



Global Commodity Chains and the Production of Surplus-value on a Global Scale: Bringing Back the New International Division of Labor Theory

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Abstract

This paper offers a critique of mainstream and critical versions of Global Commodity Chain analysis of post-1960s global-economy transformations claiming that they suffer from different types of methodological nationalism. After arguing that the key to overcoming their intrinsic problems is to be found in the critical revision of Fröbel, Heinrichs and Kreye's New International Division of Labor theory, the paper advances a novel account of the structural dynamics of the stratified capitalist world-system developed by Iñigo Carrera (1998). Finally, the paper substantiates its main claims with an analysis of the long-term development of the global semiconductors industry.

Keywords: Global Commodity Chains; Semiconductor industry; Global economic transformation; International division of labor theory



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In the last half century, the global economy has experienced notable changes in the location of industrial activities and hence in the structure of the international division of labor (IDL). These changes have been central elements of the so-called contemporary process of “globalization.” Of crucial significance in this process has been the consolidation of East Asia as a manufacturing powerhouse. Several methodological approaches and theories have emerged to account for the post mid-1960s transformations in the economic geography of global society. Global commodity chain (GCC) analysis and the New International Division of Labor (NIDL) theory are two of such attempts. Both originated from within the same scholarly tradition, namely, World-Systems Theory (WST). Yet, while the former has become part of the mainstream in the fields of economic geography, industrial organization, and development studies, the latter has, after a short-lived success, fallen into the dustbin of intellectual history.

The present paper has two main goals. The first goal is to advance a critique of “chain-focused” analyses of global economic development, crucially those inspired by institutionalist and neo-Marxist views. Secondly, to re-evaluate the analysis of post mid-1960s changes in the spatial location of industrial activities proposed by Fröbel et al. (1980) in their original NIDL thesis, especially the rise of East Asia as the new “workshop” of the world. For these purposes, the paper is organized as follows. The next section reviews the main ideas of leading scholars working within the GCC framework to account for global-economy dynamics and national-development experiences, uncovering their contributions and weaknesses. Section two revisits Fröbel et al.’s main claims regarding those processes and the critiques advanced against them. It also reveals central positive aspects and key problems of their analysis that have been ignored by early critics. Section three puts forward an alternative account of the structural dynamics of the stratified global economy that appropriates key parts of Fröbel’s analysis, while overcoming its shortcomings, in order to contribute to the development of critical analyses of GCCs. Section four presents an analysis of the evolution of the global semiconductors industry that illustrates the main points advanced in the previous sections, thus supporting the general claims made there. A final section closes the paper with its main conclusions.

Global Commodity Chains and Uneven National Development

As noted above, GCC analysis emerged as an attempt to account for the structure and dynamics of the global economy within the tradition of WST: i.e., to explain the long-term reproduction of the stratified capitalist world-system and the trajectories of national societies within it (Bair 2005, 2013; Selwyn 2012: 207-8). Unsurprisingly, it did not take long for this analytical tool to become popular in a variety of social sciences studying the contemporary process of economic “globalization” and associated changes in the location of industrial productions and national-

development experiences. In particular, for the study of East Asia's structural transformation throughout the 1970s and 1980s, in view of the inability of dependency theory-inspired branches of WST to account for such process (Gereffi 1990; Storper 2008).

Defining development as the process of upgrading the mix of economic activities towards technology- and, crucially, skill-intensive ones (Gereffi 1990: 524), as the East Asian nations undoubtedly were managing to do, GCC analysis attempted to provide a methodological framework to study the micro- and meso-economic foundations of the process of national economic development. GCC analysis, in this instance, focused on the forms of integration of individual capitals in the global market – i.e., how they relate to other firms and contribute to the creation and appropriation of the value of commodities. This framework provided a hierarchical typology of individual capitals (and eventually of petty commodity producers) and a mapping of their progression within the world-system; and thus a way to represent its stratified structural dynamics (Selwyn 2012: 209).

Due to its micro/meso-level perspective, GCC analysis soon found practical use; it offered a conceptual framework for sectoral studies and for the design of public policies directed at fostering firm's upgrading capabilities and, hence, national development. Yet this approach to the study of economic development has not been without issues that bring into question its transformative power. First, "chain focused" analyses tend to take the direct, non-market relations amongst firms (i.e. the structure of governance of commodity chains) as the underlying force accounting for their economic relationships, even though the former are the concrete forms through which the latter come about. They thus misrepresent the nature of inter-firm relations and the forces explaining the flow of surplus-value amongst them in the process of differentiation of industrial capital that results from the immanent laws of capitalist competition.¹ Secondly, and the focus of the critique advanced here, the GCC framework provides only a formal account of *how* inter-firms relations reproduce the structural dynamics of the stratified world-system (i.e. of the spatial dynamics of the global economy) but not of *why* this occur in the way described, which is ultimately needed to understand national developmental experiences and, to devise political actions tending to affect them (Selwyn 2012: 207).² Hence, despite its theoretical origins in WST, the GCC framework has been used by mainstream political institutions (World Bank, World Trade Organization, UK and U.S. international development

¹ See Iñigo Carrera 2008: 137-48 for the general-theoretical development; and, Starosta 2010a, 2010b for a discussion in the context of GCC analyses of contemporary organizational changes in industrial production.

² See Starosta (2010b: 555-7) for an outline of the critique of the GCC literature offered below.

agencies, among others) as much as by their irreconcilable critics (Selwyn 2015: 257; Bair 2013: 3-4).

Indeed, notwithstanding the widespread and variegated use, the mainstream version of GCC-focused analysis of national, regional and global development has, as much as the rest of the development economics discipline, increasingly revolved around an institutionalist view of state/market dynamics. Effectively, when accounting for the specific participation of national firms and economies in the global production networks developed since the mid-1960s by industrial multinational corporations (MNCs) attempting to reduce production costs, crucially East Asia's upgrading dynamics, leading scholars have gone from a focus on state policies and institutions (Gereffi 1995: 124-6; Humphrey 2004) to rather unspecific non-state institutional and cultural factors allegedly determining the quality and quantity of local entrepreneurs and firm behavior (Gereffi 1998: 58-9). The question that is not answered in these analyses, however, is why it was only then that industrial capitals began to find it profitable to pursue the international separation of productive activities leading to a new kind of IDL, and why East Asian institutional settings only then became conducive to economic development (see Grinberg 2013 for a critique of the institutionalist literature).

Picking up these tensions in mainstream versions of GCC analysis, leading young scholars working with the framework to analyze contemporary global-economy transformations, crucially the trajectories of "non-core" regions, have begun to propose forms for reclaiming it for critical social theory. Thus, Bair (2005, 2013) and the other contributors to this Journal's special issue on the topic (*JWSR*, Vol. 20(1); see, e.g., Quark 2013) suggest that the way forward is to bring WST back into the heart of GCC analysis: i.e. to understand GCCs as conduits for the reproduction of a stratified global political-economy rather than as developmental opportunities. Undoubtedly, this strategy points in the right direction. Yet, it should be taken cautiously. Despite claims to the contrary, many, though certainly not all, WST analyses reproduce mainstream methodological nationalism while considering, often implicitly, the capitalist *world-system* as the outcome of the politico-economic interaction of *nation-states* rather than understanding these as the former's modes of existence.

From a perspective that has points in common with that of Open Marxism (see, e.g. Burnham 1994), Selwyn (2012: 2015), in turn, claims that, to the degree that it fails to see the specificity of capitalist social relations in the production of surplus value, WST becomes part of the problem and, hence, cannot be part of the solution. In a series of papers in the *Journal of Economic Geography*, this author develops the point and proposes an alternative solution.

The problems with WST and GCC are cumulative: a limited understanding of capitalism gives rise to an overly exclusive focus upon technologies and managerial strategies in the understanding of innovation which then obscures labor from sight. Noting these numerous weaknesses might lead some to reject the GCC framework as possessing any methodological utility. However, the ways in which GCCs are structured and connect capital and labor in one part of the world with capital and labor in other parts of the world means that they are real determinants of labor regime formation, local capitalist configuration and its developmental trajectory. [...]. What is required is a methodology that enables us to investigate whether and how workers' actions impact upon the accumulation process and contributes to the shaping of wider developmental processes. (Selwyn 2012: 215-7)

In other words, in his first paper Selwyn, like Open Marxism's key contribution, proposes to include labor-capital antagonistic relations—i.e. the allegedly open-ended and contingent process of class struggle—as a “co-determining” factor of national-level technological development and therefore of firms' upgrading pathways. Yet, as his second paper makes it clear, “[c]lass relations cannot be understood only as existing within nation states (or workshops), but must be conceived of as global social relations. That is, just as the most powerful units of capital (lead firms), with the assistance of hegemonic states and international institutions, seek to organize their relations with subordinate units of capital, so too do they seek through the governance of their GCCs to organize global capital-labor relations” (Selwyn 2015: 267-8).

Again, this approach certainly constitutes a parallel move in the right direction. Yet, it falls a step short. On one hand, Selwyn (2012, 2015) rightly argues that the production of surplus-value and the valorization of capital take place on a global scale. On the other, this author misses that class relations cannot, at the same time, be considered as co-determining forces of national developmental processes, and hence of the world capitalist economy. For, irrespective of the historical processes in which they are constituted, in capitalism, social classes, and hence their antagonistic relations, are continually reproduced in the process of capital accumulation, which is global in terms of its immanent structure, long-term potencies and general dynamics, and national in its forms of realization (Marx 1976: 723-4). Put differently, Selwyn's approach is unable to account, other than with references to seemingly conjunctural processes and subsequent path dependence, for the determination of the relative strength of social classes and the outcome of their interaction in each national section of the world market.

Indeed, the historical specificity of the capitalist mode of re-producing human life resides in that the organization of social labor—i.e. the allocation of each of the individual fragments

that constitute society's total capacity to produce use values—is regulated autonomously, through the exchange of the products of individual capitals that pursue no purpose other than maximizing their valorization and expansion; their never-ending augmentation. In other words, the thing-like general social relationship amongst private and independent producers (commodities/money) develops into the automatic subject of social reproduction (capital), and this process takes the historically specific form, and becomes a by-product, of the accumulation of the total social capital. With social labor organized under this form, free individuals not only have to put all their senses, conscience and will to produce for markets. They also need to represent in the market the exchangeability of the commodities they own. Hence, in the process of social reproduction they relate to each other not as individual persons but as *personifications* of commodities who recognize each other as owners of private property (Marx 1976: 178-269; Postone 1996: 75-83; Iñigo Carrera 2014: 557-59).

Organized as a process of capital accumulation, social reproduction becomes, for the first time in human history, a universal, worldwide process. Not only the impersonal character of market transactions allows for the interaction of geographically-dispersed individual fragments of social labor (i.e. productive units in the form of individual capitals). The boundlessly expansive nature of the process of capital accumulation itself necessarily results in such ever-increasing interaction. Yet, due to the private form under which social labor is realized, capital accumulation started, and has so far existed, as formally independent, though fully interdependent, national processes that constitute politico-economic (i.e. accumulation) units in themselves. The world market, then, is not the context in which individual capitals and national economies develop, or simply the sum total of national markets interconnected through flows of commodities, money-as-capital and labor-power, as mainstream economics considers it. It is the other way around: national markets/economies are integral parts of the totality constituted by the world market/economy, and hence the forms in which the process of capital accumulation on a global scale realizes itself. International movements of commodities and “factors of production” are concrete forms through which the global unity of capital accumulation comes about (Marx 1976: 222, 247, 702, 929; Fröbel et al. 1980: 8; Wallerstein 1983: 18-9; Burnham 1994: 226-9; Postone 1996: 100, 149, 258; Iñigo Carrera 2008: 148-9).

Intra-class cooperative relations and inter-class antagonistic interactions are political (i.e. direct as opposed to market mediated) forms of organizing the allocation of the individual fragments of social labor. Yet, contrary to Selwyn (2012) and Open Marxism, they are the product of the actions of individuals who are themselves personifications of commodities, and hence forms of realization of the general social relationship of capital accumulation. Put differently, class relations are the form through which individual sellers and buyers of labor-

power—the commodity whose consumption by capital results in the creation of wealth, value and surplus-value—engage in the collective trading of that commodity in order to maximize/minimize its market price; thus subsuming their inherently competitive relationship as sellers/buyers of the same commodity into a cooperative relationship that clashes with that of those at the other pole of the market relationship (Marx 1976: 373-413; Iñigo Carrera 2008: 95-105).

The historical specificity of the *capitalist* state thus develops in this process as the direct representative of the process of capital accumulation in its unity, assuring the normal consumption of labor-power and its reproduction with the attributes needed by the total social capital. And, by virtue of its very nature, the capitalist state subsumes all the *direct* actions necessary for the normal development of the process of capital accumulation beyond those related to the reproduction of labor-power—e.g. the partial or complete centralization of capital; the political representation of national processes of capital accumulation in the global economy. These actions, however, do not develop as planned, consciously regulated processes. Rather, as any other necessary form of realization of the autonomously regulated process of capital accumulation, they develop through profitability crises and class-based political conflicts (Marx 1976: 779-80; Iñigo Carrera 2008; 106–108).³

In sum, the actions and antagonistic interaction of social classes, as well as the nation-state policies in which they manifest themselves, should not be seen as autonomous forces that (co)determine national developmental experiences, as in policy- and politics-centered analyses of GCCs. Rather, they should be understood as forms of realization, politicized mediations, of the global process of capital accumulation, through the specific determination of each national

³ This analysis of the capitalist state shares with other Marxists analyses the view that the state is a non-neutral institution, as in mainstream contractualist theories, that yet appears as autonomous of particular interests. However, the analysis of the state pursued here departs from these Marxist approaches in various ways. Crucially, this Marxist tradition that goes from structuralism-functionalism (Poulantzas 1969) to Open Marxism (Burnhman 1994), through the German “state derivation” school (Hirsch 1978), does not understand the state as a concrete form of realization of the most general direct social relationship amongst commodity owners—the class struggle—through which their general indirect social relationship—capital accumulation—comes about. Rather, Marxist analyses, explicitly or not, regard the state as an institution whose necessity springs independently of the process of capital accumulation, yet is formally subsumed by capital to fulfill several functions the help reproduce the system as a whole while gaining some de facto autonomy. Hence, the capitalist state is not understood there as a necessary form of realization of the normal reproduction of capital accumulation, and of its historical potencies, but as a second-best, contingent solution for capital to address the crisis tendencies and contradictions inherent in the process of accumulation—e.g., inter-capital competition, fall in the rate of profit, the power of labor. Even Open Marxism authors who regard the state as a mode of existence of fetishised social relations fail to see the inherently antagonist capitalist class relations that take form in the state as modes of existence of the general social relationship of capital accumulation. In other words, they fail to recognize the thing-like general social relationship amongst commodity owners as the alienated subject of social reproduction and social classes as collective personifications of the commodities in which the capital relation is embodied.

portion of the total social capital, which includes the political representation in the world market, with its specifically determined strength, *vis-à-vis* other national portions of global capital (Iñigo Carrera 2008: 150-64).

Hence, the issues raised in this section against “chain-focused” analyses of global economic development are not directed at the methodological research framework, but to the theories incorporated in it. Nevertheless, as Bair argues (2005), the framework’s meso-economic orientation is partly to blame insofar as it tends to divert attention from the analysis of the general dynamics of the process of capital accumulation (see, e.g., Mahutga 2013). Consequently, authors working with it, crucially those discussed here, fail to understand GCCs as economic forms of realization of the autonomously regulated process of capital accumulation on a global scale, which comes about through the IDL and both global- and local-level political developments.

The NIDL and Late Industrialisation⁴

It was argued in the previous section that, as a theory-light framework, GCC-focused analyses of regional uneven development can be filled up with various theoretical contents. The mainstream branch of GCC analysis fills it with firm- and policy-centered institutionalism that fails to account for the inner dynamics of global capital accumulation. Alternative GCC analyses like those of Bair (2013) and colleagues (see, e.g., Hough 2011; Quark 2013), as well as those of Selwyn (2012, 2015) fill it with different versions of critical social theory that, though moving beyond firm- and policy-centrism, remain, intentionally or not, focused on national-level, politico-economic processes as underlying explanatory factors. In this section, it will be argued that the key to overcoming the limits of these versions of GCC analysis of contemporary global-economy transformations, crucially the process of “globalization” and East Asian developmental experiences, is to be found in the critical revision of the work of Fröbel et al. (1980). Their NIDL theory was consolidating as the leading political-economy branch within WST when the GCC analysis came on stream and dethroned it. Yet their views are largely ignored by authors working with the latter approach. The next section will put forward an account of those processes that builds on the insights on the Marxian critique of political economy reviewed in the previous section, incorporating the rational kernel of Fröbel et al.’s theory but leaving aside its problematic tenets.

⁴ This section is based on, and elaborates from, Grinberg (2011: 160-5). Early versions of the section were written in collaboration with Guido Starosta.

The main novelty, and key contribution, of the NIDL theory developed by Fröbel et al., resided in that the fast post-1960s expansion of “developing-country” manufactured exports that resulted in the overhauling of the economic geography of industrial production was not regarded as being simply the product of nation-state economic policies trying to promote them, or the planned design of lead firms (i.e. MNCs) attempting to cost-cut through off-shoring or subcontracting, as in mainstream GCC analyses. Rather, these authors argued, it resulted from changing objective conditions in the process of valorization of industrial capital on a global scale. First, there had been significant improvements in communications and transport methods leading to strong reductions in the costs of spatially dispersing productive activities. Secondly, there had been large advances in the simplification of manual labor processes in manufacturing production, as a result of the intensification in the technical division of labor, which could then be performed by lower-skill workers. Thirdly, there were large industrial reserve armies (i.e. surplus populations) in the “periphery” of the world-system as a consequence of technological developments in the primary sector, such as the Green Revolution, and rapid population growth. According to these authors, these “new” objective conditions allowed industrial capital to relocate several production processes to “non-core” countries and take advantage of the low-cost labor-power available there by establishing world-market factories.

Hence, the fast growth of manufacturing production and exports, and of national output, in the East Asian Newly Industrializing Countries (NICs) during the 1960s and 1970s is understood by Fröbel et al. (1980) to have resulted from the combined effect those three processes, however limited the long-term developmental potencies of this modality of capital accumulation were thought to be by the authors. Though the vast pool of relatively cheap and unskilled labor existing in East Asia made the region *particularly* suitable for the development of world-market factories, Fröbel et al. (1980) did not consider these processes to be *specific* to that region. Conversely, these authors argued, world-market factories were by the mid-1970s establishing and consolidating in most of the periphery of the world-system.

Although these hypotheses were at the center of scholarly debates in the fields of economic geography, industrial organization and development studies until the late 1980s, they have been abandoned after receiving a wide range of criticisms on both theoretical and empirical grounds. First, as critics have rightly stressed, the initial formulations of the NIDL theory contained generalizations which cannot account for evident differences in national/regional developmental trajectories that would unfold subsequently (Jenkins 1984; Henderson 1989). Contrary to the predictions emerging from their analysis of the global economy, the development of world-market-oriented industrial sectors would not spread evenly across the periphery of the capitalist world-system. Even during the period covered by their study, 1960s and 1970s, while

the East Asian NICs, the so-called Tigers, were becoming major producers of garments and electronic goods for world markets, South American industrial sectors, though not those of Caribbean Basin countries (Grinberg 2010), remained largely unaffected by these global-economy changes and continued producing mainly for domestic consumers, even if some countries in the region also began to host Export Processing Zones (e.g. Brazil). Secondly, also contrary to the predictions offered in Fröbel et al.'s early analysis of the process, some of the countries which developed world-market-oriented manufacturing sectors would go through continuous industrial deepening/upgrading, labor-force up-skilling and steady increases in real wages. In this sense, the impressive developmental and growth record of the first generation of East Asian NICs openly undermines a theory which made export-oriented industrialization (EOI) based on low-waged, unskilled labor-power the center of its argument, as pointed out by critics (see, e.g., Gereffi 1990). Fourthly, and closely connected to the latter point, changes in the IDL have been more variegated in terms of nations' participation and firms' commercial strategies than envisaged in Fröbel et al.'s formulation of the NIDL theory (Sayer 1985; Henderson 1989; Gereffi 1995).

Yet, despite these untimely problems, the original NIDL theory got it right in one crucial point. Contrary to what is usually claimed by some of their critics (see, e.g., Jenkins 1984; Schoenberger 1988), MNCs were considered by Fröbel et al. (1980: 46) not as the underlying driving force but as “institutional” *mediations* of the structural changes that were transforming the geographical location of productive units and the direction of capital and trade flows. In effect, Fröbel et al. (1980: 8, 24-5, 44-8) rightly related the emergence of the NIDL, and the specific GCCs in which it has materialized, to the process of self-valorization of capital, and hence the production of surplus-value, on a global scale. Nevertheless, as Iñigo Carrera points out (2008: 66), they failed to understand this process as a historical form of realization of the development of society's productive forces, and thus exclusively focused their analysis on the de-skilling aspects of technological developments (Fröbel et al. 1980: 25).

As a consequence of that, the authors failed to notice that neither the three “pre-conditions” they pointed out, nor the development of industrial productions for world markets based on them, were processes exclusive of the post-late-1960s period. As the “industrious revolution” metaphor reveals, Japan's pre-1960s industrialization had been similarly based (Sugihara 2003). What was then new, however, were the replacement in several industrial productions of the increasingly expensive Japanese labor-force with that of its poorer neighbors, including some of its former colonies; and, crucially, the rapid advance of computerization and robotization of industrial productions which, directly or indirectly, multiplied the scope of those

three conditions, crucially the variety of simplified labor-processes that could be performed by a relatively cheaper and lower-skilled workforce.

Indeed, though missed by their critics, the main problem with Fröbel et al.'s (1980) approach to the NIDL, and the cause of their inability to grasp fully the transformations at stake, including its long-term potencies and the above-mentioned regional disparities, was that they failed to properly locate their origin in the increased mechanization/automation of large-scale industry and its impact upon the differentiation of the skills of the different parts of the industrial labor-force, rather than in the intensification of the manual division of labor (Iñigo Carrera 2008: 66; Grinberg 2014: 732). Hence, the authors missed that even in the labor-intensive sector they studied in detail, the garments industry, unskilled manual workers were incipiently performing tasks as appendages (feeders) of the automated machinery (sewing machines). In other words, it was not the tool but the raw material what largely remained in the hands of manual workers. And, though they realized that automation in the capital-intensive textile industry was having a similar effect on the IDL, they related the process to differential legal restrictions on working hours and production runs favoring the “economical” use of relatively expensive means of production rather than to the transformations in the productive subjectivity of the global collective worker (Fröbel et al. (1980: 150-6), as will be argued in the next section. It was that problem that led the author's to one-sidedly focus on a single, and arguably the most superficial, manifestation of the NIDL (i.e. the relocation of unskilled-labor-intensive activities to cheap-labor countries), as their critics rightly noticed (Jenkins 1984; Sayer 1985; Schoenberger 1988; Henderson 1989).⁵

This section advanced a critique of Fröbel et al.'s analysis of post-1960s developments in the IDL, stressing its main contributions and uncovering the source of its problematic tenets. The next section will put forward an account of the structural dynamics of the process of global capital accumulation and of the formation and development of contemporary GCCs that starts from the analysis of the forms of production of relative surplus-value on a global scale—i.e., from the analysis of the manifestations of the Marxian Law of value on the world market. This account of global political-economy developments attempts to address the theoretical concerns of critical analyses of GCCs like those of Bair and colleague (2005, 2013) and Selwyn (2012, 2015).

⁵ Interestingly, Gereffi (1995) recognizes the development of flexible automation as being at the center of the technological changes at stake in the formation of the NIDL. However, following Kaplinsky (1989), he focuses on the impact that technological changes in production processes were allegedly having on plant sizes and not on the industrial labor-force skills requirements. Moreover, empirical studies have subsequently shown that the development of flexible automation only reduced production scales at product level (mainly by reducing the time setting and calibrating the systems of machinery) but not at plant and firm level (see, e.g., Alcorta 1999).

Global Capital Accumulation and the NIDL⁶

As every concrete form of realization of the process of capital accumulation, its global unity is only fully developed in the process of production of relative surplus-value. Effectively, beyond the expansion of markets, which requires new consumers to have sold something first, it is in attempting to reduce the value of labor-power, and thus increase the amount of surplus-value produced in a given period of time, that the total social capital searches for places where particular natural or historical conditions allow it to reduce the cost of producing the commodities that directly or indirectly reproduce the labor-force without investing in productivity-enhancing technological development. As is broadly acknowledged, this process originally centered on the search for regions where, due to non-reproducible natural conditions, raw materials could be produced at a lower cost, or at all, which gave place to the classical IDL (Marx 1976: 579-81; Howe 1981: 91-4; Iñigo Carrera 2014: 562-3).

This form of subsumption of portions of the planet into the global circuits of accumulation, however, was ridden with a structural contradiction that determined the long-term pattern of capitalist development there. If, on the one hand, the total social capital managed to enhance its valorization capacity by reducing the value of labor-power, on the other, this was partly offset by the drain of social wealth in the opposite direction towards the owners of the natural conditions of production in the form of ground-rent (Marx 1981: 779-916), regardless of how these social subjects were constituted in the historical process of appropriation of the new territories. From being simply a source of cheap primary commodities, these spaces of accumulation thus became also determined as sources of ground-rent for industrial (productive) capital (Iñigo Carrera 2008: 150-6; Iñigo Carrera 2014: 562-3; Grinberg and Starosta 2014: 241-2).

Until the approximately 1930s, the process of capital accumulation through ground-rent appropriation generally revolved around the production, transport and international trade of one or various primary commodities. Then, whenever colonial states did not directly appropriate rent-bearing lands or monopolize foreign trade, capitals invested in those and related sectors, as well as foreign creditors, became private landowners' main partners in the appropriation of the local ground-rent. But, from the 1930s, and crucially after the end of the Second World War (WWII), this position began to be taken over by industrial capital invested in manufacturing, in whose valorization cycle originated the bulk of the surplus-value that formed the ground-rent. The so-called process of import-substitution industrialization (ISI) that consolidated in most

⁶ This section is based on, and elaborates from, Iñigo Carrera (2008); Grinberg and Starosta (2009); Grinberg 2013).

primary-commodity producing countries between the 1930s and 1950s, reached its peak during the commodities boom of the 1970s, and reproduced in a limited form thereafter, has been the paradigmatic form through which this specific modality of capital accumulation has come about (Iñigo Carrera, 2013: 149-52). As any other politico-economic manifestation, these regions' specific participation in GCCs (mainly as producers of raw and semi-processed materials) has been a form of realization of this specific modality of capitalist development. Unlike primary-sector capitals, industrial firms other than those processing raw materials (both foreign- and domestic-owned) have almost exclusively produced for the small-sized, yet protected domestic markets while their capacity to valorize normally (despite their small scale of production and the use of obsolete technologies) has depended on their ability to appropriate ever-increasing amounts of ground-rent.

As every concrete form of realization of the production of relative surplus-value on a global scale, the IDL has also been subjected to the former's continuous development. During the last forty years or so, both have experienced profound transformations as a result of the process of computerization and robotization of large-scale industry, especially since the microelectronics revolution of the mid-1970s. Though the process is inherent to the capitalist development of society's productive forces through the system of machinery (Marx 1973: 632; Marx 1976: 492-553; Iñigo Carrera 2014: 564), this leap forward in the automation of industrial activities— i.e. in the transformation of the productive attributes of individual labor into productive attributes of the collective laborer that yet exist as powers of capital objectified in the machinery—has greatly accelerated the internal differentiation of the collective worker of large-scale industry. On one hand, these technological transformations have involved the further expansion of the productive attributes of wage-laborers performing the more complex parts of the work-process, both of those involved in the vanguard development of scientific knowledge and its technological application and of those in charge of organizing the material unity of increasingly large and complex production processes. The cost of producing and reproducing these kinds of wage-earners has thus tended to increase. On the other hand, the automation of production processes has rapidly simplified the productive functions of most manual laborers remaining in the shop-floor as operators or appendages of the increasingly self-calibrating and self-adjusting machines, whenever it has not replaced these altogether and transformed workers into a surplus for the process of capital accumulation. Tacit, particularistic skills gained through lengthy on-the-job experiences of learning-by-doing have been replaced by a set of general skills acquired through formal technical education which, in most cases, have required a shorter period of overall training and have rapidly become trivialized, standardized and routinized. The cost of producing and reproducing this type of wage-laborers has thus tended to decrease. Moreover, the

new technological conditions have themselves generated a multitude of production processes still subjected to the manual intervention of low-skilled laborers, like the assembly, testing and packing of electronic micro-components and appliances (Aglietta 1979: 122-30; Coriat 1992; Balconi 2002; Iñigo Carrera 2008: 56-9; Grinberg and Starosta 2009: 771; Grinberg 2013: 178-82).

In terms of their general content, potencies and dynamics, those transformations in the productive attributes of the different portions of the collective worker of large-scale industry have been global. Yet, they have resulted in a novel differentiation of national spaces of accumulation and in the reconfiguration of the IDL, and hence of the production of surplus-value on a global scale (Iñigo Carrera 2008: 55-93; Iñigo Carrera 2014: 565; Grinberg and Starosta 2009: 771-2; Grinberg 2013: 180-1). Effectively, based on those transformations in the labor-process, and the associated revolution in communication and transportation methods, industrial capital has become increasingly able to disperse spatially the component parts of the labor-process according to the most profitable combinations of costs and productive attributes of the different national fragments of the global collective worker, rather than out-rightly engaging in the politically-expensive differentiated reproduction within the industrially-advanced countries, where the technological developments originally generated; thus giving birth to the NIDL.⁷ Regardless of individual capitals' national origin, and the changing forms and structure of the GCCs through which it comes about, the NIDL has, directly or indirectly, reduced the costs of reproducing the global labor-force and has thus increased the mass of surplus-value available for the valorization of the total capital of world society, the active *subject* of the process of accumulation. In other words, it has enhanced the process of capital accumulation on a global scale (Fröbel et al. 1980: 46; Iñigo Carrera 2008: 63-72).

In general terms, the formation of global chains of production of surplus-value has been driven by the location of simplified labor-processes in regions where local labor-forces are not only *relatively* cheap but, also, whose specific productive attributes include the disciplined subordination to centrally- and hierarchically-organized collective labor-processes and the habituation to repetitive manual work during long hours. This has been the case of working classes whose formation occurred in wet-rice cultivating societies, like those of East Asia.⁸

⁷ Transport and communication methods have not developed independently of the changes leading to the conformation of the NIDL. First, the technologies behind the development of transport and communication methods have been the same as those leading to the automation and computerization of industrial labor-processes. Second, industrial capital's necessity to spatially disperse productive activities has constituted a key pulled factor for the development of labor productivity in those areas.

⁸ Wet-rice cultivation is highly labor-intensive, notably during implantation and harvest periods, and, crucially, whatever their extent and complexity, irrigation systems require – unlike dry-land agriculture or husbandry – the

Those characteristics have made the East Asian labor-force particularly productive when working as an appendage of the increasingly automated machinery systems or in manual assembly operations (Iñigo Carrera 2008: 65-72, 76-83; Grinberg and Starosta 2009: 772; Grinberg 2013: 182). It is this historical background, rather than the alleged initial egalitarian distribution of landed property suggested by Selwyn (2012: 216) following Kay (2002), that has determined the region's central place in the NIDL and its consolidation as a global industrial power (see Grinberg and Starosta 2009 for a detailed critique of this argument). As noted, the emergence of the Japanese textile industry as a global leader in the early twentieth century, and its consolidation in the post-war period, had already resulted from similar *skill-replacing* technical changes (the replacement of mule-spinning with ring-spinning machinery), well before that post-1960s developments in equipment automation greatly accelerated the process (Silver 2003: 87-9). Similarly determined was the emergence and growth of the Japanese electronics industry throughout the 1960s, as will be shown in the next section for the case of the components sector.

As any other global-scale economic process, the NIDL has come about through the consolidation of a variety of national- and international-level political processes, in particular of specific nation-state policies and institutions, described in great detail by neoliberal (World Bank 1993) and statist/institutionalist scholars (Wade 1990), and specific class and international relations, as described by their Marxist counterparts (Hart-Landsberg, Jeong, and Westra. 2007). Contrary to GCC-focused scholars reviewed in section 1, these political process did not determine the specific characteristics of capital accumulation in East Asia, and the region's rapid industrial upgrading and mode of participation in the IDL through GCCs; they simply mediated its transformations and development. Thus, in those Northeast Asian countries (plus Singapore) that around the early 1960s became sources of relatively cheap and disciplined labor-power to perform the simplified parts of industrial labor-processes, state policies and political/economic institutions concentrated on the creation and subsequent reproduction of the necessary conditions for industrial capital to accumulate under that new specific modality. Despite different national variations, all East Asian "developmental" states not only facilitated the outward-orientation of the industrial sector while centralizing capital in productions with large scale economies and nurturing private infant industry. They also pursued decisively the repression of the labor-force while upgrading worker skills. In other words, policies and institutions associated with East

"cooperation at various levels between the farmers in a single water control unit" (Bray 1986, 67). Moreover, intensive agriculture has also led to particularly marked (hierarchical) gender division of labor, as it drew male labor away from household activities and resulted in the large use of heavy ploughs (Baserup 1970; Alesina, Giuliano and Numm 2010). See Quark (2013) for a WST-inspired analysis of GCCs that considers the structuring role of gender relations.

Asians “developmental” states and EOI experiences, and local firms’ chain-participation patterns, have been the political and economic forms of realization of processes of capital accumulation based on the use of a relatively cheap and disciplined workforce for simplified industrial activities, through which the production of relative surplus-value on a global scale has come about (Grinberg and Starosta 2009: 772-3; Grinberg 2013: 182-3; Grinberg 2014: 718-31). On the other hand, in those countries that became exporters of capital to, and importers of commodities from, the East Asian NICs, economic policies changed in the direction necessary to mediate the transformations at stake. And, so did the discourse and actions of those international institutions of governance that have expressed more directly the material unity of the process of capital accumulation on a global scale (e.g. World Bank and World Trade Organization).⁹

As mentioned above, processes behind the NIDL have not been static, as Fröbel et al. (1980) suggested in their original theorization on the topic, but have resulted in a wide and constantly changing range of combinations of relative cost and characteristics/productivity of national labor-forces. First, though the NIDL initially centered on the international relocation of unskilled-labor-intensive processes, like clothing, footwear and microelectronics assembly, the aforementioned skill-replacing technological changes have increasingly affected relatively complex processes and industries, like chemical, steel, shipbuilding, motor-vehicles, and microelectronics production/design (Coriat 1992; Hasegawa 1996; Ernst 2001; Brown and Campbell 2001; Balconi 2002).

Secondly, while surplus populations in the most advanced East Asian economies became exhausted, domestic labor-forces began to be reproduced, increasingly through state mediation, under new conditions which, in turn, have enabled them to perform increasingly more complex activities. As this process of skills upgrading occurred, the conditions of reproduction of industrial workers improved substantially. In some cases, the transformations came about smoothly (e.g. in Japan). In others cases, crucially when the process had to be done relatively rapidly, they were realized through working-class strong activism leading to political opening (e.g. in late-1980s South Korea). Thus, contrary to Selwyn (2012, 2015), local-level processes of class struggle, and working-class agency, have been the political forms through which the reproduction of industrial workers’ productive attributes have come about, and hence the production of value and surplus-value in national economies, as a result of the development of

⁹ Geopolitical processes cannot account by themselves for the transformation of East Asian economies. Briefly put, they cannot explain the, initially reluctant, U.S. support for EOI rather than ISI programs as originally envisaged for the region. See Grinberg (2014: 714-15).

the NIDL and the production of relative surplus-value on a global scale (see Grinberg 2014:728-30 for the South Korean experience).

Thirdly, new sources of relatively cheap and disciplined labor-power became available in the region and in other non-core parts of the capitalist world-system. Productions in specific industrial branches and subsectors, then, expanded in some countries while contracting in others where new and more advanced activities developed, following a rhythm determined by the evolution of those factors—i.e. the technological changes and the relative cost and productivity of national work-forces. The multilayered, dynamic structure that thus emerged has not, however, negated the original characteristics of the NIDL, as claimed by many of Fröbel et al.'s critics. Rather, this structure has been a concrete form of realization of the NIDL. The different sub-regional divisions of labor have all revolved around the NIDL's main trend, namely, the relocation of simplified labor-processes to territories where capital has had access to a labor-force that, due to its historical origins as surplus population (largely) working in wet agriculture, has been relatively cheap and highly disciplined, and thus productive under the prevailing technological conditions (Iñigo Carrera 2008; Grinberg 2010, Grinberg 2014: 719-20).

Undoubtedly, the NIDL has come about through a variety of continually-developing, across-the-border inter-firm relations and, in some cases, has resulted in the emergence of global-scale capitals in non-core countries, as rightly noted in GCC-focused analyses (Gereffi 1995; Sturgeon 2008). None of these developments contradict the original characteristics and general trends of the NIDL. They have been its concrete historical forms of realization, broadly determined by the materiality, including proprietary structure, of the productive processes at stake—i.e. whether or not it has been technically and commercially viable for industrial capital to fully or partly fragment them internationally, and whether or not the processes emerging in non-core countries have required relatively large scales of production. In other words, within each GCC, regardless of its structure of governance (and the differences between them have become increasingly slight as noted by GCCs authors like Sturgeon (2008)),¹⁰ production processes have been subdivided and spatially-located according to the inner dynamics of the NIDL, as accounted for a revised NIDL theory. In some industrial branches, crucially where fixed-capital investments, including patent licensing, have been considerable, and minimum efficient scales high relative to total demand, as in the case of semiconductors, the process has

¹⁰ Effectively, unless the chain driver in a “buyer-driven” GCC is simply a commercial capital with no involvement in the production and design processes in a kind of putting-out system, the difference between buyer-driven and producer-driven GCCs is more of form than substance, revolving around a cut-off point in terms of outsourcing/off-shoring activities. The excessive focus of most GCC analyses on the governance structure of GCCs—i.e. on the direct forms of realization of inter-firm indirect relationships – rather than the valorization cycle of industrial capital have led scholars to miss out this point until global-economy trends reduced the differences.

led to the emergence of global suppliers based in non-core countries. In others cases (e.g. garments assembly), production in these parts of the capitalist world-system has been under the control of small capitals. In all cases, differences in the participation in the production of relative surplus-value have constituted the source of inter-firm, and across-the-border, transfers of surplus-value and, hence, the force behind the differentiation of firms' valorization capacities (Iñigo Carrera 2008: 137-48; Starosta 2010a).

Hence, the NIDL has superseded the classical IDL based on the determination of some countries as producers of raw materials for the world market (whether or not this has been accompanied by the development of industrial production for domestic markets as a form of recovering ground-rent by capital) and the concentration of advanced industrial production in others. The presence of distinctive natural conditions, enhancing the productivity of labor in primary productions, or simply permitting them, in the former group of countries played a crucial role in their form of participation in the capitalist IDL. The NIDL has tended to revolve around the international fragmentation of the different segments of the collective laborer of large-scale industry. Some countries have tended to concentrate within their boundaries the great bulk of the skilled labor-force and therefore of the most complex, core-like work-processes, while increasingly incorporating low-skilled, low-wage activities (mainly the United States and the European Union).¹¹ Other countries/regions have been mainly transformed into sources of *relatively* cheap and disciplined labor-power for simplified, though increasingly complex, productions (initially Japan and the East Asian Tigers, and then Southeast Asia, Mexico, China, India, etc.). Yet, a third group of countries has remained participating in the world market as producers of raw materials and, therefore, as sources of ground-rent for global industrial capital (e.g. South America, Africa and Australasia), and, in some cases, as reservoirs of surplus population (Iñigo Carrera 2008).

The NIDL and the Semiconductors Industry

The previous section put forward an account of the post-1960 structural dynamics of the stratified global economy rooted on the Marxian critique of political economy that reveals the nature of processes leading to the formation and on-going development of the NIDL. In this analysis, it was argued that GCCs should be understood as conduits of the IDL, and hence as forms of realization of the production of surplus-value on a global scale. This section examines

¹¹ First, immigration from Third World countries and regional economic integration has helped satisfy the increasing local demand for unskilled labor-power. Second, the replacement of the welfare state with its neoliberal successor has also played its part in increasing the local supply of this type of labor-power (Sassen 1988; Iñigo Carrera 2008, 72-6).

the specific manifestation of those general trends in the semiconductors industry. The experience of this sector is particularly illustrative of those processes. Not only has it been at the center of the skill-replacing technical transformations leading to the NIDL, but also, partly due to its young history, it has been itself a leading sector in the process of international fragmentation of industrial production under its different stages and modalities. Moreover, to a large extent due to the latter, the evolution of this industrial sector has been used as key evidence to disprove Fröbel et al.'s hypothesis (see, e.g. Sayer 1986; Henderson 1989).

The production of semiconductors is at the core of the microelectronics, and thus electronics, industries. The sector emerged in the aftermath of WWII when the transistor replaced the vacuum valve as the main device used to control the motion of electrons and produce electrical amplification through non-mechanical means. Though the industry was originally closely related to the U.S. defense sector, the transistor rapidly became a key input used to manufacture consumer and capital goods incorporating electronically-controlled functions. Already in the early 1960s, however, the transistor was replaced by the integrated circuit (IC), as technological improvements in materials and production equipment permitted the combination of several transistors into one single system. The IC, or microchip, is basically a network of tiny wires fabricated on a surface, connecting transistors that switch on and off for processing data in binary code (Flamm 1985: 39-48; Brown and Linden 2005: 280).

Since its origins, the production of ICs has involved several labor processes which, though functionally integrated and subjected to on-going transformations, are technically disarticulated and thus spatially separable: design of the device's physical structure and functionality; wafer production (the production of a thin slice of a semiconductor material, usually silicon); mask making (the production of the celluloid filaments that contain the microscopic electronic circuits); wafer fabrication (the process by which the circuits in the mask are transferred to the silicon wafer and etched into its surface); assembly of transistors, diodes and integrated circuits into the package; and, testing of the product. These component labor-processes have required different types of equipment investment, specialized inputs and, crucially, labor skills. The design stage is relatively capital-intensive and, crucially, has required highly-qualified scientific and engineering workers. Wafer production, mask making and wafer fabrication, in turn, are the most capital-intensive parts of the production process, needing highly-skilled engineers as well as large numbers of technicians. Wafer fabrication has also required significant numbers of semi-skilled workers, particularly in the operation of diffusion furnaces. The assembly stage has been predominately an unskilled-labor-intensive process, though since the mid-1980s automated equipment has begun to replace manual labor. Finally, the testing stage, although increasingly capital-intensive and automated, has required large amounts

of both technical and unskilled labor-power (Flamm 1985: 48; Henderson 1989: 31-2; Brown and Linden 2005: 284, 296).

Though semiconductor technology was born in the northeast of the United States, the industry rapidly relocated to the west coast, the Silicon Valley, in search for a more cost-effective mix of labor-power:

On the one hand, the industry's demands for unskilled and semiskilled labor was largely filled by [relatively cheap and compliant] immigrant female Latino and Asian (especially Filipino) workers who resided in the San Jose area of the County, some distance from the centre of production in such north-County cities as Palo Alto, Mountain View and Sunnyvale. On the other hand, the industry's demands for highly trained scientists, engineers, and technicians have been filled largely by white male graduates of local universities and colleges who tend to reside in relatively close proximity to the semiconductor plants and laboratories (Henderson 1989: 40).

This "spatial fix," however, would not be the industry's last. A new one, replicating those national-level developments on a global scale, and anticipating those associated with the NIDL, would soon after take place. Taking advantage of the vast local availability of relatively cheap and highly-disciplined, crucially female, labor-power of peasant origin, Japanese industrial capital emerged, already in the late 1950s, as a major producer of simple transistors, mainly used in the local manufacture of radios for export markets. Later on, in the early 1960s, as argued by Fröbel et al. (1980), U.S. firms responded to this competitive pressure by moving their assembly facilities to East and, subsequently, Southeast Asian locations, where a labor-force with similar characteristics as, but cheaper than, the Japanese could be found, or by subcontracting these activities to local firms in the region. A similar process of international relocation of productive activities took place later on, when ICs became the leading semiconductor device used in electronic consumer and capital goods. Trade policies in the United States, including tariff laws, and in the recipient countries were modified to mediate politically these transformations in the IDL. The relatively low transport costs involved in the international movement of ICs, due to their low weight and small size, facilitated this process. Only the two leading captive producers (i.e. producing for internal use), IBM and AT&T, kept their assembly operations in the United States and adopted a higher level of automation than the offshore plants (Flamm 1985: 48-9; Scott 1987: 145-50; Brown and Linden 2005: 282-5).

The place of Japanese capital in the global semiconductors industry, however, would not be limited to the lower end of the GCC, namely, the production of simple transistors used in low-

technology electronic goods. A major transformation of the local industry occurred during the 1970s and by the end of the decade Japanese firms were beginning to compete successfully with U.S. manufacturers in the production of one type of complex ICs: Dynamic Random Access Memory (DRAM) chips. This qualitative change in the economic geography of the global microelectronics industry, however, was not *simply* the result of the bold actions by the Japanese “developmental” state accelerating the process of industrial upgrading, as often argued (see, e.g., Cho, Kim and Rhee 1998, Mathews and Cho 2000). Rather, several other inter-connected forces favored this development in the structure of the microelectronics industry, all of them expressing the transformations in the process of capital accumulation on a global scale reviewed in the previous section.

First, though equipment automation had already begun, thus standardizing/simplifying labor-processes and reducing the tacit skills necessary to perform them, advances were limited and various steps of the production process (e.g. mask etching and wafer packaging) still required the intervention of manual laborers (Flamm 1985: 50-1; Balconi 2002: 366-7). By the 1970s, industrial capital had access in Japan to a large supply of electronic engineers and technicians, though not of PhD-trained workers, at internationally-low cost while the fragmented or dual character of the local labor market, which resulted from the historical origins of the local working-class and manifested itself in the extended use of subcontracting to small capitals by lead firms, assured the provision of the semi-skilled portion of the labor-force at prices substantially below international levels. This was especially so in manual-assembly operations, where young female workers of rural origin predominated. Under these technological conditions, the acquiescence and discipline of the Japanese labor-force, of all types, manifested itself in fast learning processes and large productivity increases. Indeed, contrary to neoclassical economics predictions, Japanese producers were incorporating automated equipment more rapidly than their U.S. counterparts, despite having access to a lower-cost workforce (Linville, LaMond and Wilson 1984: 21, 48, 51; Mody and Wheeler 1987: 371-80).

Secondly, memory chips were (and still are) the most standardized, low-end segment of the ICs market (Tassey 1990: 91; Brown and Linden 2005: 285). They have thus been the segment of the industry with the lowest level of scientific and engineering skills requirements, needing relatively low design capabilities (Cho et al. 1998: 499; Ernst 1998: 29). Unlike in the microprocessor or application-specific ICs (ASICs) subsectors, in DRAMs manufacturing, especially since the introduction of complementary metal-oxide technologies in the late 1960s, most productivity gains have come from “improving process technology and thus learning economies and yields, primarily through continuous improvements on the shop-floor and tedious trial-and-error” (Ernst 1998: 29-30).

Thirdly, Japanese firms were able to exploit the substantial scale economies existing in DRAMs production due to their vertical integration and large stake in the global electronic-goods industry, also resulting from the dynamics of the NIDL (Cho et al. 1998: 494-6).

As noted above, the extended and far-reaching actions of the Japanese “developmental” state, the political representative of the process of capital accumulation in Japan, accelerating the concentration of capital in the scales required and providing protection for local firms during their early-development stages, *mediated* politically the emergence, consolidation and growth of the local microelectronics industry. In other words, these direct forms of allocating individual portions of social labor came to life, and remained in place for some time, only because they realized a necessity of the indirectly regulated process of capital accumulation on a global scale—namely, the formation and development of the NIDL.¹²

By the mid-1980s, as the “microelectronics revolution” manifested itself in a leap forward in the automation of operations in the sector, Japanese memory-chip manufacturers were not only comfortably out-competing their U.S. counterparts due to their lower production costs. They were also leading the way in the introduction of innovations in process, production and, consequently, product technologies in this segment of the industry (Tassey 1990: 93; Cho et al. 1998: 496). By the late 1980s, Japan became the largest producer of semiconductors by volume and an important producer of manufacturing equipment (Linden et al. 2004: 251). Nevertheless, to a large extent chip designs were, well into the 1990s, developed through the local adaptation of circuit architectures licensed from U.S. firms. In the case of higher value-added devices like microprocessors, the technological dependence was even higher; they were mainly done under licenses from U.S. firms. This commercial strategy was not, however, without problems, as disputes over the copyrights of basic designs were frequent and contested in the courts of law (Mathews and Cho 2000: 152).

In capitalism, however, the only constant is change. Through the early 1990s, the same forces that had led to the emergence, development and growth of the Japanese semiconductors industry began to move against it. While the automation of production equipment, including that used in assembly operations, advanced rapidly, microchip design also began to be affected by tacit-skill-replacing technical changes through the use of specialized software programs. The

¹² Despite being on-par to its U.S. counterpart during the pre-IC era, the Western European semiconductors industry fell behind thereafter. Crucially, without access to Japanese-style labor market and without a large US-style military contracts, European firms lack the scale to efficiently manufacture most ICs. Hence, they remained specialized in niche products for home markets and, crucially, in the production of equipment and inputs (Morris 1990: 111-33). European producers would need to wait until the integration of the European market advanced, and with it the consolidation of state support for the industry, and the “fabless/foundry” model consolidated, to regain global presence in the mass-production subsector.

development of equipment automation and design computerization not only permitted the production of more complex semiconductors, and thus reinforced the trend. It also resulted in the further standardization/simplification of production processes and gave place to new transformations in the industry's IDL that have gone beyond Fröbel et al.'s predictions but fit the analysis of the NIDL (i.e. the revised NIDL theory) advanced in the previous section (Brown and Campbell 2001: 452; Balconi 2002: 367-9; Leachman and Leachman 2004: 207).

First, U.S. firms began to concentrate on the higher end of the industry's value chain: the production of semiconductor-manufacturing equipment; the production of automated-design software; and the design and production of microprocessors and, to a lesser extent, ASICs. The latter were increasingly produced in the East Asia Tigers, notably in Taiwan and Singapore, and to lesser extent in the Caribbean Basin countries, where there was already a large semi-skilled and highly disciplined/acquiescent (thus productive and easily-trainable), yet relatively low-priced labor-force, as well as a sufficiently large supply of specialized engineers.¹³ This type of commodity-chain structure manifested itself in the emergence of non core-country "foundries" specialized in wafer fabrication for different clients (in some cases outsourcing the assembly work to lower-wage countries) and core-country "fables" (i.e. without fabrication facilities) companies specialized in the design of the microchips (Leachman and Leachman 2004: 220-4; Brown and Linden 2005: 289-92). On these bases, the U.S. semiconductors industry reversed the previous trend and by the mid-1990s had, again, secured a larger share of the world markets of semiconductors than its Japanese counterpart (Linden et al. 2004: 251).

Secondly, Japanese producers began to lose an increasingly larger segment of the DRAMs market to Korean capitals producing under own brand as well as for others, without being able to compete successfully with U.S. firms in the design and production of higher value-added microprocessors and ASICs. Korean capital took advantage of the relatively low design- and skill-intensity of the product and the easy access to production technology. Yet, Japanese capital expanded and consolidated its position in the market for semiconductor-manufacturing equipment, thus moving up the global value chain (Ernst 1998; Leachman and Leachman 2004).

Like in Japan before, widespread and far-reaching state actions mediated the development of the industry, including worker upskilling, in the East Asian Tigers, especially in Korea and Taiwan where the more capital-intensive parts of the sector's commodity chain

¹³ In 1996, wages in "Electrical Equipment, Appliance and Component Manufacturing" in Singapore, Taiwan, South Korea and Mexico were 8.85, 6.40, 6.97 and 1.40 US\$ per hour, respectively. They were US\$ 16.64 in the United States and US\$ 20.93 in Japan. Even if these industry-wide averages hide differences in the quality of the workforce and complexity of the tasks performed, they serve as an indication of international labor-cost disparities (Bureau of Labor Statistics).

consolidated and domestic capitals thus played a more extended role (Mathews and Choo 2000). Yet, contrary to the authors reviewed in section 1 and in accordance with Fröbel et al.'s analysis, East Asian state actions were, like the earlier actions of the Japanese “developmental” state, the political forms through which local processes of capital accumulation came about as an expression of global-scale economic transformations.

In South Korea, for instance, extended state investments to transform the local microelectronics industry from low-skilled, foreign-controlled assembly operations into high value-added components manufacturing (i.e. to move it up the global value chain) started around the early 1970s, but would only fully pay off in the mid-1990s, when the material conditions for this to occur (i.e. further skill-replacing technical changes) had matured and the Korean workforce finally reached the levels of productivity of their U.S. and Japanese counterparts, at a fraction of their cost (Baily and Zitzewitz 1998: 265). In the mid-1980s, around 80% most of the sector's workforce was still employed by MNCs, or domestic firms subcontracted by these, to assemble and package semiconductors, while the other fifth were employed by domestic firms both fabricating wafers and assembling them for own consumption and under original equipment manufacturing arrangements (Henderson 1989: 59, 64-6). Until the early 1990s, indigenous advances in “memory-chip” wafer fabrication depended heavily not only on often outdated foreign technology and designs, but also on foreign-trained engineers to manage the projects and overseas investments in R&D centers. Moreover, Daewoo's mid-1980s attempts to move beyond DRAM manufacturing into more complex, skill-intensive ICs, like microprocessors, failed completely and were quickly abandoned (Bello and Rosenfeld 1992: 157-61; Hong 1997: 99, 106-7; Mathews and Cho 2000: 121-9).

As Tiger firms moved up the global value chain, and the local workforce thus improved in quality and increased in cost, as a form in which the NIDL's inner dynamics realized themselves, their place in lower-value-adding activities was taken over by capitals located in other countries of the region, and the Caribbean Basin, where industrial capital had access to labor-forces with relatively similar productive attributes but significantly lower prices. In some cases, this spatial movement was coordinated by U.S. and European lead firms; in others, by Japanese and Tiger firms. Yet in other cases, the process emerged through the relatively more independent actions of indigenous companies (Brown and Linden 2005). These business-models, and related institutional variations, did not, however, change the economic content of the process at stake—namely, the relocation of simplified/standardized labor-processes to places where industrial capital could use a relatively cheap and disciplined workforce and thus increase the mass of surplus-value available for its process of valorization on a global scale.

Those national experiences sharply contrast with the South American ones, where industrial capital has continued accumulating through the recovery of a portion of the local ground-rent. In Brazil, for instance, extended state efforts to promote the production of semiconductors for domestic consumers began in the late 1970s, when an enlarged ground-rent and large loanable-capital inflows complementing it were sustaining the expanded reproduction of the process of capital accumulation through ISI deepening. However, as soon as these masses of extraordinary surplus-value contracted in the course of the debt crisis, state actions channeling them to industrial capital reversed (i.e. state support dried out) and the local microelectronics industry rapidly collapsed. It only started to revive somehow in the mid-2000s, when the global commodity-price boom manifested itself in the strong expansion of the Brazilian ground-rent and of the process of ISI mediating its appropriation by industrial capital (Grinberg 2016).

The automation of microchips design has not only facilitated the international separation of the design and fabrication stages. This process has also tended to simplify several parts of the design engineering work, made possible its modularization and its international fragmentation. Effectively, taking advantage of these developments, the improvements in telecommunication technologies (resulting themselves from the on-going microelectronics revolution) and the local availability of relatively low-cost engineers, industrial capital began in the late 1990s to relocate to Asia the less tacit-skill- and creativity-intensive parts of the now simplified design work. Due to the large local labor-force with engineering skills and experience in chip manufacturing, Taiwanese and Korean capitals have been at the forefront in this new transformation in the IDL in the semiconductors industry (Ernest 2005). Yet, the production of (high value-added) circuit-design software and manufacturing equipment, as well as the capacity to design and produce microprocessors and complex ASICs, have lagged in these countries well behind world-market leaders in the U.S. and Europe (Joo 2005: 21; U.S. Department of Commerce 2015).

Hence, the experience of the semiconductors industry shows that the key force explaining the formation and development of the NIDL, and the contemporary process of stratification of the capitalist world-economy through GCCs, has not been the general necessity of lead industrial capitals (i.e. MNCs) to reduce costs in order to increase profits, as in mainstream GCC-focused analyses, but the realization of this necessity under specific historical conditions that determine the forms of production of surplus-value on a global scale. The analysis of the semiconductors industry presented here has also shown that those conditions have not resulted from the simplification of manual work-processes due to the intensification of the technical division labor, as envisaged by Fröbel et al. (1980), but due to a leap in the automation of manufacturing equipment—i.e. in the transformation of manual labor's productive attributes into productive powers of the machinery. This trend has resulted in the increased differentiation of the

productive attributes of the collective worker of large-scale industry and in its international fragmentation. Finally, the analysis of the global semiconductors industry also showed that East Asia's ability to benefit from, rather than being exploited by, GCCs has not come from national state's capacities, entrepreneurial quality, or the initial balance of class forces, as argued by the chain-focused authors reviewed in section 1. Rather, it has resulted from industrial capital's access there to a labor-force whose historically-developed, and politically-enhanced, productive characteristics have closely matched those required by the new technological conditions at a relatively low cost.

Summary and Conclusions

This paper presented a critique of GCC-focused analyses of the structural dynamics of the global economy. This critique showed that despite their multiple contributions those analyses remain nation-centered and thus fail to account fully for the forces behind the conformation and evolution of the IDL and hence of national and global developmental patterns. The paper then argued that the key to overcoming the limits of these versions of GCC-focused analysis of recent transformations in the capitalist world-system is to be found in the critical revision of the work of Fröbel et al. (1980).

Hence, the paper claimed that the process of capital accumulation is global in terms of its general structural dynamics and national only in its forms of realization. It was argued, then, that the global unity of capital accumulation is developed in the process of production of relative surplus-value, which comes about through the IDL and the formation and development of GCCs. Originally, this process revolved around the spatial separation of industrial and raw-material production, resulting in the classical IDL. Since the 1960s, automation-driven tacit-skill-replacing technical changes resulted in the transformation of the composition of the collective worker of large-scale industry and in its international fragmentation, thus giving place to a new type of IDL that superseded the classical IDL; the so-called NIDL. This process has materialized in specific GCCs and in the specific geographical dispersion of their component parts. Industrial capital then began to take advantage of the particular historical origin of the East Asian working classes, and subsequently of those of other regions, to locate there those simplified productive activities that could be profitably performed by cheaper though highly disciplined/acquiescent labor-forces. South America and much of Africa, on the contrary, have remained integrated in the global economy as producers of raw materials and, increasingly, reservoirs of surplus population.

Processes behind the NIDL have not been not static; nor have their effects on the productive attributes of the global collective worker. Contrary to Fröbel et al., they have

manifested themselves in the continuous transformation of labor processes, increasingly affecting relatively complex activities, and, in some cases, in the upgrading of workers' skills and firms' capabilities. Hence, the structural transformation of the East Asian societies and the massive improvements in the conditions of reproduction of the labour-force there. These claims were substantiated with the analysis of the global semiconductors industry which showed the concrete manifestation of those general trends in a crucial manufacturing sector.

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