

**Does Urban Agriculture Enhance Dietary Diversity?
Empirical Evidence from a Sample of Developing Countries**

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Food and Agriculture Organization (FAO)
March 2008

Draft. Not for quotation

1. Introduction

Urban agriculture (UA) is defined as the production of crop and livestock goods within cities and towns. According to some accounts, 200 million people are employed in urban farming and related enterprises, contributing to the food supply of 800 million urban dwellers (UNDP, 1996). In African countries 40 per cent of urban dwellers are said to be engaged in some sort of agricultural activities and this percentage rises to 50 per cent in Latin American countries (see studies quoted in Ruel et al., 1998: p. 26).

If such numbers are accurate (and they may well *not* be, as we discuss in this paper), urban agriculture may have a role to play in addressing urban food insecurity problems, which are bound to become increasingly important with the secular trend towards the urbanization of poverty and of the overall population in developing regions. Ravallion (2007) estimates that about one-quarter of the developing world's poor live in urban areas, but also that poverty is becoming more urban and that the poor are urbanizing faster than the population as a whole.

Our understanding of the importance, nature and food security implications of urban agriculture is however plagued by a lack of good quality, reliable data. While studies based on survey data do exist for several major cities, much of the evidence is still qualitative if not anecdotal. This paper attempts to fill some of the key research gaps in this area, using a recently created dataset bringing together comparable, nationally representative household survey data for 15 developing or transition countries. Exploiting the wealth of data contained in the dataset, the paper analyzes in a comparative international perspective the importance of urban agriculture for the urban poor and food insecure.

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Against this backdrop, the two basic research questions the paper sets out to address are straightforward:

What is the magnitude of UA in terms of the share of households that are engaged in agricultural activities in urban areas and the share of income they derive from it?

Question 2: Is there any evidence that household participation in UA has a significant impact on household food security?

After a brief review of the literature (section 2), the paper sets out to quantify (in Section 3) the importance of urban agriculture in terms of the participation of urban households in agricultural activities, the share of income rural households (and in particular the poor) generate from farming, and the relative importance of crop versus livestock production. In Section 4 we use multivariate analysis to gauge how participation in urban agriculture impacts household food security as proxied by dietary diversity. While dietary diversity is but one important aspect of food insecurity, dietary diversity indexes have been shown to be good proxies for calorie intake and nutritional outcomes (Ruel, 2006). The key findings and policy conclusions of the paper are briefly outlined in Section 5.

2. The importance and role of urban agriculture: Facts and artefacts. A brief review of the literature

2.1 Characterising urban agriculture

In this paper we define urban agriculture as the production of agricultural goods by urban residents, according to the official definition of the urban space utilised by the surveys we work with. Our definition is eminently driven by the definition of rurality adopted by national governments and reflected in our dataset, and we don't deal with the conceptual definitional issues discussed for instance by Maxwell (2003), FAO (1996) and Ellis and Sumberg (1998). The two main problems with our dataset (which is describe in the next section) are (a) the comparability of the definition of urban and rural across countries, and (b) that we have information on where the household resides, not necessarily on where their agricultural production is located. In that sense we should strictly speaking be talking of 'agriculture practiced by urban households'. But having made those caveats, we will for simplicity stick to the standard expression 'urban agriculture'².

One of the objectives of this paper is to try to rigorously quantify the magnitude of urban agriculture in a reasonably large cross-section of countries, responding to the need for more

² We also cannot make any distinction between urban and peri-urban areas.

efforts in this direction expressed by several of the authors who have contributed to this literature (Nugent, 2001; Egal et al., 2001; Ellis and Sumberg, 1998). Possibly the most widely cited claim concerning urban agriculture is that “the United Nations Development Programme estimates that 800 million people are engaged in urban agriculture world-wide” (Mougeot, 2000: p. 1; but see also Armar-Klemesu, 2001; and Nelson, 1996). Tracing this source backward in time we arrived at UNDP (1996). Their table 2.1 reports the following estimates: 800 million people actively engaged in urban agriculture, 200 million of them producing for the market, with a full-time job equivalent estimate in production and processing of 150 million jobs. The source of the table is however “estimates by the Urban Agriculture Network based on the authors’ experiences and observations and extrapolation from data”. The authors also caution that their intent is simply to “present a thumbnail sketch” and that a more systematic estimation would be needed. Unfortunately many of their readers and citers have overlooked this caveat and the figures are frequently quoted as hard evidence. This may be partly due to the fact that one substantial strand of the literature on urban agriculture is driven by an advocacy objective, more than by analytical rigour (Ellis and Sumberg, 1998). A very different figure is quoted by FAO (1996), which states (ironically quoting again a UNDP publication) that 100 million people are estimated to earn some income directly from urban farming (one eighth of the 800 million urban agriculture producers and one half of the 200 million commercial urban farmers recalled above). Rigorous quantifications are in fact available, but mostly for case studies. Reviews of these case studies can be found in Egziabher et al. (1994), FAO (1996); Ellis and Sumberg (1998), Bakker et al. (2001), and van Veenhuizen (2006). An annotated bibliography of 170 pages compiled by Sida and ETC (2003) also provides an interesting overview of the available figures as well as of the magnitude and directions in which the urban agriculture literature has expended. Figures vary widely between and within countries and regions, and differences in definitions and methodologies compound the uncertainty.

2.2 Urban agriculture and food security

One major theme of the literature on urban agriculture is the discussion of how it can contribute to the food security and nutrition of cities as a whole, and of the households that are engaged in farming within urban boundaries.

One distinction that is often made in the literature refers to the extent to which urban households that engage in agriculture have some degree of market orientation or are purely producing agricultural goods for own consumption. There seems to be a consensus, based on

case study reviews, that the direct food security purpose prevails, but that a substantial number of urban farmers also sell their produce on the market, and more so in Latin America than in Africa (Maxwell, 2003; Ellis and Sumberg 1998).

There are a number of ways through which urban agriculture can, in principle, have an impact on urban food security. At the household level, urban agriculture can be a source of income, can provide direct access to a larger number of nutritionally richer foods (vegetables, fruit, meat) and a more varied diet, can increase the stability of household food consumption against seasonality or other temporary shortages, and can increase the time mothers spend caring their children, as opposed to non-agricultural activities that are more likely to be located further away from home (Maxwell, 2003; Maxwell et al., 1998; Armar-Klemesu (2001); Egal et al., 2001). There is also some evidence, again based on case studies, that it is the poor households that are mostly engaged in UA, although not necessarily the poorest, which may lack access to land (Ruel et al., 1998).

Moving beyond the household to a more aggregate level, urban agriculture can account for an important share of some foods, particularly the more perishable such as vegetables and milk, and there is evidence that this is indeed the case in several of the case studies mentioned above³

Despite the relatively large number of studies that have looked at the link between UA and food security, the amount of quantitative work that has been published is surprisingly limited. We could only identify one paper (Maxwell et al, 1998) that attempts to explore this link using a multivariate framework. Their findings, based on data from Kampala, indicate that there is indeed an impact of UA on children nutritional status, an outcome indicator of food and nutrition security.

3. Opening the urban agriculture black box: What the data say

In this section we address the first research question of the paper, i.e. the quantification of the magnitude of the UA phenomenon in a cross section of countries. As we said above, this study is fundamentally different from any other study we are aware of in that it uses (a) nationally representative data, (b) a comparable definition of agricultural activities, and (c) a comparative international perspective.

Our data do not allow dealing with another dimension of comparability, that is the definition of what constitutes a urban area. Countries have their own unique mechanisms of defining

³ Nugent (2001) reports on the importance of urban agriculture for some of these foods in a number of cities worldwide.

what constitutes urban or rural, and these mechanism determine the definition of urban and rural in our dataset. On the other hand, it may make sense to use government definitions since presumably these reflect local information about what constitutes rural and is the definition used to administer government programs. One additional caveat is that with the information available we identify and agricultural activity to be urban via the domicile of the household, and not the location of the activity. It is probable that a number of what we identify as urban agriculture activities in this report are in fact taking place in nearby rural areas.

Our analysis is based on the Rural Income generating Activities (RIGA) database, which is constructed from a pool of several dozen Living Standards Measurement Study (LSMS) and other multi-purpose household surveys made available by the World Bank and other national and international institutions. The choice of countries to be included in the dataset was guided by the desire to ensure geographic coverage across the four principal development regions – Asia, Africa, Eastern Europe and Latin America, as well as adequate quality and sufficient comparability in codification and nomenclatures. Furthermore, an effort was made to include a number of IDA (International Development Association) countries as these represent developing countries with higher levels of poverty and are therefore of particular interest to the development and poverty reduction debate.

Using these criteria, survey data from the following countries were utilized (corresponding survey years in parentheses): Ghana (1998), Madagascar (1993), Malawi (2004), Nigeria (2004); Bangladesh (2000), Indonesia (2000), Nepal (1996), Pakistan (2001), Vietnam (1998); Albania (2005), Bulgaria (2001); Ecuador (1995), Guatemala (2000), Nicaragua (2001), Panama (2003). While clearly not representative of all developing countries, the list does represent a significant range of countries and regions and has proved useful in providing insights into the fundamental aspects of livelihood strategies of households in the developing world.

To quantify the magnitude of UA in the countries at hand we first look at the rates of participation in, and the shares of income from, urban agriculture. The nature of our data also allows us to separate agriculture into crop and livestock activities. The picture that emerges from these data is one of an extreme variation (Figure 1). The shares of urban households that earn any income from agriculture, varies from around 10 to almost 70 percent in (Indonesia and Nicaragua, respectively). In nine of the fifteen countries in our dataset, the share of household participating is over 30 percent. In general livestock activities are less common than cropping activities, but there are cases (Ecuador, Madagascar) in which livestock is as, if not more, important.

The income shares coming from urban agriculture are, as expected, smaller than the participation rates (Table 1). They range from 1.7 to 18.4 percent (Panama and Ghana, respectively), but they are higher than 10 percent in just four cases.

Looking at regional patterns, no clear regularity can be found in terms of participation rates, while it is interesting to note how it is three African countries that display the three largest income shares, all at around 18 percent (the fourth African country, Malawi, comes fifth at 9.5 percent). Should this result be representative of Africa at large, one may indeed be inclined to conclude that urban agriculture is a significant source of livelihoods for urban households in that continent.

Outside of Africa, the highest share of income in our dataset is in Nepal at 10.7 percent, with most other countries displaying shares of 5 percent or less, and in several cases much lower. Given these results, urban agriculture – while by no means negligible – does not appear to be the major economic activity that some of its most enthusiastic advocates sometimes claim it to be.

When we decompose the participation rates and income shares by quintile of expenditure levels (our preferred welfare measure) we do find confirmation that urban agriculture is eminently an activity for the poor (Figure 2). With very few exceptions (mainly Bulgaria) there is a clear negative correlation between participation in agricultural activities and level of welfare. Participation rates for the poor are extremely high at over 50 percent in seven out of fifteen countries for the poorest quintile, testifying how urban agriculture does play a role for a non negligible number of poor households in the developing world.

Just how big is this role can be gauged somewhat more precisely by looking at the shares of income that correspond to being engaged in agricultural activities (Figure 3). Again, the picture that emerges points to a stark contrast between the African countries in our dataset and other regions. Nigeria stands out with over 50 percent of the income of the poorest quintile originating in agriculture, but rates higher than 20 percent are also found in the poorer strata of the Ghana and Madagascar sample, with only slightly lower rates in Malawi. Outside of Africa only a handful of the Nepal and Vietnam quintiles display shares surpassing 10 percent, with all the others well below that mark. Again, should this picture be confirmed by a larger cross section of countries, it is hard to see UA playing a substantial role in poverty alleviation outside of Africa⁴.

⁴ One caveat is that our data being nationally representative, we cannot rule out that agriculture may be playing a more substantial role in some specific urban settings within a country.

4. Urban agriculture and food security

As explained in section 2, UA can in principle have a positive impact on the food security situation of the households that engage in this activity through two main avenues: the income it generates, and the direct access to the food which is produced. Households that engage in farming may have access to relatively cheaper food, and to a wider variety of particularly nutritious foods, such as vegetables and products of animal origin (milk, eggs, meat). The latter mechanism may be particularly relevant should urban food markets, particularly in the poorer neighbourhoods, be inefficient. Under such conditions direct access to food may allow households to consume greater amounts of food and a more diversified diet, richer in valuable micronutrients.

In this section we analyse whether this is the case, by looking at the correlation between dietary diversity and participation in agricultural activities, within urban areas. Dietary diversity is often used as a food security proxy in nutrition surveys, and has been generally found to be closely correlated to both caloric adequacy (the amount of kilocalories consumed) and anthropometric outcomes (for a review see Ruel, 2006). Our measure of dietary diversity is based on 13 food groups, following the methodology developed by USAID's FANTA project, as adapted by FAO's nutrition division (FAO, 2006), with the addition of an extra food group to account for prepared foods that could not be otherwise classified.

As we mentioned earlier we could only find one study (Maxwell et al., 1998) that investigates the link between UA and food security in a multivariate framework, using child nutritional status as the dependent variable. Our dependent variable is however different, and it allows us to look at only part (albeit a large part) of the food security picture. In fact dietary diversity is the product of the food access, availability, and stability dimensions, but does not reflect the dimension concerning the utilization of food, its preparation, and care and sanitation practices that are instead subsumed in anthropometric indicators.

Our analytical model is very simple, and builds on the conceptual links between household food security and participation in urban agriculture that we have just outlined. The model is thus specified as follows:

$$dd = \alpha_0 + \alpha_1 p_onfarm + \alpha_2 \log(pcexp) + \alpha_3 landown + \alpha_4 hhsiz + \alpha_5 educ_ave + \alpha_6 agehead + \alpha_7 flaborshare$$

where dd is our dietary diversity measure (simple count of food groups), p_onfarm is the dummy variable indicating whether the household participates in agriculture, $pcexp$ denotes

per capita consumption expenditure, *landown* is a dummy variable identifying households that own land (the default), *hhsiz*e is the sum of members of the household, *educ_ave* is the average education of the adult household members, *agehead* is the age of the household head, and *flaborshare* the female share of the working age adults. The regressions also included a set of geographic dummy variables, and square terms for the age and education variables. Household level identifiers and the independently, identically distributed error term are omitted from the notation for simplicity.

The model is run separately for the full urban sample for each country, so that we have 15 regressions in total. As it would be cumbersome to report the complete results for all the regressions, we summarise in Table 2 the results related to the main explanatory variable of interest, participation in urban agriculture. For illustrative purposes we also report the regression output from Stata for Ghana in Appendix Table 1⁵.

After introducing the set of controls specified above, we do find evidence that engagement in farming in urban areas is associated with greater dietary diversity in 10 out of 15 countries. This is true in the four Latin American countries, 3 of the 5 Asian ones, Nigeria and Ghana in Africa, and in Bulgaria. The sign on the coefficient is not significantly different from zero in the other five cases.

These results provide a fairly robust confirmation of earlier suggestions of city case studies, nutritional surveys, and qualitative and anecdotal observations, that engagement in farming by urban households can allow them consuming better, more nutritious diets. The magnitude of the coefficients is not large, ranging between 0.14 and 0.60 when significant. This is not surprising given that the variability in the dietary diversity variable is not all that large either (Table 3).

One area for further refinement of these estimates concerns the possible endogeneity of some of the right hand side variables, such as per capita expenditure. We plan to explore this issue, and possibly use instrumental variable estimation, in a future version of this paper.

5. Concluding remarks

This paper set out to tackle to very specific research questions concerning (1) the importance and magnitude of agricultural activities for urban households; and (2) the relationship between engagement in urban agriculture and household food security. Our findings indicate that agriculture is indeed a not negligible reality of the urban economy, involving anywhere

⁵ The full regression results are available from the authors.

between about 10 to 70 percent of urban households. In terms of income generation, though, its role appears to be much more limited, with the important exception of the African countries in our sample, and of the households in the poorer quintiles in Nepal and Vietnam. Our data also confirm that urban agriculture is an activity in which the poor are disproportionately represented, and that this occurs in all regions.

In terms of answering the second question we stopped short of looking at the whole food security picture and focused on dietary diversity. It appears from our results that, in two thirds of the countries we analyse, being active in agriculture does increase the dietary diversity of urban households, after controlling for economic welfare and a set of household characteristics.

In terms of policy implications, it is not for a paper of this kind to go into any degree of specificity about what urban planners should do about urban agriculture. We know very well from case study literature that cities are very different in the characteristics of their urban agriculture, and that even different neighbourhoods in the same city might require different approaches. Whether urban agriculture makes economic sense is an empirical question⁶, and will depend on its profitability and on the extent to which it provides food for the food insecure at a lower opportunity cost in the use of their resources than alternative means of procuring that food.

If households are engaging in agriculture (and our data suggest that a fair number are indeed), however, this means that under the circumstances they are benefiting from their involvement in the activity. How large these benefits are and to whom they accrue is difficult to quantify precisely, but some clear hints do come from our analysis. On the one hand, the potential for urban agriculture to play a substantial role in urban poverty and food insecurity reduction should not be overemphasised, if one looks at the sort of income figures we produced. On the other hand, though, its role should also not be too easily dismissed, particularly in Africa and in all those countries in which agriculture provides a substantial share of income to the poor, and as we have shown that it does appear to have an impact on dietary diversity, a measure related to food security.

Urban planners and policymakers should therefore think twice before taking drastic action against urban agriculture, as it has often been the case in the past, and consider the poverty and food security implications this might have on the households that participate in it. Whether urban agriculture is worthy of direct public policy support, though, is more debatable

⁶ The issue of environmental externality and competition over scarce natural resources (e.g. water) will likely form a substantial part of the response to this question, which this paper has not touched upon.

and not a question this paper can address, as one should in each case specifically consider the alternative possible pathways out of poverty and possible alternative measures to increase household's access to food, be it through the promotion or different income generating activities and employment opportunities, or by improving the efficiency of the urban food markets the poor rely on.

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Table 1. Share of income from urban agriculture

Country and Year	On farm
Albania 2005	2.9
Bulgaria 2001	2.4
Ghana 1998	18.4
Madagascar 1998	17.9
Malawi 2004	9.5
Nigeria 2004	18.2
Ecuador 1995	4.0
Guatemala 2000	2.7
Nicaragua 2001	5.5
Panama 2003	1.7
Bangladesh 2000	3.0
Indonesia 2000	3.0
Nepal 1996	10.7
Pakistan 2001	3.7
Vietnam 1998	6.2
Mean	7.3
Max	18.4
Min	1.7

Table 2. Regression results

Country and year	ρ_{onfarm}
Albania 2001	0.05
Bulgaria 2001	0.29***
Ghana 1998	0.33***
Madagascar 1998	-0.09
Malawi 2004	-0.11
Nigeria 2004	0.23***
Ecuador 1995	0.39***
Guatemala 2000	0.19***
Nicaragua 2001	0.16**
Panama 2003	0.60***
Bangladesh 2000	0.14**
Indonesia 2000	0.19*
Nepal 1996	0.20**
Pakistan 2001	0.01
Vietnam 1998	0.06
Positive on total	10/15

Note: ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

Table 3. Summary statistics for dietary diversity variable

<i>Country and year</i>	<i>mean</i>	<i>s.d.</i>
Albania 2001	10.7	1.1
Bulgaria 2001	10.1	1.2
Ghana 1998	10.2	1.6
Madagascar 1998	11.1	1.4
Malawi 2004	9.9	1.6
Nigeria 2004	8.8	1.8
Ecuador 1995	9.8	2.0
Guatemala 2000	10.5	1.8
Nicaragua 2001	9.6	1.7
Panama 2003	11.0	2.1
Bangladesh 2000	10.6	1.7
Indonesia 2000	9.9	2.4
Nepal 1996	10.9	1.2
Pakistan 2001	4.2	0.7
Vietnam 1998	12.1	0.9

Figure 1. Participation in urban agriculture

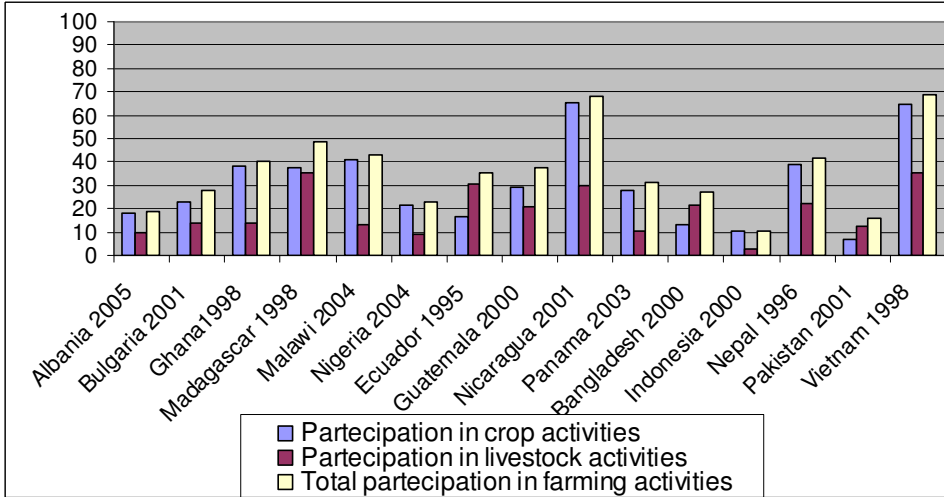
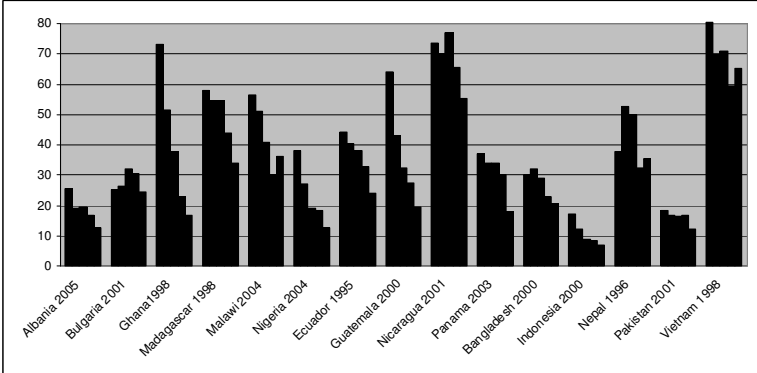
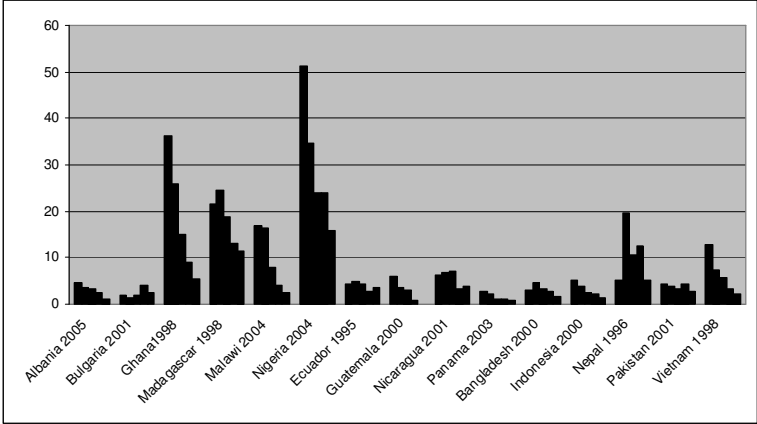


Figure 2. Percentage of households participating in urban farming, by expenditure quintile



Note: The bars correspond to expenditure quintiles, from the poorest (to the left) to the richest (to the right).

Figure 3. Share of income from urban agriculture, by expenditure quintile



Note: The bars correspond to expenditure quintiles, from the poorest (to the left) to the richest (to the right).

Appendix Table 1. Stata regression output, Ghana

Number of obs = 2154

F(13, 2140) = 32.11

Prob > F = 0.0000

R-squared = 0.1632

Adj R-squared = 0.1581

D_DIVER	Coef.	Std. Err.	P> t
p_onfarm	.3256067	.0800599	0.000
landown	-.007159	.0152838	0.640
logpcexp	.8988513	.058699	0.000
agehead	-.0374302	.0122516	0.002
ageheadsq	.0002995	.00012	0.013
flaborshare	.5727068	.0927192	0.000
hhsize	.1782971	.0167795	0.000
educave	.0973023	.0259924	0.000
educavesq	-.0094219	.0019776	0.000
geodummy1	-.0614838	.1247132	0.622
geodummy2	.1802325	.1202126	0.134
geodummy3	-.0836723	.0837774	0.318
geodummy4	.0002973	.1382229	0.998
_cons	-2.710301	.8854859	0.002
