

# World hunger, can one do much about it?

Intervention mechanisms and margin for maneuver in seeking world food security

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## **World hunger, can one do much about it?**

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*Farewell address as professor of Mathematical Economics at the Faculty of Economics and Business Administration and as director of the Centre for World Food Studies of VU University Amsterdam, delivered on June 27 2014.*



Vice Chancellor, distinguished guests,

« Qu'ils mangent de la brioche! », "Let them eat cake then!", that is how Jean-Jacques Rousseau (1782), trailblazer of the French Revolution, quotes Queen Marie Antoinette when news came to her at her palace in Versailles about serious shortage of bread in the French countryside. Hearing this in class at my primary school in Rueil-Malmaison, a town not far from Versailles, it immediately occurred to me that there had to exist some better plan than feeding the people brioche. But what could that be? And this is how it all started.

Rousseau's quote presents a spoiled young woman who believes that hunger befalls those who are lazy and immoral, and who get too many children. As the higher classes cannot change this, they do not have to worry about the problem. Reproachable as it may be, such reasoning is of all times, which is why in reaction to it, initial indignation should be followed by some reflection. What can we actually do about world hunger, as a world community, as a country, as citizens, as scientists? This is a question I have asked myself so many times. At first sight, the remedy seems simple enough: show some compassion and feed the needy. "Marie Antoinette, come on, hand out your cake" we think as we support aid campaigns that promise immediate relief. But true remedy seldom lies so close to the ailment. Free handouts are mere emergency measures that eventually tend to create major new problems, to wit the refugee camps in Darfur and Jordan. Enough to turn even the Good Samaritan himself into despair. More is needed than charity alone, but what, then?

Could self-earned purchasing power be the answer? Let us imagine a more generous Marie Antoinette buying wheat flour and having cakes baked from it for the poor. That would have caused the price of wheat to rise, assuming that adequate tariffs prevented a surge in wheat imports from the newly established colonies abroad or from elsewhere. The price rise would of course diminish the purchasing power of the urban population, but not to worry, the Queen will provide for all who need it, and meanwhile the high prices will benefit the French countryside. That sounds like a plan. Unfortunately, at the time most of the lands, the more fertile ones in particular, belonged to the nobility and the clergy that through lease and taxation skimmed every surplus they could get hold of. Farmers would, therefore, gain little from the price rise. Furthermore, the cropping pattern was strongly specialized in wheat, which kept farmers quite vulnerable to drought, and caused wheat prices to fluctuate wildly from one year to the next. In short, with food aid and import duties on wheat as sole policy instruments, there was no way to reduce hunger, and any intervention package designed to improve the situation of one group would harm

another, which is not that rich itself.

This interconnectedness makes the issue so intricate. After graduation from high school it led me to start studying economics, in search of the right interventions, and of the best way to sequence and mix these. I have continued that quest until present and it may well be in defense of my pursuit that I want to tell you more about it today. To help us along the way, I now call on Marie Antoinette's often maligned consort, King Louis XVI.

After his ascension to the throne in 1774, Louis XVI soon realized that the grain market would not offer him sufficient margin for maneuver to deal with the economic problems of his country. He started searching for other instruments, sometimes literally strolling around outside his palace. This is how in the garden of the royal army hospital Les Invalides in Paris his eye one day fell on a plant unknown to him with pale purple flowers. They told him it had been planted there upon the head pharmacist's explicit instruction, because he firmly believed that this was a miracle plant that could put an end to world hunger once and for all. That may sound far-fetched, but this pharmacist, called Parmentier, was not that far off, for this was a potato plant. The potato had been introduced to Europe by Columbus about three centuries earlier, but was almost everywhere only deemed useful for feeding pigs, albeit that in Great Britain<sup>1</sup> and The Low Countries the poor had started eating it already. As it happened, Parmentier had been taken prisoner in Westphalia during the Seven Year's War. During captivity, he and the other French prisoners had been fed nothing but potato soup,<sup>2</sup> and they all survived quite well on this diet. Hence, back in France, he started what would nowadays be called a branding campaign. He personally developed various potato recipes such as the well-known Pommes Parmentier, fried potato served in cubes, a predecessor of French fries, which he served at various gatherings, and preferably in higher circles. Yet, poor or not, the French will refuse to eat pig food, and these attempts failed as well. Nobody liked his dishes. This all changed on that fateful day in 1785 when Louis XVI visited Les Invalides. The King immediately saw the potato's potential and understood his role in promoting it by using what we nowadays would call 'soft power'. He gave Parmentier a field in Neuilly,

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<sup>1</sup> Adam Smith (1776) in *The Wealth of Nations* acknowledges the high nutritional value of the potato but he also expresses strong doubts about its suitability as a staple, because of its high perishability in storage.

<sup>2</sup> Westphalia was part of Prussia. From 1746 onwards, King Frederick II of Prussia issued a series of regulations ordering farmers to cultivate potatoes. His subjects consistently refused to eat them, however, possibly also because he was never seen to do this himself.

close to the center of Paris, to conduct a royal experiment, and assigned soldiers to guard it in full uniform by day, but by day only, simply leaving at sunset. Soon enough, perfectly according to the King's plan, hungry and curious Parisians began sneaking into the field to dig up potatoes and taking them home for cooking into a nutritious soup. Some months later, the King appeared at the dinner table in Versailles with the blossom of a potato plant in his button hole. He placed some in Marie Antoinette's hair, who after this bravely took her part in the promotional campaign by serving potato dishes at her most exquisite banquets. Gradually acceptance set in and potatoes even became a staple food throughout Europe. This would make it much easier in the 19th century to feed the growing population of cities, while offering farmers a new crop that they could easily cultivate in the backyard for personal use, avoiding the often heavy taxation on cereals. Of course, without Parmentier or the King's help potatoes would surely have made it to the French menu sooner or later, but their soft power campaign considerably accelerated the process, saving many lives.

Louis XVI's did considerably more than planting potatoes. Immediately after his inauguration, he appointed as minister of finance the energetic economist Turgot, who developed the proposal to improve the public's purchasing power by reducing the tax on food while raising the tax on land. Land was, however, the prime asset of nobility and clergy, who, therefore, fiercely opposed the plan, and as the King's primary creditors had the power to do so. Within two years Turgot was dismissed, and the Swiss banker Necker appointed in his place. Rather than embarking on controversial reforms, Necker chose the easier path of issuing additional government bonds and while selling annuities to ordinary citizens. These elites even went a step further and pressured the King to finance Lafayette's expeditions in support of American independence, purely as an investment. As the proceeds of this investment turned out to be much lower than they had anticipated, however, these same elites refused as main creditors to recognize their mistake and write off the loans. As a result, France fell into a prolonged credit crunch. Maybe the past might is not that different from the present in this regard.

Louis XVI had inherited huge debts from his predecessors. Against all odds he kept on trying, and promoted various by and large effective interventions. That he lost eventually is largely because he proved unable to make use with sufficient speed and force of the window of opportunity, that hole in the clouds available to him. Correctly gauging the available margin for maneuver is difficult for every ruler, because it never is quite fixed. Moreover, a ruler constantly has to choose between working within the margin available and expanding it, possibly by brute force, that is, by

sending in the troops. Louis XVI's gentleness and hesitation were perceived as a weakness. After the severe drought and crop failure in the summer of 1788 and the extremely cold winter that followed, passions flared up in Paris during the summer of 1789, so much that the revolution broke out and the Jacobins caused the monarchy's fall. Louis XVI nowadays tends to be known as a typical loser. I believe he was a committed, intelligent and conscientious man, who unfortunately lacked strategic insight.

## **Multidisciplinary research for soft and hard power policies**

You did not come here today to hear about Louis XVI's life, I understand that, but this account introduces the remainder of my story. Indeed, today as much as in his days, except under emergency situations, malnutrition is primarily due to a lack of purchasing power rather than to production shortage, and policies to reduce hunger always have losers. Nonetheless, as long as with rising population numbers and prosperity world demand continues to grow, output expansion remains essential, calling for the corresponding panoply of technical measures towards modernization, such as improvement of crop varieties, application of appropriate plant nutrients, improved irrigation, better storage, mechanization, and so on. All these improvements should be applied with moderation though, to prevent a price collapse under a surge in output, and a wave of dismissals of farm laborers.

And so everything is connected: food demand with food supply, one person's gain with another person's loss, the technology with the economy, the short term with the long term. It takes a lot of research to find the policy mix with the correct sequence and dosage of interventions that remain implementable within the margin for maneuver available, or room for discretionary choice, and are not overshadowed by too many undesirable side effects.

True as this may be, similar interconnectedness applies in other policy domains as well. Yet, our research on food security possesses some distinctive albeit by no means unique characteristics. Let me mention three.

First comes the multidisciplinary approach. Food security offers a fantastic and eternal theme of research for sure, but that does not make it an independent discipline. Research on food security considers the interdependencies between natural environment, cultural practices, economic processes and political choice, and consequently, encompasses a whole conglomerate of scientific disciplines. At the basis, all these operate more or less separately. One field of specialization cultivates a new crop variety; another develops technology to distribute seeds among farmers; yet another conducts surveys among households in the countryside to find out which innovations would benefit them most, and so on. All disciplines make contributions of their own.

However, a mere line up of regularities and relationships established in each of them will not lead to a policy package that can improve food security, as this requires studying the system's operation in full. The rich diversity of countless households and companies has to be accounted for, each of which

behave according to patterns of their own that cannot be summarized in relationships among a handful of macro variables. The various disciplines are to be considered in their mutual relationships, and hence within a multidisciplinary framework.

This is where the mathematical economist can make a distinct contribution, thanks to the theoretical framework of welfare theory and microeconomics as developed over the past one and a half century, which offers a remarkably powerful conceptual platform for integration and synthesis (see Koopmans, 1957; Debreu, 1959; and Arrow and Hahn, 1971).

Intimately linked to this emphasis on integration is also the second distinctive characteristic, which is that in this kind of research detecting new general relationships would tend to be less of a priority than application of available general knowledge to a specific case, to a single patient as it were, which in our case means a certain group of people, a region, a nation or even the entire world. Besides technical and theoretical knowledge, this takes an adequate understanding of how the different parties that are represented in the model themselves view the world in which they operate. There is not always need for developing a detailed applied model for this. In many cases, the appropriate vehicle will be to conduct a logical analysis that invokes general theoretical principles and is well supported by empirical evidence. A more thorough treatment will often require an empirically well-founded simulation model though, that allows for mapping out the impact of various policy scenarios, much like in a flight simulator.

Such an approach significantly differs from the currently dominant practice in policy oriented branches of applied econometrics that focus on estimating the effectiveness of a certain intervention as such, with individual cases serving as mere guinea pigs.

Like in medicine, there is an experimental trial, part of which consists of households or firms that are subjected to a specified intervention, while others receive a placebo treatment or no treatment at all. This may tell us what does not work and what usually does garner results but it will not provide much guidance as to the best treatment of the individual guinea pig, for two reasons.

The first is that the trial, whose sample size is usually quite small relative to the population from which it was drawn, will hardly have any external impact from the intervention. Once the experiment is scaled up to a wider segment of the population, as should be the intention eventually, more pronounced impacts can be expected, for instance because market prices

are affected. Policy makers wishing to avoid surprises in this domain will need a computational tool with more structure than what such an experiment can ever deliver.

The second reason the econometric estimates will not teach much about appropriate individual treatment is that they deal with differences in the reactions of different individuals in the trial as random errors, even though it is common knowledge that these in fact reflect a wide set of historical, cultural and natural factors that are too diverse or too poorly understood to be taken into account explicitly.

In short, econometric estimation seeks generalization, in search of common properties. This is fine to identify interventions that tend to fail on all fronts, and those that in general work quite well, but it neglects the particularities of every individual, be it a household, a firm, or a whole country. The modeling approach in mathematical economics we often follow focuses precisely on the particular, through multidisciplinary, custom-made products that incorporate as much as possible of the available pieces of knowledge, and adapts the model structure to prevailing characteristics.<sup>3</sup> This often exposes us, however, to criticism from referees of our journal submissions who ask for more generalization after pointing out to us that there will be no broader readership interested in the specifics of our case. Anyway, that is a problem inherent to our work we have to live with. We simply have no one-size-fits-all therapies in the offering.

This takes me to the third special characteristic of our research on food security, namely that it has to cover a broad spectrum of soft and hard power policies, often within one and the same project. In retrospect, I can within this spectrum distinguish four policy domains that I will now discuss briefly. For convenience and because this is the angle we mostly took in our projects, I will do this from the perspective of government policy, but only after noting that everyone who, like Parmentier, tries to achieve something in the world, be it as an individual, a firm, or a social movement, is actually pursuing a policy of sorts.

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<sup>3</sup> Here our approach differs strongly from the nowadays far more common Computable General Equilibrium (CGE) approach (see Dervis et al. 1982), which uses a standard model (see Dervis et al. 1982), with corresponding standard software, often with standard coefficients, and only the classifications of commodities, households and firms differences across applications, with calibration to some income-expenditure tables of the country or regions in a particular year as sole distinctive element. Such models are easy to use and hence very useful in teaching but they will not provide the dedicated tools needed for policy analysis (also see Gunning and Keyzer, 1995 and Ginsburgh and Keyzer, 2002).

This qualification applies in particular to the first domain, of soft power policy, which does not rest on formal authority. Here, the policy maker depends fully on effective dissemination of information and on smart communication. The room for discretionary choice available will merely consist of the collection of non-coercive means to impact on public opinion,<sup>4</sup> like Louis XVI was able to select a small field for potato cultivation. Now, as scientists, we prefer not to get involved in propaganda campaigns, but when asked to contribute to the formulation of well-articulated, scientifically based vision for the future, we keenly accept.

Our task is then mainly to identify remarkable developments and to interpret these as objectively as we can. In this way, emerging issues can be signaled so as to ensure their timely emergence on the policy agenda. We obviously do not stop at signaling, and also look for measures to help address the problems. That is if there are any, because we also consider it our task to put unfounded worries to rest.

Diametrically opposed to soft power is the second policy domain, of pure hard power. Here the leadership possesses well-defined intervention mechanisms and clear powers, legitimate or not. The margin for maneuver is clear and our policy analysis is more straightforward as well in that it evaluates the effects of various policy packages under given circumstances, and highlights possibly unexpected side-effects. We may occasionally look in retrospect as well, in an evaluation exercise that compares historically observed outcomes against what would have happened under a different strategy.

Quite often within this domain of hard power policy the margin for maneuver will prove to be too narrow to achieve the set goals. Then, the leadership may decide to activate a wider range of intervention mechanisms and to expand this margin, "sending in more troops" as it were, and try once more but nowadays the common response will rather be to invest more resources in soft power.

However, if all of this fails and the leadership has to admit that its propaganda has no effect and sees its authority is falling short, it has little choice but to delegate some of its powers, that is, to decentralize. This is the third policy domain. One mode of decentralization proceeds by

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<sup>4</sup> As this not the occasion to detail what this collection actually consists of, I merely refer to two of my basic sources on freedom of choice: Berlin (1958), en Spinoza (1675).

delegation to lower echelons, say, the country's provinces or municipalities in the country. Another mode is to delegate the fields involved to the market after privatizing them. In both cases supervision remains necessary. Decentralization undeniably has the merit that it strengthens autonomy at local level but its recent history clearly shows that it is no miracle cure. So much can go wrong both at the local level and in the supervisory body, through incompetence as well as through corruption. We have often been asked to look into this beforehand, using simulation models, but also through more qualitative investigations, that for example indicated what could and what could not be achieved via product labeling and certification to maintain food safety after central market regulations had been abolished.

Finally, there is a fourth policy domain, in which several parties are engaged in consultations but no one is actually in control. International negotiations or national policy dialogues fall within this category. In such a setting our main research task is to sketch the playing field by showing likely consequences of possible agreements. Hence, the margin for maneuver is no more than hypothetical. This may sound rather vague but as long as all main players are represented at the negotiation table, there is a good chance that the agreements reached will lead to serious hard power policy. This working for negotiators, however, imposes a special responsibility as scientists, because the agreements that are reached tend to amount to compromises that shift much of the burden to parties that were not represented, such as the natural environment, animals, future generations, and vulnerable people in other countries. It is then our duty to voice such interests, even if policy makers cannot appreciate this and prefer to avoid dissent than organize it.

Whatever the domain we work for, we generally follow a multidisciplinary approach, paying due attention to the specifics of the case our advice is being sought for. Hence, reluctant to apply any pre-established template, we develop a custom-made application. This also applies to computational tasks, where we invoke the specific properties of the model to derive efficient algorithms.<sup>5</sup>

Data availability obviously restricts our work as well. We are in no position by far to go down to the field and collect data on our own. Hence we use almost every dataset we can get hold of: maps, satellite images, surveys, censuses, and so on. Nonetheless, I think that for the eventual outcome a

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<sup>5</sup>Usually we build on well-established mathematical techniques as described in Ortega en Rheinboldt (1970), Hirsch en Smale (1973), Avriel (1976) but we occasionally move beyond this (Ermoliev et al. 2000).

well-adapted model structure is more important than detailed statistical information. One builds such a structure primarily on the basis of what one sees, reads and above all hears. This establishes the storyline as it apparently has to be told. Detailed statistics are like the dye of a painting. They add color and make the image more credible but they will not change the overall design. These statistical data are in practice seldom the solid, objective measurements outsiders might expect. They show many gaps and inconsistencies that we have to remedy to. Similarly, we rarely can represent the technical relationships in the detail specialists of that discipline might want us to.<sup>6</sup>

Thus, to obtain a coherent and empirically founded result we need fantasy and imagination. There is no fraudulence whatsoever in this but the approach unquestionably presents the danger, nonetheless, of us model builders falling in love with our own creation, like the sculptor Pygmalion, since it is so specific that outsiders, referees included, can never get to know it as well as they can themselves. Self-criticism, good documentation and open dialogue with peers, therefore, become an absolute necessity. Our work is in many respects like creative art. It should be innovative and fresh, and at the same time stern and disciplined. An extreme level of detail will be irresponsible, because it requires information that is not available. Far-reaching abstraction is equally unjustified, because it neglects so much knowledge that it turns into repression. That is how I put it in my inaugural speech (Keyzer, 1995) and how I still feel about this today.

I will share how this operates in practice on the basis of some of my experiences with studies I have been involved in, and by “my” and “I”, I of course mean “our” and “we”, because I am referring to work done by the research groups I have been a part of.

### **Can one do much about world hunger?**

But first I have to return to the question in the title. Can one do much about world hunger? The question is meant to express a doubt not so much about the direct effect of interventions themselves, as about the likelihood of that effect eventually dissipating, because conflicts, population growth or environmental degradation eventually wash away all progress. Then, any

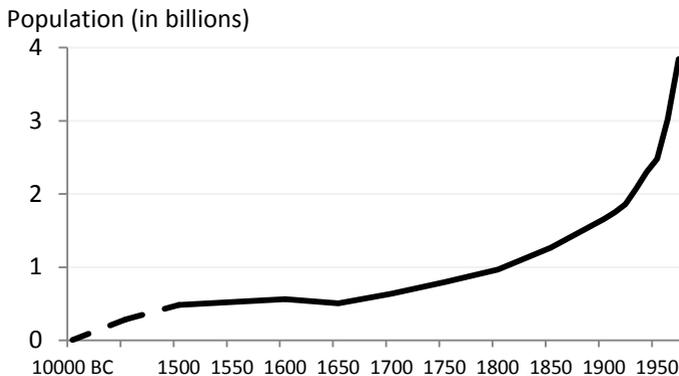
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<sup>6</sup> This primarily is because such relationships tend to be incompatible with the convexity requirements of the mathematical programs in our models, in the absence of which existence of equilibrium solutions becomes questionable, and computation very difficult.

intervention amounts to fighting a lost cause, which seems to be what Rousseau's Marie Antoinette was already hinting at. And yet, it took until the end of the 18th century, some years after her execution, before this concern was clearly articulated, by Reverend Thomas Malthus (1798). According to Malthus, population growth is the result of an innate human urge to reproduce, which remains unstoppable until it is halted by soil depletion, wars and plagues. Malthus was responding to the more optimist writings of the French mathematician Nicolas de Condorcet and the English writer William Godwin, which expressed the expectation that mankind would eventually be able to expand food production and also have the wisdom to introduce family planning in due time.

Who is right, Malthus or his opponents? It would be most convenient if this debate could be settled once and for all. Indeed, birth-rates are what in the long run determines population growth, provided life expectancy does not keep on rising for too long. These birth-rates are hard to predict though, particularly as long as governments refrain from intervening. Let us now take a look at the population trends as they were until the early 1970s [fig. 1], when I graduated from university.

**Figure 1: World population**

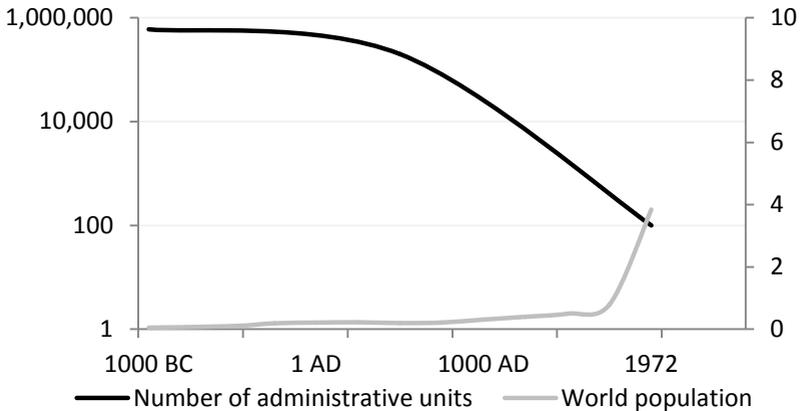


Source: US Census Bureau (2014) and UN Population Division (2014).

The figure clearly shows that by the 1820s the trio Condorcet-Godwin-Malthus indeed stood on the verge of major change, with a near exponential population growth setting in. In Europe, this was made possible by progress in public health and in agricultural production.

I will briefly discuss both but first I would like to point at a somewhat lesser known long standing trend in the political sphere. Going further back in time and also inserting the trend in the number of administrative units into the population graph, we find that population growth is undeniably associated with administrative integration [fig. 2].

**Figure 2: Number of administrative units and the world population**



*Source: Carneiro (1978), US Census Bureau (2014) and UN Population Division (2014).*

Carneiro's theory of the circumscribed land explains this as follows. Human culture only really gets successful at capital accumulation in the form of buildings and machinery once groups can fence off their properties territorially, subsequently to combine them into increasingly larger units so as to protect them from the outside world, to avoid internal conflicts and to strengthen the division of labor. In other words, in the long run there is no progress without further administrative integration, into larger units that cooperate and trade safely and peacefully. While this trend persists until present, it might well be that the trend will be halted in the near future, as decentralized energy production and 3D-printers bring the old dream of local self-reliance closer to realization.

Let us now return to the progress made in the course of the 19th century, in public health to begin with. Many efforts were made at the time to improve hygiene both by investing in sewage systems and by intensifying educational efforts say, regarding the importance of hand washing. Additionally, there were several major breakthroughs in health care. The main one was vaccination of young children, starting with smallpox injection, which greatly

reduced child mortality. Although this relates more to demography than to food security, I would like to dwell upon it for a moment, because it teaches us great lessons of how to connect knowledge, research and policy that are still relevant today.

In Europe, up to the mid-19th century, smallpox had been the most deadly plague of all, terrorizing the continent over many centuries. Other parts of the world had been able to address this curse much earlier. I was never told this at school but vaccination against small pox and other diseases was already well accepted in China by the end of the 16th century. From there, knowledge of it spread to India in the course of 17th century to eventually reach the Ottoman Empire. Only in the 18th century did word of it reach Europe, not via publication of a scientific article but through the personal dedication of the wife of a former British ambassador in Istanbul, Lady Mary Wortley Montague, who witnessed full-scale vaccinations in Turkey during an epidemic that even hit her personally. When she returned to England around 1720 and tried to convince her countrymen, she came up against a brick wall of incomprehension, just like Parmentier would experience little later with his potato. And just like Parmentier, hard power being out of the question, she started a branding campaign. For years, she pleaded for vaccination among the high aristocracy, including the royal family, and eventually had success. It nonetheless took until the middle of the 19th century before smallpox injection was broadly accepted, incidentally with a better vaccine. Mind you, it was not European science that discovered the principle of the vaccination and the small pox vaccine, one of the most important contributions to public health ever, and offered it to the rest of the world, but the other way around. And as had been the case on several occasions in the past, the knowledge reached Europe thanks to the progressiveness of the Islamic world. I would argue that Lady Montague, who also happens to have been an early champion of women rights, deserves more recognition than she got.

I will go on about smallpox vaccination a little longer, because it led to the first applied equilibrium model for policy making, the research line we pursued in much of our work. The model was formulated by the famous mathematician Daniel Bernoulli, born in Groningen to Swiss parents. Bernoulli observed heavy resistance to smallpox vaccination. This resistance was understandable, as the vaccine available at the time was not exactly safe, which is part of why making it compulsory constituted a major moral dilemma.<sup>7</sup> Bernoulli recognized this. He took the position that this should not

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<sup>7</sup> Encyclopedist d'Alembert was a fierce opponent of vaccination.

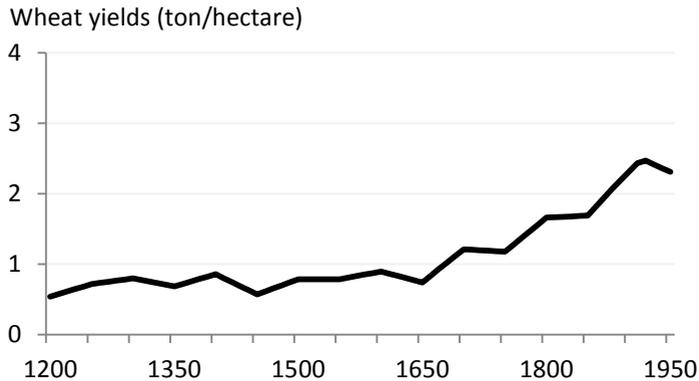
stop the repression of the epidemic but that unnecessary vaccination should be avoided whenever possible.

So in 1766 he published his policy model (Dietz et al. 2002) that on the basis of a neat differential equation, could determine the probability of infection and corresponding death with and without vaccination, from which it could calculate the equilibrium level of population susceptible to infection against that of the population which was immune. In this way, he could prioritize locations with high danger of infection.

Bernoulli can rightly be called a founder of serious quantitative, multidisciplinary policy analysis. His representation of immunity and danger of infection was a theoretical breakthrough, and his model has often been applied in practice since. Furthermore, it has played a constructive part at purely analytical level in heated discussions about whether or not vaccination is necessary, and in prioritizing vaccination campaigns elsewhere. In this regard, Bernoulli established for us a high standard that has not been matched very often later on. Incidentally, he owed much of the practical relevance of his numerical applications to a whole string of Swiss doctors, who decades earlier, had taken the initiative to register all deaths and the diseases that caused them. Basic data collection laid the ground for improved model representations back then just as it does today.

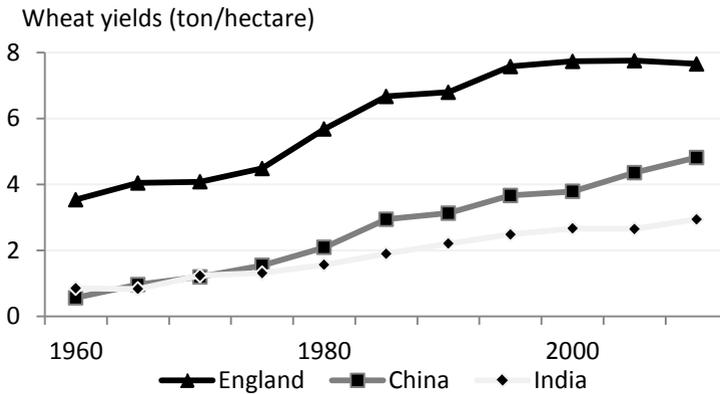
Now let us get back to the population trend [fig. 1] that shows the growth of population worldwide, not just in Europe. This growth since the middle of the 19th century is also the consequence of colonization of previously rather unpopulated areas in North- and South-America, as well as Eastern Europe and Central Asia, where mechanization made it possible to reclaim land for cultivation, and to supply food for the motherland.

That brings us to the second big change, namely the increase in food production, which, next to mechanization, and area expansion was by the middle of the 19th century, largely brought about by increase in the yield per hectare, through seed improvement as well as through the introduction of new crops, such as the aforementioned potato, but primarily through fertilizer application. Fertilizer of suitable chemical composition makes it possible to prevent land degradation that inevitably sets in if one keeps on depleting the soil of its plant nutrients [fig. 3].

**Figure 3: Wheat yields in England between 1200 and 1950**

*Source: Stanhill (1976), Clark (1991) en FAO (2014a)*

If we now look to more recent developments in yields [fig. 4], we can see that the Green Revolution that took place in the sixties and seventies of the past century worked miracles, through the cultivation of new varieties of wheat, rice and corn, and intensified application of fertilizer and pesticides. In South and East Asia especially, this led to a fantastic growth of food production, but also to a dependence on chemical inputs that may not be sustainable in the long run. Africa profited less, partly because of more difficult soil and climate conditions (Voortman et al. 2003).

**Figure 4: Wheat yields in England, China and India since 1960**

Thus, with regard to mankind's creativity, it would seem that Condorcet and Godwin have the evidence on their side, for the time being. Yet, Malthus has not quite been defeated, because population growth goes on, and the Earth is finite. Material consumption inescapably meets limits to growth.

### 1972 – 2014: research projects from then to now

My first exposure to this limits-to-growth issue was in 1971, at the start of my last academic year in Groningen, when a high school friend suggested me to read the first Club of Rome report on the topic, written by Jay Forrester (1971). I discussed this report with my friend Jan Willem Gunning. Both of us saw many deficiencies in Forrester's model but we were captivated by it, nonetheless, and chose to write our master thesis about it.

#### *MOIRA*

A few months later, we heard that Jan Tinbergen and Hans Linnemann after the publication of a second Club of Rome report by Dennis and Dana Meadows (Meadows et al., 1972), had accepted the invitation of the Club of Rome for a follow-up study about the question as to how the world could prepare itself for the doubling of the world population expected to occur between 1972 and 2010, a future that now has become past. The study was to be conducted at VU University. I applied and in October 1972 I was appointed at the Economic and Social Institute of the Economics

department, in the first year under funding by the Ministry of Social Affairs through some employment generation program, and later on by the Ministry of Foreign Affairs.

Quite soon, the project focused on world food security. Just like our Club of Rome precursors Forrester and Meadows, we developed, under leadership of Jerrie de Hoogh and in collaboration with Cees de Wit and Piet Buringh in Wageningen, a world model, which we named MOIRA (Linnemann et al., 1979). The study dealt with income distribution in great detail. While Forrester and Meadows treated the world as a whole, in MOIRA all nations appeared on their own, each distinguishing a number of income groups in the city as well as in the countryside, and mutually connected through one world market for food. While Wageningen dealt with estimation of the agricultural production potential, the VU economists worked on the connections between hunger and price formation.

Resulting model simulations confirmed that hunger was primarily attributable to a lack of purchasing power, and not to insufficient food production potential, as it appeared that technically considerable increases in yields per hectare were still achievable. At the times surpluses were actually the common ailment of world food markets, whereas shortages occurred only in exceptional years, after major droughts. Hence, rural areas would only lose from reduced scarcity of food, which in the scenario constructed could occur due to rich people shifting to vegetarianism, and to rich countries boosting their food output. Simulations also suggested that the South would significantly gain from a reduction in trade protection in the North, and that this would also help stabilize world market prices. All in all, the picture was much less depressing than what Forrester and Meadows had presented, and more solution oriented. This was typical soft power oriented research, as it interpreted trends and sought to put issues on the agenda for a wider audience as well as for interested policy makers, obeying Bernoulli's precepts in making a model that is as tightly structured and theoretically as understandable as possible. Yet, unlike Bernoulli's model of vaccination, ours was far too rough to guide actual policy, even for consultations in a soft power context. This called for a follow up.

*//ASA*

Besides its roughness, particularly as regards its commodity classification, the MOIRA-model was less suited for practical consultations also because it paid no attention to the most pressing concern at the time, the Cold War. In the mid-seventies, fear of a nuclear war gripped the world far more than the Club of Rome related issues of pollution, hunger or resource scarcity. At the

same time, the awareness was growing that the connection between the two could not be neglected. This led in 1972 to the creation of the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, near Vienna. Its chairman Jermen Gvishiani, son-in-law of Soviet prime-minister Kosygin, was also a member of the Club of Rome. One of the first staff appointments was that of the mathematical economist and future Nobel laureate Tjalling Koopmans, who towards the end of his career had developed a strong interest in world food and energy problems. Just like Bernoulli, Koopmans held the strong conviction that policy analysis should rest on flawless theory, and conversely that economic theory primarily serves to inspire policy. In 1975, with Tinbergen's intermediation, Koopmans invited our MOIRA team to present its findings at one of the global modeling conferences he was organizing. After positive reception of our presentations, I was invited to join IIASA as a mathematical economist, with the assignment to develop the MOIRA model further, primarily by expanding the commodity and country detail and by improving the representation of food and agricultural policies. I went to Austria and stayed for just over two years, until 1978, when I was urged by VU University to return and work at the Centre for World Food Studies (SOW), a new institute that had been established a year earlier in continuation of the MOIRA-project, with staff at VU University as well as at Wageningen university, and with Wouter Tims as its director. I did return, but for more than ten years pursued cooperation with IIASA on a number of versions of the new model (Fischer et al., 1988) and also wrote my PhD-dissertation about it at VU University. During these ten years our studies confirmed in more commodity and country detail earlier findings with the MOIRA model, particularly as regards the benefits of improved access of poor countries to the markets of Europe and the USA. Like MOIRA, this project engaged in trend interpretation and prioritization of concerns, but its contribution to soft power policy was more practical, because it served as a vehicle for international dialogue on agricultural trade, a field where even close allies such as the US and Europe are up to the present day engaged fierce confrontation. Moreover, it gave the communist, second world, as well as the third world, particularly India, the opportunity to actively take part, because it reached well beyond academic cooperation. Many of the researchers used to report to the highest echelons in their home countries. Moreover, the model also contributed for many years to climate research for the IPCC.

### *Europe's Common Agricultural Policy*

This close connection to policy makers increasingly laid to bare a weakness that once more triggered follow-up studies, because during the discussions about model results, the EEC was too often criticized by the US that the

model it had contributed did not represent well enough the specificity of the intervention mechanisms of Europe's Common Agricultural Policy. The logical consequence was a new project that would build a separate multi-country model for EEC agriculture. This project was fully funded by the Netherlands, and executed in cooperation with the Agricultural Economic Research Institute (LEI) and the Netherlands Bureau for Economic Policy Analysis (CPB). The resulting model (Folmer et al., 1995) has been used in successive versions for about fifteen years, initially in studies for the European Commission and for policy formulation of the Netherlands, and later for the GATT Agricultural Committee of the Uruguay Round, in studies commissioned by its Dutch chairman Aart de Zeeuw. French institutions regularly consulted us as well. So, at the time we operated rather close to the policy making process, which also meant that our room was limited to present a more independent vision. We managed to preserve some profile, nonetheless, pointing out for example that Europe surely is an important agricultural region that contributes to world food security, but that abolition of European support would in no way lead to collapse of European agricultural output, because the better land would remain in production anyway, particularly in North Western Europe. Abolition of support, however, speeds up concentration of farms, as it drives out of the smaller ones, and this will most likely endanger the quality of life and the general attractiveness of the countryside. Be sure, therefore, resolutely fight the latter, but do not invoke false arguments in your struggle. It only weakens the cause eventually. We have also kept on arguing since the 1970s that because of growing world population and rising prosperity in countries such as India and China the dairy sector has fine prospects in Europe, the Netherlands in particular, even without subsidies. All of this is more widely accepted today than it was thirty years ago.

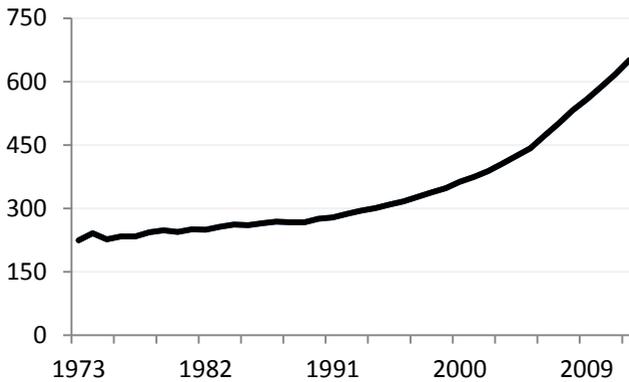
### *Country studies: Bangladesh*

After all those trends and negotiations, let me now say something about a project that we undertook in Bangladesh and had a more direct advisory function of the hard power kind. Because Wouter Tims had worked in Bangladesh before, we had soon started studying its prospects, and in 1983 I was asked to lead a local UN-team to deliver for the military government under General Ershad the quantitative framework for the country's third five-year plan, something like what we would now call a binding coalition agreement. Previous five-year plans had mostly been pep talk documents. This time we were asked to provide something more serious, also to safeguard the vast sums of development aid the country was receiving. We decided to work in great detail, and incorporated into the plan projects of all sorts and sizes, with special focus on agriculture and water management.

The resulting model simulations indicated that the future of food production was not as bleak as the outside world was thinking back then (Ahmad et al., 1986). In summertime, three quarters of the land is flooded. No planning can change this. The dry winter season, however, offers more scope for development, because irrigation makes it possible to cultivate more profitable crops such as wheat and vegetables with intensified use of fertilizer. Hence the advice was to limit expansion of paddy cultivation in the summer, because the country readily reaches self-sufficiency in the rice produced in that season, which is not of export quality. Therefore, expansion would only lead to a surplus and cause domestic prices to drop, with major negative consequences for the already so vulnerable rural population. Another recommendation was to purchase from domestic producers more of the large volume of food aid that was distributed by government, rather than importing most of it. These recommendations were by and large adopted in the plan. Beyond this, the government had come to appreciate that the country's foreign trade, so far almost fully regulated through licenses, had to be liberalized. We used our model to show the possible effects of this, which turned out to be fairly positive.

In 1990, Ershad was deposed by a coalition of the two main political parties, which, however, kept one another entangled in a perfect political deadlock ever since. Remarkably, and possibly thanks to that deadlock, they have held on to liberalization, which has set development into motion, primarily in textiles and garments, but also in construction and telecommunication, which allowed for a uninterrupted rise in per capita income since the nineties of no less than 3.5% annually [fig.5], while life expectancy has climbed from a miserable 40 years in the sixties to the world average of 70 years by now (World Bank 2014). The nation deserves more credit for this than we tend to give it. At the same time, the dramatic working conditions in the textile industry as exemplified by the tragedy in Dhaka last year show that it is about time for tighter intervention, through soft as well as hard power.

**Figure 5: Per capita income in Bangladesh  
(in constant dollars of 2005)**



Source: World Bank (2014)

### *Projects since 1995*

So far, I have spoken of projects most of which already ended around twenty years ago. I feel this is fitting for my farewell address, because these projects showed us a direction that we pursue until present, and also because this is not in my opinion the right occasion to advertise what we are currently engaged in. Nor is it actually the occasion to denounce abuses or to grind any axes, I would argue, since that is what life after retirement is for, after all! This is, however, in no way to suggest that we have been standing still since. This is why I will now very briefly discuss our more recent work.

For the past twenty years or so, we have, in the soft power branch of interpreting trends and prioritizing specific issues, focused more sharply on specific issues: recycling and purifying of manure and chemical fertilizer, for phosphate in particular; animal welfare and the contribution of cattle to rural development; product labeling and corporate social responsibility; the European biofuel policies and their harmful consequences (Keyzer et al., 2008). In those fields, we now cooperate more closely than before with the business community. We also work more often in European consortia, such as agriculture reform in Ukraine (Keyzer et al. 2013) and that country's relations with the EU and Russia, a topic about which we discussed extensively with a large Russian delegation as recently as in May this year.

Also, like many others, we have started conducting surveys of our own but unlike others we try very hard to also take other data sources on board in such projects and have developed dedicated software for that purpose. In some of these projects, the survey work serves hard power policy because they are a major input in the formulation of aid programs. This applies to studies for the World Bank and for the UN in Central and Eastern Europe, Caucasus countries included. On Lebanon and Syria, too, we managed to gather unique data. At the moment we are working on a survey among Afar-nomads in Ethiopia, which is of a more exploratory nature.

With regard to methodology development, we have considerably developed our skills in building general equilibrium models, with stronger emphasis on representation of soil and climate conditions, paying much attention to spatial aspects. We also worked on and applied new methods in mathematical statistics outside regular econometrics (Schoelkopf and Smola, 2002; Norkin and Keyzer, 2009). Geographically, we have dispersed somewhat, with a stronger emphasis on Africa, more specifically Nigeria, Benin, Ghana, Mozambique and Ethiopia.

Also since the end of the nineties, we have cooperated acutely and in detail with Chinese colleagues close to hard power policy, reporting on issues such as the income gap between city and countryside, the consequences of China's accession to the WTO, biofuel policies, and the consequences of excessive use of chemical fertilizer (Qiu, et al., 2011; CRI 2013, 2014).

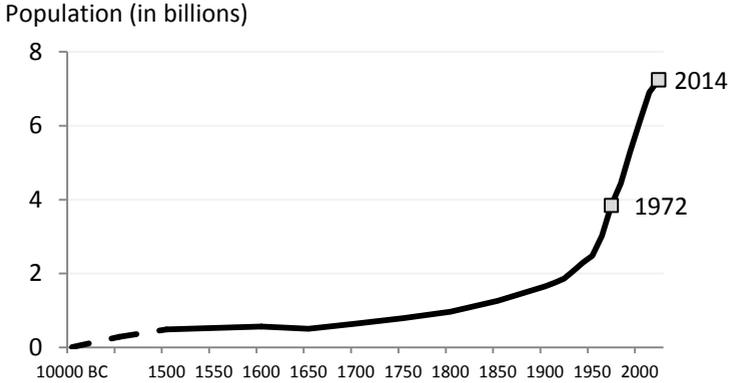
Lastly, in the field of soft power consultation I should mention our Jordan basin project, a project in which researchers from universities in Lebanon, Jordan, the West Bank and the water institute of the Arab League in Syria collaborate to better share and manage the scarce water resources and water pollution. This project, which is still ongoing, has already led to quite some innovation in model building, for example on how to represent spatial and temporal variation in levels of water pollution from salinity and human waste. This summary of projects might be somewhat fragmented, but this happens to be a time that a lot is happening in parallel.

### **State of affairs by 2014**

We now live in 2014, four years after the time horizon of the MOIRA model ended. If we look at the current size of world population, we see that the doubling predicted in 1972 did not materialize in full. In the mid-fifties there were 2.5 billion people, by 1972 the figure had risen to 3.8. There has been

significant growth since reaching 7.2 now in 2014, but no full doubling. Nonetheless, imagine, almost a tripling since the fifties!

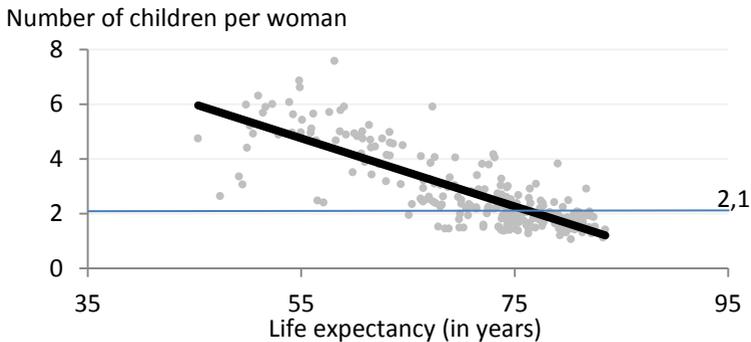
**Figure 6: Current world population**



Source: US Census Bureau (2014) and UN Population Division (2014).

Yet, the situation may be less dramatic than it might seem, because the increase is primarily due to greater longevity, owing partly to lower child mortality. And as shown in figure 7, greater longevity very much tends to be associated to lower birth rate.

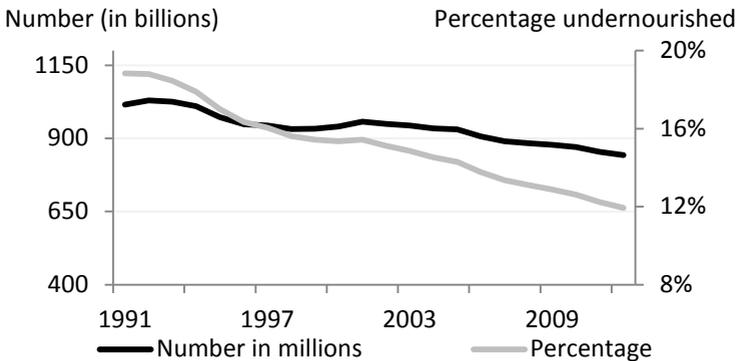
**Figure 7: Number of children per woman during her lifetime against life expectancy, per country in 2010**



Source: UN Population Division (2014), regression estimated over 199 countries

Indeed, since the 1950s the average number of children born to a woman during her lifetime has fallen from 5 then, to just above 2.5 now, hence still above the critical 2.1 threshold below which population will shrink in the long run, but not much. In many of the rich countries and in China the figure already lies much below this threshold. In those countries population numbers are to inevitably drop in absolute numbers and even more relative to poorer countries. This development inevitably causes tensions that will find expression in higher migration pressure, but it also carries the very hopeful message that rising prosperity and consequent increase in life expectancy appears to function as a reliable mechanism for defusing the demographic bomb. Indeed, it would seem that we are also on the right path for now as far as world hunger is concerned, since malnutrition has, since the 1960s decreased both in percentages and in absolute terms [Fig. 8]. This is primarily attributable to rising prosperity in China and to a lesser degree in India, followed by Indonesia and, as mentioned earlier, Bangladesh.<sup>8</sup>

**Figure 8: Number and percentage of undernourished people in the world**



Source: FAO (2014b)

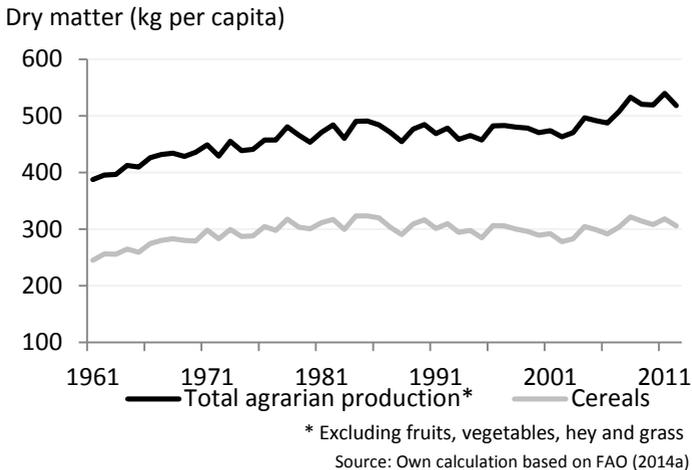
In the sixties, pessimists like Gunnar Myrdal (1968) portrayed that part of Asia as a basket case. They should have taken a better look at the success in Japan, South Korea, and Taiwan, and known better, is what we say now.

<sup>8</sup>For Sub-Saharan Africa, estimates on malnutrition differ significantly. In Wesenbeeck et al. (2009) we obtain on the basis of anthropometric data like BMI figures lower than the FAO estimates. This is not necessarily a positive sign though, as we get higher levels of child mortality, and children who die young no longer count for undernutrition..

And still, there are today more hungry people in India and China than in the whole of Africa. We should not forget that either.

On a similarly positive note, the claim for resources to nourish this rising and more prosperous population might not be as problematic as some might fear. While per capita meat consumption has tripled over the past thirty years, the per capita use of plant-based food and animal feed appears to remain rather stable [fig. 9], which is largely attributable to efficiency gains in animal husbandry that have significantly reduced feeding requirements per kilogram of meat, by ensuring that animals reach their slaughter weight much faster and that fewer die prematurely. It would seem unlikely though that animal welfare has improved in the process as well.

**Figure 9: Agricultural production per capita measured in dry matter equivalents**



Now, more to the right in the graph we see some increase in the last ten years, but this is mostly due to these horrendous biofuel policies, that impose mandatory blending of cereal and vegetal oil based biofuels in car gasoline and diesel. Do this on a large scale, and the Earth will never be large enough, of course.

*Who deserves the credit?*

'World hunger, can one do much about it?' was the question in the title. My answer has by and large been affirmative. While much progress was made in governance, public health and food production, it also appears that on the

population front we are not fighting a losing battle, since better living conditions are leading to durable and voluntary reduction in birth rates. So, success? No doubt, and also in Africa. Never in past centuries could the fraction of world population that is malnourished get as low as it is today. Never before did forty years enable so many people to escape malnourishment. All this was made possible by wise policies that grant and respect the markets and the state in their distinct roles, while keeping a watchful eye on the most vulnerable groups.

However, who deserves credit for this? I kept the question “can one do much about it?” vague on purpose. Who is this “one”? Innumerable unknown actors have practiced a mix of soft and hard power policies, many of them operating in silence and outside the government sphere. This makes it very hard to attribute the credit to anyone in particular for the success, which is not surprising in a world so intertwined. The individual citizen should not feel powerless because of this, since Parmentier, Lady Montague and Bernoulli already taught us how much soft power and private initiative can accomplish. At any rate, I want to maintain firmly that the improvement never could have happened without decades of international cooperation. All sorts of professions, including scientists, doctors and engineers, have shared their knowledge, built up common experience, and given vulnerable groups a voice. Dutch development aid has selflessly supported this process for years as well. Do not let anyone delude you: all of that really did help a lot.

As far as our own work is concerned, all I can say is that we often have been around when and where it mattered, and that we did provide clarification now and then. Our involvement has in some instances affected the course taken. This cannot be measured though, let alone proved, also because the more we stay behind the scenes the better we are listened to, and vice versa. At any rate, no final decision was ever ours. We are no elected politicians after all. At the same time, our contribution reached beyond teaching, preparation of reports and publication of articles as we also fulfilled a useful role, I would assert, in establishing and maintaining the process of collaboration itself. Collaboration will almost always enhance mutual understanding; there is nothing special about that, but the tight and disciplined framework we have committed ourselves to achieves more than this. It elevates the dialogue to a higher level, away from empty rhetoric and bungling, particularly because every project offers the participants the opportunity to explore and to grow scientifically. That pays off until many years later, when all have long since moved to other activities.

*Where to go from here?*

Where to go from here? Should I come up with a definite plan at this point, this would contradict all I said so far about limited margins for maneuver. I will, therefore, limit myself to the soft power line of trend interpretation and only raise two points for the agenda.

The first is simply: *Do not forget the countryside*. It is common knowledge by that in the next fifty years growing world population, rising prosperity, urbanization, shortage of fresh water and climate change create formidable challenges to food security. This is far more than a technological issue though, as this food for the cities has to be obtained from rural areas, and despite all international trade these will mostly continue to be the rural areas in the own country or its direct neighbors. In many of the better production zones that are to supply this food, aging has been setting in at a fast rate, as the young prefer to leave. Those who stay are ever less keen to seek their future in farming. Mechanization can substitute for much of their labor but not for all of it, as one still needs well trained workers to drive and to maintain the machines, workers who prefer to have their families settle in provincial towns with better amenities. This disconnects the local communities in rural areas from the rest of society, and this all the more radically in the less fertile areas that harbor about one third of the world's population and three quarters of the malnourished (Fan, 2010; WFP, 2014). They stand on the sidelines powerless, and are very much aware of it. This cannot go on. Do not forget the countryside!

My second and final point is: *Stop the advance of the winner-takes-all principle*, once imported from top-level sport, whereby everything is viewed in terms of a contest that almost exclusively rewards the winner, while the others have to live on crumbs. I have seen the process marching on in triumph for many years now, also at this university. Economists undoubtedly have helped its advance. Competition keeps you on alert and on the ball, there is no doubt about that but following one's own course with dedication is I would think just as important in a world that increasingly depends on creativity, trust, and reliability of service provision. Winner-takes-all appeals to a misguided sense of honor, it plays people off against one another, undermining their intrinsic motivation and it unties their mutual bonds. This eventually makes everyone a loser, including the winners of earlier days. Furthermore, this undermines cultural resources that are critical to the functioning of every economy, ours included. One can deplete the wealth of soils and oceans, and much is yet to be done to counter this, but cultural resource can erode just as well. At some point, the limit will be reached and the Jacobins will come rattling at the gate.

I do not expect that the nation state will be able to address this problem, because it has become too chilly and anonymous itself, and because it is no match for the mighty forces on the international scene. This creates a void. Who knows how it will be filled, but some bridging structure is badly needed. I would see a role for communities that connect meaning to entrepreneurship, and help organize solidarity (see also Greene, 2013; Pinker, 2011; and Walzer, 1983). Their members jointly save for their pension, and invest part of their savings in specific sectors of the economy, maybe somewhat like the Quakers in the past, but now representing a much wider range of perspectives. Such communities might eventually develop into true political movements that through the soft power of their message and the hard power of their investment will provide direction to both government and private business.

Economists can help fill the void by better representing such movements in their theoretical models, where perfect competition so far would almost seem to be the only well-articulated ideal. Their research could also help protect the democratic process against all the lobbying such movements will undoubtedly engage in. And while these movements will have several features in common, their effectiveness will very much depend on the diversity they can offer.

Economists can look into this, and build once again the bridges between the general and specific, between science and consultancy, perhaps not so much by developing new pieces of knowledge, as simply by more ambitiously taking on board knowledge that is available already from a wide array of disciplines, so as to provide a platform for multidisciplinary collaboration, possibly preceded by fierce disputes, all with the aim to reach better harmony between culture, nature and commerce. That will be far from simple, especially from a mathematical economic point of view. Abstraction will be unavoidable, no doubt, but do it well and with moderation. And never listen to colleagues who dismiss all of this as unnecessary complexity.

### **Word of thanks**

And now my word of thanks. That is a tricky subject, because I have cooperated with so many people throughout the years. I am fully aware that it is impossible for me to give all of them the credit they deserve, and yet, I will do my best not to leave out too much.

I especially want to express gratitude towards those who made it possible

for me to be engaged in this exciting work for all these years, and as part of an inspiring team at that. To begin with, I mention once more Hans Linnemann, who recruited me back in 1972 for the Club of Rome project and immediately gave me his full trust. Next, I commemorate Wouter Tims, SOW's director from 1977 until 1995, who gave me ample opportunity to grow scientifically, while he persistently took on the more tedious tasks.

The Centre itself was established in 1977 by the Minister of Agriculture and the Minister for Development Cooperation jointly as a public foundation. In the statutes of this foundation both ministers commit to provide funding, an obligation that they and most of their successors have honored. I thank them for this. The uninterrupted support of many SOW board members was important as well, particularly of the four chairmen, starting with Dick de Zeeuw, who was succeeded by Cees van Dijk, Eisso Woltjer and current chairman Rudy Rabbinge, who with much dedication has been striving to ensure my succession. I also mention the special contribution of board members Ate de Jager, Age Bakker and Arie Kuyvenhoven – others follow later. SOW has its own mandate, which is very different from that of VU University, and is not even serving any other institution in the Netherlands. Without the cover of the SOW-board I would not have been able to hold my ground for very long, because as a mere institute director one is in this draughty land little more than fluff in the wind.

The relationship with VU University has, let us say, a rather special one. To illustrate this: in 1996 I was invited to deliver the University's anniversary lecture, and I also used that occasion to warn for the spreading of the top-sport ideal (Keyzer, 1996). After dinner, then-chancellor Egbert Boeker admitted with some shame that VU University, having shed its own feathers, had sided with precisely that ideal, and was now trying to become a true master in the art of flaunting (in Dutch "pronken") another's feathers. Consequently, it would continue leaving it to the Minister for Development Cooperation to provide SOW with the necessary funding. Minister at the time was Jan Pronk, and I especially want to thank him today, not so much for this funding as for giving us, fully in Jan Tinbergen's spirit, the instruction: "Your role is not to serve the Netherlands, you should be there for others". At the Ministry of Foreign Affairs itself – Development Cooperation is part of this ministry – I would like to express gratitude for the efforts made by our contact persons Joan Boer, Ineke Duijvestijn, Jan Bade, Frank van der Staaij and Hans van den Heuvel, who endorsed our mandate with conviction.

From the field of agricultural economics, I would first like to commemorate Jerrie de Hoogh, who resolutely assured SOW's foundation after the MOIRA project had ended. I remember his special intellectual and personal qualities.

From the Ministry of Agriculture I would like to remember LEI director and SOW board member Jan de Veer, with whom I also wrote a short note for Sicco Mansholt who had asked for alternatives to “his” Common Agricultural Policy. Next, Gerard van der Lelie, de Veer’s successor in the SOW board, consistently helped us maintain course when others tried to steer us away from it. I also thank Cees Veerman for captivating conversations about agricultural policy and other topics, when he was minister and also last year when he was chairman of the VU University’s supervisory board. I appreciate that I am omitting many, but on the agricultural side there really is one person who has been our most loyal and solid anchor ever since the early eighties and that is Gerrit Meester. He was always the ideal partner, for our work on the European agricultural policy but on so many other matters as well. SOW owes him a lot.

Within VU University I am first and foremost grateful to the Faculty of Economics for the moral, albeit not financial support that we have received over the years, in particular to deans Nol Merckies and Harmen Verbruggen, who also helped us as board member. Personnel matters were always addressed with dedication by Janny Westra and Mira Maletic. Within the Faculty, I have appreciated many informal contacts, particularly those with Gerard van der Laan on subjects in mathematical economics, and with my near-neighbor Piet Rietveld, who passed away recently much too early, and with whom I biked home about once a month during all those years, discussing current matters of all sorts.

I mention Jan Willem Gunning only now, because I do not truly associate him with VU University. He became my friend in our first academic year in Groningen and has been ever since. Through his pure and clear vision on the profession and the world he has always been a central benchmark for me. In one breath with Jan Willem, I also name my friend Joan Muysken, whom I’ve known for just as long, as the three of us studied with F.J. de Jong, Ad Pikkemaat and Simon Kuipers in Groningen. I cannot think of many subjects I didn’t discuss with Joan. During our walks he is always prepared to listen patiently to every immature idea, and to comment calmly on it, with a keen eye for good and evil. Jan Willem and Joan, they are fixed beacons for me.

As to my thanks to friends and colleagues from outside the Netherlands, it is even more difficult for me to give them all the credit they deserve. Yet, proceeding in chronological order, starting in 1972, let me first mention Jelle Bruinsma who after his participating in the MOIRA project became our steady interlocutor at FAO in Rome, with a unique overview of the whole scene.

Next, I name Guenther Fischer from Austria with whom I have collaborated since 1975, first on the IIASA model and in later years on China. Guenther and his family made an essential contribution to my mental reconciliation with let us say the German-Austrian region. The latter also applies to Klaus Froberg from Germany, who joined IIASA somewhat later, and with whom we cooperated almost until his retirement.

At the same time as I met Guenther, I also met Ferenc Rabar from Hungary, then program leader at IIASA. I keep fond memories of our early morning horseback rides around the Laxenburg palace where IIASA is located, in the park, which gave us ample opportunity to reflect on the state of the world and to prepare for the day. For SOW, Ferenc's firm support has been particularly important in 1989, when it found itself in dire straits, while he served as Minister of Finance in the first democratically chosen government of his country. We have kept in touch for many years with his Hungarian friend and colleague Csaba Csaki, when he served as the rector of the Karl Marx University in Budapest, and later on as senior official at the World Bank.

My friendship with Kirit Parikh from India also dates back to our time at where we shared an office, and started our long collaboration on the IIASA model, as well as on the India model, the latter jointly with N.S.S. Narayana. Kirit is as gentle and loyal as he is bright. Kirit's wife Jyoti initiated us to the ways households secure energy in Bangladesh. Upon his return in India, Kirit founded the Indira Gandhi Institute for Development Research (IGIDR) in Mumbai, and after this became a member of the Indian Planning Commission. Just two weeks ago he came along and we discussed all recent developments in India. I want also to express my gratitude to Kirit's friend T.N. Srinivasan of Yale. As authoritative development economist T.N. has for many years been advisor of the SOW board. He gave us with guidance and help in tumultuous times. My Indian friends taught me much about development issues. They often confronted me with difficult, practical dilemmas between finding room for maneuver and creating it, often showing a striking contrast between India and China.

I got acquainted with Yuri Ermoliev at IIASA as well, when he was on post from the Soviet Union. In the early days were able to communicate by interpreter only. Yuri is a cheerful, creative and highly honored mathematician, who became my guide in parts of mathematics I never ventured to look into as more than a tourist, stochastic optimization in particular, of which he is one of the founders. He also granted me unique glimpses into the current situation in Eastern Europe, and the role of the

oligarchs, especially in Ukraine and Russia, which we kept on discussing by telephone on a regular basis.

Salahuddin Ahmad and Mustafa Mujeri are the two Bangladeshi economists with whom I worked on the five-year plan in 1980s. They enlightened me about the major policy choices their country was facing at the time. We still keep in touch, with Mustafa currently as Director General of the Bangladesh Institute of Development Studies.

Mathematical economist Mark Levin has been our “man in Moscow”. He worked with us on a project in the Caucasus and has kept on visiting us over the past twenty-five years in Amsterdam updating us on a wide range of issues.

Together, Victor Ginsburgh and I have in the nineties written a thick book on applied general equilibrium models and welfare theory, a field I have barely discussed today that, however, provides the foundation of much of my work. Here, I also want to express my gratitude to my PhD-supervisor Jean Waelbroeck, for getting me in touch with his colleague Victor, and for pointed me to the approach pioneered by Negishi (1960), a Japanese economist, which plays a central role many of the models I have worked on. Victor and I really wrote that book together, sitting at one desk, then in Brussels or Louvain, then in Amsterdam. We remarkably complemented one another. I look back on that period as a highlight of my career.

Kwadwo Asenso-Okyere from Ghana suddenly passed away last month during a service trip in Mongolia. We became acquainted through SADAOC, a research network for food security in Central West Africa that was funded by the Netherlands, and on the board of which both of us have been serving. SADAOC did have its ups and downs, but our often fruitless attempts to keep business going brought us closer together. Also later when Kwadwo became Vice Chancellor at the University of Ghana and Director at IFPRI in Addis, he gave us helpful advice on African matters. Only a few months ago, he played a key role in an SOW project for the Ministry of Foreign Affairs on the relationship between Ghana and the Netherlands. We had a drink at his place and happily went out for dinner afterwards. I still cannot believe he is no longer with us.

Moving forward in time, I recall my meeting Laixiang Sun, professor at London University. He is our most longstanding contact with China as we cooperated in three consecutive projects. During stays in China he advised me with much dedication, also about what to eat, and literally spoon fed me on occasions. Within China itself professor Jikun Huang plays the central

role, as director of the Centre for Chinese Agricultural Policy of the Chinese Academy of Sciences (CCAP-CAS) in Beijing, to which I have been connected for about ten years now as extraordinary professor, a relationship that I hope to pursue. I am especially grateful to Jikun for the trust he immediately put in me. We jointly supervised the PhD of Huanguang Qiu, who became our cheerful central fielder, and was recently appointed full professor at Renmin University. Liu Bo worked at SOW in the last one, and is now at Tsinghua University climbing academic ranks as well.

IFPRI in Washington joined our third China project, which led to fruitful collaboration in other domains, with Joachim von Braun, Shenggen Fan, Teunis van Rheenen, and Xiaobo Zhang. Mark Rosengrant's most appreciated presence today testifies to this.

Lastly, I mention our cooperation with the Joint Research Centre of the European Commission, in Italy (Ispra), with Olivier Léo on livestock in Ethiopia, as well as in Spain (Seville) where Jacques Delincé and Sergio Gomez-y-Paloma helped us continue our work on Ukraine.

It is now time to turn to my colleagues at SOW. What I am about to say about them is like a credit roll. A credit roll should not be too long. You should view SOW as a small, highly dedicated orchestra. I am proud to have conducted it and every now and then been able to supply it with compositions. Lia van Wesenbeeck has served as concertmaster on increasingly many occasions. She can read the tempi from a single gesture, so we never need many words. Wim van Veen calmly plays a clear piano part that keeps us all in tune. Ben Sonneveld takes care of the foundational percussion, currently involving a great many foreign artists. He now even makes attempts at water music, although this takes quite some supervision. Roelf Voortman does not play at every concert, but when he does his bass provides depth. Bart keeps on playing the trumpet cheerfully, come what may, whether he is in tune or not. Maarten Nubé with his nutritionist's hobo covers a tonal range none of us can reach. Geert Overbosch and Peter Albersen have previously played their distinct part, and so did Euan Phimister, Françoise Gérard and Rudi Witt. It has been a bit longer ago for Herman Stolwijk, but he has treated us to important guest performances from the CPB. And then there are the younger ones, Boualem Rabta and Alex Halsema, who are calmly climbing to higher responsibilities. A few years back Max Merbis has thrown in his European lyre. Now as superintendent he sees to it that the orchestra can play smoothly and without disturbance, with the loyal support by administrator Kees Traas and secretary Lioe Jacobs, who after her retirement was succeeded by Rian Kriesels and Clary Stolte.

Of course, I also express my gratitude to all of you who came here today, particularly to our friends who are not professionally connected to me, which actually is the sole reason for me not to name them here.

Finally, I thank my family members, for always having been there for us. I never address Andrea in public. I will only say that she has supported me ever since our student days in Groningen and has given me all I needed to do this work. Heleen was strong when it mattered. That my mother can be here today is, of course fantastic but saying this I very much miss those who are with us no longer: Keys, Harts, Grandfather and Grandmother Koning, and of course, above all, Robert.

### **Final note**

As a final note, a word about the Netherlands and VU University. Regarding the Netherlands, a country so heavily focused on foreign relations should not use its development budget for promotion of Dutch exports. This is morally wrong. Moreover, goodwill builds on selflessness, not on opportunism.

To VU University I say the following. As far as I can verify, none of my ancestors were Protestants, and yet, I always felt closely connected to the antirevolutionary<sup>9</sup> values of this institution, values of service and loyalty, service to society and to creation, loyalty to one another as well to oneself and one's own principles. This links SOW and VU University, which in turn, by ensuring my succession, indicates it wants to see the relationship preserved.

With a call to hold on to those values I will now close. I started in French, so I will do this with words by Charles de Gaulle, the great leader of my youth, in a radio speech addressed on 14 July 1943 from Algiers to his fellow countrymen in occupied France: « Soyons fermes, purs et fidèles. Au bout de nos peines, il y a la plus grande gloire du monde, celle des hommes qui n'ont pas cédé. ». "Let us be strong, pure and loyal. Our struggle eventually will be rewarded with the highest honor, namely that of not having yielded", or in plain Dutch: «Je maintiendrai ». <sup>10</sup>

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<sup>9</sup> Former Protestant Party with strong connections to VU University.

<sup>10</sup> National motto of the Netherlands.

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Cover photos from top left to bottom right:

Front cover

- Dutch cows in the meadow
- Ploughing a rice field in China
- Corn farmer in Ghana
- Organic rice cultivation in Bangladesh

Back cover

- Brioche
- Louis XVI
- Antoine Parmentier
- Lady Mary Montague
- Daniel Bernoulli
- Thomas Malthus
- Fathers of the Green Revolution:  
Borlaug, Swaminathan en Kohli, India 1964

Graphs in the text: Alex Halsema



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