

Cheap Food & Bad Money

Food, Frontiers, and Financialization in the Rise and Demise of Neoliberalism

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It is now widely understood that the “end of cheap food” has arrived. It is much less clear what this means for the ongoing crisis of neoliberalism, and for the future of capitalism. In what follows, I speak to this lack of clarity.

The “end of cheap food” is more than a populist slogan. From the rosy dawn of capitalist production in the long 16th century, cheap food has been pivotal to capitalism’s golden ages. Neoliberalism has been no exception. The cheapest food in world history was realized after the crises of the 1970s. In concert with strategies that re-stabilized cheap energy, raw materials, and labor, cheap food was decisive to the restoration of profitability in the early 1980s. The commodity boom of 2003-11, initially peaking in 2008 with another in progress for 2011-12, signals the erosion of these “Four Cheaps,” and the cascading collapse of investment opportunities created by them. For this reason, the commodity boom represents the *signal crisis* of neoliberalism – which I use as shorthand for the accumulation regime that emerged in the 1970s.² A signal crisis announces the tipping point in the regime’s capacity to deliver strategic inputs in a way that reduces, rather than increases, the systemwide costs of production. What remains to be seen is whether the present *conjoncture* is exclusively a tipping point of neoliberalism, or if the exhaustion of the Four Cheaps also signals the exhaustion of capitalism’s *longue durée* regime of “cheap ecology” (Araghi, 2010).

What are commonly regarded as a “food crisis” and a “financial crisis” are more effectively understood as expressions of neoliberalism’s signal crisis, when prices for strategic commodities begin to tick upwards (or spike!) rather than decline. This tipping point is a reversal of the system’s capacity to produce more and more food, energy, and raw materials with less and less labor. Although this reversal is often attributed to resource depletion, the reality is at once more complex and more intractable. The reversals (so far) of cheap food, energy, and raw materials (if not – *yet* – labor power) find their taproot not only in rising costs of production owing to resource depletion, but also in the hegemony of finance capital over the accumulation process as a whole. It is this hegemony that has undermined the conditions of the Four Cheaps by discouraging productive investment in favor of asset-stripping and outright plunder (the middle-run); and by favoring speculative activities that have produced unprecedented volatility in commodity markets (the short-run). These tendencies have, moreover, linked up with a new wave of extra-human nature’s revolt against the disciplines of capital – the Superweed Effect. From glyphosate-resistant weeds to spiraling antibiotic resistance,

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² One could just as easily call this era “structural mercantilism,” amongst a handful of reasonable candidates (e.g. Gee, 2009).

ours is an era marked by the rising capacity of extra-human natures to elude capitalist control.

Neoliberalism's recent history therefore highlights a crucial transition in the relation between resource depletion, capital accumulation, and financialization. In addition to the *longue durée* tendencies for soil exhaustion and resource depletion to fetter labor productivity and drive up costs – as in 18th century England – today the hegemony of finance capital has led to a massive flow of capital into commodity markets. This effectively mimics, amplifies, and diffuses across all sectors of the world-system the inflationary impact of the slowdown in labor productivity growth, in agriculture especially. For this reason, I am not so sure that finance capital *today* is best viewed as a “superstructure” (Foster and Magdoff, 2009: 124). Given neoliberal financialization's penetration of everyday life, it strikes me as more productive to view it as constitutive of capitalism's socio-ecological contradictions. Wall Street, in other words, becomes a way of organizing all of nature, characterized by the financialization of *any* income-generating activity (Leyshon and Thrift, 2007).

By crisis I refer to an irreversible decline in the effectiveness of the strategies that revived world accumulation in the early 1980s. Nearly all discussions of neoliberal crisis have refrained from placing it within long-run patterns of evolution and recurrence in the modern world-system. I would therefore distinguish neoliberalism from neoliberalization, and the middle-run of neoliberalism from the long-run of historical capitalism. Neoliberalization, as a set of practices and thought-structures, has surely survived. But these are not creating the conditions for a new long wave. Neoliberalism as accumulation regime took shape in the 1970s, consolidated in the 1980s, and entered a period of crisis after 2003.

What, then, of historical capitalism? This is a world-system that weaves together human and extra-human nature on the basis of endless accumulation. Capitalism is therefore not a social system, much less an economic one. It is, rather, a *world-ecology*. Capitalism does not “have” an ecological regime; it *is* a world-ecological regime – joining the accumulation of capital, the pursuit of power, and the production of nature as an organic whole. The present argument focuses on the dialectic between the accumulation of capital and the production of nature, but these categories themselves are heuristic devices aimed at illuminating the historical geographies of the *oikeios* – the relation of human and extra-human nature. While *ecology* is often used interchangeably with nature and environment, my redeployment is to offer the concept as a relation of human and extra-human nature, the *oikeios*. Relations between humans are messy bundles of social and biophysical natures, and bound up, at every turn, with the *rest* of nature (Moore, 2000, 2003, 2007, 2009, 2010a, 2010b, 2010c, 2010d, 2010e, 2011a, 2011b, 2011c). When I say that capitalism is an ecological regime, I am saying that capitalism is a world-historical matrix that knits together humans with the rest of nature in specific ways, above all pivoting on endless accumulation. This world-ecological approach allows a view of financialization and the food regime since the 1970s as crystallizations of the specifically capitalist *oikeios*. This dialectic, then, is not one of a “social” process and its “environmental” consequences, but rather a dialectic of two bundles of human and extra-human nature – the agro-food and financial systems of the neoliberal era.

Productivity and Plunder: Finance, Frontiers, & the End of the World-Ecological Surplus

Historically, the resolution of “great depressions” in capitalism has been achieved through world-ecological revolutions that created new sources of wind-fall profits. These new sources are the Four Cheaps, which are at the core what I call the world-ecological surplus. It is a “surplus” relative to the average costs of production in capitalism, which take many forms but are ultimately rooted in the productivity of labor. Marx once observed that the fertility of the soil could “act like an increase of fixed capital” (1973: 748), without all the nasty side effects of rising capital-intensity – like the falling rate of profit (Moore, 2011a). I am arguing, in effect, that Marx’s observation holds for the long history of enclosure and exhaustion of forests, peat bogs, oil fields, aquifers, peasant societies, and yes, soil fertility in the modern world. Cheap food is especially crucial, as it is strongly related to price of labor in commodity production.

When the ecological surplus is very high, as it was after World War II, productivity revolutions occur and long expansions commence. Naturally, this is not merely a story of appropriation, but also of capitalization and socio-technical innovation. The ecological surplus emerges as new accumulation regimes combined plunder and productivity, joining the enclosure of new geographical frontiers (including subterranean resources) and new scientific-technological revolutions in labor productivity. Great leaps forward in labor productivity, expressing the rising material throughput of an average hour of work, have been possible through great leaps forward in the world-ecological surplus. It is impossible to overstate the irreducibly socio-ecological character of this surplus, which comprise not only food, energy, and raw materials but also human nature as labor power.³ The origins of the long 20th century were found not only in the mass production systems of the “second industrial revolution,” but also in multiple appropriations of human and extra-human natures: of the soil and water resources of the American Midwest; of eastern European and south Asian peasantries; of the forests, fields, and resource veins of the colonial and semi-colonial worlds (Moore, 2010c, 2011a, 2011b).

The neoliberal era unfolded through a rupture with this world-historical pattern of productivity and plunder. Accumulation revived by the early 1980s, but it did so on a much different basis than the postwar golden age, or the mid-19th century zenith of British industrialization. The frontiers that could yield a cornucopia of nature’s free gifts were fewer than ever before, and the scientific-technological revolution in labor productivity, greatly anticipated in the 1970s, never materialized (Balakrishnan, 2009; Gordon, 2010; Moore 2010c).

What did materialize was a middle-run strategy of financialized asset-stripping, a poor but functional compensation for the closing of frontiers. On its own, however, finance capital could go only so far. “Without protection from some non-bourgeois group,” it was “politically helpless” (Schumpeter, 1950: 138).

The revival of accumulation has always been linked to new forms of territorial power and geopolitical leadership, not least because world markets and the Four Cheaps are politically constructed and coercively sustained. Successive eras of accumulation have consequently emerged through state-capital compacts whereby the leading territorialist power secures, protects, and otherwise facilitates the conditions for revived accumulation. In the neoliberal era, finance capital could make

³ The appropriation, capitalization, and exhaustion of labor power in the rise and demise of neoliberalism merits further investigation but is beyond the scope of this essay (see Moore, 2010c, 2011a).

its hegemony – establishing its leadership through the revival of accumulation – only by entering into a shifting mosaic of alliances with states large and small, from the United States to Chile, although of course strategically dependent on the former. This was the “armour of coercion” (Gramsci, 1971: 267) in finance capital’s hegemonic project. The powerfully coercive-intensive character of accumulation since the 1970s is an important break with previous waves of financialization (Harvey, 2003; Arrighi, 1994; Moore 2010b). This break had quite a bit to do with the closure of frontiers: as opportunities contracted for attenuating contradictions within a more expansive global container, capital turned to extract as much wealth as possible as quickly as possible from inside the existing container.

This epochal shift in the closing of vast frontiers of appropriation is therefore central to the specificity of finance capital in the neoliberal era. We are dealing with long- and middle-run processes here. One moment of financialization consists of the “pattern of accumulation in which profits accrue primarily through financial channels, rather than through trade and commodity production” (Krippner 2005: 174; also Arrighi, 1994). Since the 1970s, however, a quantity-quality shift has occurred in this longstanding “pattern of accumulation.”

This shift is characterized not just by the temporary domination of finance capital, but by the *hegemony* of finance capital over industrial and all other forms of capital. It explodes the firewall between the financial and productive circuits of capital, reproduced successfully for five centuries. Finance capital’s hegemony is revealed in its capacity “to define norms, visions, and even fashions, that become decisive for business strategies” in general (Kädtler and Sperling, 2003: 55). These norms and visions – dramatically expressed by the transition from “stakeholder” to “shareholder” capitalism and the privileging of market-price over reproduction cost accounting – shaped a peculiar expansion of profit-maximization. Faced with few possibilities for expansion across space, finance capital allowed for an equalization across economic sectors. It was a functional, if anemic, analogue to previous movements of global conquest.

Instead of looting the gold and silver of the Americas, as in the classic era of primitive accumulation, finance capital in the neoliberal era worked to extract maximal wealth from the “real economy.” The financial circuit of capital, M-M+, became a gravitational field to which capital as a whole was compelled to respond. Productive capital was locked into the pursuit of a rate of profit established in the financialized universe of symbolic equivalents, a paper chase from which followed the rapid exhaustion of the webs of *all nature* that sustained the historic accomplishments of industrial capital (Blackburn, 2006; Aglietta, 2008). That this was a matter of capital developing through the web of life, rather than simply acting upon it, can be seen in the unprecedented ways that financialization penetrated the structures of everyday life, from pension funds to university educations to consumer credit (Moore, 2011a).

Financialization presented a remarkable solution to the withering marriage of plunder and productivity marked by the progressive closure of frontiers. This solution was found in an extractive strategy that discouraged long-term investments by states and capitals, and encouraged socio-ecological “asset stripping” of every sort – pension funds were raided, state enterprises privatized, water and energy sources depleted. In the process, neoliberalism accelerated not only turnover time (Harvey, 1989), but also rapidly exhausted the conditions that permitted capital to overcome systemic crises for the past six centuries.

Neoliberalism’s cheap food regime was premised on creating a great leap forward in the food surplus *without* a corresponding agricultural revolution; indeed,

the era was characterized by the progressive deceleration of yield growth. Agricultural biotechnology, the standard bearer of neoliberal agricultural revolution, has made little progress on this pivotal issue (Gurian-Sherman, 2009). It has redistributed wealth and power from cultivators to capital, but not realized a significant yield boom characteristic of agricultural revolutions in the modern world. And as if to move from the frying pan to the fire, by 2010 it also became clear that agricultural biotechnology is contributing to a new set of constraints, further limiting the space for a new agricultural revolution: the “superweed effect” (Moore 2010c). The superweeds’ dramatic, if still-regional, impact on labor productivity points towards a broader set of erosive forces undermining not only neoliberalism’s, but also historical capitalism’s, cheap food regime.

It is now looking like a strategy of killing the goose that laid the golden eggs, as there are seemingly no more golden eggs to appropriate. This extractive strategy revived accumulation, but it did so by cannibalizing the accomplishments of the Fordist-Keynesian order. On the one hand, finance capital achieved its hegemony at a moment when the system’s capacity to achieve a world-ecological fix was weaker than ever before. On the other hand, the hegemony of finance capital has exhausted capitalism’s greatest source of dynamism, found in successive scientific-technological revolutions that have dramatically increased the productivity of labor, and subordinated extra-human nature in pursuit of this accomplishment. This double exhaustion socio-ecological and technological fix strategies is not simply coincidental with the hegemony of finance capital, but constitutive of it. Neoliberal capitalism, it seems, has been cooking goose for dinner.

The Nature of Cheap Food: Neoliberalism & the Four Cheaps in the Capitalist World-Ecology

While neoliberalism survives, its dominant strategies no longer yield the same returns as in the glory days of the 1980s and ‘90s. The turning point in the history of this accumulation regime was reached in 2003-08, dramatized by the longest, most inflationary, and most inclusive commodity boom of the 20th century (Hache, 2008; IMF, 2008). It was followed by the near-meltdown of the world’s financial system (Mason, 2009). This was the *signal crisis* of the neoliberal order. A terminal crisis awaits.

The revival of world accumulation in the early 1980s consolidated two ruptures in the history of capitalism. The one reinforced the other. First, finance capital emerged as hegemonic within the accumulation process, and also, as a political force, within the states of the Global North. The hegemony of finance capital at the commanding heights of power was part and parcel of its penetration of everyday life, from pensions to new prison construction.

Finance capital’s emergent hegemony implicated a second rupture, the exhaustion of capitalism’s capacity to launch new scientific-technological revolutions in labor productivity. There was an epochal shift from technological *revolution* to technological *redistribution*, reinforced by finance capital’s alliance with state machineries to redistribute wealth and power from the poor and producing classes to the very rich. Hence financialization, technological stagnation in the productive economy, and wide-ranging brutality of redistributive politics formed a world-historical unity.

Have these strategies (financialization), processes (technological exhaustion), and projects (accumulation by dispossession) established the basis for a new era of capital accumulation? Or do they represent the last gasp of historical capitalism?

Is the present crisis, in other words, a *developmental* ecological crisis, one that can be resolved through further commodification? Or are we witnessing an *epochal* ecological crisis, one whose resolution is found in the transition to a new mode of producing wealth, power, and nature?

The revival of world accumulation has always relied on the Four Cheaps – food, energy, raw materials, and labor. This essay focuses on the first of these, while recognizing that all four moments have become progressively intertwined over the past five centuries, and especially in recent decades.

“Cheap” is a way of expressing the value composition of these commodities – roughly corresponding to what Marx calls abstract social labor, the average labor-time necessary to produce the average commodity (1976). Capitalism’s dynamism owes much to this value form, manifested in strategies to maximize labor productivity by appropriating the nature as a “free gift.”⁴ For example, coal, oil, forests, and other energy sources have been extracted much faster than their replacement rates because labor productivity (value) is the decisive metric of competitive fitness in historical capitalism. Capitalists who appropriate nature most effectively are rewarded.

Successive great eras of accumulation have been built on the foundation of high labor productivity, made possible through the expansive plunder of the rest of nature. New socio-technical innovations in production, and new innovations in the appropriation of nature’s free gifts (labor power included) have generated revolutions in labor productivity. British-led industrialization, for instance, was unthinkable without cheap calories (sugar, and later, imported cereals) and cheap energy (coal). Their cheapness resulted from the wealth of soils and coal seams that could be freely appropriated with very little labor power. Calories and coal, in other words, had a *low value composition*. The quantum of abstract labor involved in their production was low, relative to commodity production in general. While there is much more to the story, the successive, punctuated reduction in the value composition of the Big Four inputs has been central to successive, punctuated revivals of accumulation. This reduction in the value composition of the Big Four is necessary for the revival of world accumulation. The Four Cheaps have been a recurrent historical condition for the renewal of accumulation for a good reason. All things being equal, a decline in these costs of production – reducing the costs of circulating, fixed, and variable capital – favors a higher rate of profit. This is because labor costs fall (because cheap food is crucial to determining the costs of reproducing labor power), or because the costs of machinery and inputs fall (Marx, 1967 III; Moore, 2011a, 2011b). In both instances, the gap between production costs (value) and sale price can be widened.

The neoliberal era diverges from this *longue durée* pattern of revolutions in labor productivity. After three decades of seemingly breakneck technological innovation, there is little prospect of a new productivity revolution. The upshot? The cheapness of these vital commodities in the neoliberal era has relied less on rising efficiencies in production and much more upon the coercive dispositions of the state-finance nexus.

The erosion of the Four Cheaps invariably signals a contraction of investment opportunities. Hence, financial expansions typically coincide with (although it is far from coincidence) new and ruthless initiatives to exploit extra-human nature (resources), which entail new and ruthless initiatives to appropriate human nature (labor power). These initiatives establish new conditions for a revival of profitabil-

⁴ This includes, perhaps counter-intuitively, uncapitalized sources of labor power, such as peasantries, or unwaged domestic labor.

ity in the productive circuit. This was as true for the “Age of the Genoese” in the century after 1557 (Moore 2010a, 2010b) as it has been for the neoliberal era.

At its core, the neoliberal project reordered the global relation between humans and the rest of nature through financialized mechanisms of redistribution from poor to rich – “backed, as ever, by state powers” (Harvey, 2003: 152). This tendency is captured in discussions of the neoliberal debt regime (e.g. George, 1993; Bello, 1994). But neither a North- nor a South-centric story will suffice. The new logic of finance capital permeated much more than core-periphery debt relations. It extended into the very heart of productive capital and household reproduction in North American and other core zones.

Finance capital after the 1970s no longer depended *directly* on the vitality of the “real economy.” The productive circuit of capital (M-C-M+) was subjected to a rate of profit determined in the world of fictitious commodities (M-M+). This favored asset-stripping and the progressive dilapidation of the sources of productivity revolutions. On a systemwide basis, the rise of finance capital to hegemony within the accumulation process amplified the difficulties faced by productive capital “on the ground” in launching a new scientific-technological revolution in labor productivity. This amplification turned on finance capital’s notorious impatience, “short-circuiting flows of production and trade, garnering an immediate profit at the expense of what might have been long-term social surplus” (Blackburn, 2006: 67). Privileging the imperatives of “immediate profit,” finance capital shunned long-term investment in the very productive innovations that might allow accumulation to revive. This rupture between financialization and productivity revolution would lend the revival of world accumulation from the early 1980s a decisive character.

Food and Finance in the Rise of Neoliberalism

The neoliberal era was characterized by the cheapest food in the history of humankind. World food prices dropped 39 percent between 1975 and 1989, and still further in the decade that followed (McMichael, 2005: 278; FAO, 2009). This was brought to an end, as we know, by 2006, with food commodity prices peaking in 2008. By 2011, it became clear that the commodity boom of 2003-08 must be extended, with food prices exceeding the 2008 peak in January 2011 (FAO, 2011).

The sharp fall in food prices after 1975 reflected a peculiar sort of agricultural revolution in the modern world-system. Historically, such revolutions had been made through transformations of class structures and property regimes that compelled cultivators to “sell to survive.” The result was a series of market-driven (if juridically enforced) productivity revolutions that distinguish the capitalist era from premodern booms (Brenner, 1976). Insofar as metropolitan capital and states pioneered a new global order that delivered cheap food for the revival of accumulation between 1983 and 2007, the neoliberal agricultural revolution fits the historical pattern. The rise of the Dutch, British, and Americans to world hegemony was made possible through agricultural revolutions that yielded cheap food to a growing layer of the non-agricultural workforce (Moore, 2010c). But in contrast to previous agricultural revolutions, there has been no great leap forward in agricultural productivity since the 1970s. Indeed, quite the opposite. Yield growth, and labor productivity with it, has progressively slowed, despite the introduction of new agronomies (biotechnology) and the unprecedented deployment of fertilizers and other inputs.

How, then, was cheap food realized?

One pillar of neoliberalism's cheap food regime came from another era. Essentially, neoliberal accumulation rode the wave created by the Fordist sensibilities of the Green Revolution. Often regarded as a product of the 1960s, the Green Revolution emerged first in the United States during the 1930s. Its core synthesis brought together the 19th century's dynamic family farm model with hybrid corn, the biological pivot of a new property regime. Hybrid corn would raise yields more than four-fold between 1935 and 1980 (Kloppenborg, 1998: 89), and spending on food dropped from 24 percent to 14 percent of average household income (Elitzak, 1999: 20). This hybrid revolution was won at heavy cost to farmer autonomy. Because hybrid crops, in contrast to open-pollinated ones, produce seed of inferior quality, hybridization "uncouples" seed from grain. This compelled farmers to make an annual pilgrimage to seed firms, where they purchased new seed for planting (Kloppenborg, 1988: 93). Hybridization was a strategic wedge, opening new opportunities for the capitalization of farming. The result was an radical extroversion of farming, as purchased inputs more than doubled, and chemical inputs soared nearly 20-fold in the four decades after 1935 (*ibid*: 33).

This model would be progressively globalized after World War II, at first in Mexico and then famously in South Asia (Sonnenfeld, 1992; Perkins, 1997). Not only a pillar of American world leadership, the Green Revolution achieved an unprecedented yield revolution. In South Asia, wheat and rice yields increased between 100 and 200 percent in between the mid-1960s and mid-1990s, with the lion's share of the boom coming before 1985. Between 1950 and 1990, global cereal output nearly tripled, propelled by a rise in "grain yield per hectare... by roughly 2.4 times" (Weis, 2007: 17; Kendall and Pimentel, 1994). Meanwhile, the real price of rice, corn, and wheat dropped 60 percent between 1960 and the end of the last century (FAO, 2002: 11). Even after the crisis of the Fordist-Keynesian world order in the 1970s, the vitality of the national farm sectors created through the Green Revolution provided strong yield growth for another decade (Tilman, et al., 2002; IMF, 2008).

From the mid-1980s, agricultural productivity growth slowed worldwide. The slowdown was especially pronounced in capital-intensive zones (Fuglie et al., 2007; Hazell, 2010: 3483). Delayed by a few years relative to the North, the experience of Indian wheat yields was hardly exceptional: per hectare yield growth averaged 3.4 percent annually between 1982 and 1992, falling to a paltry 0.6 percent over the next decade (Matuschke and Qaim, 2006: 2). Nevertheless, food commodity prices continued to fall until 2002-03. In the absence of a new agricultural revolution, the gap between falling prices and stagnating productivity was in part filled by the bellies of the world's poor. This is the dietary moment of Araghi's "forced underconsumption" (2009). Patnaik sees declining "per capita foodgrain absorption, *taking direct and indirect absorption together,*" in India from the mid-1980s, and China from the mid-1990s (2011). Even before the food price spikes of 2003-08/11, somewhere between one-third and one-half of all humans experienced nutrient deficiencies (Scoones, 2002; Weis, 2007). Meanwhile, food expenses in the Global North as a share of income declined between 1980 and the end of the century, from 13.4 percent to 10.7 percent in the U.S. (Elitzak, 1999: 20) – even as median income stagnated and a fast-food revolution came to the rescue of the temporal reproduction squeeze faced by two-income households.

This dietary moment of combined and uneven development was hardly novel. Baltic grain flowed into Amsterdam during the mid-17th century as Polish peasant diets were squeezed – and soil fertility exhausted – under the Dutch-led "system

of international debt peonage” (Wallerstein, 1974: 121-122; Moore 2010b). But Poland’s crises led to a relative de-linking from world trade by the 18th century; although hardly prosperous, its exposure to agro-extractive dispossession, dietary immiseration, and resource exhaustion was greatly relaxed. No such relaxation occurred at the dawn of the neoliberal era. The financial-imperial power that fused in the early 1980s as the “Washington Consensus,” was directed at preventing the South’s relative withdrawal from the world market. This had long been the pattern, as world-economic contractions provided breathing space for peripheral and semi-peripheral zones to develop home markets and pursue “core-like” capitalist development – Mexico during the 17th century, British North America after 1763, Latin America in the 1930s and ‘40s. But such relative withdrawal was precisely what could not be tolerated by an emergent accumulation regime that was *not* in the midst of a new productivity revolution.

This was all the more crucial at the dawn of the 1980s, after a decade of very low productivity growth. For neoliberalism to succeed, there had to be a way to keep cultivators locked into a treadmill that ramped up commodity production even as world market prices fell. The flood of cheap capital loaned to the South in 1970s, spearheaded by New York banks (in a shift from the older dominance of multilateral loans), established the conditions for sustained overcapacity in agro-extractive sectors in the neoliberal era. These conditions were partly realized through infrastructure projects – such as the trans-Amazonian highway expansion – and partly through capital goods imports. But the tendency was not limited to the South. Indeed, the South’s agro-extractive overcapacities were sustained in the 1980s and ‘90s by grain farmers in the North. Their relations were joined through the debt regime. American farmers saw their debt burden triple in the 1970s (Strange, 1988: 21-22). In a dramatic break with the postwar pattern, US farmers financed expansion largely through “outside debt capital,” fueling an asset boom that reinforced overproduction tendencies in the early 1980s (Barnett, 2000: 371). The “*new* agricultural countries” in the South and the *old* agro-industrial complexes in the North were differentiated moments within a world-historical unity (Friedmann, 2004).

The world recession of 1980-82 was “even more severe than that of 1974-75” (Kolko, 1988: 43), and it threatened to fracture the neoliberal order just as it had consolidated power in the North and realized counter-revolution in key zones of the South. The recession was initiated by the Volcker Shock in October 1979, as the U.S. Federal Reserve suppressed inflation – finance capital’s greatest fear – by nearly tripling the real interest rate over the next two years, relative to the 1965-79 average (Kolko, 1988: 41-42; Engdahl, 2008). Mexico’s interest bill, for example, tripled between 1979 and 1982 (Schaeffer, 2003: 101). As we have seen, the trend was not limited to the periphery.

The resulting debt crisis, not just in Mexico but across the South, had two possible outcomes. The danger was that Mexico and other heavily indebted states would default, refusing to pay their debts without significant restructuring. This would have devalORIZED loan-capital on a massive scale and reflatED primary commodity prices, transforming the severe recession of 1980-82 into a prolonged depression for the North. American banks would have been especially hard hit (George, 1988). As we know, this did not happen. The debtor states of the South acceded to the new debt regime – which included the rapid liberalization of domestic financial sectors – following the fiscal turbulence of 1982. Among the decisive consequences was a system of debt peonage that reinforced the “export glut” of primary commodities (McMichael, 2008: 130). “Land and natural resources in

general [became] the objects of enhanced export strategies to generate foreign exchange, often to service debt” (McMichael, 1999: 26-27). Far-reaching transformations of earth and bodies ensued across the South, as deforestation advanced, toxification intensified, and diets suffered (Bello, 1994; George, 1993; Wright, 2005).

The “economic” result was immediate. In the periphery, negative “price shocks” – any decline in real prices by 10 percent or greater relative to the previous year – grew from 25 to 90 between 1981-83 and 1984-86; the severity of these deflations was 25-50 percent greater (IMF, 2003: 37). Worldwide, non-energy raw materials prices fell by nearly half between 1980 and 1992 (Schaeffer, 2003: 103). As Peter Gowan wryly observes, within the North, the new debt regime worked wonders for rentiers, who “[got] their debts paid,” and also for industrial capital, who got “cheaper imports for the inputs needed for production” (and cheaper food for workers) (1999: 42).

The debt new regime compelled the radical extroversion of the South’s tenuous national farm sectors that had emerged in the postwar era. This made “global distress-sellers” of nearly all the world’s cultivators, especially but only within the South (Patnaik, 2003: 3). In sub-Saharan Africa, we find the most dramatic expressions of two systemwide compulsions: to maximize production for the market even in the face of falling prices and absent technical innovation; and to suppress incomes for the producing classes, manifested across the South in declining per capita food consumption. Patnaik puts her finger on the basic logic of the situation. During the 1980s,

[Sub-Saharan Africa’s] six most populous countries, all under structural adjustment, experienced a 33 percent fall in cereals output and a 20 percent fall in food staples output per head in the 1980s, while at the same time cash crops in volume terms were being exported at an annual rate of 6.5 percent (Kenya) to 13.9 percent (Sudan), despite falling unit dollar prices, while the competitive export thrust ensured a 35-50 percent fall in unit dollar price for primary exports, so that no increase in exchange earnings took place at all for countries expanding exports at 6-8 percent or less every year. World Bank documents on Africa urge these countries to redouble their efforts to export ... selling more and more at falling prices, which means that they will continue to be global distress-sellers. All except one country suffered declines in average calorie intake even after food imports were taken into account (ibid).

This regime was anchored by a new web of relations between finance capital, state power, and agribusiness in the construction of world agriculture as a “world farm” (McMichael, 2009b). Structural adjustment’s encouragement of “export glut” was quickly reinforced by a further decoupling of world market prices and regional production costs. This was realized through the “political determination of world agricultural commodity prices [that] emerged through the Uruguay Round negotiations” of the General Agreement on Tariffs and Trade, and continued into the World Trade Organization era after 1995 (McMichael 2005: 282).

The force of such political determination was not unprecedented. During the late 19th century’s financial expansion, the British-instituted global market succeeded in compelling peasant producers throughout the new peripheries to sell “without regard to price of production,” as Engels observed in the midst of the process (in Marx 1967 III, 726). But finance capital remained subordinated to a system driven by industrial capital. Hilferding, in his classic statement, saw banks

becoming “to a greater and greater extent *industrial* capitalists” (1910: 225). The late 19th century was an era of profound productive dynamism, what we now call the second industrial revolution. What is unprecedented in the neoliberal era is the depth of finance capital’s penetration and subordination not only of industrial capital but also, *in so doing*, the reproduction of capitalism’s vital commodities. For a time, this worked quite well, facilitating the revival of accumulation after 1983. By 2003, the financialization of everything began to generate serious contradictions for world accumulation.

Neoliberalism’s radical decoupling of world price and production costs created major new opportunities for the concentration and centralization of capital in the agro-food sector, such that by 2000 just four corporations controlled “82 percent of beefpacking [in the U.S.], 75 percent of hogs and sheep, and half of chickens” (Greider, 2000). By 2008, “five corporations control[led] 90 percent of the international grain trade, three countries produce[d] 70 percent of exported maize, and the thirty largest food retailers control[led] one-third of world grocery sales” (McMichael 2009a). By the end of the 2000s, however, these dominating agribusinesses were no longer the more-or-less equal actors alongside finance capital that they appeared in the late 1980s. The shift rippled down through the agro-food system as both food processors and input providers were disciplined by global finance, which, directly and indirectly, “extract[ed] surplus value through the imposition of contracts, unequal financial agreements, or economic dependencies of various kinds” (Pritchard, et al., 2007: 79). By the dawn of the new century, the reduction of farmers to “propertied laborers” set in motion during the 1930s (Kloppenborg, 1988: 34) had become a pillar of financialized accumulation. Increasingly subordinated to the logic of shareholder value and its iron law of “at least 13 percent return on capital employed” (Williams, 2000: 6), transnational agribusiness reproduced the new rules of the game under the hegemony of finance capital:

Mainly financed by credit (and partly consolidated through shares), the food empires have contributed considerably to the making of ... the financial crisis. The dependency on credit (and the requirement to enlarge stockholder value) introduces the need to generate a large enough cash flow to pay redemption and interest rates as well as to co-finance further expansion. Thus, the structures that link the production and consumption of food have a strong inbuilt need to ‘squeeze out’ as much value as possible, by exerting a permanent downward pressure on the prices received by primary producers and an upward pressure on food prices paid by consumers, allowing for considerable accumulation. This explains why massive levels of chronic undernutrition coexist with persistent trends towards de-activation of primary production (van der Ploeg 2010: 102; also Burch and Lawrence, 2009).

Finance capital’s impatient drive to “squeeze out” as much value as possible within the shortest amount of time helps to account for two successive transformations. First, neoliberal financialization, married as we know to the institutions of the Washington Consensus, effected a historic deflation of food commodity prices (Patnaik, 2003). Second, once the bloom was off the rose in other key spheres of financialization (e.g. subprimes, tech stocks), this was followed by the spectacular inflation of food prices after 2003. One spectacular peak was reached in 2008, and another in early 2011, with little relief for Southern consumers inbetween (Ghosh, 2010; FAO, 2011). This second movement, exerting “a permanent

upward pressure on food prices paid by consumers,” is expressive of an epochal shift in the historical pattern of food regimes. This is the transition from a regime that drives down the price of wage-foods to one premised on a “price assault on vulnerable consumers” (McMichael, 2009a: 284). Here agro-food transnationals reproduce the logic of finance capital, seeking to “capture profits through price inflation” rather than through productivity increases (ibid). Naturally, this price inflation is reinforced by speculative activities, but more significant is agribusiness’s internalization of finance capital’s internal logic, which says, in effect, *take first, and make second*. Financialization, in other words, is undermining the conditions for a new capitalist boom every bit as much as faltering productivity fueled by resource exhaustion; they are two sides of the same world-historical coin.

Here we return to Wall Street as a way of organizing nature. In part, this is the role played by the “centrality of short-term financial results... [in] provok[ing] a long-term decay in biophysical productivity within the industrializing poles” of world agriculture (van der Ploeg 2010: 100). Profitability was sustained through an agro-ecological asset-stripping homologous to private equity firms’ asset-stripping in industry (Bellofiore and Halevi, 2009), rather than revolutionizing production from within. This entailed a profit squeeze on petty commodity producers, the key to rising agribusiness profitability. The average Iowa farmer saw his rate of profit drop from 35 percent to 9 percent over the second half of the 20th century (Halweil, 2000). Median farm has income stagnated from the mid-1980s, as the farm-to-retail price spread dramatically widened, and as input prices rose sharply relative to farm commodity prices from the mid-1990s (Elitzak, 1999; Glenna, 2003).

But the centrality of short-term financial results, reinforcing a longstanding “technological treadmill” in agriculture (Kloppenburger, 1988: 119), is only part of the story. The hegemony of finance capital also subordinates all commodity production

to the competitive logic of global financial markets. Food companies, for example, are no longer simply competing in yoghurt, or carbonated drinks or processed meats. They are competing on financial markets to deliver the fastest and biggest possible rates of return to “impatient” financial capital (Rossman 2007: 5).

These “fastest possible rates of return” were realized by undermining the middle-run conditions necessary for the revival of profitability in the productive circuit. As finance capital gained hegemony in the accumulation process – punctuated by the emergence of private equity firms and funds – it entrained a shift from “stakeholder” to “shareholder” capitalism (Secombe, 1999). The hegemony of M-M+ reworked the “hierarchy of management objectives,” through which share price and market-value accounting was to be privileged across *all* sectors of the economy (Williams 2000: 6). Through private equity firms and the principle of shareholder value, there emerged a rapacious “extraction of value” that progressively undermined the opportunities for productive investment (Froud and Williams 2007). The point is the expansive sphere of influence exerted by private equity firms rather than their direct activities (however significant), which seek to “bypass the stock market while keeping the short term notion of capital gains of financial markets” (Bellofiore and Halevi, 2009: 8). This sphere of influence relies on cost-cutting, and only when necessary, investment to serve “simple” rather than “expanded” reproduction (ibid; Foster and Magdoff, 2009). Focusing on Eu-

rope's food processing sector, deeply subordinated to finance capital, Rossman points to a "declining rate of real investment" (2007: 5). Rising profitability in short-run was possible through outsourcing, casualization, the degradation of working conditions, and "inducing competition between individual units within the firm on the basis of existing plant and equipment" (ibid).

Such asset-stripping as systemic tendency explains something of the ongoing erosion of the productivity/plunder dialectic that has been central to renewing accumulation since the 16th century. The synchronicity of financial expansion and socio-technological innovation at the birth of the long 20th century was distinctive but not exceptional. The Dutch-led financial expansion (c. 1740-80) overlaid the early phases of steam engine development in England. And the Genoese-led financial expansion (c. 1557-1620s) saw the emergence of standardization in ship-building, new milling and refining technologies in sugar processing, and a new wave of agricultural innovation in northwestern Europe.

But it is precisely the *absence* of a scientific-technological revolution – one that advanced labor productivity and reduced the costs of production – that characterizes the history of neoliberalism. Annual labor productivity growth in the OECD declined from 4.6 percent in 1960-73 to 1.8 percent in 1973-79 and just 1.6 percent in 1979-97 (Crotty, 2000: 6). In the core, most of this growth occurred outside basic industry and agriculture, compounding the problem still further. Labor productivity growth in agriculture slowed across the Global North after 1980, in the USA falling by more than one-third in 1980-2004 relative to the postwar era (Fuglie, McDonald, and Ball, 2007: 5). Worldwide, agricultural labor productivity ticked upwards slowly after 1990, rising to just 1.36 percent through 2005, over the 1.12 percent average of 1961-90 (Alston, Babcock, and Pardey, 2010: 461). The modest increase was largely attributable to Chinese agricultural reform, which has yet to provide a hegemonic model for the world-system along the lines of the Dutch, British, and American agricultures in their golden ages. Indeed, for all the remarkable accomplishments of the Chinese "miracle," labor productivity in industry and agriculture both remain one-quarter (or less) the average obtaining within the Global North (Jefferson, Hub, and Su, 2006; Jin, Huang, and Rozelle, 2010). There are few signs that the China's ascent, however successful on its own terms, promises a hegemonic model for industry and agriculture that might be emulated by our era's rising powers.

Cheap Food and the Closure of the Great Frontier: Superweeds & Other Barriers to a New Agricultural Revolution

By 2001, food had never been so cheap, at least for the world's industrial and urban proletariats. By December 2007, food prices were at their highest in real terms since 1846 (Buntrock, 2007). They peaked in the summer of 2008, with a new high reached in the early months of 2011 (FAO, 2011).

What accounts for this dramatic reversal? The short answer turns on the rise and demise of the world-ecological surplus enabled by the enclosure of modernity's last frontiers. Neoliberal capitalism emerged, and sustained itself, by appropriating what free gifts remained for the taking: the oil frontiers of the North Sea, Alaska, and the Gulf of Mexico; the crest of Green Revolution agriculture in South Asia, appropriating and exhausting fertile soil and cheap water; the integration of the old Soviet Bloc into the world market, allowing cheap metals and oil to drive down production costs in the 1990s; the appropriation of the Chinese peas-

antry as a vast labor surplus; the privatization of state and quasi-state firms and public services. These free gifts will not recur.

This marks the closure of the “Great Frontier” (Webb 1964). This frontier, opened in the long 16th century, provided an astounding wealth of nature that reduced production costs, increased profitability, and generally greased the wheels of accumulation for many centuries. Its exhaustion is a turning point in the history of capitalism.

The closure of the Great Frontier removes the central way that capital dealt with the rising costs of production over the centuries. While there may still be forests and tracts of “underutilized” land to enclose and exploit, *today’s* frontiers are but drops in the bucket relative to the demands of value accumulation. The historical conditions through which a series of ecological revolutions have been realized – each yielding a quantum leap in the mass of “physical bodies” (Marx) available for commodity production – may be understood as essentially non-substitutable, or at best, substitutable only within very definite limits. Capitalism has moved from peat and charcoal to coal to oil, from the breadbaskets of the Vistula, southern England, the American Midwest, from labor frontiers in Europe and Africa, Latin America, and South and East Asia. These are not repeatable events. Substitutability does not unfold through infinite time and space.

If capitalism confronts definite limits to the present configuration of accumulation, this is hardly a novel occurrence. Indeed, the history of capitalism is a long series of revolutions – bourgeois, industrial, agricultural, and otherwise – that transcended seemingly insuperable limits to accumulation. From this perspective, we can rightly ask if biotechnology constitutes the basis for new agricultural revolution as we have known it? Biotechnology fits the classic model of agricultural revolution, in so far as it redistributes income (further differentiating classes of farmers), is enabled by the property-making and –securing capacities of states and state-like institutions, and constitutes a promising opportunity for accumulation by *some* sectors of capital. It does not fit the model, insofar as it has yet to deliver a yield boom, sufficiently large to create (in concert with cheap energy and cheap inputs), the conditions for a new systemic cycle of accumulation.

The Biotech Revolution and its Thermidor: The Superweed Effect

Biotechnology has not halted, much less reversed, faltering productivity growth in world agriculture. The slowdown became evident in the second half of the 1980s, and the trajectory has not been altered by GMOs after their widespread introduction in the mid-1990s (Tilman et al., 2002; Fuglie et al. 2007; Hazell 2010: 3483). Indeed, agricultural biotech has done little to improve intrinsic yields – “intrinsic” in the sense of raising the yield ceiling, in contrast to raising operational yields, the amount harvested (Gurian-Sherman, 2009; Benbrook, 2009). The mounting research on this question even prompted Monsanto to respond that “the main uses of GM crops are to make them insecticide- and herbicide tolerant. *They don't inherently increase the yield. They protect the yield*” (quoted in Ritch, 2009, emphasis added).

Alas, RoundUp Ready crops are not doing so much to *protect* yield lately, either. “Superweeds” have evolved to survive the onslaught of the famed herbicide (Benbrook 2009). Soy is a particularly thick case. Considering that GMO soybeans already constitutes 57 percent of world output, and that the U.S. remains the leading soy producer (37 percent), the rise of the superweed is something of a world-historical event (Pechlaner and Otero 2008; Masuda and Goldsmith 2008). In the

US, especially in soy-regions, ten weed species, on millions of acres in 22 states, are now immune to the famed herbicide (MCT News Service, 2010). The American superweed frontier expanded four-fold between 2008 and 2011, to 10 million acres (CFS, 2011). Even allowing for exaggeration, some projections point to a superweed explosion that would engross 38 million acres by 2013 (Syngenta, 2009). This amounts to one of “every four row crop acres” in US agriculture (Freese, 2010).

The superweed frontier has also advanced rapidly in the GMO soy zones of Argentina and Brazil (Villar and Freese, 2008). The Latin American dimension is all the more suggestive as the soy revolution has been realized not only through conversion of existing arable land, but also through massive forest clearing and other forms of agricultural expansion (Altieri and Pengue, 2006). This is the classic model of the commodity frontier, which has always served to attenuate agro-ecological contradictions within cash crop agriculture. When weeding became too great a drag on productivity in 17th century Barbados, for instance, the sugar frontier moved to bigger islands such as Jamaica ((Moore, 2007). But the soy commodity frontier in Latin America has enjoyed little of the historic “yield honeymoons” that accompanied these previous episodes; the superweeds are advancing faster than agro-capitalism can run.

The problem is that biophysical natures are now evolving faster than the capacity of capital to control them – a “Darwinian evolution in fast-forward” (Neuman and Pollack 2010). Can capital continue to innovate to stay ahead of this decidedly non-linear treadmill? The experience of 2008-10 suggests otherwise, as herbicide-resistance developed so powerfully in the US, the global heartland of GMO agriculture, that even the national media came to feature a growing family of superweeds (Gillam 2010; Kilman 2010).

Monsanto’s famed RoundUp Ready crops are at the center of this socio-ecological fast-forward. While it would be unwise to give Monsanto too much credit, the underlying superweed tendency is nevertheless crystallized nicely by the firm’s GMO soy (Gurian-Sherman, 2009). The promise of GMO crops was declining herbicide and pesticide use and rising operational yields. That promise is now turning quickly sour with a secular tendency towards rising toxicity and diminishing returns (Benbrook 2009). Notwithstanding the claims of Monsanto and other Big Ag boosters (e.g. Monsanto 2009), it appears that glyphosate-resistant (GR) crops such as RoundUp Ready Soy are bound up with ominous implications for human health (Benachour and Séralini, 2009) and encourage fungal invasions of GR root systems (Kremer and Means, 2009). Add to this an apparent exhaustion of operational yield gains – “We’re back to where we were 20 years ago,” Tennessee soy farmer Eddie Anderson told *The New York Times*, as he prepared to revert to older ploughing techniques and chemical regimes (Neuman and Pollack, 2010) – and we have a real problem for capital.

This bundle of contradictions, pivoting on the accelerated evolution of herbicide-resistant weeds, is the cutting edge of the *superweed effect*. At its core is the tension between capital’s efforts to control and commensurate extra-human nature, and the latter’s co-evolutionary capacity to elude and resist that control: “the more [capital] “tames” natural processes, the more they spin out of control, provoking new and more aggressive taming measures with increasingly disastrous outcomes (Wallis, 2000: 505).

The superweed effect speaks to the wildly proliferating and increasingly unpredictable responses of extra-human nature to the disciplines of capital, above all to what McAfee aptly calls “neoliberalism at a molecular scale” (2003). The short-run

promise of RoundUp Ready crops was to maximize operational yield by reducing costs and weeds simultaneously. The middle-run yield is not only more weeds and more herbicide, but a tendency towards combining glyphosates with “more toxic weedkillers” such as atrazine, an endocrine disrupter, and 2-4D, a powerful carcinogen. All of which would be acceptable (to capital) if it produced a new yield boom, producing more food with less labor. But this boom has not materialized.

To be sure, some group of capitalists will find a profitable fix to the yield-suppressing manifestations of the superweed effect, at least in the short-run. Some group of capitalists always finds a profitable response to one or another of capitalism’s contradictions. But capital *as a whole* does not benefit from the rising cost of food implied by the superweed effect. In an era of generalized wage stagnation or worse, rising food prices promise to squeeze working class incomes and raise reproduction costs for proletarian households, developments hardly favorable to a new expansion.

The superweed effect heralds a quantity-quality shift in the history of an enduring contradiction. The long history of agro-ecological control regimes began with the monocultures and highly-regimented work disciplines of early modern plantations and has today crossed a world-historical threshold with molecular and other disciplinary projects. This shift is a new era of extra-human nature’s resistance in which the short-run fixes not only become progressively shorter-run, but also progressively more toxic. In previous eras, capital’s need for totalizing control, however significant, was less, precisely because faltering labor productivity in one zone could be “fixed” through a new round of global expansion. Problems with English agricultural productivity in the 18th century, for example, were never resolved within England, but fixed through successive frontier movements, especially in North America. And recall that the rise of England as an agricultural superpower was bound up with falling yields and the progressive exhaustion of “free gifts” in Poland, the breadbasket of Dutch hegemony (Moore, 2010b, 2010c). The accessibility of sizeable frontiers of appropriation in previous eras meant that capital’s pursuit of control was more relaxed, its capacity to achieve rising productivity greater, and its toxification tendencies weaker.

The superweed effect overlays, and amplifies, the resource and soil depletions of capital-intensive agriculture. Capitalist agriculture exhausts the soil, demands energy-intensive inputs, and slakes its thirst by exhausting groundwater (Weis, 2010). This is what Marx describes as the tendency for the “overproduction” of machinery to outrun the system’s capacity to supply energy and raw materials. This leads to the “underproduction” of these inputs (Marx, 1967, III; see Moore, 2010c, 2011a, 2011b). While there is an important cyclical moment to this tension between overproduction and underproduction, there is also a cumulative moment – the superweed effect and its non-linear amplification of a longstanding tension between the overproduction of machinery and the underproduction of inputs. Today, the very productivity gains achieved by mechanization and standardization, enabled by the “biophysical overrides” of cheap oil (Weis 2010), are now threatened by their own successes. Underneath the long-run pattern may be a more fundamental shift. In contrast to previous eras, neoliberalism’s underproduction tendencies emerge, *first*, from the progressive cannibalization of its production (and reproductive) foundations, and only secondarily from historical capitalism’s vaunted productive dynamism. This was revealed in the 2003-08 commodity boom as rising energy prices propelled rising fertilizer and food prices. Neoliberal financialization had suppressed the investment mechanism which might have pro-

longed the cheap energy regime, manifested in the reorientation of Big Oil's supermajors away from exploration and towards stock buybacks (Moore, 2011a).

Capitalism today confronts the exact opposite of its early modern bounty. The rise of capitalism was greatly facilitated by a series of "yield honeymoons" (Dark and Gent, 2001). These honeymoons offered a great advantage: very little labor power could produce very large amounts of food, without large outlays of capital. The introduction of Old World crops into the New World (sugar), and New World crops into the Old World (potatoes), provided massive yield windfalls (Moore 2007). Today, we are looking at a yield honeymoon in reverse – the superweed effect.

Food and the Crisis of Neoliberalism: Towards a New Golden Age?

If agro-biotech is going to come to the rescue, it had best do so immediately. The timing is crucial, for we are now at the beginning of a "long depression" (Shaikh, 2010). This depression cannot be resolved without a world-ecological revolution that delivers a significant reduction in food prices while feeding a significantly expanded world proletariat.

In the late 19th century – also an era of long depression and financialization – wrenching famines throttled the periphery as the world proletariat grew prodigiously and world cereal prices declined by 27 percent (Arrighi, 1994; Davis, 2001; O'Rourke, 1997). But the contours of the present conjuncture appear favorable to the first of the conditions, which is helpful to capital only to the degree that such dietary immiseration frees up a significant (not marginal) surplus. Given that half of humanity now lives with nutrient deficiencies, it is difficult to see how a further squeeze could be accomplished in the face of a new wave of proletarianization.

This puts us face-to-face with the future of cheap food. Tellingly, it is not only radical critics who are putting a fork in the era of cheap food. (*It's done.*) In 2008, the OECD forecast real inflation of 10-35 percent over the next decade for a basket of key food commodities. The 2008 projection was grounded on the assumption that yield growth would follow the "historical trend" of 1960-2000 (OECD 2008; OECD/FAO 2008, 47). As we shall see, there are good reasons for questioning this assumption. Two later, the FAO revised upwards its earlier estimate, to 15-40 percent real price hikes for cereals. And this was the *good* news: "vegetable oils real prices are expected to be more than 40% higher" (OECD/FAO 2010: 11). In a qualification scarcely designed to promote confidence, the FAO's estimates "assume normal average weather conditions... [and] long-term productivity trends" (ibid).

The challenges to a new agricultural revolution are extraordinary. This is true even if we bracket the geopolitical tensions that have stalled agro-food liberalization, and class struggles from below that have challenge market-dependent "food security" in the name of food sovereignty (McMichael, 2005; Weis, 2007). The list of prominent biophysical challenges surely begins with global warming, already implicated in the yield suppression of major cereal crops. Every 1°C increase in minimum growing temperature for wet rice cultivation yields a 10 percent decline at harvest (Peng, et al., 2004). A strong relation between warming and yield suppression has been found for wheat, maize, and even soy (Cerri, et al., 2007; Cline, 2007; Lobell and Field, 2007; Kucharik and Serbin, 2008). The UN's Environmental Programme sees "an absolute decline" in net primary productivity across 12 percent" of the planet (Nellemann, et al., 2009: 40) by 2050, but declining NPP

is not merely a hypothesis. While global NPP increased between 1982 and 1999 – was this merely coincident with the neoliberal golden age? – it declined between 2000 and 2009 (Zhao and Running, 2010). With global impacts concentrated in the South (Indonesia’s NPP declined nearly 20 percent), the decade was punctuated by a series of severe droughts (*ibid*). These have continued, with Russia’s in 2010 accompanied by the “worst drought in six decades” in the North China Plain in 2010-11 (Anna, 2011). To climate change we can add the rising energy costs; escalating competition for arable land from agrofuels; the proliferation of invasive species; the superweed effect; the end of cheap water as global warming melts glaciers, rearranges precipitation patterns, and drives aquifer depletion; and the declining effectiveness of fertilizers on yield growth.

If the crisis of neoliberalism today is in fact a *developmental crisis*, one open to resolution within the capitalist mode of production, we would expect to see an agricultural revolution taking shape in the most dynamic new center of accumulation, China. But following the burst of productivity and output growth in the 1980s, there is little to suggest that China is on the brink of an agricultural revolution that will not only feed the world, but *lead* capitalism to a new golden age. True, after 1979 there began a “*de facto* privatization of agriculture” in China, accompanied by skyrocketing fertilizer use, which boosted yields and output considerably (Wen and Li, 2007; Lin, 1992). Cereal production rose from about 300 to 500 million tons a year between 1979 and 1996 (Wen and Li, 2007). But yield growth in wheat – China is the world’s largest wheat producer – has stagnated, and output declined by eight percent between 1998 and 2004 (Lohmar, 2004). In rice, by the 1990s yield growth had slowed to less than half the pace of the 1960s, and output declined by four percent. China’s soy imports exceeded domestic production for the first time in 2003 (Defeng, 2000; People’s Daily, 2004; Brown, 2009). However one cuts it, China does not appear poised to launch an agricultural revolution of the sort we have known in the history of capitalism – one that not only feeds the ascendant power, but *leads* the system to new phase of material expansion. Nor does China appear to be initiating the kind of “external” agricultural revolution that characterized Dutch power in the Baltic, or British power in the Caribbean and South Asia (Moore 2007, 2010a, 2010b, 2010c).

CONCLUSIONS

Cheap food has always been central to the sustained revival of accumulation in the modern world-system. It was no coincidence that the Dutch, British, and Americans pioneered epoch-making agricultural revolutions that not only fed domestic proletariats cheaply, but provided a model for advanced capitalist agriculture in general. Today, capitalism’s capacity for re-establishing the conditions for cheap food in the present conjuncture has reached an all-time low. Neither the agencies of the corporate food regime, nor Chinese farmers, are poised to effect one of these quantum leaps in the food surplus that would feed the world’s laboring classes at lower cost.

We can be sure of one thing. The conditions that underpinned neoliberalism’s signal crisis in 2008 have not gone away. To paraphrase Rupert Murdoch, the solution to the crisis is \$20/barrel oil, and its functional analogues in food and raw materials (quoted in Harvey 2003: 150). But this solution does not appear to be forthcoming. This has everything to do with the hegemony of finance capital – the primacy of the circuit M-M+ as the gravitational field for (non-fictitious) commodity production. The issue is therefore only secondarily one of speculation.

Rather, it is primarily one of financialization's appropriation and exhaustion of the last frontiers. These frontiers were the basis for productivity revolutions, and therefore meaningful reforms within the capitalist order. This appropriation has unfolded through the equalization of profit-imperatives across *all* sectors of the capitalist world-ecology, driving socio-ecological asset stripping to such an extent that it has undercut the world-historical basis for a Polanyian counter-movement towards the self-protecting society (1957). Finance capital's drive to make all parts of the capitalist world-ecology commensurable with one another has reshaped the global determination of profitability – Nebraska corn farmers now compete not against other farmers so much as they do against Goldman Sachs, ExxonMobil, and Microsoft, but above, against Goldman Sachs.

We have noted that one pillar of the neoliberal golden age (1983-2007) was a series of appropriations – oil frontiers in the 1970s, deruralization in China, cheap metals from Russia, and above all, cheap food from the Green Revolution and later, debt-driven trade liberalization. These were not huge frontiers relative to past eras, but finance capital made good use of them. This was accomplished through a quantum leap not only in turnover time but also in commensurating all of reality into generic income streams (Bryan and Rafferty, 2006; Leyshon and Thrift, 2007). As a project immanent to neoliberal financialization, commensurability was so useful because it allowed capital to *control* production more rigorously and therefore to extract rising surplus value even in the absence of a productivity revolution. Time-space appropriation and time-space commensuration were dialectically joined.

This was the conjuncture that compelled and enabled neoliberalism to burn through its paltry inheritance of uncommodified energy, water, resources, and labor. This has riveted the attention of green thought and activism. But it is possibly misplaced. We have entered a new era in which capital's *longue durée* strategies of radically simplifying nature are generating forms of uncontrollable diversity. The superweed effect, propelled by financialization as the vanguard of a new phase of radical commensurability, is the world-ecological foundation for the spiral of unpredictable, and ever less tractable, responses that we see today from extra-human nature – superweeds, glyphosate-producing fungi, MRSA staph infections, manifold cancers and autoimmune disorders, avian and swine influenzas.

Since the 1970s, capital has moved so rapidly to appropriate and exhaust the conditions of its reproduction that it is far from clear that capitalism can survive the crises that neoliberalism is provoking. Just to take the most spectacular instance, climate change will so dramatically constrain the possibilities for rising labor productivity in agriculture that cheap food will not return. There are few indicators that finance capital will invest the \$45 trillion necessary to halve greenhouse emissions by mid-century (IEA, 2008a: 3); for that matter, it is unclear if finance capital will allow historically low investment levels in the metal and oil sectors to revive (IEA, 2008b; Hache, 2008). What Charles Bowls (1980) once remarked about the crisis of European feudalism could well apply to late capitalism. To paraphrase, after nearly four decades of using nature as collateral for its debt-financed expansion, the bills came due in 2008 with the interlinked commodity boom and financial crash. Finance capital now appears to be doing what Europe's seigneurs tried to do at the end of the 13th century: find new ways of extracting wealth from the productive economy, removing the surplus necessary for reinvestment, and in the process killing the goose that laid the golden eggs!

Productivity and plunder have been so intertwined that it is impossible to identify an epoch-making technological innovation that did not depend on new fron-

tiers. But frontiers are not merely geographical places. They are socio-ecological relations that unleash a new stream of nature's bounty to capital: cheap food, cheap energy, cheap raw materials, and cheap labor. No phase of capitalism has emerged their absence.

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