (NW)	Dienbien	Laichau
	Hoabinh	Sonla
North Coastal (NC)	Hatinh	Quangbinh
	Hue	Quangtri
	Nghean	Thanhhoa
South Central Coast (SCC)	Binhdinh	Phuyen
	Danang	Quangnam
	Khanhhoa	Quangngai
Central Highlands (CH)	Daklak	Lamdong
	Gialai	Daknong
	Kontum	
Southeast (SE)	Baria - Vungtau	Dongnai
	Binhduong	Ninhthuan
	Binhphuoc	TP Ho Chi Minh
	Binhthuan	Tayninh
Mekong River Delta (MRD)	Angiang	Kiengiang
	Baclieu	Longan
	Bentre	Soctrang
	Camau	Tiengiang
	Cantho	Travinh
	Dongthap	Vinhlong
	HauGiang	

Table A3
Comparing GSO and VLSS-based Nominal Output and Crop Price Deflators by Year

Year	(1) GSO	(2) VLSS	(3) GSO	(4) GSO	(5) GSO	(6) GSO	(7) GSO	(8) VLSS	(9) VLSS
	Nominal Output (Billions of VND)		Real Output Base=1994	Implicit Deflator (1)/(3)	Base 1994	Base 1992	Base 1993	Deflator Base 1992	Base 1993
1985	41		41,951	0.1	0.1	0.1	0.1		
1986	190		43,471	0.4	0.5	0.6	0.6		
1987	999		42,571	2.3	2.9	3.4	3.4		
1988	5,201		45,406	11.5	14.1	16.8	16.5		
1989	10,706		48,900	21.9	27.0	32.2	31.6		
1990	16,394		49,604	33.0	40.8	48.5	47.7		
1991	33,345		51,248	65.1	80.4	95.6	93.9		
1992	37,540	33,642	55,133	68.1	84.1	100.0	98.3	100.0	
1993	40,818		58,906	69.3	85.6	101.8	100.0		100.0
1994	49,921		61,660	81.0	100.0	118.9	116.8		
1995	66,794		66,183	100.9	124.7	148.2	145.6		
1996	71,989		70,779	101.7	125.6	149.4	146.8		
1997	77,358	82,780	75,746	102.1	126.1	150.0	147.4	170.7	
1998	91,226		80,292	113.6	140.3	166.9	164.0		170.7
1999	101,648		86,381	117.7	145.3	172.8	169.8		
2000	101,044		90,858	111.2	137.4	163.3	160.5		
2001	101,403		92,907	109.1	134.8	160.3	157.5		
2002	111,172	99,153	98,061	113.4	140.0	166.5	163.6	155.2	155.2
2003	116,066		101,786	114.0	140.8	167.5	164.6		
2004	131,552	134,318	106,423	123.6	152.7	181.5	178.4	188.9	188.9
2005	134,755		107,898	124.9	154.3	183.4	180.2		
2006	144,773	182,822	110,822	130.6	161.4	191.9	188.5	234.4	234.4

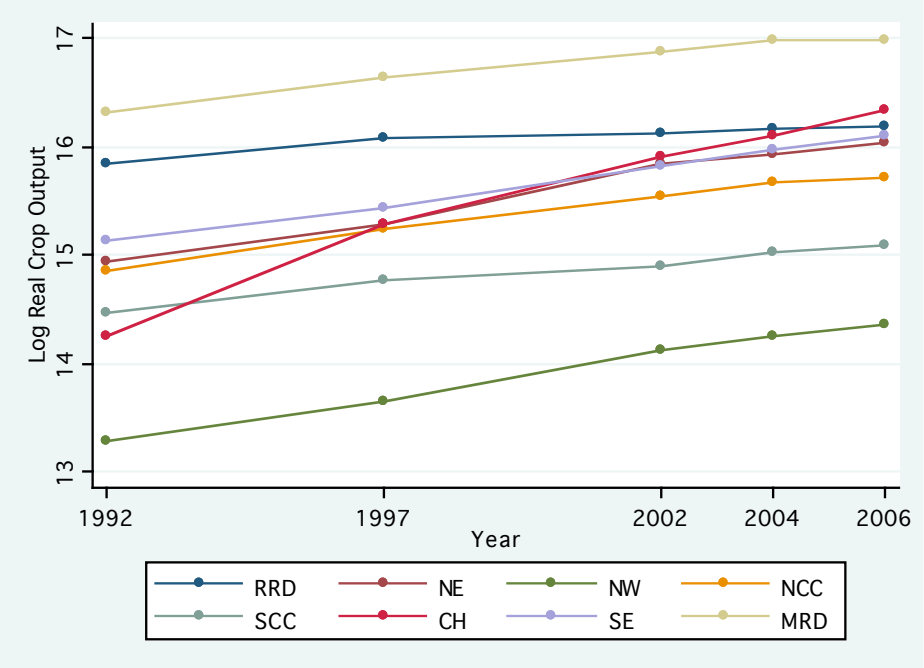
Notes:
1/ See Appendix

Table A4
The Evolution of World Prices, Selected Crops
Base Year = 1992

Year	1992	1997	2002	2004	2006
Grain					
Rice	100	113	72	92	113
(year to year)		13%	-37%	28%	23%
Corn/Maize	100	112	95	107	117
(year to year)		12%	-15%	13%	9%
Annuals					
Peanuts	100	135	101	140	128
(year to year)		35%	-25%	39%	-9%
Soybeans	100	134	90	132	104
(year to year)		34%	-33%	47%	-21%
Tobacco	100	103	80	80	86
(year to year)		3%	-22%	0%	8%
Cotton	100	137	80	107	100
(year to year)		37%	-42%	34%	-6%
Cassava (Tapioca)	100	57	48	67	79
(year to year)		-43%	-15%	38%	18%
Sugar	100	118	96	69	93
(year to year)		18%	-19%	-28%	34%
Perennials					
Coffee	100	185	71	85	161
(year to year)		85%	-62%	21%	89%
Pepper	100	430	157	175	220
(year to year)		330%	-64%	11%	26%
Rubber	100	116	81	134	220
(year to year)		16%	-30%	66%	64%
Cashews	100	102	77	91	88
(year to year)		2%	-24%	17%	-4%
Tea	100	144	121	132	144
(year to year)		44%	-16%	9%	9%
Fruit					
Bananas	100	110	112	111	144
(year to year)		10%	1%	-1%	30%
Oranges	100	94	115	175	169
(year to year)		-6%	23%	51%	-3%

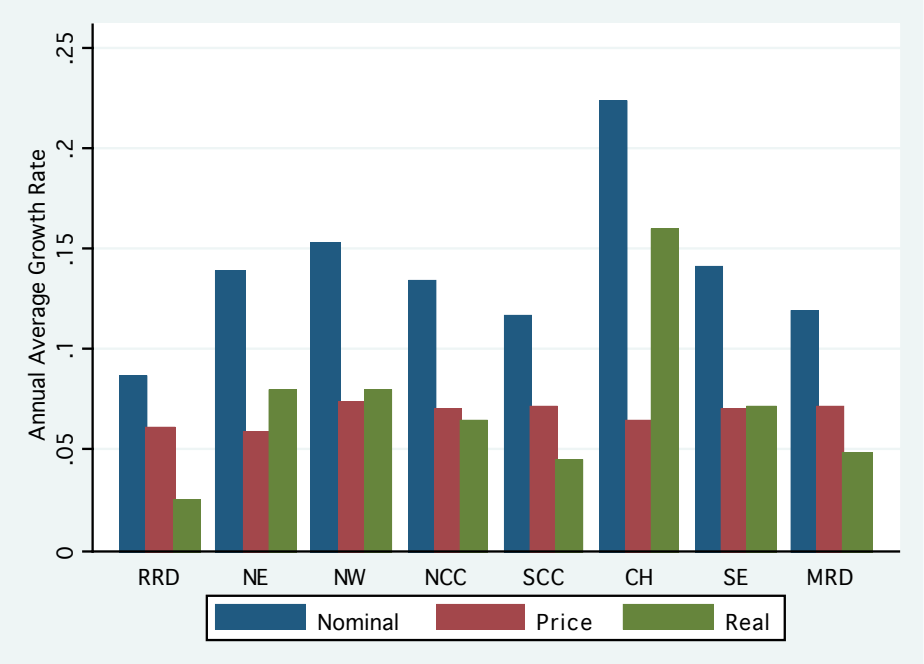
Notes: 1/ All price indices are expressed relative to the base year (1992), while the "year to year" change is the percentage change between survey years;
2/ Prices in the index are calculated on the basis of U.S. Dollars per metric ton.

Figure 1: Real Crop Output by Year (in logarithms)



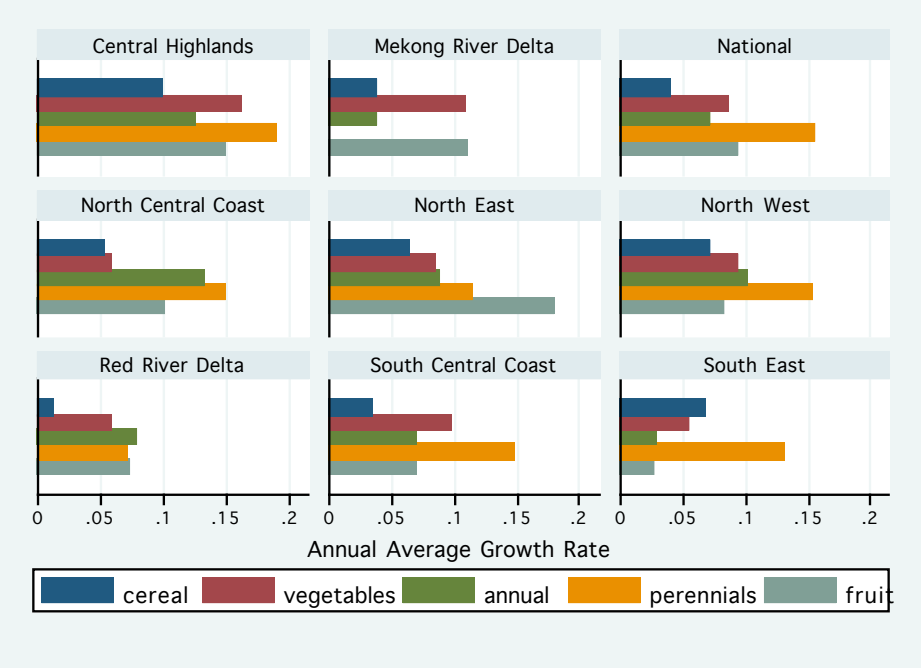
Notes: Based on authors' calculations, and numbers reported in Table 1.

Figure 2: Decomposition of Growth Rates by Region



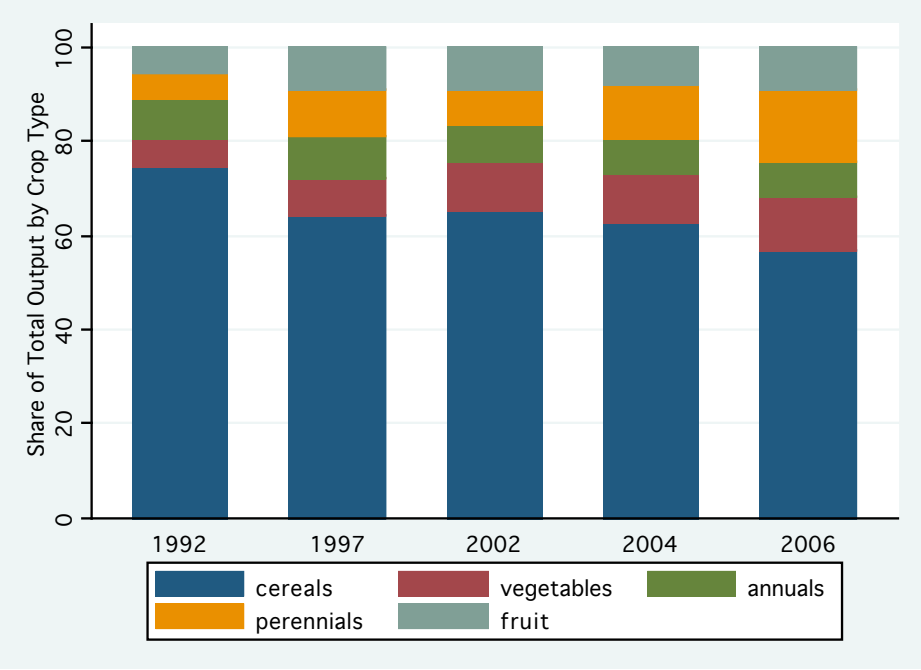
Notes: Based on authors' calculations, and numbers reported in Table 2.

Figure 3: Real Annual Average Growth Rates by Crop and Region, 1992-2006



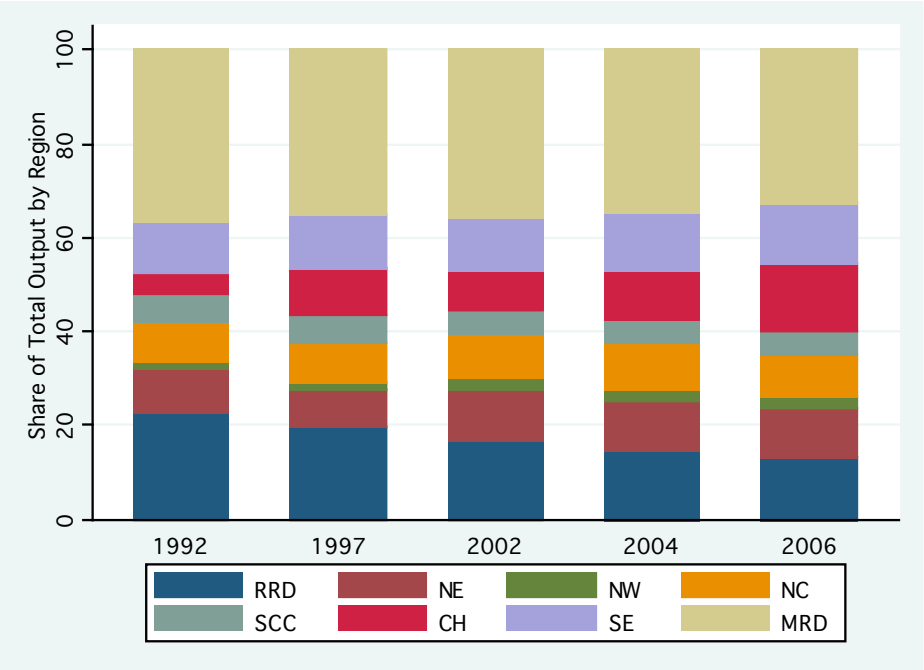
Notes: Based on authors' calculations, and numbers reported in Table 4.

Figure 4: Share of Real Crop Output by Crop Type, by Year



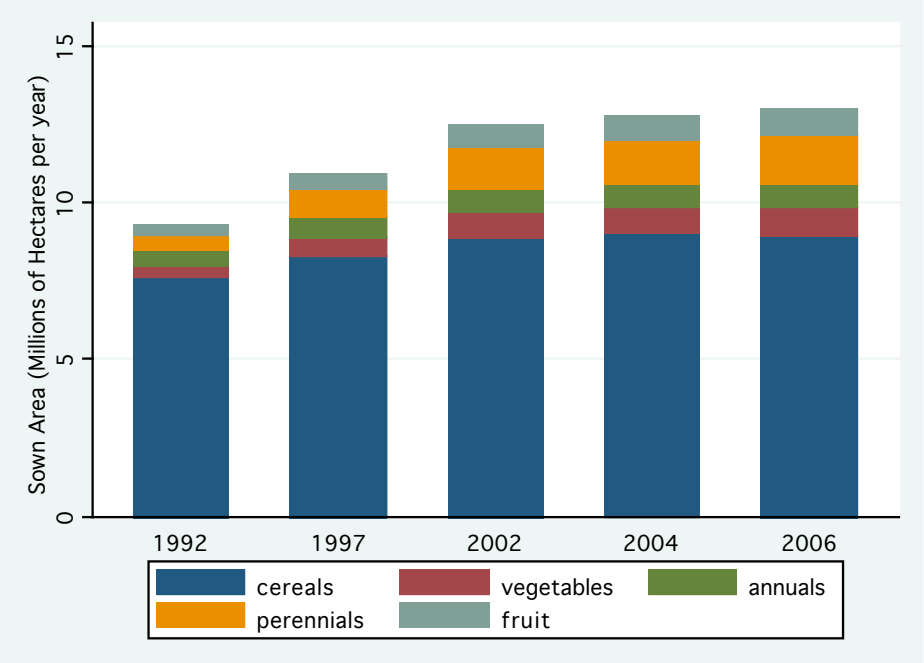
Notes: Based on authors' calculations, and numbers reported in Table 5.

Figure 5: Share of Real Output by Region and Year



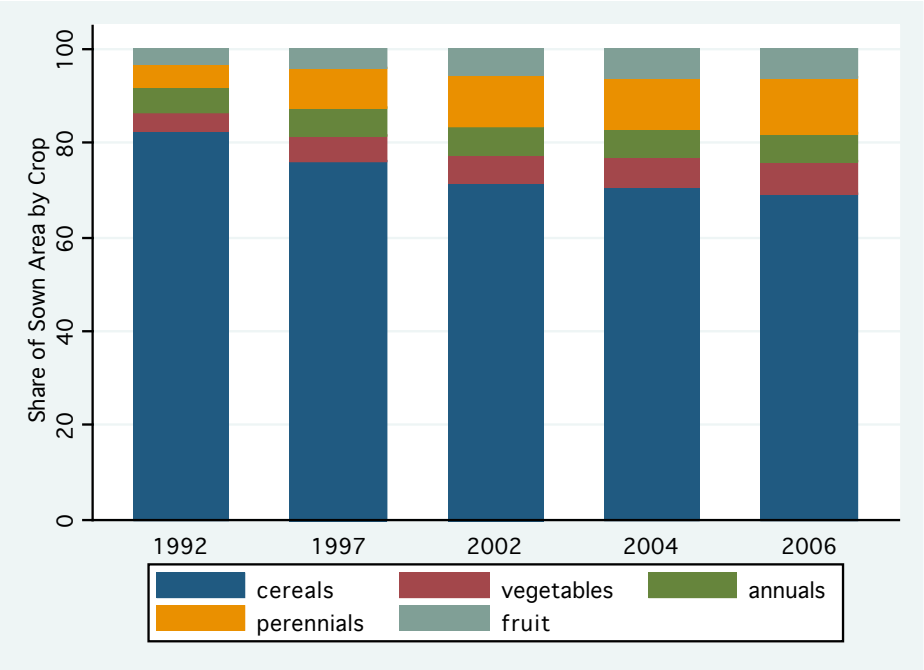
Notes: Based on authors' calculations, and numbers reported in Table 6.

Figure 6: Sown Acreage by Crop and Year



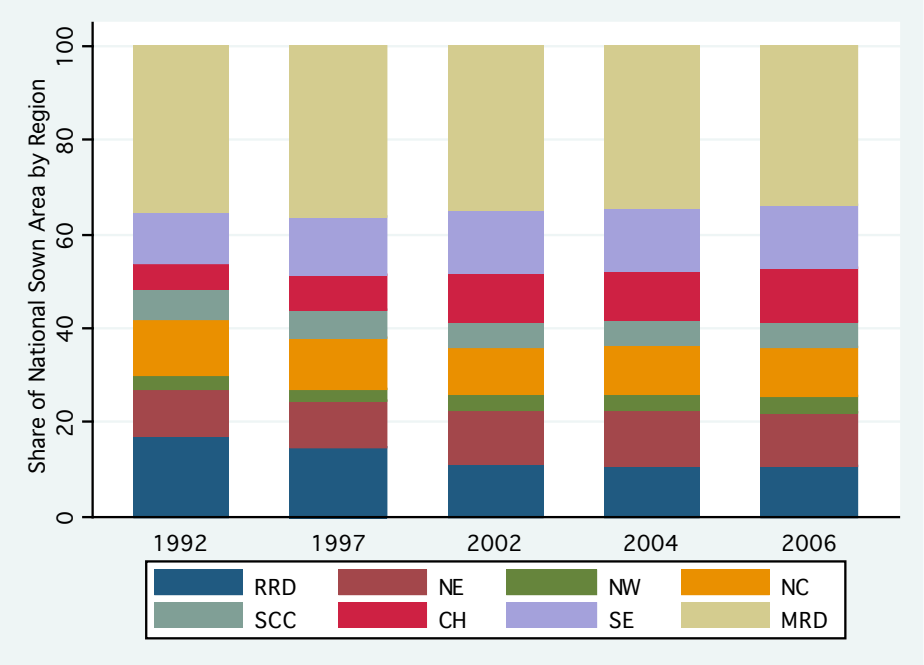
Notes: Based on authors' calculations, and numbers reported in Table 7.

Figure 7: Share of Sown Acreage by Crop and Year (All Vietnam)



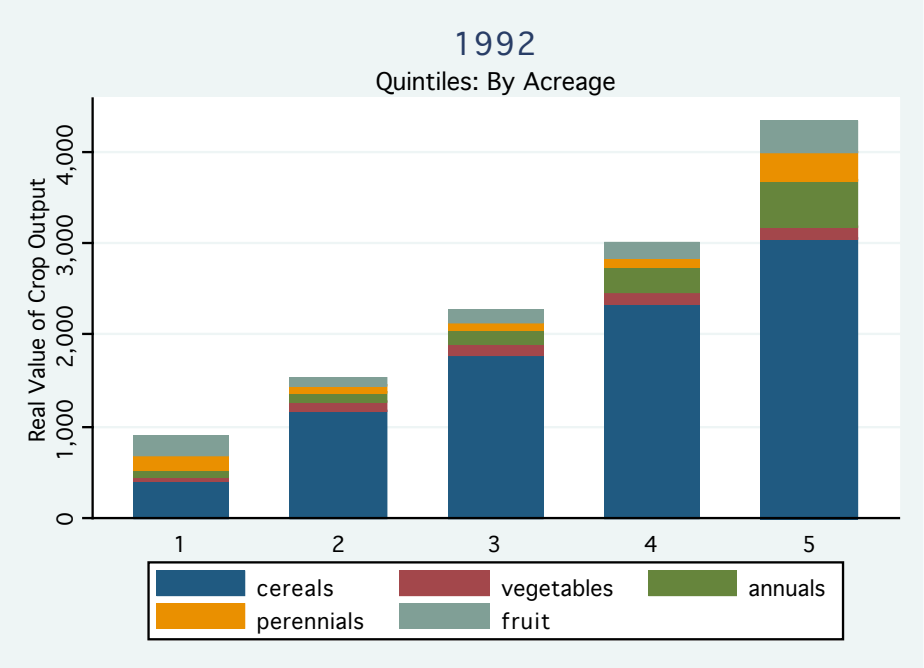
Notes: Based on authors' calculations, and numbers reported in Table 8.

Figure 8: Share of Sown Acreage by Region and Year



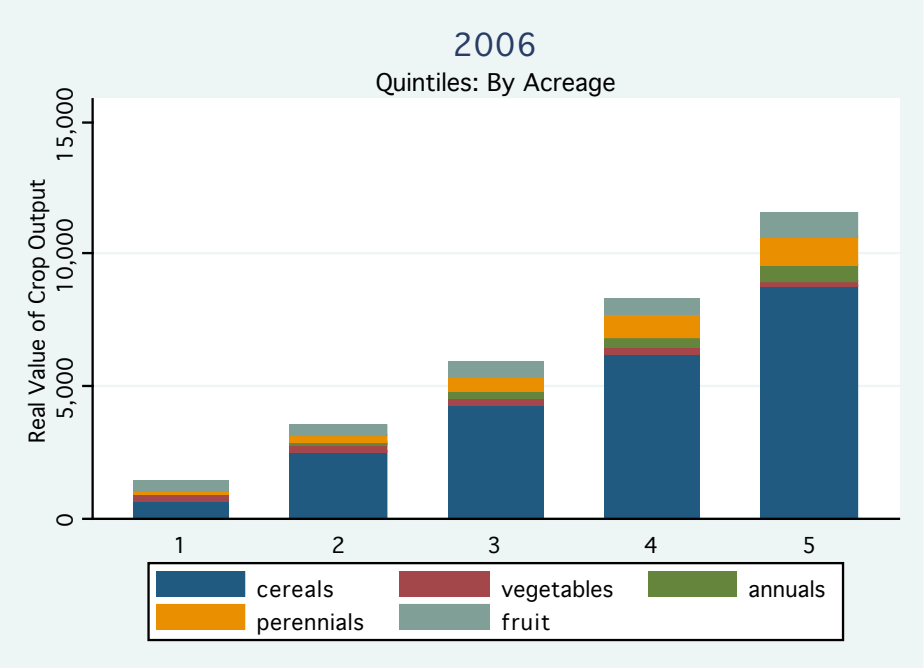
Notes: Based on authors' calculations, and numbers reported in Table 9.

Figure 9: Crop Output by Quintile (Based on Land Quintiles, 1992)



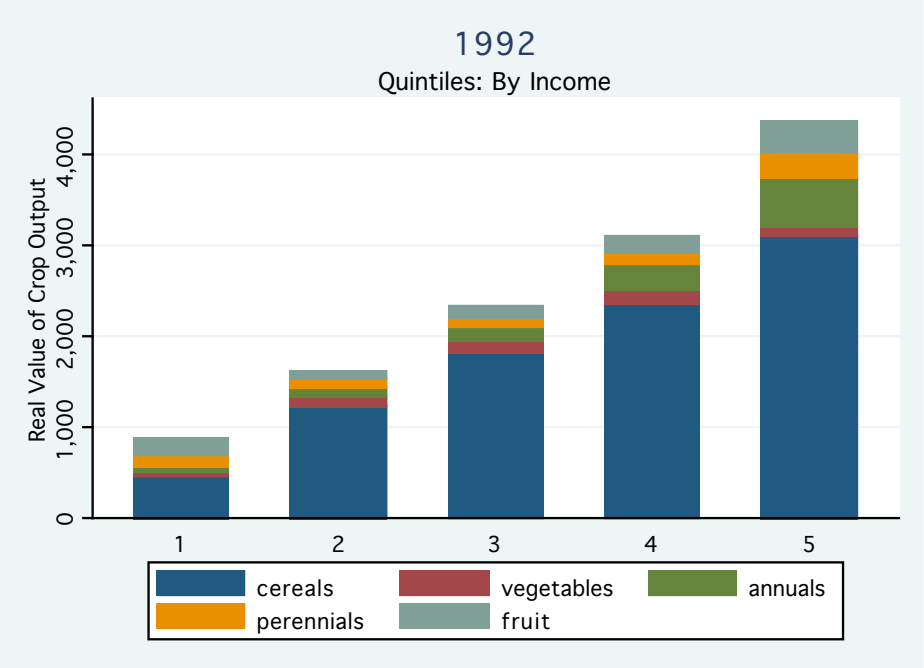
Notes: Based on authors' calculations, and numbers reported in Table 13.

Figure 10: Crop Output by Quintile (Based on Land Quintiles, 2006)



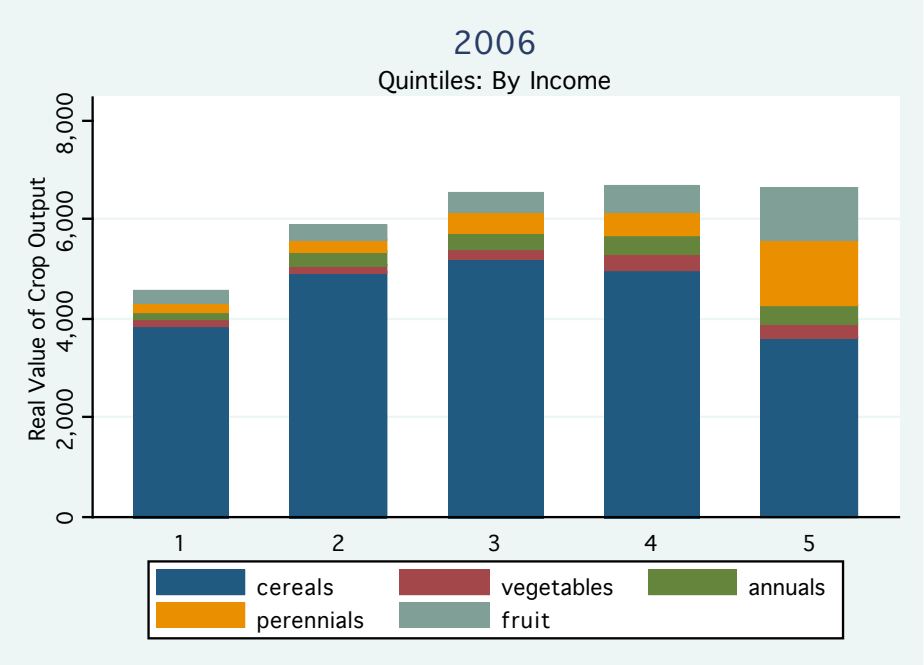
Notes: Based on authors' calculations, and numbers reported in Table 13.

Figure 11: Crop Output by Quintile (Based on Income Quintiles, 1992)



Notes: Based on authors' calculations, and numbers reported in Table 14.

Figure 12: Crop Output by Quintile (Based on Income Quintiles, 2006)



Notes: Based on authors' calculations, and numbers reported in Table 14.