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Chapter 2 A Methodological Memo of H. Tsujii for the Analysis of the Farm Survey Data of Socio-economic Sub-group of the ICCAP

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Introduction

This memo is my thinking about the method by which we can analyze the farm survey data and the related data in order to identify the effect of climatic change to farmers' perceptions, farmers' responses, and agricultural production through the complicated effects to agricultural production of socio-economic, institutional, technological, natural resources, and climatic changes. In this memo I especially consider how to integrate farm survey data analysis and agloclimatological analysis in order to identify the effects of climatic change to agricultural production.

2. Three Stages of Analysis

First, using farm survey data I planned to conduct at least three types of studies. They are (1) Analysis to identify the factors affecting farmers' perceptions of climatic change and of natural resource conditions. These factors are agro-climatological conditions, household characteristics, agricultural practices such as cropping pattern, leguminous crop intercropping, fallowing, use of manure as fertilizer, use of chemical fertilizers, use of new seed, village characteristics such as access to town, extension contacts, road condition, and institutional conditions. (2) Analysis of farmers' agricultural and economic responses to these perceptions. (3) Analysis of the factors determining the real yield and sown area of major crops such as wheat and barley. These factors are farmers' perceptions of climatic change and of natural resource conditions, levels of major inputs, cropping patterns, fallowing, use of new technology, prices and interest rate, policy changes, etc.

Behavior of farmers are considered different between rain-fed area and irrigated area. Thus we have to analyze farmers' behavior in rain-fed area and in irrigated area separately. For this step of our study we can use the qualitative dependent variable methods and conventional agricultural economics methods such as production function analysis and supply response analysis, as I will discuss in the later part of this document. There are severe interdependences among some of the variables among three types of analyses, so that we need to adopt the simultaneous equation approach such as 2SLS or 3SLS. I also expect severe multi-colinearity and confounding(in our qualitative dependent variable analyses) in our analyses, and we have to deal with them by the standard econometric methods.

From this study stage we will come to know how farmers' perceptions of climatic change and of natural resource conditions are formed, and how farmers respond agriculturally and economically to their perceptions. Further, we will know what are the factors determining yield and sown area of major crops including the farmers' perceptions. Based on these findings we will come up with an integrated hypothesis explaining a causal relation among the perceptions, the responses, and the real yield and sown area. This hypothesis has important implications to agricultural sustainability of Turkish agriculture, and to the impacts of climatic change to Turkish agriculture. In order to find this hypothesis, we have a strong need to conduct our farm surveys and agricultural field study in representative areas of Turkey.

Second, I planed to conduct a time series agro-climatologic and economic analysis among yield and area sown of important crops, monthly weather data, and economic, policy, and agronomic variables using published provincial and national data. I will discuss this methodology later in this document. I had done it for Thailand and Japan before, and I published some English and Japanese papers. I have asked Mr. Gultekin during his stay in Japan to conduct a preparatory time series agro-climatologic and economic

analysis among yield and area sown of wheat and barley, monthly weather data, and economic and agronomic variables for Adana, Konya, and Turkey. We have reached some results on this research trial already. Some of my past English papers are

TSUJII, Hiroshi, "Effect of Climatic Fluctuation on Rice Production in Continental Thailand," in K. Takahashi and M. Yoshino eds. ***Climatic Change and Food Production***, University of Tokyo Press, pp. 167-79, 1977.

TSUJII, Hiroshi, "An Economic Analysis of Rice Insurance in Japan," in P. Hazel, C. Pomareda and A. Valdes, eds. ***Crop Insurance for Agricultural Development Issues and Experience***, Johns Hopkins University Press,pp.143-155, 1986 .

TSUJII, Hiroshi with M. M. Yoshino and others, "The Effects of Climatic Variations on Agriculture in Japan," in M. L. Parry, T. R. Carter and N. T. Konjin, eds. ***The Impact of Climatic Variations on Agriculture, Volume 1, Assessments in Cool Temperate and Cold Regions***, Part VI, Dordrecht, The Netherlands: Kluwer Academic Publishers, for International Institute of Applied Systems Analysis (IIASA) at Vienna and United Nations Environment Program, pp. 725-863,1988.

Third, is the comparison and integration stage of our studies. The second stage of our study is to be done for the statistical confirmation of the hypothesis found in the first stage of our study. If confirmation is made, then we can finish our work. If not confirmed, we have to find the reasons for the contradiction, and try to modify the methodology of the first and second stages of our research and try to reach a consistent result. After we reach this stage, I think we can infer the effects of climatic change to Turkish farmers' behavior and economy, and Turkish agricultural sector.

I can see a few problems ahead of us. First, we will find a long run hypothesis from the first stage of our study since we will use cross section farm survey data. From the second stage of our research, we will find a short run statistical relation since we will use time series data. Thus there is a theoretical difficulty to reach the confirmation that I have just discussed in the last paragraph. We could use, for example, the adaptive adjustment approach to relate the hypotheses of these two stages of our study. Second, I found from my short experience attending our farm surveys in Turkey and other countries, observing the results of analysis of our farm survey about farmers' perception of weather change, and time-series agro-climatological analysis with Dr. Gultekin that there is a problem of inconsistency between farmers' perception of the weather change and the real weather change. And I think we have to find out a method to deal with this problem too.

In my questionnaire, I try to obtain farmers' perception of climatic change quantitatively using the indexing approach, and inserted the questions into the original questionnaire in order to do it. As you could understand from above that the quantitative data for the farmers' perception of climatic change is very important in our farm survey research in the ICCAP socio-economic sub-group. I told Dr. Erkan when we met before that we could collect this index data in our farm survey by using the proportional piling method (Using twenty or so small stones or other small objects when we ask this question.). I have done it in Nigeria and Indonesia and I was successful to collect the indexed data for this perception, and I have published some papers using the data and the methodology stated just above already. The published or accepted papers are as follows:

1. TSUJII, Hiroshi and Ageng S Herianto and Siti Sugiah Machfud Mugniesha, "An Econometric Analysis of Agricultural Sustainability in a Montainous Village of West Java: Use of the Multinomial Logit Model to Soil Fertility Perception," Takeuchi and Hartono, Eds. ***Sustainable Agriculture in Rural Indonesia***, Gahdja Madha University Press, September 2003.
2. CHIANU, Jonas Nwankwo, and TSUJII, Hiroshi, 'Missing Links in Sustainable Food Production in West Africa: the Case of Savanna of Northern Nigeria, 'Accepted and in press for

Sustainable Development in October 2003.
3. CHIANU, Jonas Nwankwo, TSUJII, Hiroshi, and KORMAWA Patrick, 'Agriculture in the savannas of northern Nigeria: Pressures, transformations, damaging and promising coping strategies.' Accepted for publication in ***Outlook on Agriculture*** and will be published in June 2004.
4. CHIANU, Jonas Nwankwo and TSUJII, Hiroshi. ' Integrated nutrient management (INM) in the farming systems of the savannas of northern Nigeria: What future?' Accepted for publication in ***Outlook on Agriculture*** and will be published in December 2004.
5. CHIANU, J.N. and H. Tsujii. "Determinants of Farmers' Decision to Adopt or Not Adopt Inorganic Fertilizer in the Savannas of Northern Nigeria." Accepted (in June 16, 2004) for publication in ***Nutrient Cycling in Agroecosystems***

But in our farm surveys in Turkey during the last two years the proportional piling method that I planed to use was not used, and the indexed data was not collected. Only qualitative farmers' perception data about change of climatic variables were collected by simplifying the relevant questions in our questionnaire. As I write below, we still can use this qualitative perception data, but I hope we can collect the indexed perception data in 2004.

I told Dr. Gultekin the details about my research strategy, methodology, and survey methodology, especially application of the proportional piling method. I also write some details about our research methodology that I think we should use together in the near future in the later part of this memo. I hope very much that Dr. Erkan and other Turkish and Japanese participants of our sub-group will give their inputs to this memo as soon as possible. I also request that Dr. Gultekin will inform Turkish participants more details about what I wrote in this document.

Now, we have to discuss and agree what we will do in 2004 very urgently. I plan to publish an English interim report of the study results of the socio-economic sub-group of ICCAP of both descriptive and analytical characteristics using the survey data of both of our farm surveys in 2002/3 and 2003 by inflating the monetary value data of 2002/3 data using appropriate price index, probably GNP deflator, and compiling the research results of other participants of our sub-group. We can finish inputting the data of our 2003 survey late 2003. I also plan to publish our academic papers starting in 2004. It is now urgently needed that how to synchronize Turkish side research work with the Japanese side, and how we can conduct our research truly together. I think Dr. Gultekin's short visit to Kyoto in 2003 was very productive for contributing to this objective. I worked with him very intensively in the agro-climatological and economic analysis of the relationship among yield and area sown of wheat and barley, and weather, agronomic, economic and policy variables, and I hope we can publish a paper together soon. I think we have to publish some of our publications together. I expect very much the good effect of Mr. Kemalttin's visit to Japan in 2004 for the integration of our research.

In order to identify the hypothesis or the causal relation among the farmers' perceptions, the climatic change, the farmers' responses, and yield and area sown that is closely related to the objective of ICCAP and agricultural sustainability in the arid area of Turkey, we need to conduct our farm surveys in representative areas of Turkey. The research objective of the ICCAP is the identification of the effects of global warming to arid agriculture in Turkey. I think Adana and Konya do not represent Turkish agriculture well. So I would like to conduct farm survey and agricultural study in northeastern Turkey and western Turkey, in addition to the survey and study of Adana and Konya in 2004 and in the future. I like to get response about the future sites of farm survey from Turkish side especially Dr. Erkan and Dr. Riza Kanber, the Turkish side leader of ICCAP.

3. The Framework of Tsujii's Methodology for Conducting Analysis of Our Farm Survey Data and the Other Data and Information

1. Here I shall describe the methodological framework for the analysis of the relationship between farmers' perceptions of natural resource conditions such as inherent soil fertility and of climatic change and farmers' agricultural and economic responses to these perceptions.

1.1 The soil fertility and agricultural sustainability analysis using our farm survey data

A. The multinomial logit model approach to identify determinants of farmers' perception concerning the change in soil fertility.

Separate the surveyed farms between rain-fed area farmers and irrigated area farmers. Make farmers' perception of inherent soil fertility change as a discrete dependent variable and try to identify its determinants such as household characteristics, rainfall, irrigation condition, underground water level, cropping pattern, leguminous crop intercropping, fallowing, use of manure as fertilizer, use of chemical fertilizers, use of new seed, village characteristics such as access to town, extension contacts, and road condition, etc. by the multinomial logit model approach. By this analysis we can find out how this perception is formed, and whether farmers can understand the concept of inherent soil fertility.

B. The tobit analysis of farmers' wheat yield.

C. The logit analysis of fallowing.

D. The tobit analysis of keeping livestock.

E. The logit analysis of using manure as fertilizer.

F. The logit analysis of using manure as fuel.

G. The logit analysis of using manure as fertilizer.

H. The logit analysis of intercropping leguminous crops with serials for nitrogen fixation.

1.2 The multiple regression analysis of why farmers are poor.

A. Farm household income is explained by farm survey data.

B. Agricultural income is explained by farm survey data.

C. Non-agricultural income is explained by farm survey data

1.3 Farm food security study using crop and livestock balance data of our farm survey

1.4 The farmers' choice of cropping patterns and fallowing, and their determinants using our farm survey data.

A. The farmers' choice of cropping patterns and its determinants

Use farm survey data for rain-fed area and irrigated areas separately and try to explain the farmers' choice of cropping patterns by the appropriate variables obtained in our farm survey data. This analysis can have long run sustainability implications.

B. The farmers' choice of fallowing and its determinants

1.5 Multinomial logit analysis of the determinants that influence the farmers' water use.

Somehow, try to classify the surveyed farms among low, intermediate, and high water use farmer groups in irrigated area using our water fee data paid by the surveyed farmers, then try to explain this discrete variable by appropriate variables obtained from our farm survey using the multinomial logit analysis.

1.6 The long run production function estimation using our farm survey data.

Separate farms between rain-fed area farmers and irrigated area farmers and choose a common crop. Then make the value of household agricultural production as a dependent variable and try to estimate its production function using household characteristics such as family size, tractor owned, and total area cultivated, rainfall, irrigation condition, underground water level, cropping pattern, leguminous crop intercropping, fallowing, use of manure as fertilizer, use of chemical fertilizers, etc obtained from our farm survey. Then we can conduct input optimality analysis and critical input limitation analysis based on the marginal productivity estimates.

2. Production function and supply response approach using the published data

2.1 Time series production function analysis for agricultural production or important crops such as wheat

2.2 Time series supply response analysis of sown area of wheat

Provincial and national sown area of wheat is explained by inputs and outputs prices, monthly rainfall data, monthly temperature data, availability of water or water fee, fallowing, cropping intensity, leguminous crops intercropping, technology, a dummy for 1980 coup de tat, a dummy for the agricultural land protection law, a dummy for the pasture law, etc.

2.3 Time series supply response analysis of yield (Yw) of wheat

Using provincial and national time-series data,

Yw=f (weather data, new variety, output price, inputs prices, cropping intensity (fallow period), leguminous crop intercropping)

is estimated and analyzed.