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Interview to L. R. Klein for the Journal on Applied Economy Studies, "Estudios de Economía Aplicada". Autonomous University of Madrid

ADOLFO CASTILLA IN COLLABORATION WITH ALFREDO COUTIÑO

Q1. – It is an honor and a pleasure to have an interview with you for this special issue of the Spanish Journal on Applied Economy Studies ("Estudios de Economía Aplicada"). This issue is especially dedicated to you and your work as homage from the University of Madrid, the Institute Lawrence R. Klein, CEPREDE, and from all the Spanish people who have had the privilege to work with you in the last thirty years. It was in the spring of 1975 when I took my first course in Econometrics taught by you at Wharton School. At that time, I also met Abel Beltran, with whom I initiated my practice of economic forecasting and collaborated together with the already famous Wharton Econometrics Forecasting Associates (WEFA). It has been thirty years cultivating a close relationship, professional and personal; first, building the Wharton-UAM Model for the Spanish Economy; secondly, founding CEPREDE and the forecasting service for Spain in collaboration with Antonio Pulido; and thirdly, with my participation at Project LINK as a member of the executive board in the last ten years.

You were 54 years old when I first met you, and you were at the top of your successful career as an economist and a professor. Can you tell me, how and why did you decide to study economics? Why econometrics? Was economics a popular field when you started your studies?

A1.- When I was in my later years of high school in the 1930s, I developed an interest in financial and economic issues, confronting the United States and the entire world in the form of the Great Depression, but my main conceptual interests were not so much in trying to understand "the economy" as a structured social and political system but more in terms of individuals' management of their affairs in a turbulent world situation.

When I entered university my interests began to take shape in the world of ideas. I specialized in both economics and mathematics. I could not see their eventual use together to deal with problems that the world faced. Also, I was not equal to the quick-witted star mathematicians at the university, but I kept being attracted by mathematical problems and their potential use in natural, physical, and social sciences – especially in economics.

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At the University of California, where I was enrolled in my last two years at university I was fascinated by the lectures and research of some world-class mathematical statisticians and economists who were playing significant roles in the founding of econometrics. This was, however, simply an eye-opening for me. When I went, one day, to the University Library and browsed among recent issues of ***Econometrica*** on the shelves and noticed the lively contributions of Paul A. Samuelson, I knew at once what would capture my imagination. When I soon learned that MIT was advertising a new program in postgraduate economics and that Paul Samuelson was on their faculty, I immediately applied for their openings for students to enroll in their doctoral program, in what would be their second entering class. MIT had, for a long time, compulsory academic offerings in economics for undergraduate students of science and engineering. When my application was accepted with a very generous financial stipend (generous for the times) I accepted the offer without hesitation.

I knew a few scattered facts about the interest in mathematical economics and econometrics and had noticed the interesting content of ***Econometrica***, the journal of the Econometric Society. I knew then that my lifetime choice was clearly made. My interaction and supervision with Samuelson at MIT proved to be my formal starting point in econometrics. For his 90th birthday, I have written a short piece (to be published) on what student life was like under Samuelson's tutelage in those first years of the graduate economics program at MIT – later to be recognized as the number-one department of economics in the world. I had, there, unlimited opportunity to pursue development of mathematical and statistical methods in economic analysis. I also developed, at that time a favoritism for quantitative, empirical econometrics.

Econometrics was not completely established then (1942-44), but it was growing fast. Samuelson steered my interest to a problem in applied econometrics at the very beginning of my arrival at MIT, and that has become my principal line of professional interest.

Q2.- Undoubtedly, you have had a successful career as a professor and economist, most of it closely related to the application of econometrics, modeling and forecasting. In that regard, is econometrics still an important field, and what about the future of econometrics? Can you recommend the study of econometrics to the new generations of students?

A2. – As I stated in my previous remarks, I was just beginning my plans for graduate study towards a doctoral degree, when econometrics was in its infancy. The founding of the Econometric Society and the research plans for the Cowles Commission (now Cowles Foundation) were interrelated events. Econometrics and mathematical economics were both taking root in the most advanced centers of study Harvard, MIT, Yale, Princeton, California, Chicago, Cambridge, Oxford, Oslo, Stockholm, Paris and Rotterdam were some major centers of activity in the subject, and it is noteworthy that the first two recipients of the Nobel Prize in memory of Alfred Nobel in 1969, chose Ragnar Frisch of Oslo and Jan Tinbergen of Rotterdam as the first recipients. Both were specialists in developing econometrics and mathematical economics. Some leading research studies

that opened this field were ***Demand Analysis*** by Henry Schultz, ***Production Function Analysis*** by Paul Douglas and ***Macroeconometric Models*** by Jan Tinbergen. These were all empirical studies, based on theoretical analysis from the theory of consumer demand, theory of the firm, and models of the economy as a whole. Many leading economic theorists held to their literary and simplified graphic analysis, proclaiming in some cases that the mathematical treatment would never last, and then amounted, to a large extent, to mere copies of what had already been accomplished in physical and natural science. The new developments turned to specific problems and applications to public policy, thus leading the way in post World War II economics.

Econometrics, in a strict sense, required research teams such as that from the Cowles Commission to handle databases, complicated computation (in the era before electronic computing) and forecasting. As academic promotion depended heavily on publication records, many young minds turned to single-person activities, or research investigation involving very few people, and econometrics began to be accepted and emphasized on a sparing basis.

For people or organizations that must deal with major problems of the economy, as a whole, or major parts of it, the main use and development of large-scale econometric models became an activity of large government agencies, private consulting companies, and multinational organizations. Individual researchers turned to small and easily manageable models that are useful for pedagogical purposes, but the large-scale comprehensive econometric models are, for the most part, not centered in academic research. There is considerable research with large-scale realistic models for econometric research and policy outside academia, but it plays less of a leadership role in academic economics, especially in an applied form.

My recommendation for economic study, with specialization in econometrics, now is to acquire ever stronger mathematical skills, master the help of the large-scale computer, and focus on careful use or interpretation of databases. In the formation age, large system could be well handled. Now more revealing data are being published and made available; the time unit of analysis is shifting from yearly intervals to months, weeks, days, or even real time. Computation is being harnessed to more complex needs.

Q3. – Several economists from the 50s, 60s, and 70s were Keynesians, including yourself with your doctoral dissertation. Why was Keynesian theory so popular at that time and why has it lost relevance since the 80s? Is it possible to expect the return of Keynesianism?

A3. – Keynesian analysis. The Great Depression which followed the speculative build-up of the 1920s and the ill-effects of the Treaty of Versailles, seemed to require new thinking about macroeconomics and associated policy, both in the United States and Western Europe. Keynes had attracted much attention by his analysis of the Treaty's expected effects and gathered together his students and colleagues in Cambridge, England, to reconsider a theoretical framework that could give rise to the theory of effective demand and the possibility that major economics could be trapped

in an "equilibrium position of less-than-full employment". Parallel analysis was taking place, inspired by Keynes' group (called a "circus", in Cambridge, England) in Cambridge, Massachusetts, USA. As I entered post-graduate school at MIT, and Paul Samuelson had shifted just one year earlier from Harvard to MIT (both in Cambridge, Massachusetts), Samuelson's macroeconomics appreciated Keynes' contribution, and it was he who suggested to me the possibility of writing a doctoral dissertation on the Keynesian Revolution, which I started to do immediately after that suggestion was made. I worked on this subject from three major points of view: I tried to interpret the changes in Keynes' thinking about the macro economy from his early writings on Indian Currency and Finance (1913), to A Treatise on Money (1930), to The General Theory of Employment, Interest, and Money (1936). After my dissertation defense, I went to the Cowles Commission at the University of Chicago where new approaches to statistical inference were being introduced into econometrics, and I was assigned the task of building a macro model of the United States to bring Tinbergen's pioneering effort at the League of Nations up to date, with the explicit purpose of estimating the path of the US economy following victory in World War II (which seemed imminent) in a phase of reconversion from war to peace time production.

In revising Tinbergen's effort, I paid special attention to the micro-foundations of macroeconomics, influenced by my teachers from the University of California (G. C. Evans and F. W. Dresch. Samuelson's views on the issue of economic equilibrium at less-than-full employment guided my specification of the model. My colleagues at the Cowles Commission emphasized the power of new estimation techniques, inspired by Abraham Wald, Trygve Haavelmo, and T. C. Koopmans. Personally, I laid more stress on having improved data and good institutional information.

The Committee for Economic Development, headed by Theodore Yntema (a former research director of the Cowles Commission) and Albert Hart, in the research wing of CED, prevailed on me and the Cowles Commission to use our model, in its first application, even though we felt that it was not quite ready for application, but the seriousness of the issue demanded that we try. Several American Keynesian economists and some Europeans were pessimistic, thinking that the demobilization effort would result once again in very high unemployment and Depression conditions.

Albert Hart supplied the policy assumptions (fiscal, monetary, and deployment), I managed input into the model and solution of a system of simultaneous equations.

I was, at first, oriented in my thinking, about results that would show a return to large scale unemployment and economic depression, but after many trial solutions with different assumptions, the results were definitely for no depression and only modest unemployment. When I took our first results to economists in a variety of Washington, DC offices, our findings were always challenged. During 1945, they looked at me (fresh from graduate studies) and said, "wait until summer 1946, and you will find that 6 million persons are unemployed." During the War unemployment hardly existed. As events turned out, there were just 2 million unemployed in 1946.

Was the discrepancy between two forecasts important? Many economists, at home and abroad, wanted to orient policies toward supporting mass unemployment of demobilized service persons. We had allowed for their return to higher education supported by the GI Bill, whose fiscal provisions had been put into the institutional aspects of our forecast by Albert Hart. I estimated consumption in durable and non durable categories, and assumed that people would not hold back on consumption simply because many highly desired goods were not fully available by 1946. In Europe, some economists in government looked upon the Western powers as economically weak, and made unfortunate economic agreements with Eastern countries where they (wrongly) thought the economic action would be far more positive.

Judgment about econometric success should be based on ability to forecast. That is my primary criterion, and the only real test of alternative models. I consider the 1946 forecast for post war demobilization to have been as good as such efforts can ever be. It was a truly important forecast for orienting thinking about postwar economic life.

The next big trial came after the Korean War. In this case the success of the forecast story is somewhat different. After leaving the Cowles Commission and spending two years in European travel (mainly in Norway) and at the National Bureau of Economic Research, I joined the Survey Research Center at the University of Michigan, with the express purpose of studying the Surveys of Consumer Finances to estimate the wealth effect, in particular, associated with the population's holding of US savings bonds. Also, from the fruits of the Ford Foundation's distribution of research grants to various universities (including Michigan), I received enough support to found the Research Seminar in Quantitative Economics, where it supervised a rebuilding of a US macro model to look into improvements in data, model specification, and use of information from the Surveys of Consumer Finances where we studied the wealth effect in great detail. Arthur Goldberger and I built the first in a series of Michigan models, and promptly used it to make forecast of US economic performance. We were soon confronted with another war termination situation.

The Korean War was drawing to a close, and at Michigan we organized an economic forecast conference for 1953 to estimate performance in 1954. Colin Clark had stunned the world by using his own model to forecast US activity in 1954 in the Manchester Guardian. On reading the international weekly edition with Clark's article, estimating that the US was heading for a Great Depression set-back in 1954, we sent the Guardian our contrary forecast, namely that there would be only a mild down-turn in the US economy for 1954, but not a serious recession. In a sense, this is attempting to use a model for "fine-tuning", but it was a straightforward forecast application of the Michigan Model, that turned out to be quite accurate. When, I was in England, the following year, Keynes' successor as manager of Kings College investment portfolio, Richard Kahn, told me that Colin Clark's dismal forecast had pushed him into large-scale shifts into gilt-edged securities and that he wished that he had been in possession of our forecast from Michigan when it was first released in the

Guardian. The forecast of the performance of the US economy after the Korean War settlement is another example of an important forecast. I believe that the detractors of econometrics, as it was being used in line with the Cowles Commission approach, and the opponents of Keynesian economics have done a very poor job of looking into the facts and have no appreciation of the attitudes of the postwar public.

Keynesian economics exists in splinter groups who dispute claims of the macroeconomics of conservatives who want no or very little economic guidance during times of adverse performance of the macro economy. Meanwhile, the original Keynesian economists have, for the most part, formulated a Keynesian-neoclassical synthesis. I would argue that Keynesian economics of this synthetic blend, equipped with good econometric models that have evolved from the original systems built by Tinbergen is the best form of "Western" economics in the evolution of the Anglo-American tradition that evolves from the Keynesian Revolution. An interesting way to build an econometric model that reflects the Keynesian-neoclassical synthesis is to combine structural models in the traditional Keynesian spirit for the demand side of the economy with an input-output system of the Leontief type in order to reflect the supply side in a systematic way. Keynesian economics focused on the weakness of aggregate effective demand. Some economists may state differently that it is a system of depression economics. The Great Depression leading into the all-out mobilization for war against Nazism and Fascism introduced a complete set of new problems. This situation did not challenge Keynesian economics, as such; it simply showed the need for generalizations to encompass new problems; that is why the Keynesian economist had to face fresh supply side economics, particularly in implementing the Marshall Plan for Europe and modernization of economic thinking in Japan, after the Korean War. Also, the new postwar economic analysis had to deal with the issues raised by the Cold War.

The breakdown of the exchange rate mechanism that was put in place by the International Monetary Fund according to the Bretton Woods exchange parities broke down as a result of the rebuilding of Germany and Japan. They successfully rose again through international trade and accumulated financial wealth to such an extent that revaluation and implementation of new trading systems came into force. In particular, the United States had to recognize that it, like very other country, is an open economy. International trade rounds had to be implemented, eventually leading to the establishment of the World Trade Organization and its oversight of the vast area of international trade.

Out of the Western European Iron and Steel Organization grew the Benelux system of trade, eventually the European Common Market and later the North American Free Trade Association. These developments are by no means anti Keynesian; they are simply developments that cause Keynesian oriented economists to generalize their thinking about the world economy. This has evolved into Globalization with a European Union, an international banking and finance system in Europe and consideration of currency arrangements on a broader scale.

Although a departure from Keynesian economic analysis took place in the 1980s and was called supply-side economics in contrast to Keynesian focus on the demand side, the proponents of supply-side economics turned their main attention to tax reduction. The sitting President during this period was Ronald Reagan, and he should more appropriately be called the greatest Keynesian policy maker of all time. His tax reductions were instrumental in turning the US economy upward, but from an analytical viewpoint it was not different from the Kennedy-Johnson Administration that moved the economy strongly upward in the 1960s with their tax cuts. In each case, Reagan of the 1980s or Kennedy-Johnson of the 1960s the tax cuts were significant, but government expenditures also rose, and the joint policy (tax cuts with spending increases) left the economy in difficulty because federal deficits were very large and limited follow-through policies after the original Keynesian stimuli had run their course. Johnson's spending was largely for the Vietnam War, while Reagan's was for "Star Wars" and large-scale expansion of Cold War military spending.

It should be remarked that two supply-side events were features of other administrations in the United States and called for radically different policies from the strict Keynesian economists who were giving advice to policy makers, namely, the OPEC's pricing pressures in the period starting in 1973 and the Information Technology stimuli for productivity gains in the 1990s. It should be emphasized that many Keynesian economists have broadened their scope of analysis and are fully aware of the importance of supply as well as demand influence and made very perceptive estimates of the inflationary impact of oil price rises, as well as anti-inflationary aspects of productivity increases. Much of the published debate about the relevance of Keynesian economics or the use of up-dated Keynesian models for studying modern technical change is strongly misguided. Forecasts from large-scale models show this clearly.

Q4. – According to some economists, the world economy is facing a situation similar to that in the 50s, with trade surplus and lack of productive investment. Do you think the present situation is close or similar to the one in the 50s?

A4. – In the 1950s, the world situation was dealing with the Korean War and getting Japan back to peacetime economic performance just as the Marshall Plan was helping Europe. The Japanese recovery started on a larger scale and on a high growth path in the 60s – their "income-doubling" decade. Actually they over performed and more than doubled Japanese GDP during the 60s. Their recovery was comfortable until the speculation in land and their unsound financial practices ultimately led to a financial crash and deflationary movement in the 1990s.

Western Europe started to recover during the 1950s with the help of the Marshall Plan. This led to much better performance, but needed economic integration, financial reform and attempted monetary unification. This process is still taking place on an experimental basis, but I would not say that the present global situation is like that of the 1950s. There is reason to be more hopeful now, but the world still must absorb more peaceful, cooperative policy and performance.

Q5. – A successful economy with increasing trade surplus is China. Some economists attribute the China's success to its undervalued currency. Is the revaluation of the Yuan necessary? Is the economy carrying the risk of overheating? Is China an economic threat for the world?

A5. – Ever since the reform process got underway in China, during the late 1970s and continued after formal reform features were introduced in 1980, China has amazed almost all onlookers. China has made an enormous advance, in lifting its citizens out of poverty – said to have done this for 400 million people; this stands as a remarkable achievement. Personally, I am very positive about the strong Chinese performance since 1978. China still faces problems in the open World Economy, but they are learning fast and should be economic leaders well into this century. China has demographic problems; they must curb speculation (domestic and foreign), but capital inflows, transfer of technology, comfortable export earnings, bringing the infrastructure up to world standards and building an up-to-date financial system all pose problems, but these have been very well handled for 25 years.

Q6. – Let's now talk about India. What's the real possibility for India to become one of the biggest players in the future? Since India is more an open market economy, can it surpass and displace China in the world economy?

A6. – India has long been attractive for study by sociologists, political scientists, anthropologists, economists and others, but little economic progress seems to have been realized. India, now, is attracting much new attention and is expected to share dominance in Asia with China. Each has more than 1.0 billion person.

There are two new factors in the heightened interest in India at the present time. For more than a decade, India has been developing unusual export earnings in the service sector by selling software services, other business services, financial services and health services throughout the world. These services come, to no small extent, to India as export earnings for white-collar workers. The "offshoring" of software and other computer services have grown remarkably. The importance of this new source of foreign exchange earnings is that it helps to stabilize an economy that has had traditional cycles as a result of varying monsoons. Not only have these hit agriculture but have caused cyclical forces to related sectors of the economy, thwarting extended growth in the economy as a whole.

A second feature of the Indian economy is liberalizing reform to reduce the public sector's involvement in the economy. India is well known for a strong bureaucracy, which is now being streamlined in the interests of economic growth. There is definite hope now in India. It is growing on the heels of China at about one or two percentage points lower. Even at this subdued rate, there are signs of significant improvement and self confidence now in India. Much effort needs to be expanded, in order to bring India up to China's level, by raising India's GDP per capita. This is no small issue, especially in a country with many poor people, possibly held back by a time-honored caste system. India would have to duplicate the achievement cited previously about the lifting of millions more people above the accepted poverty line.

Q7. – What about Africa? Is there any real possibility for African countries to attain some degree of development? What regions or countries have more possibilities of development?

A7. – Africa is the largest problem area in the world economy. Two observations make this point evident. A well known and time-honored piece of economic analysis deals with Malthus' dire prediction in the 19th century that population would grow faster (at a geometric rate) than food supply (at an arithmetic rate), thus generating famine or great deficiency of food supply. The Malthusian law and its frightening prediction have never come to pass on a global scale because of agricultural productivity increases, aided by such things as the Green Revolution, insecticide, fertilizer, irrigation, and gene modification. But we do find famine, starvation, and acute shortages of food supply in parts of Africa – not persistent in any one place, but prevalence of food shortages somewhere in Africa from time to time; thus one might say that Africa, to date, has been the only place where the Malthusian problem has been encountered on a large scale.

A second observation about Africa is that in the sub-Saharan region, GDP per capita has failed to grow, at least for long periods of time, from place-to-place. Efforts at providing economic assistance, training, public health, and other counter measures has finally allowed Africa, as a whole, to register positive growth on a per capita basis. This has not always been the case.

Africa is not homogeneous. North Africa does not share all the adverse circumstance of sub-Saharan Africa. During Apartheid, the white population of South Africa enjoyed a good life, while the black population did not. There are variable circumstances across the African Continent. Also there are some well-endowed areas that produce crude oil, mine diamonds, mine gold, and enjoy a correspondingly better life than do neighbors.

Changes are taking place, and Africa will undoubtedly enjoy better life styles in the future, but at the present time, Africa lags behind other developing areas in the world economy. North Africa will probably continue to have a better economy than will others.

Q8. – During the past few years, the world economy seemed to be performing well and with price stability. At present we have some current account imbalances, high prices of energy, and some incipient inflationary pressures. What are the main risks for the global economy? How does the world economy look for the medium term?

A8. – The global economy is mixed. Some areas are stable and prosperous; while others face food and health problems. Corruption is prevalent and those areas that have valuable mineral resources, are not likely to enjoy their present advantageous positions. They may not always have things on a favorable basis.

Those are imbalances in the world economy now. For the moment China and India, as discussed above, are enjoying modernization, wealth, and visible progress. The more advanced countries are not growing fast – not up to potential. Inflation is held

in check in Western Europe and Japan, but they do not enjoy good real growth. The United States has growth that is comfortable, but below what I would call potential. After the United States cut the statistical calculation of inflation and raised the growth numbers accordingly, the potential rate of real growth should have been increased from about 3% to 4%, but the economy does not get up to 4% in most projections, on a sustained basis, and unemployment stays near 5%. The massive layoffs of workers taking place now, and the coexistence of twin deficits (fiscal and international) lead me to believe that trouble lies ahead. I would not rate the US as a favorable economy at the present time. China and India, on the other hand, have more potential to exploit; an Asean miracle should include South East Asia, as well as RoK (Korea). This is the favorable part of the world economy. Naturally, for some time ahead, the well-endowed oil exporting countries should do very well in the present world environment.

Q9. – Poverty has always been an issue. In your opinion, is there a real cure to poverty? What do you think about the recent proposal of creating an International Investment Fund, mainly financed by the richest countries?

A9. – Poverty is one aspect of the broader issue of distributional properties of income and of wealth. It is popularly defined as having an income of less than $2 per day for a family unit, and this serves as a well-defined point at which to start in trying to improve the world's income distribution.

At a conference in Cambridge, Massachusetts last October, a researcher from MIT, stated that China's macroeconomic success, as distinct from microeconomic success (or failure), has been to lift 40 million people above the well defined poverty line. This is one of the achievements of the economic transformation in China since 1978 and other poor countries could very well aim at such a magnificent target. Some can do that on a relative scaled basis, taking population size into account, but China should go further in the direction of improving the distribution of income and wealth. Other developing countries should attempt to follow suit, and the idea of an International Investment Fund should be established among the "rich" countries to duplicate something like the Chinese achievement. It could be an important step forward in establishing international peace.

Q10. - What's your impression about the construction process of the European community? Can you see a unified Europe with unique economic policy? Do you see the European project similar to the construction of the US in the XXI and XX centuries?

A10. – The concept of the European Union is a fine step in economic unification towards better conditions for Europe, especially on an enlarged basis by bringing in new members from the East. The monetary union has made some success in unifying financial conditions within EU, but they have failed to encompass a fiscal policy that will promote growth. From my perspective, monetary union is but one step, but pure inflation targeting has not served Europe well. A unified target that combines price stability with employment and output stability would be the kind of organization that I would like to see in Europe. In terms of emulation of the US, institutions combining

our 50 states could be a model, but the practical target should aim for conditions of the second-half of the XXth Century and XXIst Century America, but not in the hegemonic style of our present foray into the Middle East.

Q11. – Going back to Econometrics. How do you see the future of econometrics, modeling and forecasting? Why has econometrics lost relevance?

A11. – From the time of my doctoral degree in economics (1944), I have focused on macroeconomic model building, using quantitative methods of econometrics. For me, this activity followed the synthesis between Keynesian and neoclassical economics, with the latter branch owing much to Wassily Leontief in the form of input-output economics.

Of course, I have taken up other narrower or more specific matters, such as work on the economics of Peace and fairer distribution of economic welfare, but I do believe that the true test of economic analysis is its ability to produce accurate forecasts that can be useful in achieving a stable, high employment, and widely distributed economic welfare.

Forecasting is inherently difficult in economics, and it is my belief that most economists all too readily give up the task of making useful and reliable forecasts. The noise-to-signal ratio is relatively high in economics, as it is in other non-experimental disciplines such as meteorology and seismology, but improvements can be made and have been made in other "noisy" disciplines. At present, I am occupied to a great extent by studying the China-India economic awakening and find enormous opportunities for making gains in economic understanding from the careful study of these two cases, which may be one of the most important developments of our times.

Q12. – You have been one of the first developers and promoters of the High-Frequency Methodology. In that regard, what is the potential expansion of High-Frequency Forecasting Models (HFFM)? Do you think the HFFM can gain the same popularity as the structural models? Do you see the HFFM as a competitor or complement of structural models?

A12. – My interest in developing high-frequency models for very short-term forecasting (up to six months ahead) developed because the IT sector expanded so fast with much more frequent and plentiful data about the economy and also enabled software improvements to be made so that forecasts could be quickly updated and widely distributed, immediately. This prompted me to mimic the statisticians in the government statistical offices in producing national income and product accounts frequently. In the United States, our accounts are updated (on a quarterly basis) monthly, and it is possible to use the same stream of weekly or monthly data flows to publish new forecasts every week. In fact, as soon as a new high frequency item of data is released, it is possible to recalculate a new forecast. In practice, I have been doing this for the US every week, but I am now experimenting with more frequent forecast revisions, and even going beyond usual monthly or weekly data reports to daily or real time releases on a purely experimental basis.

In connection with forecasting for transition economies, such as China and Russia, the monthly databases have only recently come into existence and are available since the early 1990s. Accordingly, my first thought in building forecasting models for China and Russia was to undertake high-frequency models. Other strategies seemed inferior. The user community in China and in Russia, however, immediately asked for longer time (medium range of 3-5 years) for their forecasts. My response is to improve the high-frequency models for these two very important cases, and gradually accumulate data until a medium-term structured model can be estimated. With two mutually compatible systems – one at high frequency and one at quarterly or annual frequency. I expect to project the two together, requiring that the early year for the medium-term system to come "as close as possible" through parameter adjustment to duplicating the short-run, high-frequency projection. At present, I am working with a colleague, Professor F Kushnirsky of Temple University, into formulating this joint solution at two frequencies.

In the interesting case, at present, in India. I am moving in the opposite direction. A useable structural model based on annual data is already in use, and I am working with Indian statisticians on building a compatible high-frequency model, for comparison with the China case.

The high-frequency models are not competitors with structural models based on quarterly or annual data; they are definitely complementary when applied with our new algorithms.

In the literature of econometric research, there is great interest in pure time series models, often univariate or bivariate, or in the form of fairly small systems with just a few variables in VAR models (vector autoregressive). The approach of high-frequency modeling and large-scale structural models is quite different. I like to distinguish between pedagogical and working models. The former are very good for teaching purposes; that is the way that the early mathematical versions of Keynesian economics were developed. They had great pedagogical powers for teaching Keynesian economics. Such systems are not insightful in tackling complicated issues of macroeconomics, either as forecast or policy judgments. For working models, it is important to get at fine details within a highly multivariate and dynamic system. This is the essence of the Keynes-Leontief synthesis. The final step has yet to be formulated, namely to combine the flow-of-funds in the form of asset-liability-matrices with the input-output matrices, and the items in the National Income and Product Tables (NIPA). This is the ultimate synthesis that is needed and is not to be found in the more popular pedagogical models of macroeconomics.