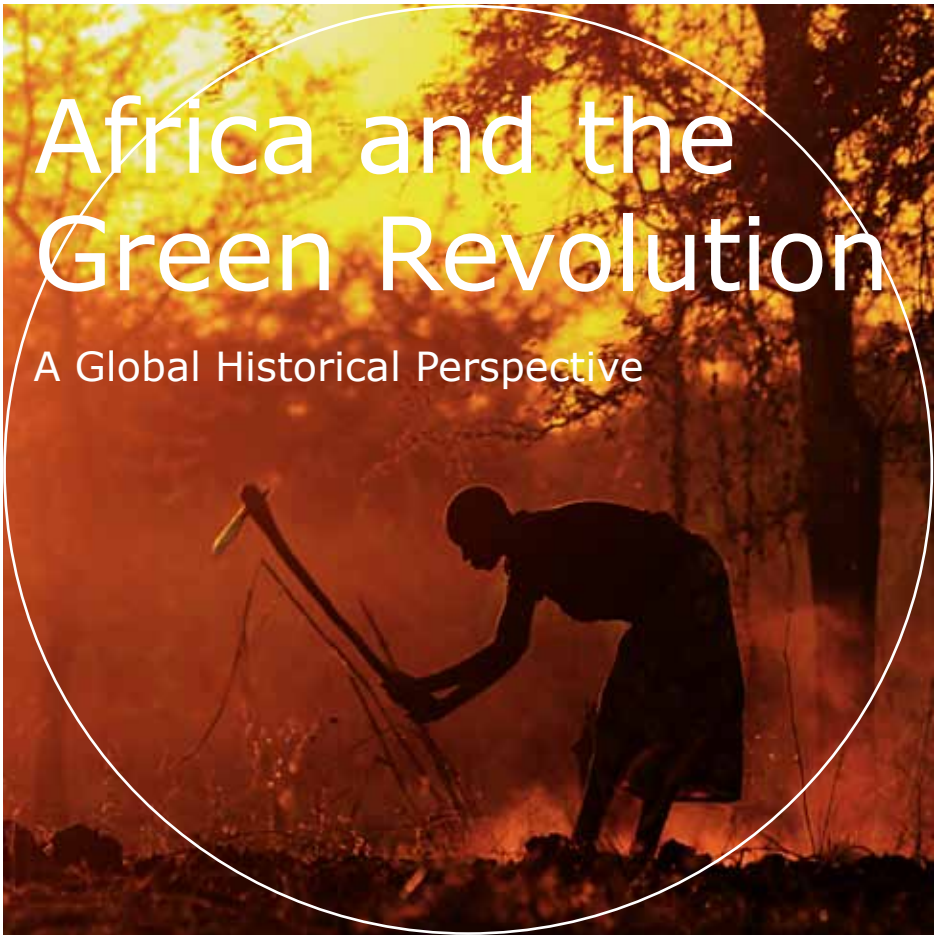
Africa and the Green Revolution

A Global Historical Perspective



Prof. dr Ewout Frankema

Inaugural lecture upon taking up the post of Professor of Rural and Environmental History at Wageningen University on 23 May 2013

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Esteemed Rector Magnificus, dear colleagues, family, friends, ladies and gentlemen,

After several centuries of rising global inequality during the so-called era of the Great Divergence, our generation is witnessing a new epoch in world history, one of rapid economic convergence[1]. Emerging economies such as China, India, Brazil and Turkey are reconfiguring the gravity centers of the global economy with astonishing speed. Even in Sub-Saharan Africa, a region torn apart by decades of civil war and economic crises, hopeful signs of growing prosperity have emerged in recent years (Radelet 2010, Young 2012). It remains to be seen, however, to which extent Africa's current growth revival builds on a profound transformation of the social, political and economic fabric. Is the region not just experiencing the inevitable recovery from an equally inevitable post-colonial collapse? And what sets this wave of growth apart from recurring African cycles of natural resource booms and busts, driven by volatile world market prices for tropical cash crops and mineral resources?

The historical analogy that shores up the argument I will develop today is that no civilization in the past has flourished for long, without an effective strategy to gather, produce or trade food in sufficient quantity and quality. Food surpluses were needed to raise armies, build cities and fill treasuries. In his monumental *Agrarian History of Western-Europe* Slicher van Bath – the first chair of Rural History in Wageningen and founding father of the 'New Economic History' in the Netherlands – has demonstrated that the affluence we enjoy at present, is rooted in millennia of agrarian change (Slicher van Bath 1963). In a similar vein, Bieleman's analysis of *Five Centuries of Dutch Farming* shows in detail how the rise of the Dutch urban economy in early modern times was rooted in a fertile exchange between city and countryside (Bieleman 2010).

The analogy does not stop here. Although the Asian renaissance of the late 20th century has primarily been associated with rapid industrialization, it has been preceded by impressive gains in agricultural output and productivity (World Bank

[1] I am grateful to Katharine Frederick and Sanne Mirck for their assistance in preparing this lecture.

1993, Kohli 2004, Otsuka et al. 2009, Henley 2012). In the Philippines, where the famous International Rice Research Institute (IRRI) was established in 1960, rice yields doubled in no time. In Indonesia, the Suharto regime accomplished what the Dutch had failed to do before, namely, to turn the country from a net importer of rice into a net exporter in just one decade after the food crisis of the early 1970s (Djurfeldt and Jirström 2005). And India, one of the most famine-prone regions of the world for centuries, managed to avert the Malthusian doom scenarios painted by many a respected scientist in the late 1960s (Ehrlich 1968, Myrdal 1968). In Latin America productivity increases were impressive as well. In Mexico wheat yields started to rise at exponential rates in the 1950s. In Brazil maize output per hectare has quadrupled since the early 1960s (see figure 1).

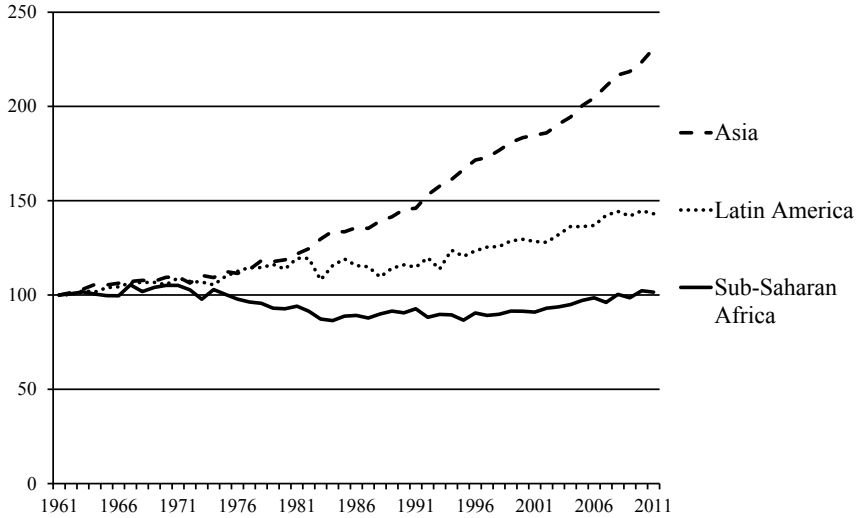

Figure 1. The per capita production of food in Asia, Latin America and Sub-Saharan Africa, 1961-2011 at national level for selected countries between 1961 and 2008. Source: FAOSTAT 2013.

The timing of the 'Green Revolution' could hardly have been better. It occurred exactly in the period when world population growth reached its peak. Except for Sub-Saharan Africa[2]. In Africa, food production did not keep pace with population growth. Certainly, agricultural production rose in absolute terms, but mainly because growing numbers of smallholders brought more land under cultivation (Larson and Otsuka 2012a, v; Mugera and Ojede 2013). In the majority of African countries the

[2] I will also use the shorter term 'Africa' as a substitute for 'Sub-Saharan Africa' hereafter.

per capita production of food declined from the 1960s through the 1990s. According to FAO statistics, even today some 30 out of 53 African countries produce less food per head of the population than they did in the early 1960s (FAOSTAT). Whereas historically food shortages had been of an incidental nature, caused by climate shocks, disease epidemics or military conflict, in the late 20th century they became the result of a structural mismatch between local demand and supply (Iliffe 1987). Large-scale famines, a typically Asian phenomenon until the 1960s, became increasingly associated with Africa (O' Grada 2009, Devereux 2009).

The recent catastrophe in the Horn of Africa has revived the images of the horrible famine of the mid-1980s, which have left a deep imprint on my childhood recollections. If anything, it indicates that amidst the present optimism, African growth experiences remain highly differentiated. That structural food shortages have not led to a much higher incidence of famine owes much to modern means of transportation and communication, facilitating large scale food imports as well as improving the effectiveness of international food aid programs. In Ethiopia in the 1980s, as well as recently in Somalia, attempts to alleviate drought-induced harvest failures were frustrated by dirty wars, causing hundreds of thousands of excess deaths. More effective interventions of food aid avoided such dire consequences in countries like Niger and Malawi, which were also coping with serious food crises in the past decade (Reij and Smaling 2008).

According to the UN, the world population will grow from roughly 7 billion at present to 10 billion at the end of this century. About 70% of the projected increase, that is 2.3 billion, is expected to occur in Sub-Saharan Africa alone (see figure 2). Yet, the challenge goes even beyond the need to improve food security in times of rapidly increasing demand. The challenge also involves the need to balance the growth of urban sectors with rising rural incomes (Haggblade and Hazell 2010). Since the majority of Africans is still employed in agriculture, improving rural living standards is the key to mitigate further increases in socio-economic inequality, the key to raising domestic consumer demand and, eventually, the key to strengthening the fiscal basis of African economies.

Fortunately, there is a renewed focus of national and international agencies on rural development in Africa. The World Bank, after a period of neglect during the structural adjustment programs of the 1980s and 1990s (World Bank 2008; Larson and Otsuka 2013) now increasingly recognizes Africa's economic, geographic and institutional diversity[3]. Wageningen University is involved in this endeavor in

[3] The Alliance for a Green Revolution in Africa (AGRA), a joint initiative of the Rockefeller and the Gates Foundations, also specifically aims to promote tailor-made projects (AGRA 2013).

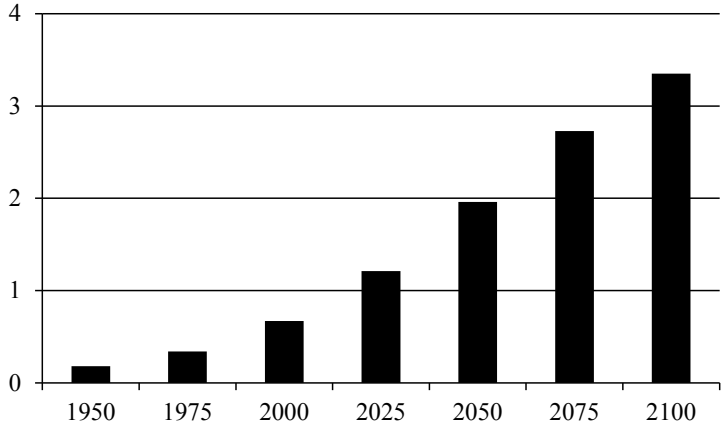

Figure 2. Observed and expected population growth in Sub-Saharan Africa, 1950-2100 (billions of people). Source: UN World Population Database.

various ways as well, for instance, through research on new African rice varieties or research on the effectiveness of aid-sponsored agrarian development programs. In addition, there is an outspoken ambition, also within this university, to avoid the environmental costs of the original green revolution in terms of water and soil pollution, land erosion and loss of biodiversity. Indeed, the call for a 'doubly green revolution' stresses the need to combine agricultural productivity growth with more sustainable forms of natural resource management (Conway 1998).

But while embarking on renewed investment and research efforts, it is worthwhile to take the long-term picture into account. After all, why did Africa miss the green revolution in the first place? And what reasons do we have to think that this time is different? In the remainder of this lecture I hope to convince you that a global historical perspective offers some insights that deserve to be heard in the present debate on Africa's growth revival.

The Green Revolution

'Timing' is a crucial aspect of revolutions. To understand what the green revolution exactly entailed, we need to understand why it occurred when it did. The standard tale portrays the green revolution as a technological breakthrough in the development of new high-yielding varieties of cereal grains, especially wheat, rice and maize, between the early 1940s and the late 1970s (Estudillo and Otsuka 2012). Experiments with these new varieties started in Mexico in 1943 by the team of Norman Borlaug, an American agronomist who won the Nobel peace prize in 1970 for his path-breaking research. These new varieties were designed to transform

increasing inputs of water and artificial fertilizer into a larger number of kernels per ear. Heavier ears were made to grow on shorter and stronger stems in order to prevent the plants from lodging. The cultivation of new varieties was complemented by an intensified use of machinery, irrigation, and a wide range of insecticides, pesticides and herbicides.

It is important to recognize, however, that most of the 'technological' ingredients of the green revolution had been in the delivery room of history for quite some time. The increased use of fertilizer had been part and parcel of expanding global trade in the 19th century, when large quantities of Peruvian guano and Chilean nitrates were shipped across the Atlantic and the Pacific to fertilize European and North American acres (Melillo 2012). The economic historians Alan Olmstead and Paul Rhode (2010) have made a compelling case that most of the productivity gains in American agriculture during the 19th century stemmed from biological innovations in plant and animal disease control, including the experimentation with, and application of, cross-breeding techniques. In other words, the 'green revolution' was already gaining steam in the industrializing countries in the 19th century and I would argue that the real revolution was not so much a technological one, but rather the rapid diffusion of useful scientific knowledge across large parts of the Southern hemisphere.

If we pursue this argument, the question of timing redirects attention to the role of state policy in overcoming certain market imperfections. Asian governments channelled substantial public resources into the development of rural infrastructure and credit facilities. They subsidized and coordinated technical support to farmers. They offered infant-industry protection to emerging fertilizer industries and, in some cases, Asian governments went as far as to distribute micro-packages of hybridized seed and fertilizer to encourage farmers to grow new cultivars (Jirström 2005).

The political momentum that pushed Asian governments into such a pro-active role had been building up during the Cold War. The Americans, in particular, feared that the impoverished masses in Asia would act as a magnet to socialist propaganda. The term "Green Revolution" was introduced to contrast America's foreign policy with the violence associated with Red guerilla movements[4]. "Green", as opposed to "Red", was the color of peace. Peaceful scientific progress was presented as the capitalist alternative to combat hunger, poverty and inequality (Cullather 2010). Leaders like Marcos, Suharto and Indira Ghandi came to see 'rice, roads and schools' as crucial components of their attempt to centralize power and raise popular support (Djurfeldt and Jirström 2005).

[4] USAID director William Gaud is credited with the invention of this term in 1968 (Cullather 2010, 7).

So when it comes to explaining agrarian transitions, there are several perspectives one may take, varying from a strictly technological approach that emphasizes the specific opportunities and constraints of local ecologies, to a political economy approach that focuses on the incentive structures underlying specific forms of human cooperation, or lack thereof. These perspectives are not mutually exclusive, on the contrary. In African history they are deeply intertwined.

Africa's legacy of extensive agriculture

Modern genetic research suggests that our common ancestors originated in Africa and that they reached anatomical modernity some 200,000 years ago. However, although the *homo sapiens* had been around in Africa for perhaps twice as long as in the rest of the world, the first urban civilizations supported by sedentary agriculture emerged outside Africa. In fact, Africa has remained one of the least densely populated areas of the world until today, and it is only in the second half of the 20th century that it was home to one of the biggest population booms ever recorded in human history. Although the debate on the demographic impact of the African slave trades is still unsettled (Manning 2010), few scholars would dispute that Africa offered a comparatively inhospitable environment for sustaining large concentrations of people. Apart from the high incidence of tropical diseases such as malaria, there were a number of barriers to the development of sedentary agriculture.

To begin with, Africa is not very well endowed with navigable waterways. Anyone who has some affinity with Dutch economic history will recognize what this implies for the opportunities of commercial development. When excluding the Sahara and Kalahari deserts, where supporting large concentrations of people is impossible anyway, the lion's share of Africa's cultivable land lies in the tropics. Rain forests host a broad range of edible crops, but food cannot be stored for long in warm and moist climates. The possibilities for the refinement, processing and trading of food items were therefore more limited than in temperate climates. Tropical soils are fertile, but also quickly exhausted, favouring systems of extensive land use and day-to-day harvests of roots, tubers and starchy fruit, such as plantain, for immediate consumption, along with the production of cereal grains.

Livestock breeding broadens the opportunities to store wealth, mediate risks and raise land productivity in pre-industrial societies. However, the presence of the tsetse fly in the African tropical forest belt has rendered large tracts of cultivable land unsuitable to the development of mixed farming systems (Goody 1971, Alsan 2012). The tsetse fly is the principle biological vector of African trypanosomiasis, better known as sleeping sickness (see figure 3). Apart from threatening human lives, it kills cattle and horses. Tsetse has hampered the intensification and commercialisation of

African agriculture in several ways. It impeded the development of ox-plough cultivation, it reduced the animal manure available for soil regeneration, it limited sources of animal protein, and it impeded the use of cattle and horses for transportation purposes. Hence, whereas in Eurasia a considerable part of the energy required for soil preparation and transportation was supplied by animals, in tropical Africa the energy had to be supplied by scarce human labour. The hoe thus remained the principle tool for soil preparation and human porterage the principle method for moving goods over large distances.

Large parts of the African savannah outside the tsetse-infested forest zone cope with prolonged periods of drought. The highly erratic rainfall patterns caused by the Asian-Australian monsoon system, turn the cultivation decisions of many East African farmers into a repeated gamble (Nairobi 1979). Interestingly, there is archaeological evidence of various pockets of intensive agriculture in East Africa, none of which have withstood the test of time. Historians are unsure about the causes of their disappearance, but it seems likely that climate shocks have played an important role (Widgren and Sutton 2004). In the most arid parts of the West African Sahel and East African coastal regions, nomadic pastoralism has proven to be the only way to sustain a living.

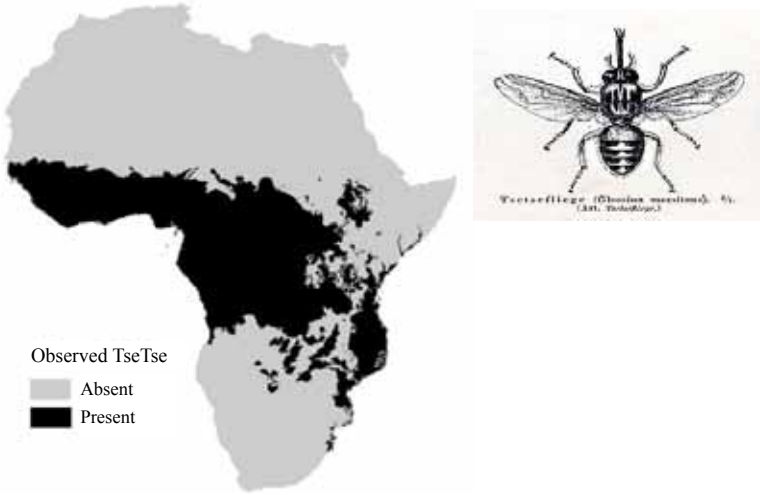

Figure 3. Tsetse infested parts of Sub-Saharan Africa. Source: Alsan 2012.[5]

[5] Marcella Alsan kindly provided me with the map of African tsetse incidence. The map is based on original data from Ford and Katondo (1976).

A map of current population densities reveals how environmental conditions have shaped human settlement patterns in African history. Large concentrations of people can be found along the river Nile in Egypt and the Niger river system in present-day Nigeria. Other spots of high concentration can be found in the African rift valley, stretching from Ethiopia in the North all the way South into the Shire highlands of present-day Malawi. This area contains fertile land at higher altitudes where tsetse flies and malaria mosquitos fail to thrive.

Environmental determinism?

We may safely conclude that the widespread practice of extensive agriculture did not create optimal conditions for the type of intensification that characterised the green revolution in Asia. However, before reading a strong version of environmental determinism into African history, I would like to put forward three arguments against over-simplifying conclusions.

First, we should not dismiss African agriculture as a 'primitive' undertaking. Shifting cultivation was a logical response to long regeneration periods of tropical soils that were poorly understood by European colonizers, who often regarded this waste of land as a sign of laziness or African irrationality. If we dig deeper into the historical record of African agriculture, the terms 'adaptive' or 'responsive' offer a much more adequate conception of its long-term evolution. After all, maize and cassava, the two biggest staple crops of Sub-Saharan Africa, did not originate in the region, but were adopted from the New World (McCann 1995, Agboola 1979). The same goes for potatoes, beans, peanuts and a large range of cash-crops such as tobacco, cocoa, cotton, and rubber (Tosh 1980). In fact, there is little historical ground for the idea that African farmers fail to see the potential of new crops or new crop varieties. There is a much better case to make that seemingly conservative cultivation decisions are guided by deep-seated strategies of risk-minimization, rather than income-maximization (Seavoy 1989).

Second, we should not conclude without further empirical investigation, that extensive agriculture left the average African subsistence farmer worse off than his counterparts elsewhere in the world[6]. Recent research into historical African living standards, the focal point of my ERC and VIDI research projects, suggests that during the colonial era nutritional conditions have been considerably better in West Africa than they were in Eastern and Southern Asia. And there are reasons to believe that this also holds for earlier periods. Yes, there existed competition over scarce

[6] See for expressions of what may be called "the persistent poverty view" Bloom and Sachs (1998, 207) or Allen (2011, 91). See for a response to this, Frankema and Waijenburg (2012, 897-9).

water resources and high-value land, which also played out in violent confrontations, but such conflicts were fought out in the context of an open land frontier where Malthusian pressures were largely absent.

The distinguished British historian Tony Hopkins recently noted that according to dependency theorists life in the African colonies was "nasty, British and short"[7]. A new generation of historians, and I count myself among them, is trying to break out of the ideological chains of neo-Marxist history, and the Eurocentric explanations of African history it has forged, by simply acknowledging that the experiences of the Kuba in the Congo Free State during the rubber terror in the 1890s contrasted sharply with those of the Asante cocoa farmers in the Gold Coast during the 1920s (Hochschild 1999, Austin 2005, Vansina 2010). The research of Alexander Moradi and others points out that, if anything, average human stature rose during the colonial era (Moradi 2009; 2012; Austin et al. 2012). In several studies conducted together with Marlous van Waijenburg we document a rise in urban real wages starting in the 1880s and continuing until the late 1960s (Frankema and van Waijenburg 2012, 2013b). These welfare gains were more impressive in some places than in others and much research remains to be done in documenting and explaining these varying trajectories of welfare development (see figure 4).

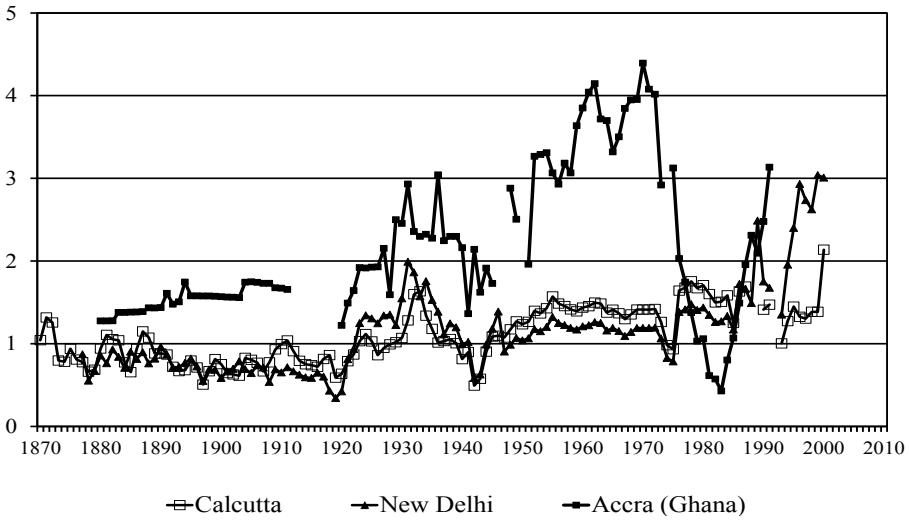

Figure 4. Real wages of urban unskilled workers in Calcutta, New Delhi and Accra, 1870-2000 (1 = subsistence level). Source: Frankema and van Waijenburg 2013b.

[7] Walter Rodney's *How Europe Underdeveloped Africa* (1972) is the classic study, but much of what has been written between the 1970s and 2000s contains traces of dependency theory. See also Gareth Austin's critique (2008) of Acemoglu et al. (2002).

However, in anticipation of a better empirical foundation I remain sympathetic to John Iliffe's qualification of historical African poverty as "land-rich poverty" (Iliffe 1987). African poverty was rooted in a high exposure to tropical diseases and pre-mature death, but those who survived had access to a comparatively rich nutritional environment. African cattle herders, who had access to animal protein and dairy in exceptional quantities, were exceptionally tall for pre-industrial standards (Moradi 2012). Yet, the rinderpest epidemic that swept across East and Southern Africa in the 1890s killed approximately 90% of all cattle. Pastoral groups such as the Masai in Kenya, who were generally regarded as a healthy and wealthy tribe, starved to death in large numbers along with their animals (Mack 1970).

But the most important argument against environmental determinism is the enormous potential of industrial technology and mechanical power that has become available in the past two centuries. Railways have cut back transportation costs. Artificial fertilizers can compensate for a lack of animal manure, tractors for a lack of animal draft power. There has also become available a broad range of new crop varieties that are specifically tailored to local African ecologies. Examples of technological innovation and knowledge improvements can be discussed at length, but the argument can also be framed into a more fundamental question: if the advances in modern medical technology and knowledge have allowed the African population to quadruple since 1950, why then would similar gains be inconceivable in African agriculture?

African state formation in retrospective

Some studies suggest that the 11% food shortfall in Niger in 2005 could have been prevented by a simple program of distributing micro-doses of fertilizer to farmers and that such a program, even apart from the long-term knowledge spill-overs, would have cost only a quarter of the actual incurred emergency aid expenses (Reij and Smaling 2008, 413). If we accept that states have played a critical role in the spread of the green revolution in Asia, namely by addressing a number of market failures in the supply of rural infrastructure, credit facilities, education and access to intermediate inputs, we should also pay some attention to the historical features of African state formation.

Early independent African states were fiscally underdeveloped, their bureaucracies were understaffed and undereducated, and there was a widespread incapacity to support economic policy-making with reliable statistical information (Frankema 2012; 2013, Frankema and Jerven 2013). State policies designed to serve 'national interests' were paralyzed by a mosaic of ethnic, religious and tribal identities. If early independent African states were able to secure a monopoly on the use of violence in

the first place, it tended to be an unstable monopoly at best. Obafemi Awolowo, one of the founding fathers of independent Nigeria, put it as follows: "Nigeria is not a nation. It is a mere geographical expression. There are no 'Nigerians' in the same sense as there are 'English', 'Welsh' or 'French'." (Awolowo 1947, 47)[8].

It has become a commonplace to argue that the creation of 'states without nations' was among the worst long-term legacies of European colonial rule in Africa, and I fully subscribe to this point. Few people realize, however, that the effective broadcasting of power by colonial governments was complicated by similar conditions that had hampered state centralisation in pre-colonial times. The crux of the problem was how to integrate relatively isolated and mobile groups of people, scattered across vast rural hinterlands, into the structures of a central state administration? In a context of shifting cultivation and nomadic pastoralism it is virtually impossible, and prohibitively expensive, to impose taxes on land or agricultural output. African state development was thus bound to the extraction of rents from trade and human captives. However, for the maintenance of courts, bureaucracies and armies, tax revenues from sedentary agriculture were far more stable. Slave raiding, in particular, created a highly adverse dynamic of violence, fugitive conduct and counter-insurgencies (Inikori 2013).

Since control over people, rather than land, was key to achieving political ambitions, there were little incentives to formalize institutions for land tenure. The imposition of the European state concept in Africa, in which delineated territorial borders were a central part of the political logic, thus caused a rupture in the historical evolution of the African state (Herbst 2000). Yet, colonial borders were primarily designed to prevent intra-European conflicts on African soil, without having to overstretch limited government resources to actually control these territories. Frederick Cooper (2002) aptly depicted these colonial constructs as 'gatekeeper states'.

Colonial arrangements with respect to land tenure differed widely. In the settler colonies of Southern and Eastern Africa, land was alienated at a considerable scale to facilitate the settlement of European farmers. In Central Africa large tracts of land were given in concession to private companies and missionaries. In parts of West Africa, however, European land ownership was discouraged or even prohibited (Amin 1972). Although the colonial state managed to extract some revenue from land grants, it primarily relied on a combination of trade, hut and head taxes (Frankema 2010; 2011). These tax revenues were re-invested in the exploitation of mines and the facilitation of cash-crop exports. The improvement of subsistence agriculture was

[8] Quote obtained from Nugent 2012, 91 .

given no priority, and in some cases also suffered from the labor that was withdrawn from it to spur the more profitable sectors of the colonial economy. Yet, in many landlocked regions colonial tax revenues remained insufficient to finance even the lightest skeleton of a state administration. To accommodate this problem, the French created large federations in West and Equatorial Africa to redistribute revenues from the richer coastal colonies such as Gabon, Senegal and Dahomey towards the poor periphery consisting of present-day countries like Niger, Chad and the Central African Republic (Frankema and van Waijenburg 2013a).

Environmental constraints to state formation also show up in the history of African warfare (Reid 2012). Since the use of horses was essential to military operations in the open savannah lands, but useless in the tsetse-infested forest zone, it proved difficult to integrate both areas into an overarching state structure. The large Islamic states that emerged in the West African Sudan, such as the medieval and early-modern empires of Mali and Songhai, were kept together by armies of horseback warriors that were able to cover large distances. The political challenge of these empires was to keep the military elite, who had made significant investments in their equipment, united and prevent disintegration by establishing a monopoly on the Trans-Saharan trade in horses (Reid 2012, Goody 1971). In the forest zone the reach of foot soldier armies was considerably smaller. The slave states that arose along the West African coast, such as Dahomey, Asante and Oyo, were more compact and often incorporated women and children in their armies for logistic purposes (Reid 2012). For these coastal states it was crucial to maintain their first-mover advantage in the African-European trade of slaves for guns (Fage 1969, Whatley 2013). This was an effective strategy for as long as the Atlantic slave trade continued, but in the 19th century, when British abolition efforts took effect, these states were forced to reinvent themselves.

This is not to suggest that the process of African state formation was caged in an iron law of population scarcity and population mobility. The Sokoto caliphate in Northern Nigeria actively promoted the construction of *ribats*, small fortified towns that provided a basic level of security, schooling and market exchange. In order to settle the pastoral Fulani people and underpin the fiscal basis of the state, a network of agricultural plantations was established. The Sokoto caliphate was eventually swallowed up by colonial Nigeria, but it had amassed sufficient power to inspire Frederick Lugard in formulating his famous principle of indirect rule (Lugard 1922). The most obvious aberration of the aforementioned pattern, however, was Ethiopia. This country was ruled by the Solomonic dynasty for seven centuries in a row, until the military coup of 1974 deposed its last emperor, Haile Selassie. Interestingly, the ox-drawn plough had been used in this region for millennia and the Abyssinians had

also developed their own scripture for recording state affairs (McCann 1995). And yes, European powers tried, but never succeeded, to colonize Ethiopia.

The bottom-line, however, is that a process of strenuous interstate competition, which had spurred the build-up of fiscal and military capacity in early modern Europe, remained largely absent in Sub-Saharan Africa (Jones 1981). Nor did there emerge an African version of the Chinese state. The physical support structures of African states were too porous. The recent war in Mali has demonstrated that even for modern African states it can be very difficult to control vast empty hinterlands. After all, where did these insurgents come from and where did they go? Furthermore, the lack of well-defined rules of land tenure resulted in increasing conflicts with the rapid closing of the land frontier in the 20th century. Multiple overlapping claims to land complicated the investments needed to intensify production (Berry 1993, Goldstein and Udry 2008). Hence, at the time the green revolution conquered Asia, African states faced problems of a more fundamental nature, problems that were difficult to resolve quickly, and especially so without stable institutions of conflict resolution at the central political level.

Relative prices

That early independent African states were weak, does not mean that its leaders neglected food crop agriculture. Food self-sufficiency aligned very well with anti-colonial ideologies emphasising Africa's newly won political and economic independence. In Tanzania a comprehensive program of rural development was implemented, which ran aground due to an overdose of ill-directed state intervention, not because of neglect. In Zimbabwe, Kenya and Nigeria, groups of well-connected large farmers were able to articulate their demands to the central government and successfully adopted high-yielding varieties of maize. In many other countries productivity gains were also recorded in the smallholder sector during the 1960s and 1970s, but most of these were not sustained.

Let me discuss one more factor that highlights the added value of a global historical perspective: the green revolution itself! Similar to how former European and present-day Asian textile manufactures have hampered the development of local textile industries in Africa, the increasing supply of food grains, and especially rice, flooding the world market in the wake of the green revolution supressed the profit-margins of African farmers. In the second half of the 20th century world trade in agricultural products grew at an annual rate of 3.2 percent (Federico 2005, 29), while real food prices dropped by 10 to 15 percent between the 1967 and 1992 (Mundlak and Larson 1992, Mundlak, Larson and Grego 1997; see also Federico 2005, 24). This effect was further compounded by the structural overvaluation of African currencies

(Harrison 1987, 55). Of course, cheap food imports were beneficial for the rapidly increasing number of urban poor. But they also relieved the pressure on African governments to endure their agrarian development programs under difficult circumstances. The food price hikes of recent years (see figure 5), which led to food riots in for instance Mozambique, not to mention the Arab world, are a wake-up call that the era of cheap food may have come to an end. Despite the negative consequences in the short run, a higher equilibrium price for food may turn out to be a blessing in disguise for African food producers in the long run.

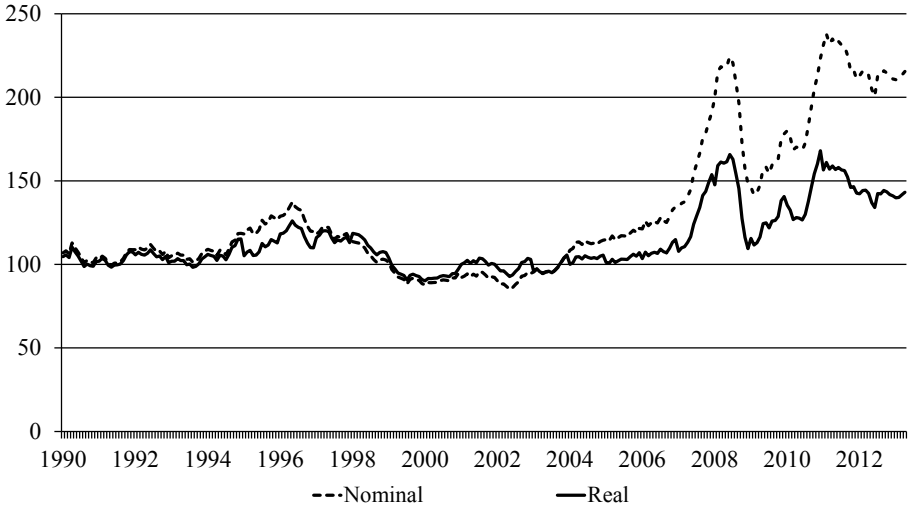

Figure 5. FAO Food Price Index, 1990-2013. Source: FAOSTAT 2013[9].

Will this time be different?

At the celebration of the 95th anniversary of Wageningen University in March of this year, our Rector Magnificus, Martin Kropff, has pointed to an acceleration in the diffusion of modern agricultural technology and a structural break in rice yields in Africa[10]. A survey of aggregate production statistics indeed reveals strong productivity growth in some African countries. Rice yields in Benin started to grow in the early 1990s and quickened the pace after 2007, reaching a level that exceeds 4 tonnes per hectare at present. In Rwanda there has been a break in the long-run

[9] The FAO has constructed the real food price index by deflating its basket of nominal food prices by the World Bank Manufactures Unit Value Index. See: www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/

[10] Speech delivered by Martin Kropff at the symposium preceding the official celebration of the 95th Dies Natalis of Wageningen University, 15 March 2013.

pattern from the turn of the century onwards, with yields exceeding 5 tonnes per hectare today. Similar upshots have been recorded in cassava yields in Malawi, following the introduction of a new variety around the turn of the century (Holmén 2005, 78-9). Moreover, at the micro-level there are many more examples of rapid change (Reij and Smaling 2008, Haggblade and Hazell 2010, Larson and Otsuka 2012b), which may eventually show up in the aggregate statistics as well. But we have seen such movements before, and most of these were not sustained. What reasons do we have to believe that this time is different? In concluding this lecture I will discuss a number of current developments that represent a clear break with history.

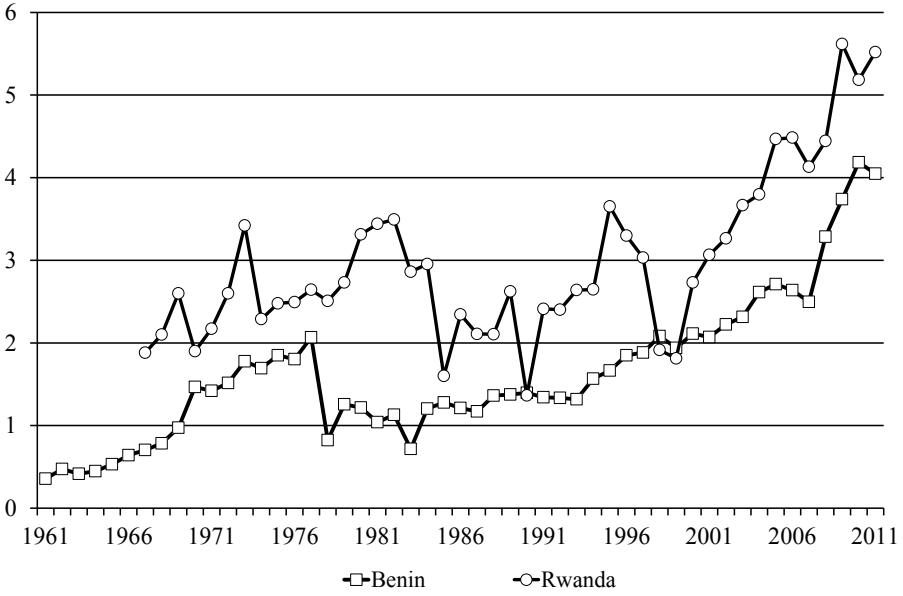

Figure 6. Rice yields (paddy) in Benin and Rwanda, tonnes per hectare, 1961-2011. Source: FAOSTAT 2013.

First, Africa is currently experiencing nothing short of a transportation and communication revolution. As I have argued, throughout African history physical distances have hampered the commercialization of agriculture and the formation of central states. Colonial investments in railways and harbours connected local economic enclaves to European markets, but today's investments in road infrastructure, transport equipment, electricity and ICT infrastructure allow for a much more fine-grained process of domestic market integration. To illustrate this, in 1990, only 1 percent of Africans had a subscription to a mobile or fixed telephone connection. Today nearly every African adult has one (African Development

Indicators 2012). New communication technologies offer real time market information to farmers at very low costs. They enable instant financial transactions and facilitate new forms of credit, saving and insurance. The tyranny of distance in Africa dissolves as we speak.

Second, current rates of population growth and urbanization are widely regarded as one of Africa's biggest problems today. Some fifty years ago similar concerns were raised about Asian population growth. However, if we take serious the argument that low population densities and high population mobility have impaired the development of sedentary agriculture and the growth of urban centres, Africa's current demographic transition is bound to change the parameters of agrarian production. Growing urban demand in combination with higher food prices, makes investing in local food production systems much more attractive than it was even a decade ago[11]. The problem with African demography is not the growth of the population itself, nor its growing concentration. It's the speed of it that puts pressure on the adaptive capacity of African societies.

Third, the current macro-economic outlook is far better than in the last quarter of the 20th century. There is controlled inflation and exchange rates are more in balance with the economy. Notwithstanding the aforementioned diversity, the majority of African economies grows at rates of 3 to 6 percent per year despite the severe financial and economic crisis in the industrialized world (IMF 2012). This is an important observation. In previous periods of global economic crisis, for instance during the Great Depression of the 1930s or the oil crises of the 1970s, African economies immediately experienced the setbacks. But not today. Average levels of government debt in Africa hover around 40% of GDP, half the rate of Dutch government debt, not to mention Southern European levels (IMF 2012).

Fourth and finally, I would argue that the rapid transitions in African settlement patterns and the open access to worldwide media and useful knowledge is bound to change the rules of the political game. Of course, the formation of social identities, personal loyalties and political machinations has always been in flux, but the current rise of African urban culture goes against a long historical tendency of ethnic and social fractionalization. Moreover, with the pressure building up, African politicians face increasing incentives to concern themselves with the lot of the urban ánd the rural poor, whether they are democratically elected or not.

[11] I have deliberately refrained from the discussion whether such investments should be channelled to smallholders or large-scale farmers. I believe this issue depends very much on local conditions and history suggests that bi-modal production systems

Having said this, I don't believe that we will see a repetition of the Asian green revolution in Africa. The variety in Africa's ecological conditions and historical development trajectories is too large. I am far more optimistic about West African coastal countries such as Ghana, Senegal and Benin, with a comparatively strong historical record of commercialization. I am less optimistic about landlocked countries in the interior such as Niger, Chad, or the Central African Republic. In addition, I believe that the more compact African countries with a historical legacy of agrarian intensification, such as Rwanda, Burundi and Uganda are in a more favourable position than the giant colonial constructs such as the Democratic Republic of Congo. If anything, the effects of climate change are likely to deepen intra-African disparities and enhance intra-African migration. In other words, it would not surprise me if the Great Divergence that has happened at the global scale in the past five centuries, will be repeated within Sub-Saharan Africa in the 21st century.

Word of thanks

I would like to say a few words of thanks. First of all, I thank the Board of Wageningen University and, in particular, the Rector Magnificus, Martin Kropff, and the Director of the Social Sciences Group, Laan van Staalduinen, for granting me their confidence. I would also like to acknowledge the special efforts made by Arthur Mol and Gert Spaargaren in preserving the history chair for Wageningen.

Some 15 years ago I enrolled in a business history course at the University of Groningen thaught by Professor Pim Kooij. Since our first encounter, we have met at various occasions in Groningen and elsewhere, for instance at meetings of the Posthumus Institute. The oddest encounter we had was at the Groningen train station in January 2001, where Pim helped me get rid of a bunch of flowers just before I was to jump on my bike to India. I guess neither of us could have imagined that our paths would cross in Wageningen as well, but life is full of surprises. Pim, I appreciate your unconditional support and I hope that you and your wife Anje enjoy this day as much as I do.

I am proud that the Rural and Environmental History group has been strengthened by so many bright and energetic people in the past year. Especially the coming over of Elise van Nederveen Meerkerk, and her VIDI-project on female and child labour in the Dutch Empire, has been of great added value to the professional and social development of our group. I am also very pleased that another excellent scholar, Piet van Cruyningen, has recently joined us. Maarit Junnikkala, Carry Vleeming and Margaret van Wissen have done a great job in making the expansion of our group possible. I am delighted that you are all here and I am very much looking forward to working with you in the coming years.

I want to use this occasion to thank Anton Schuurman in particular, for the tremendous effort he has made in the past couple of years as the deputy chair of our group. Anton has carried the full load of administration, management, teaching, research and supervision and it kept him occupied, as we can see, even during his holidays. It's fair to say, Anton, that without your sacrifices this pulpit would have remained vacant today.

During the past five years I had the privilege to be part of the extremely creative and stimulating community of social and economic historians at Utrecht University. I am indebted to Oscar Gelderblom and Tine de Moor for their support of my grant applications. Whenever my impatience with university bureaucracy required a diplomatic massage, Maarten Prak and Bas van Bavel, gave up their Sunday afternoons. With their unique personalities and distinct senses of humour, they have made me feel at home in Utrecht. Jessica Dijkman and Auke Rijpma have been fantastic roommates. I also got to know various excellent students. In particular the cooperation with Marlous van Waijenburg and Michiel de Haas has been highly stimulating and exciting. More than anyone else though, I am indebted to Jan Luiten van Zanden, one of the world's leading economic historians. The sheer scope of his research agenda has been a continuous source of inspiration for me and his personal guidance has been of pivotal importance to my academic career. Indeed, moving to Utrecht has been one of the best decisions in my life.

My time in Groningen has been enriched by many wonderful people as well. Jeroen Bartels encouraged me to develop my teaching skills in philosophy. Richard Paping introduced me to the archives in the province of Groningen. Thomas Lindblad offered me the opportunity to conduct research in Indonesia. With Jutta Bolt I discovered the magnificent city of Kiel. Alan Taylor hosted me during my stay at UC Davis. But above all, I want to thank Bart van Ark and Jan Pieter Smits, promoter and co-promoter of my PhD thesis. Their handwritings remain visible in all the work I produce.

My parents have granted me a rather unusual amount of freedom to discover the world in my own way. I am grateful for your support during this journey and the way in which you have nourished my intellectual curiosity and encouraged me to make the most out of my studies. I also want to thank my parents-in-law for their support, and especially, the help you have offered us during the past five years with solving the many logistic puzzles at home.

I didn't touch upon the best decision in my life yet, but it wasn't really a decision. Arjanne, for your love and dedication you deserve flowers every day, but I rarely if ever bring you flowers. Even when I bring home myself, I am often not fully there. But I hope you find some compensation in our strong shared conviction that we are blessed with an extremely rich and fortunate life. A life worth living together.

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