The Effect of Refugee Inflows on Host Country Populations: Evidence from Tanzania *

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Abstract: Despite the large and growing number of humanitarian emergencies, there is very little economic research on the impact of refugees and internally displaced people on the communities that receive them. This paper analyzes the impact of the refugee inflows from Burundi and Rwanda in 1993 and 1994 on host populations in Western Tanzania. The analysis shows large increases in the prices of non-storable food items. Examination of household spending and assets show positive wealth effects of refugee camps on nearby villages. This contradicts anecdotal evidence, and suggests that under certain conditions, the interaction between refugees and their hosts may result in positive welfare effects for local residents.

Keywords: Refugees, Forced migration, Impact analysis, Tanzania

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Once I accompanied one of our Ministers to the Eastern Region, and we all drove out of town to look at a new wave of refugees arriving from Eritrea. Before reaching the camp, the Minister – who was not familiar with the region – saw a cluster of shelters made of mats and under their shade were a number of families with children who were very thin and almost in rags. The Minister turned to the Governor of the Region and asked him whether these were refugees, and the Governor promptly replied, "No, Your Excellency, these are the hosts." – the Sudanese Ambassador to Britain, from Chambers (1993).

1 Introduction

Every week seems to bring news of new refugee crises, and the trend is increasing. In 1980 the official global count of refugees and internally displaced people was 5.7 million; current statistics from UNHCR indicate that that number has risen to over 15 million, with over 4 million in Africa alone (UNHCR United Nations High Commission on Refugees 2004). This paper turns the spotlight on the millions uncounted in UN statistics: the hosts. The burden of refugee and internally displaced person (IDP) flight falls upon the poorest countries. Although the world refugee population has decreased over the past few years, there were still over 9 million refugees worldwide in the beginning of 2005, with almost 3 million of those in sub-Saharan Africa. 23% of the world's IDPs are currently located in sub-Saharan Africa.

Despite the prevalence of humanitarian crises, the economics profession has produced little research on the topic. Williamson & Hatton (2004)'s review of the current state of the literature reveals a considerable amount of work on the determinants of population displacement – usually civil wars (see Collier & Hoeffler (1998), Hatton & Williamson (2002)) – as well as the on how policies in Europe and the United States have affected the direction of human flight from conflicts in developing countries. There is little mention of the effects of these crises either on the refugees and IDPs directly, or on the communities that receive them. The present paper focuses on one facet of this complicated issue: the impact of refugee camp presence on host communities. This interaction has received some attention from development practitioners and other social scientists. Both Borton

(1996) and Whitaker (1999) discuss large price spikes and increased volatility and suggest that local populations suffer from these events. Landau (2002), on the other hand, compares a market near the refugee camps in Tanzania to one in the central part of country and finds little evidence of such inflation.

In addition to housing more refugee camps than any other nation, Tanzania has also been the destination of two very large and unexpected population flows: Burundian refugees in 1993 and Rwandans in 1994. The unexpected nature and size of these population movements generates a natural experiment which allows for the examination of their effects on the western Tanzanian regions hosting the refugees.

The first stage of the analysis uses variation in refugee inflows to look at the impact of proximity to refugee camps on prices of goods in nearby Tanzanian agricultural markets. The estimates show increases in the prices of fresh goods – bananas, plantains, and milk in the refugee-affected regions as the numbers of Rwandan refugees increase. Increases in Burundian refugees in western Tanzania are associated with rises in the price of maize. The differences in the effects are explained by the differences in the diets of the two groups, as well as the nature and magnitude of the two crises.

A difference in difference approach with household level data is then used to analyze changes in expenditures and welfare indicators. Expenditures on many food products as well as on cooking oil and firewood decreased in the wake of the construction of the refugee camps. The presence of welfare indicators - dirt floors, electricity, televisions, refrigerators, and vehicles - in the households near the camps, however, increases after the arrival of the Rwandan refugees. This is suggestive evidence that local residents living near the refugee camps may have earned extra money from selling home-produced agricultural products, profits from which they then invested in improving their homes and acquiring more assets. There is clearly no evidence that the welfare of households was decreased by the presence of the camps.

The rest of the paper proceeds as follows: Section 2 reviews the literature relevant to this study and Section 3 discusses the Tanzanian case in more detail. Section 4 describes the data, Section 5 describes the identification strategy and gives results from the analysis of agricultural prices. Section 6 looks at household expenditures and wealth indicators. The final section concludes.

2 Existing Literature

Although no economic research has focused on the impact of refugee camps on hosts, there are two strains of literature which inform the design of this study. The first is the incentive effects of food aid and the second the impact of immigrant flows on prices in recipient countries. Given that refugee flows are often followed by food aid, their expected effects are a combination of these two topics. A thorough review of the effects of food aid on local prices is provided by Barrett (2001). The empirical results have been mixed, and much of the research has been focused on food for work programs, rather than free food, which is the situation in humanitarian emergencies. Early research has shown that where food aid has been effectively targeted, as has been the case in India, the effect has been increased consumption by the targeted population, with little or no effect on domestic food prices (Insenman & Singer 1977, Maxwell & Singer 1979, Singer, Wood & Jennings 1987, Ruttan 1993). Some recent research has focused on Ethiopia, where targeting of food aid has been found to be quite imperfect (Dercon & Krishnan 2004). Abdulai, Barrett & Hoddinott (2005), using data from Ethiopian households, presents no evidence that households decrease food production in the presence of food aid, and finds suggestive evidence that they increase it. In sum, existing research finds that the supply side shock of food aid in developing countries may or may not result in local price effects, depending upon how the aid is targeted.

Food aid is only one side of the possible impacts of refugee flows. The other half of the equation – the population increase – has the potential to effect local prices through increased demand for goods and increased supply of inexpensive labor. Immigrant movements and their subsequent effects on host countries is a topic on which much economic research has been conducted and has generated two papers of similar spirit to the work at hand. In his seminal study on the topic, Card (1990) uses the natural experiment generated by the Mariel Boatlift of 1980, which suddenly increased the Miami labor force by 7%, to analyze the effects of immigration on the local labor market. He finds no effect on either wages or unemployment. In a more recent study using a structural approach, however, Cortes (2005) find that low skilled immigration decreases wages for low-skilled labor, which results in a decrease in the prices of immigrant-intensive non-tradable goods, such as gardening and housekeeping.

I mention these two studies in particular since this paper uses an identification strategy similar

in spirit to the first – the flow of refugees from Burundi and Rwanda to Tanzania in the early 1990s was just as unexpected as the Mariel Boatlift, and Miami, like western Tanzania, has played host to refugees for decades. The latter paper analyzes effect of immigrants on natives of similar skill levels, which is likely to be the case when considering the flow of refugees between these East African countries (with caveats which will be discussed below).

Neither of these studies analyzes the potential effect of the increase in demand for particular goods. This makes sense in markets like the U.S., where immigrants make up a small part of the demand for many goods, and where these goods are part of markets with very low transactions costs. Western Tanzania, however, has a much more limited range of goods which individuals may purchase, and is characterized by transactions costs which may result in much more localized price effects. Kahkonen & Leathers (1999) indicate that such costs in Tanzania are due to "movement restrictions, infrastructural impediments, limited access to credit, lack of storage capacity, and contract enforcement problems." They cite a 1990 World Bank study that concluded that only 24 percent of Tanzania paved roads were in good condition, with the remaining in a poor or fair state. According to their survey, only 16% of maize farmers live within 5 kilometers of a market where they can sell their product, and there is considerable intercity variation in prices of maize and cotton (the two crops considered in the study). Between 30 to 40 percent of maize produced in Tanzania is lost due to a lack of on-farm storage every year, and only 1 of the 139 farmers interviewed reported having obtained credit.

Therefore, this study differs from the literature on food aid by using an identification strategy that is based upon a natural experiment. It is additionally complicated by the fact that food aid in a humanitarian emergency is following a large influx of people. It is similar in spirit to some of the analyses of the effect of immigrant inflows on native labor markets, with the difference being that the inflow in the study at hand is taking place within the context of a developing country with high transactions costs which may result in more localized price effects.

3 Tanzania 1993-1994

As the rest of the world enjoyed the economic growth of the 1990s, Africa found itself suffering from repeated drought, famine, and massacres of startling magnitude. During this time, violence

erupted in Mozambique, Sudan, Eritrea, Congo, Burkina Faso, Rwanda, and Burundi, and refugees from the Great Lakes region found Tanzania to be a natural haven. Tanzania has a long history of accepting migrants from all over Africa, and its population is known to be friendly and accepting of foreigners. Since independence, the government has worked hard to promote unity among its people, and ethnic strife is minimal (Miguel 2004), even relative to peaceful Kenya, and especially in contrast with its neighbors, Burundi, Rwanda, and the Democratic Republic of Congo.

Though refugee inflows to Tanzania, largely from Burundi, have occurred since the 1970s, this study focuses on the largest of the recent inflows, those of 1993 and 1994. This is because up until 1993, refugees had largely been assimilated into Tanzanian villages. The 1993 and 1994 inflows marked the construction of large camps, a network of food distribution facilities, the sudden presence of multiple international agencies, and the beginning of the Tanzanian government's policy of separating the refugees from the local population. The 1993 and 1994 incidents also began without any prior warning, generating a natural experiment which allows for the exploitation of the data available over this period.

The timeline of events is as follows: On October 21, 1993, the first elected President of Burundi, Melchior Ndadaye, was assassinated. Revenge swept through the countryside and 700,000 Hutus fled from the country, many of them to western Tanzania. It was reported that the initial influx of Burundians into the Kagera and Kigoma regions was around 245,000, rising to over 300,000 within a month (SCN 1993-1998). An administrative map of the country is shown in figure **??**, and Figures 2 and 3 show the location of refugee camps in the two western districts which received most of the refugees. According to Jaspers (1994), the location of the camps was dictated by the Tanzanian government in cooperation with WFP and ICRC.

On April 6, 1994, just as many of the Burundian refugees were preparing to return home, the presidents of Rwanda and Burundi fell victim to an airplane crash. This event sparked a genocide in Rwanda in which 500,000 to 1 million people were slaughtered. On April 28, nearly a quarter of a million Rwandas (mostly Tutsis) flooded into northwestern Tanzania's Ngara district in a 24 hour period (IRC and UNHCR, 2002). UNHCR labeled the Rwandan influx the largest and fastest movement of refugees in modern history. To give some sense of the relative magnitude of these populations, consider that in 1998, the UN Office for the Coordination of Humanitarian Affairs estimated the local population of the refugee-affected regions at around 1,300,000 (OCHA 1998).

According to UNICEF, Burundian refugees totaled as much as 39% of the population in Ngara and Kibondo districts (UNICEF 2000)).

Finally, instability in the Democratic Republic of Congo resulted in another movement of refugees into the camps of Western Tanzania beginning in 1996. Figure 1 shows UN estimates of the total refugee load in western Tanzania from mid 1993 through 1998 (SCN 1993-1998). These statistics are produced only every 3 to 4 months, which partly explains the platteaus in the graph. They are estimated by the managers of the refugee camps, and are used to calculate how much food is required to maintain the population. Although it is hard to get a sense of the quality of this data, the population counts within SCN (1993-1998) are most often revised downwards rather than up, which suggests that estimates may often exceed the actual number of refugees in the camps. It is important to note that prior to 1993, refugees were largely assimilated into local communities. However, the inflows just described coincided with a change in Tanzanian government policy towards refugees which worked against assimilation, including forbidding refugees to work outside camps (Landau 2002).

Anecdotal evidence suggests that the Rwandan refugees brought with them considerable assets, including cattle, jewelry, and large amounts of cash, which they then used to purchase goods on local markets (Borton 1996). The Burundian group was more impoverished. The main source of food in the camps was maize or maize flour, which generally constituted 83% of the cereal distributed to refugees in the Tanzanian camps, with sorghum or rice making up the other 17%. Approximately 270,000 tons of food aid were dispatched to the entire zone, including Rwanda, Tanzania, eastern Zaire, and Burundi, between April and the end of 1994. The National Agricultural Census of 1994/1995 in Tanzania shows total production of maize in the Kagera and Kigoma regions at 68,400 tons (of Agriculture & Security 2006). Additional food was often purchased on local markets and from the Tanzanian government, and the policy was that supplemental food should be purchased in markets away from the refugee-effected area.

Jaspers (1994) report on food distribution in the first month of the Rwandan crisis states that maize was a particularly popular food for refugees to sell in order to purchase plantains, cassava, and sweet potatoes. She also notes that the buyers of the maize were frequently the truck drivers who had transported it from other parts of the country. WFP attempted to supply large quantities of beans, a traditional part of the Rwandese diet, to these camps, and their reports indicated that

they were rarely sold by beneficiaries. Five weeks into the Rwanda crisis, sufficient stocks existed to move from a three day to a weekly distribution cycle, suggesting at least adequate food supplies for camp residents.

4 Economic Framework

A simple static model can be used to highlight the possible market level effects of the refugee inflows as well as the potential repercussions for household welfare. The western Tanzanian context of poor infrastructure and market failures suggests that a non-separable household model, such as those described in Strauss (1984), Goetz (n.d.), de Janvry, Fafchamps & Sadoulet (1991) and Key, Sadoulet & de Janvry (2000), among others. The last of these focuses specifically on a model which includes transactions costs, which given the statistics above on the lack of transportation infrastructure in Tanzania, provides an appropriate starting point. Households must maximize utility by choosing how much of each of i goods to produce (x_i), consume (c_i), and take to market (m_i). This is formally described by maximizing (3) subject to conditions (4) - (7):

$$u(c) \tag{1}$$

$$\sum_{i=1}^{N} [(p_i^m - t_i^s)\delta_i^s + (p_i^m + t_i^b)\delta_i^b]m_i + T = 0 \tag{2}$$

$$q_i - x_i + -m_i - c_i = 0, i = 1, ..., N \tag{3}$$

$$G(q, x; z_q) = 0 \tag{4}$$

$$c_i, q_i, x_i \geq 0 \tag{5}$$

where c is total consumption, which is the sum of consumption of goods c_i.

The budget constraint described in (4) differs from a standard household budget constraint in that the prices that are received for goods that are bought and sold differ from the market price of that good, p_i^m, according to the size of transactions costs t_i. These transactions costs raise the price that is paid by a buyer and lower the price received by a seller. The indicator function δ_i^s is equal to 1 if the household is a seller of good i ($m_i > 0$) and zero otherwise, while δ_i^b is equal to one when the household is a buyer of the good ($m_i < 0$).

Condition (5) simply requires that for each good, the amount consumed, used as an input, and sold, must not exceed what the household produces and buys. The production function G relates inputs x_i and exogenous production shifters z_q to output q_i. The Lagrangian of the system is given by:

$$L = u(c) + \sum_{i=1}^{N} \mu_i(q_i - x_i + -m_i - c_i) + \phi G(q, x; z_q) + \lambda\Big[\sum_{i=1}^{N} [(p_i^m - t_i^s)\delta_i^s + (p_i^m + t_i^b)\delta_i^b]m_i + T\Big]$$

where μ_i, ϕ, and λ are the Lagrange multipliers. Key et al. (2000) show the formal solution to this problem, which requires solving first for the optimal solution conditional on whether or not the household is a buyer, seller, or autarkic in a particular market, and then choosing how to participate in that market. Of interest for this paper are the effects of price changes on the decision of a household to participate in the market, and how fluctuations affect subsequent utility dependent upon participation regime.

The "decision price" p_i which determines market regime is defined as follows:

$$p_i = \begin{cases} p_i^m - t_i^s & \text{if } m_i > 0, \quad \text{seller} \\ p_i^m + t_i^b & \text{if } m_i < 0, \quad \text{buyer} \\ \tilde{p}_i = \frac{\mu_i}{\lambda} & \text{if } m_i = 0, \quad \text{self-sufficient} \end{cases}$$

This implies that there is a band of prices over which a particular household will remain self sufficient in the good. Within this band, the relevant decision price is the household's shadow price $\frac{\mu_i}{\lambda}$. Households choose market participation regime by comparing their utility at as sellers, buyers, or in autarky. As is shown by Key, de Janvry, and Sadoulet, the relevant utility comparisons are:

$$\begin{aligned} V^s &= V(p^m - t^s, y_0(p^m - t^s)) \quad \text{if seller} \\ V^s &= V(p^m + t^b, y_0(p^m + t^b)) \quad \text{if buyer} \qquad (6) \\ V^s &= V(\tilde{p}, y_0(\tilde{p}) \quad \text{if autarkic} \end{aligned}$$

(7)

where y_0 is income. Utility for sellers is increasing in the decision price for sellers while for buyers

it is decreasing. Households which start in autarky may be induced into market participation if prices change such that the decision price for sellers exceeds $\tilde{p}$ or the decision price for buyers decreases enough that $\tilde{p} > p^m + t^b$.

The transactions costs result in a discontinuity in household supply, such that for prices below $\tilde{p} - t^b$, supply is upward sloping in price. At the point $p^m = \tilde{p} - t^b$, the household is indifferent between being buying the product and producing all the household requires at home. For market prices between $\tilde{p} - t^b$ and $\tilde{p} + t^s$, the household supply curve is vertical and all production of the good is done at home. Once the market price exceeds $\tilde{p} + t^s$, the household enters the market as a seller.

The question, then, is how the refugee inflows will affect the market price p^m. Assume that the inverse aggregate demand for food items $i = 1, ..., N$ is given by:

$$w_i^d = w_i^d(Q_i^R(R, F; Z^R), Q_i^h(H; Z^h)) \tag{8}$$

where Q_i^R is the quantity of the food item demanded by the refugees, which is increasing in the number of refugees R and decreasing in the amount of food aid F. Refugee income and preferences are represented by Z^R. Q_i^h is the quantity of food demanded by local residents, which depends upon their population size H, income and other characteristics Z^h [1] The inverse supply function for food item i depends upon food aid, which increases with the refugee caseload ($F_R > 0$), and other sources of food supplied to the region Q_l^s.

$$w_i^s = w_i^s(F(R), Q_l^s(Z^s)) \tag{9}$$

Non-food aid supply is a function of various exogenous supply shifters Z^s. The supply price is decreasing in both food aid and non-food aid quantities. Denote the equilibrium market price, where $w_i^d = w_i^x$ as p_i^m.

[1] Writing demand in this form necessarily assumes that the individual demand functions in the region are aggregable. In general, this requires very strict assumptions on the form of the household utility functions. However, when people's wealth is determined by a largely similar process – i.e., when they are a function of the prevailing price vector – these assumptions can be relaxed and aggregate demand can be written as a function of wealth and prices (Mas-Colell, Whinston & Green 1995). This is likely to be a reasonable assumption in rural Tanzania, where wealth is largely determined by success in agricultural production.

$$p_i^m = p_i^m(F(R), Q_l^s(Z^s), Q_i^R(R, F; Z^R), Q_i^h(H; Z^h)) \tag{10}$$

The final price effect in reaction to an increase in R is given by:

$$\frac{\partial p_i^m}{\partial F}\frac{\partial F}{\partial R} + \frac{\partial p_i^m}{\partial Q^R}\frac{\partial Q^R}{\partial R}$$

where the first term is the negative effect on price of the increase in supply due to the presence of food aid and the second increases price through raising demand due to the increase in overall population. The net effect of the refugee inflow depends upon the relative magnitude of these two terms.

The implication of these results for household welfare are ambiguous. If the first term dominates, the observed market price will decrease. For selling households, this will have a negative effect of utility and for buyers a positive one. Some autarkic households may be induced into purchasing, and if the price decrease is large enough, some selling households may even become buyers. If the second term is larger in magnitude, then market prices will increase, which will make sellers better off and hurt buyers. It may also induce some autarkic households to become sellers, and if large enough, may induce some buyers to sell what production that have.

5 Data

The data used for this study comes from various sources. The Famine Early Warning System (FEWS) set up by USAID provides monthly prices from 44 markets in Tanzania, beginning in 1985 and ending in 1998. A map indicating the location of the markets is shown in figure 4. Because up until 1991 the prices of major commodities were controlled by the government, prices prior to January of 1992 are thrown out. Although the FEWS data contains prices for a large number of crops, many of the series suffer from large gaps. I examine the more complete series of maize, beans, bananas, cooking bananas (heretofore referred to as plantains), and milk. The first four are staple crops which are both grown and eaten in the regions of interest, though maize is more preferred by Tanzanians than by any of the refugee groups. Table 1 shows FAO estimates of the percentage of calories from the relevant products in Tanzania, Burundi, Rwanda, and the Democratic Republic

of Congo. It is important to note that a much higher proportion of the typical refugee's diet comes from beans, bananas, and plantains than the in the typical Tanzanian's consumption.

In Kagera, the administrative zone bordering Rwanda and Burundi, the two most common agricultural systems are banana/coffee/horticulture and maize/legume. In Kigoma, which shares a border only with Burundi, banana/coffee/horticulture is also common, as is cotton/maize (which includes sweet potato, sorghum and groundnuts in addition to cotton and maize)(Ministry of Agriculture, Tanzania, 2005). Maize and beans, unlike bananas, are also products which are part of the standard food aid package. Milk is included in the analysis as it is often supplied to refugee camps to serve in supplemental feeding programs targeting mothers and small children. Milk production in Tanzania is generally done on a very small scale, and production in Kigoma and Kagera regions is of a traditional, low-input variety (Muriuki & Thorpe 2006).

Monthly Normalized Difference Vegetation Index (NDVI) readings for each market were also taken from FEWS. NDVI is a measure of vegetation cover calculated from satellite images, and as such is a useful proxy for weather shocks, be they heat or precipitation, which might affect agricultural production. They were extracted from geographical data with a pixel size of eight square kilometers and are merged with the price data using the reading from the pixel in which the markets are located.

There are also various sets of household level data. The first set comes from two Demographic and Health Surveys (DHS) conducted in 1991/92 and 1996. These surveys contain information on basic household characteristics, including assets and employment. This data has the disadvantage of not containing observations on income or expenditures, in addition, the two years of data can only be combined at a regional, rather than a cluster level, as the geographic location of clusters within regions is not available. On the other hand, the DHS surveys were applied to over 12,000 households over the two years, including over 1,000 households in the refugee-affected regions.

Two final household data sets come from the World Bank: the 1995 Tanzania Social Capital and Poverty Survey (SCPS) and the 1993 Tanzania Human Resource Development Survey (HRDS). The 1993 HRDS surveyed all 5,184 participants for expenditures and household characteristics. The main focus of the 1995 SCPS was to evaluate the state of social capital in the communities, though some expenditure data was also collected. Although the SCPS sampled 87 rural clusters (villages), only 53 of these were given the expenditure survey. Fifteen households were randomly

sampled in each cluster, making for a total of 1376 households (Narayan 1997). Both surveys use the National Master Sample framework maintained by the Tanzania Bureau of Statistics, which means that they can be merged by cluster. A very important feature of the 1993 round was the timing of its implementation - recall that October 24, 1993 is the first refugee influx into western Tanzania with which we are concerned. The regions of interest - Kigoma and Kagera, were surveyed from November 3 to November 9, and October 22 to November 5, respectively. These dates are after the beginning of the Burundian crisis, but before the Rwandan one. The analysis with this data is limited to those villages which were close to camps hosting Rwandans.

6 Impact of Refugee Inflows on Prices

6.1 Graphs

This section presents graphs showing variation in prices of agricultural commodities in 44 Tanzanian markets. The graphs in figure 5 show the trend in average log price of six commodities in the two villages within 20 kilometers of the refugee camps compared with the average log prices in all the other markets in the sample. Vertical lines mark the three different arrival dates of refugees into the western region of Tanzania. These prices are detrended using a linear time trend and monthly dummy variables. All of the series show increased volatility following the refugee inflows. Milk, plantains, and bananas all seem to show relatively higher prices after than before the establishment of the refugee camps, though the trend is not very clear. Maize and maize flour do not show a clear difference, while the price of beans in refugee-affected markets appears to be lower.

6.2 Estimation

The estimation of the effects of the refugee camps on prices exploits the variation in the number of refugees in Tanzania across time, and the fact that the refugees were present only in specific parts of the country. Two important assumptions are necessary for the strategy to be valid. First, there must be no other events that vary in the same way as the refugee inflows that differentially affect western Tanzania versus the rest of the country. In addition, the impact of the camps is assumed to be limited to a small area around the camps – specifically, 20 kilometers, which is not an unreasonable distance for refugees to travel in a day in order to trade goods.

The change in the natural log of prices ($log(p_{i,t})$) in market i at time t is described as a function of the number of refugees (in thousands) from Burundi (B_t), Rwanda (R_t), and the Democratic Republic of Congo (C_t) at time t. The impact of the inflows is given by the interaction of these terms with separate dummy variables for the markets within 20 kilometers of camps receiving Burundians and Congolese (Kasulu and Kibondo), and for the market nearest the camps receiving Rwandan refugees (Kibondo). These interaction terms are given by $BE_{i,t}$, $CE_{i,t}$, and $RE_{i,t}$, respectively.

It is, of course, impossible to rule out all other events that might cause spurious results, but the NDVI index ($NDVI_{i,t}$), which varies over time and space, controls for one of the main competing sources of price shocks in developing countries – the weather. The index is a measure of vegetation "greenness", and hence picks up variation in both temperature and rainfall. The index is included in both the current period for every market and for two lagged periods. In addition, a previous growing season average of this variable ($A_{i,t}$) is included to control for stocks of the crop from the previous year. Market level level fixed effects (D_i) are included to capture time-invariant market characteristics. Variations in national and world prices for agricultural goods and inputs are controlled for by the inclusion of the US price for corn at time t (p_t^c), the price of urea in Europe at time t (p_t^u), and the quarterly consumer price index in Tanzania (p_t^I). Monthly dummies (M_j) and a time trend (t) are also included to control for seasonal variation and yearly trends.

The estimated equation is as follows:

$$log(p_{i,t}) = \alpha + \beta_1 B_t + \beta_2 R_t + +\beta_3 C_t + \delta_1 BE_{i,t} + \delta_2 RE_{i,t} + \delta_3 CE_{i,t} \tag{11}$$

$$\sum_{j=0}^{2} \theta_{i,t-j} \text{NDVI}_{i,t-j} + \psi A_{i,t} + \sum_{k=2}^{44} \gamma_i D_i + \beta_I p_t^I + \beta_u p_t^u + \beta_c p_t^c + \sum_{j=1}^{11} \alpha_j M_j + u_{i,t}$$

An important disadvantage of this approach is that it cannot separate the effect of the refugees on demand from the effect of the food aid inflows. Regular statistics on food aid sent to the region were simply not available. As was mentioned above, however, approximately 270,000 tons of food aid, 83% of which was maize, were dispatched to Rwanda, Tanzania, eastern Zaire, and Burundi, between April and the end of 1994, while maize production in Kigoma and Kagera regions was 68,400 tons in 1994/95. Therefore, the δs reflect the net price changes associated with both the demand and the supply shifts caused by the presence of refugee camps.

In order to correct for serial correlation of the error terms which might lead to inconsistent

inference, the standard errors are bootstrapped using a "block bootstrap" strategy. This implies randomly drawing with replacement from the markets, maintaining with each draw the entire time series for the sampled market. Monte Carlo simulations have shown that this is a reasonable strategy provided that the panel is sufficiently wide (Bertrand, Duflo & Mullainathan 2001).

The estimates for the coefficients of interest, δ_1, δ_2, and δ_3 are contained in Table 2[2]. The estimates show significant increases in the prices of maize and beans as a result of the Burundian inflows. Increases in the number of Rwandan refugees generated price increases in bananas, plantains, and milk, while refugee inflows from the DRC resulted in significant changes in the price of plantains. The increases in the prices of maize and beans, two goods provided by the food aid bundles, implies that the demand side effect of the refugee inflow exceeded the ability of food aid to increase supply. The price increases in for bananas and and milk suggest two related possibilities. Either increased refugee demand for these particular goods was pushing up prices, or increases in incomes of local producers due to sales of other crops pushed up local demand for these items.

The second panel of this table shows results from the same regression with a sample that excludes markets in neighboring regions, as well as those markets in Kagera and Kigoma which were not within 20 kilometers of the camps. In other words, the restricted sample does not contain observations from markets in Mara, Mwanza, Shinyanga, Tabora, or Rukwa regions, or from Bukoba (in Kagera), or Kigoma (in Kigoma). The intention is to test the assumption that the effect of the camps did not extend to markets somewhat farther away than 20 kilometers. An increase in the significance of the results, or a significant change in the point estimates of the results would suggest a failure of this assumption. In fact, the results for the restricted sample are nearly identical to those of the full sample.

An additional concern is that some of the price increases shown in Table 2 result from the longer term effect of the refugee populations, or movements of Tanzanians wishing to take advantage of jobs provided by NGOs, rather than the initial inflow. In order to test whether this is the case, Table **??** shows results from regressions where the data is cut off at April of 1994, when the Rwandan inflow began (top panel), and at December of 1994 (bottom panel), when the largest part of the Rwandan inflow was largely over. INSERT NEW RESULTS.

The magnitude of the effects is hard to envision, given that the coefficient gives the change in

[2]Results for all variables are available upon request.

prices in the refugee-affected markets for a marginal increase in the number of refugees (in 1000s) in each of the groups. Figure 6 shows the cumulative predicted price changes over the period from 1993 to 1998 for the effects that were significant in the regressions shown in Table 2. The change in maize prices associated with the Burundian refugee inflows ranges from less than 5 percent to nearly 20 percent, with effects of similar magnitude on the price of beans. The Rwandan inflows are associated with predicted price changes of over 30 percent for bananas, over 90 percent for plantains, and a range from 10 to 25 percent for milk.

It is not surprising that the fresh foods - plantains and milk - exhibit price increases given the fact that transportation costs are likely to be higher for these goods. Plantains in particular are a preferred food of Rwandans and Congolese (see Table 1), and one which is grown on a small scale in Tanzania. Given the statistics on the Rwandan diet, which show zero percent of calories coming from bananas, the large effect on banana prices is somewhat surprising. However, it is possible that the FAO statistics on consumption of this good are not entirely accurate. They are used in this paper to facilitate comparability, statistics from the Rwandan Ministry of Agriculture show as much as 3.2 % of the typical Rwandan diet coming from bananas (Wanda, Ferris, Rucibango, Tuyisenge, Munkankubana, Kagiraneza, Ngaboyisonga, Gatarayiha, Uwantege, Kanyange & Butare 2002).

The lack of impact of the Burundian inflow on banana markets is somewhat surprising, especially in contrast with the Rwandan results. This might be attributed to somewhat slower and briefer nature of the refugee movement relative to the Rwandan crisis. The Rwandan refugees may also have had a greater capacity to effect local markets, given that they were reported to have brought with them considerable assets in the form of jewelry and cattle, while the Burundian refugees arrived with only the clothes on their backs.

In sum, there were increases in maize, bean, banana, plantain, and milk crises as a result of the various inflows of refugees into camps in western Tanzania. All of the price changes suggest that the effect of increased demand from the refugees or increased demand by local consumers through wealth effects from the refugee inflows overwhelms any depressive food aid effects. I now turn to the household level statistics to try to disentangle these issues.

7 Household level effects

7.1 Effects on Expenditures

72% of the men in Kigoma and Kagera regions are farmers, according to the DHS survey. The effect on the welfare of local populations depends upon whether or not they interact in these particular markets as producers or consumers, and upon the elasticities of demand/supply for the goods in question. Unfortunately, the data is not available to directly examine household market interactions. In order to assess whether households benefitted or lost from the price changes caused by the refugee effects, I use the two World Bank surveys discussed above to examine changes in household expenditures between 1993 and 1995. As was previously mentioned, the 1993 survey was conducted around the same time as the Burundian inflows, and the 1995 survey prior to the Congolese inflow, so the data is appropriate only for examining the effects from the Rwandan crisis.

A difference in difference approach is used to examine the effects of the Rwanda crisis on expenditures. Expenditures per capita ($E_{i,t}$) are assumed to be a function of household and district characteristics ($X_{i,t}$), including education of the household head, household size, district population, school, and road density, as well as the infant mortality rate of the district. A fixed effected (D_k) is included at the regional level for each of the twenty regions in the country in order to control for time-invariant regional characteristics. The treatment effect is estimated for the four clusters nearest to the Rwandan refugee camps, where the treatment is given by the interaction between a 1995 dummy (post-refugee inflow) and a dummy variable indicating whether or not the household is in a cluster that is either in Kagera province or in the district of Kibondo (C_i). The estimation equation for household i at time t is:

$$E_{i,t} = \alpha + \beta_1 C_i + \beta_2 1995_t + \delta C_i 1995_t + \Gamma' X + \sum_{k=2}^{20} \gamma_k D_k + u_{i,t} \tag{12}$$

For overall per capita expenditures, the dependent variable is the natural log of expenditures per capita. The large number of zeros for individual goods requires using actual expenditures rather than the log. These effects are estimated using a tobit. The necessary assumption for these affects to be attributed to the refugee camps is that no other event differentially affected Kagera and Kibondo over the period 1993 to 1995. Given the difficulty of ruling out all confounding events, and the

results from this estimation should be taken as suggestive rather than conclusive.

Table 3 shows estimates for the coefficient δ - the effect on proximity to the camps on overall expenditures. Total expenditures per capita are 27% lower in the households near the refugee camps after the Rwandan influx. This comes from decreases in weekly (mostly food) and monthly expenditures, which go down by 30 and 39% respectively. The effect on yearly expenditures, which are composed of durable goods purchased in the year prior to the survey, is negative but insignificant. There is also no change in the percentage of total expenditures allocated to food. Given the large decrease in overall spending, one might think that the proportion of expenditures food would increase, suggesting a negative welfare effect. The lack of change in the composition of expenditures may result from the fact that the average household in the 1993 sample was already spending 77 percent of its income on food. In addition, the power of the test may be limited by the small number of households (78) in the sample that were close to the camps in 1995. These are being compared to 237 households near camps in the 1993 survey.

Where are these decreases in expenditures coming from? Table 4 shows the signs of the changes in weekly expenditures. Where the table entry is 0, there was no significant effect of the proximity to the camps in 1995. Spending on bananas (bananas and plantains combined) decreases, which, under the assumption that these goods are staple items with a low elasticity of demand, supports the results from the price analysis. In addition, it also provides some evidence that the source of the price increase, at least for bananas, is not wealth effects of local consumers but rather increased demand due to the refugee inflow.

Furthermore, purchases of other goods for which refugees might also have high demand - sweet potatoes, potatoes, other vegetables, and cooking fuel - also decrease. There are increases in expenditures on proteins: pulses, eggs, and dried fish. One scenario consistent with this evidence is that with the influx of refugees and the increase in price of plantains and tubers, local residents decreased their own consumption of these goods and sold their home production. They then shifted their food consumption towards goods whose value had decreased on a relative scale after the refugee influx, goods which they also might not have been able to afford without the extra cash from selling food to refugees.

Monthly expenditures (Table 5) show three significant changes: a decrease in spending on wood for cooking and in cleaning materials, and an increase in spending on haircuts. Given the reports

on deforestation surrounding the refugee camps, it is not surprising to find that the price of cooking fuel had increased (this depends again on the assumption of price inelasticity for cooking fuel), which would also explain the decrease in weekly expenditures in this category. It is important to note that while increases in spending on haircuts and cleaning materials might indicate a spending shift to relatively luxurious items, these results come from a relatively few positive observations of purchases of these products.

Overall, there is no significant change in yearly expenditures. Analysis of the goods which make up yearly expenditures, however, shows significant decreases in remittances and donations to churches and mosques, while there are increases in payments to doctors/healers, for household linens, and to clubs. The change in donations to mosques and churches could suggest an improvement in welfare if people are more likely to donate to churches when they feel they are down on their luck (Chen (2005) shows increases in religious intensity (measured in Koran study and school attendance) during the economic crises in Indonesia). However, if donations to churches and mosques are normal goods, than this change suggests a negative income effect. It is somewhat interesting to note that when donations are broken down into cash and kind, cash donations show a negative treatment effect and kind donations a positive one.

The point estimates for changes in expenditures on goods which might be wealth indicators, such as household additions, appliances, bicycles, and watches were all positive but insignificant. It is possible that such large investments are so unusual for households that our sample of treated communities is simply not large enough to capture systematic changes. In addition, the timing of the 1995 survey may have missed investments happening immediately after the refugee inflow.

The combination of expenditures changes paints a mixed picture of the results of the refugee inflow. Food expenditures shift from goods whose prices increased as a result of the refugee crises towards more high protein foods. Monthly expenditures are (significantly) unchanged on all products with the exception of fuelwood, which is consistent with anecdotal evidence regarding deforestation of areas around refugee camps for fuelwood. Remittances are lower from the households near the camps after the crisis which may imply a welfare decrease, though the increase in expenditures on clubs suggests the opposite effect. Donations to churches are also lower, which could indicate either a positive or a negative welfare effect.

7.2 Effects on wealth indicators

Although total expenditures per capita decreased in the households closest to the refugee camps after the Rwanda influx, the welfare effect of this change is not entirely clear. Part of the ambiguity may be due to the small number of households used to measure the effects. The DHS data provides one way of addressing the small sample problem presented by the World Bank surveys. The 1992 and 1996 DHS surveys interviewed over 1,000 households in Kigoma and Kagera, the regions hosting the Rwandan and Burundian refugees. Although the surveys do not collect information on expenditures, they do measure the presence of durable goods - dirt floor, electricity, televisions, refrigerators, and vehicles - which can be used as wealth indicators. Again using a difference in difference approach, I consider changes in these welfare indicators ($W_{i,t}$)in the refugee-hosting regions. Wealth is assumed to be a function of household characteristics ($X_{i,t}$), including number of household members, number of women and children, gender and age of the household head, and the highest grade of schooling attained by the household head. As above, dummy variables are included for each region (D_k) to control for time invariant regional characteristics. The treatment is given by the interaction between a dummy variable for observations in the 1996 survey (1996) and either a dummy variable for the Kigoma region (Ki) or for the Kagera region (Ka). The estimation equation is :

$$W_{i,t} = \alpha + \beta_1 1996_t + \delta_1 Ki_i 1996_t + \delta_2 Ka_i 1996_t + \Gamma' X_{i,t} + \sum_{k=2}^{20} \gamma_k D_k + u_{i,t} \tag{13}$$

Table 7 shows the results of this exercise. In both regions, changes in wealth indicators suggest either increases in wealth or no significant change. In both Kagera and Kigoma, there is a decreased number of households with dirt floors after the refugee inflows. Kagera also saw increases in electrification, televisions, refrigerators, and motorcycles. In Kigoma, the number of bicycles increased after the refugee inflow, though no other indicators showed any change. This evidence suggests that the refugee camps at least did not decrease the welfare of the households nearest to them, and may even have improved it.

8 Conclusion

Refugee situations are not likely to disappear in the near future, and understanding the impacts of refugee camps on poor host populations is imperative. This paper presents evidence that the refugee inflows into western Tanzania from 1993 to 1998 resulted in increases in the prices of maize, bananas, plantains, and milk, all agricultural goods which are both consumed and produced by local populations in Tanzania. Prices in the same markets showed less impact from refugee crises from Burundi and the Democratic Republic of Congo than from Rwanda, perhaps due to differences in the diets of these groups, and perhaps as a result of the relative smaller and slower nature of the first two crises.

Household data indicated decreased expenditures on food items and fuel wood, and increased incidence of positive welfare indicators. This is consistent with a scenario where households sell off their food stocks in order to take advantage of high prices and then invest that money in household improvements and durable goods. This is suggestive evidence that the wealth of host country households was positively affected by the establishment of the refugee camps.

Clearly this is a only an incomplete portrait of the many effects that camps might have on local populations. This paper has said nothing about health, environmental, or labor market impacts of refugee inflows, and has not touched on the economy internal to the camps themselves. In addition, it has not analyzed whether or not the volatility of prices might have been affected by the presence of refugee camps. Further research is essential for informing the policies of international agencies whose missions include supporting refugees, and for the many nations who find themselves hosting refugees from other countries or large populations displaced within their own borders.

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9 Tables and Figures

Table 1: Percentage of calories from maize, beans, bananas, and milk by country

Country	Maize	Beans	Bananas	Plantains	Milk
Tanzania	34.9	3.4	0.3	1.6	2.1
Burundi	11.8	22.6	13.2	0.0	0.8
Rwanda	10.8	11.9	0.0	30.4	1.8
Democratic Republic of Congo	10.5	1.6	0.6	3.2	0.1

Source: FAOSTAT, FAO, 2006

Table 2: Impact of number of refugees in camps on agricultural prices
Fixed effect regressions, dependent variable: log(price)

	Maize	Maize flour	Beans	Ripe bananas	Cooking Bananas	Milk
	(1)	(2)	(3)	(4)	(5)	(6)
Impact Burundian Camps	.0006	-.0002	.0006	.0001	-.0002	-.00004
	(.0003)**	(.0001)*	(.0002)***	(.0005)	(.0002)	(.0002)
Impact Rwandan Camps	.0001	.00006	.0001	.0006	.002	.0005
	(.00006)*	(.00007)	(.00006)*	(.0003)**	(.0008)**	(.0002)**
Impact DRC Camps	-.0008	.002	-.0002	-.0004	.009	.0007
	(.0004)*	(.001)*	(.0003)	(.0008)	(.003)***	(.0008)
Observations	2898	2717	2981	2776	2314	2803
R-squared	.633	.713	.824	.634	.558	.826
Restricted Sample						
Impact Burundian Camps	.0007	-1.46e-06	.0006	.0002	-.0003	.00002
	(.0003)**	(.0001)	(.0002)***	(.0005)	(.0003)	(.0002)
Impact Rwandan Camps	7.04e-07	-.00004	.0001	.0006	.002	.0005
	(.00004)	(.00006)	(.00006)*	(.0003)**	(.0008)**	(.0002)**
Impact DRC Camps	.00007	.003	-.00008	-.0009	.009	.0009
	(.0004)	(.001)**	(.0004)	(.001)	(.003)***	(.0009)
Observations	1867	1700	1907	1821	1549	1796
R-squared	.616	.698	.819	.594	.557	.838

Standard errors in parentheses. *,**,*** denote significance at the 10, 5, and 1% level, respectively. These are partial results for regressions with a fixed effect at the market level. These estimations also include a time trend, dummies for the timing of the refugee inflows, a quarterly consumer price index, NDVI plus two lags of NDVI, average NDVI from previous planting season, a time trend, the price of corn in the U.S., world price of urea, monthly dummy variables and a constant. Standard errors are bootstrapped 200 times using a block bootstrap methodology.

Table 3: Effect of Proximity to Refugee Camps on Household Expenditures
Dependent variable: log(expenditures per capita)

	Total expenditures per capita	Weekly expenditures per capita	Monthly expenditures per capita	Yearly expenditures per capita	Percent of of total spent on food
Rwanda effect	-.27	-.30	-.39	-.24	-.92
	(.09)**	(.09)**	(.14)**	(.18)	(1.9)
Observations	2755	2764	2757	2766	2756
R-squared	.11	.10	.11	.07	.03
Mean dependent variable	11.3	7.3	6.6	8.6	75.7

These are partial results for regressions with a fixed effect at the regional level. These estimations also include a dummy for 1995, a dummy for households close to refugee camps, the maximum education in the household, district population density, district school density, district road density and the district infant mortality rate.

Table 4: Effect of Proximity on Weekly Expenditures
Dependent Variable: Expenditures per capita

Product	Sign	Uncensored observations
Maize flour	-	709
Maize grain	0	2207
Rice	0	1171
Millet flour	0	165
Millet grain	+	535
Sweet potatoes	-	1437
Yucca	0	1638
Potatoes	-	1271
Other vegetables	-	2506
Beans	0	2231
Ground nuts	0	1135
Oil palm nuts	0	238
Other pulses	+	830
Bananas	-	1347
Oranges	0	1033
Milk	0	1099
Eggs	+	699
Poultry	0	906
Fresh fish	0	903
Dried fish	+	1530
Beef	0	1754
Mutton	0	406
Pork	0	260
Cooking oil	0	2594
Charcoal	0	268
Other fuel for cooking	-	2577
Total observations		2762

These are partial results for tobit regressions with a fixed effect at the regional level. These estimations also include a dummy for 1995, a dummy for households close to refugee camps, the maximum education in the household, district population density, district school density, district road density and the district infant mortality rate.

Table 5: Effect of Proximity on Monthly Expenditures
Dependent Variable: Expenditures per capita

Production	Sign	Uncensored obervations
Fuel wood	-	2514
Charcoal	0	268
Soap	0	2644
Transportation	0	879
Cigarettes	0	818
Haircuts	+	234
Cleaning materials	-	232
Food from outside the home	0	721
Total observations		2762

These are partial results for tobit regressions with a fixed effect at the regional level. These estimations also include a dummy for 1995, a dummy for households close to refugee camps, the maximum education in the household, district population density, district school density, district road density and the district infant mortality rate.

Table 6: Effect of Proximity on Yearly Expenditures
Dependent Variable: Expenditures per capita

Production	Sign	Uncensored obervations
Dentist, doctor, healer	+	758
Hospital services	0	975
Medical supplies	0	1,898
Clothing	0	2,516
Cloth or fabric	0	205
House repairs	0	601
House additions	0	253
Linens	+	1,307
Household appliances	0	264
Appliance repairs	0	399
Lanterns or lamps	0	429
Watches	0	381
Bicycle	0	94
Toys	0	154
Remittances	-	1,154
Donations to churches/mosques	-	1,725
Ceremonies	0	1,855
Taxes	0	1,878
Clubs	+	372
Total observations		2762

These are partial results for tobit regressions with a fixed effect at the regional level. These estimations also include a dummy for 1995, a dummy for households close to refugee camps, the maximum education in the household, district population density, district school density, district road density and the district infant mortality rate.

Table 7: Effect of Proximity on Household Wealth Indicators

Dependent Variable	Kigoma Effect	Kagera Effect
Dirt floor	-	-
Electricity	+	0
Television	+	0
Refrigerator	+	0
Bicycle	0	+
Motorcycle	+	0
Observations	11604	

These are partial results for fixed effect OLS regressions with the effect at the regional level. Other included variables are: a dummy for 1996, the number of household members, number of women and children, gender and age of the household head, and the highest grade of schooling attained by the household head.

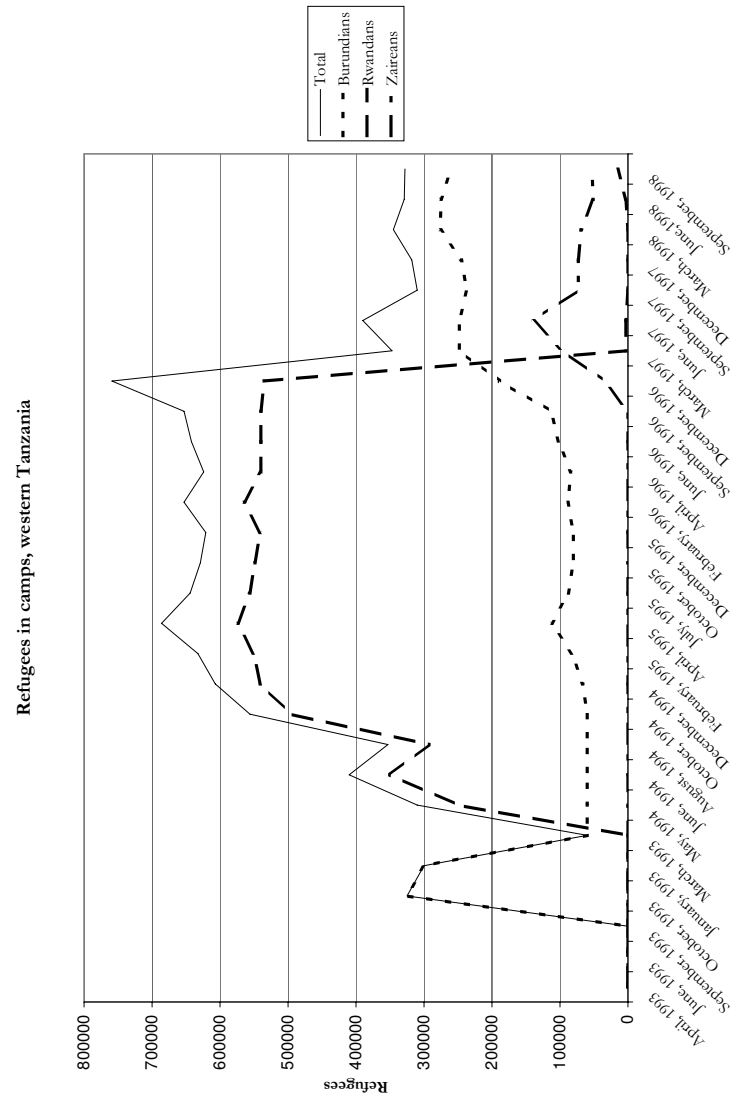

Figure 1: Refugees in Western Tanzania (Source: RNIS 1-25)

Figure 2: Map of Tanzania (source: www.lib.utexas.edu/maps/tanzania.html)

Figure 3: Map of Kagera Region (source:UNHCR Environmental Database, 1996)

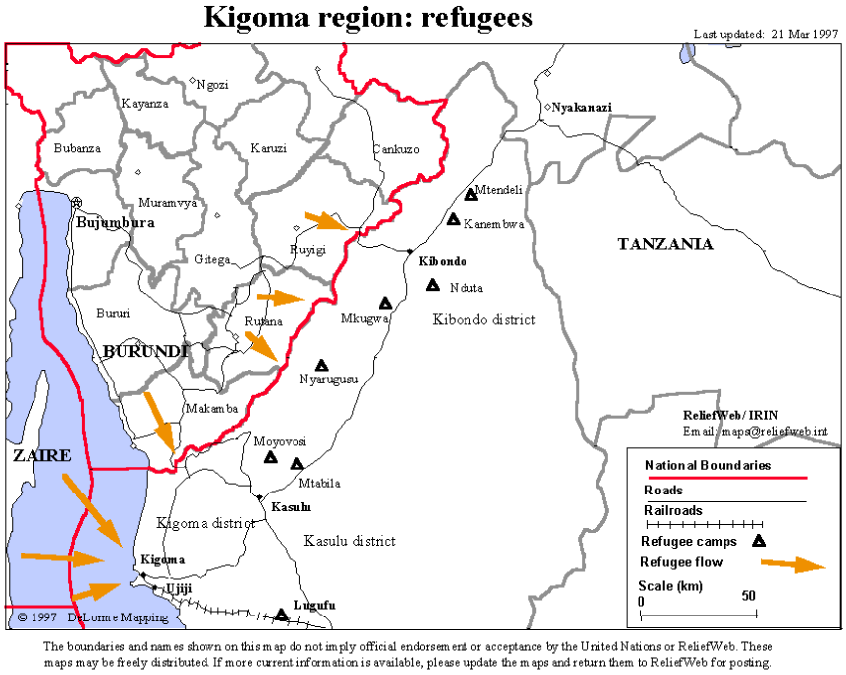

Figure 4: Map of Kigoma Region (source: Reliefweb, 2005)

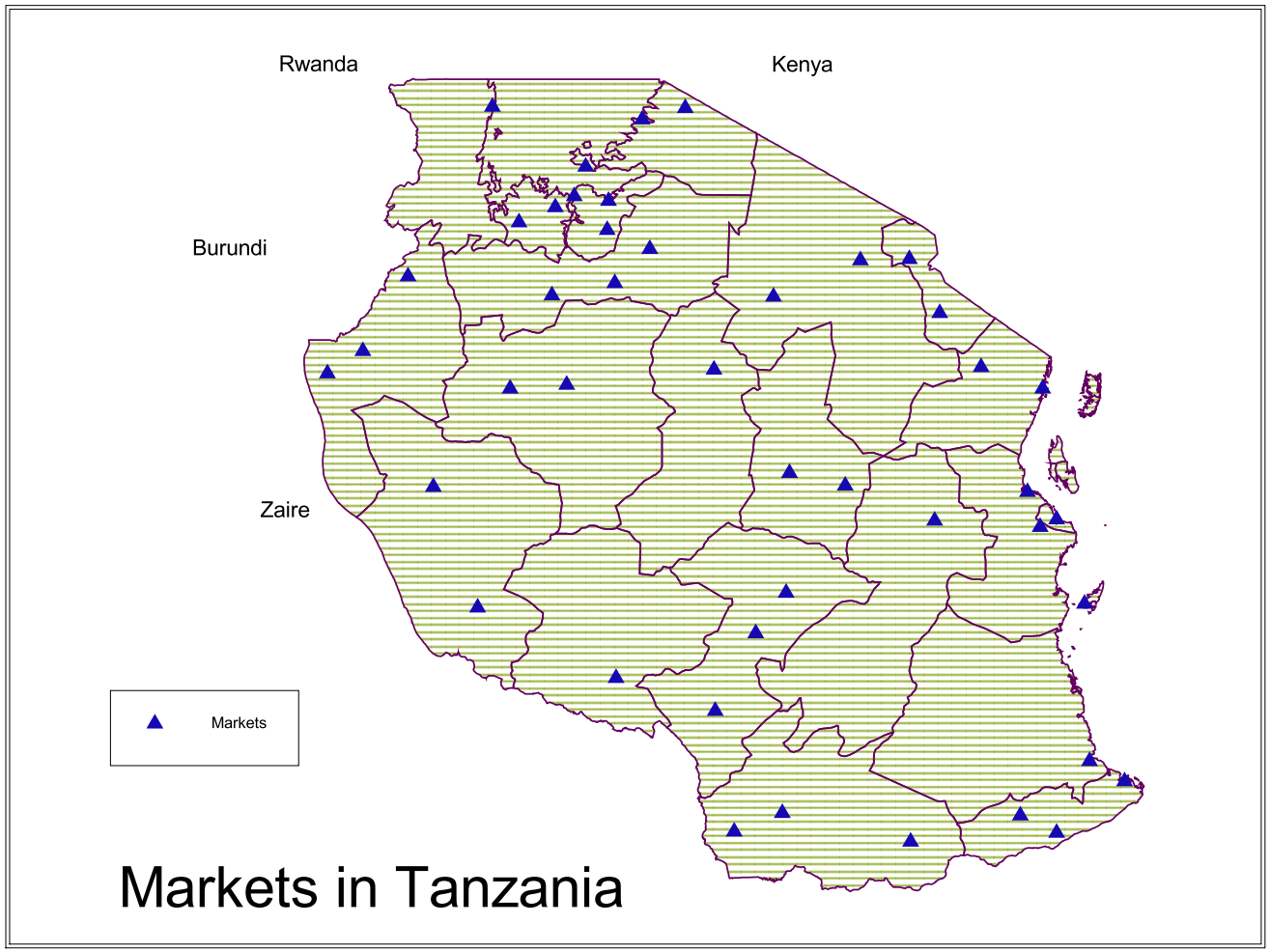

Figure 5: Markets in Tanzania

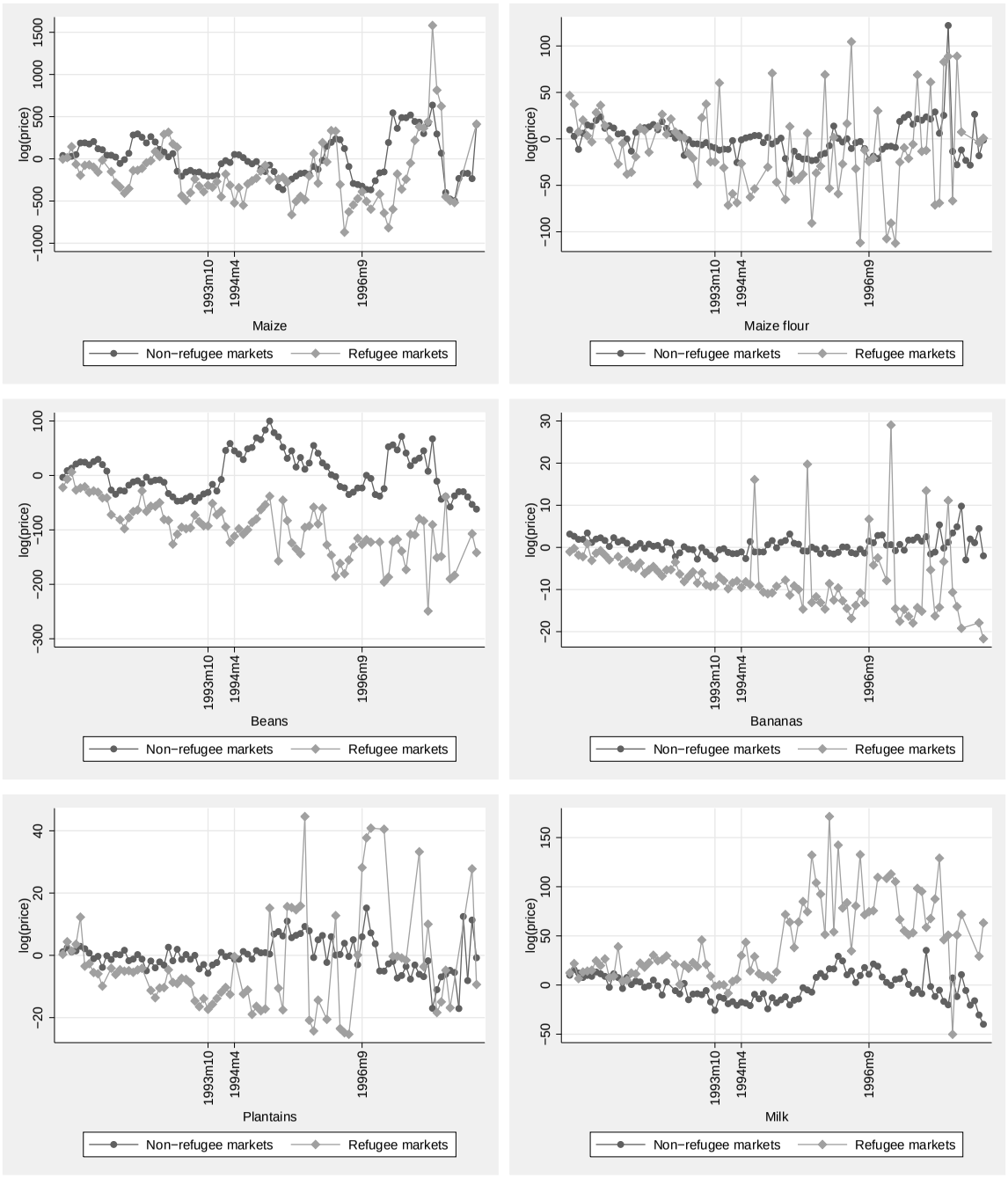

Figure 6: Agricultural Prices 1991-1998

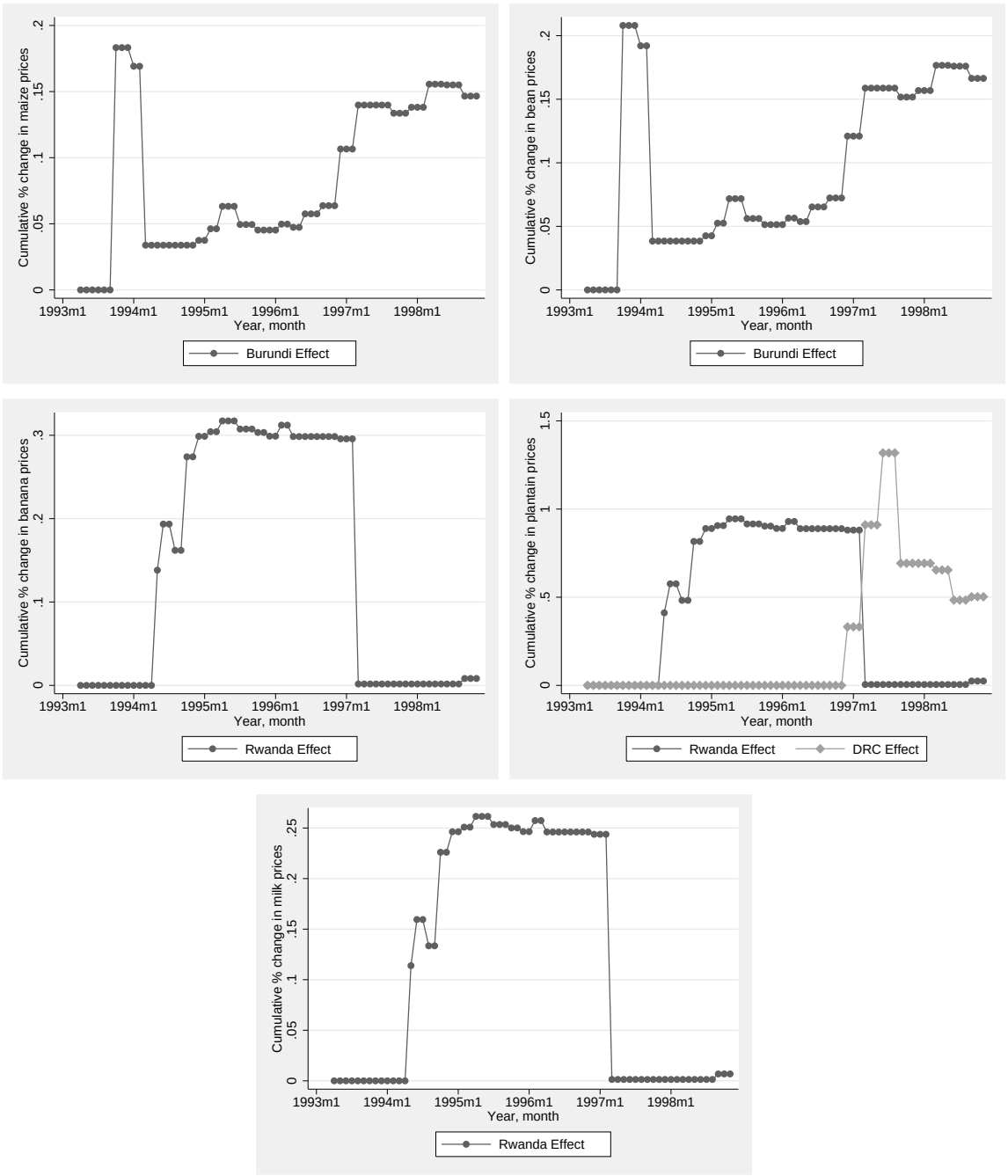

Figure 7: Predicted price effects