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Property rights in the knowledge economy: an explanation of the crisis

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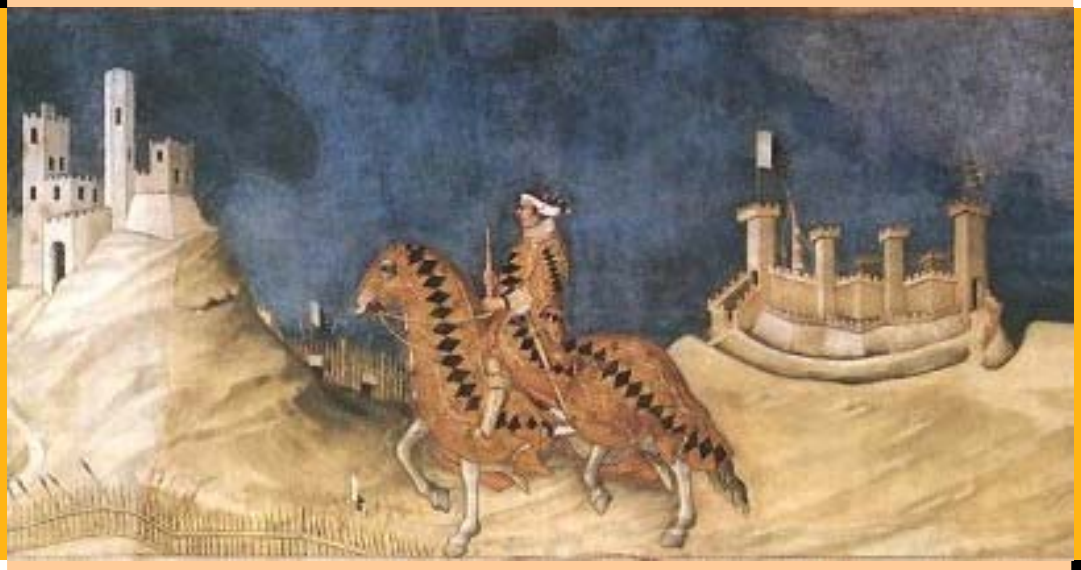

Abstract - Some of the roots underlying the recent crisis may be found in the global convergence towards a model characterized by strong property rights and an extremely limited role attributed to "open science". The modern economy has increasingly moved from an open science – open markets model toward a closed science – closed markets model. Paradoxically, while a non-rival resource like knowledge becomes the most relevant input, small firms and new entrants find it increasingly difficult to be competitive with large and well established organizations. Such a model is progressively increasing the costs of investment in new knowledge, with important negative consequences in terms of overall performance of the economy.

We argue that in the knowledge economy, overcoming inequality and the economic crisis can be part of a single coherent policy. If some essential knowledge is moved from the private to the public sphere, this is has not only desirable inequality-decreasing consequences but can also contribute to re-launching the economy, creating the conditions for a sustained development. In a knowledge economy, a *super-multiplier* could couple the traditional effects of Keynesian spending in time of crisis with the multiplying virtues human knowledge, moved from the private to the public sphere.

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INTRODUCTION

In the present economy we live a "property right paradox". Its knowledge-intensive characteristics should favour small size firms, managed, or even owned, by the people working in them. By contrast, firms size as well as traditional forms of capitalist ownership show little sign to undergo a substantial change in contemporary knowledge-intensive economies. In this paper we will argue that the current crisis is somehow related to this "property right paradox": the present prevailing ownership structure of knowledge economies inhibits investments, favours the generation of crises and limits the development of the world economy.

Some roots of the recent crisis may be found in the global convergence towards a model characterized by strong private property rights on knowledge and an extremely limited role attributed to "open science"[i]. Such a model prevents the shift towards the allocation of organizational rights to workers, i.e. towards a property rights allocation congruent with the intrinsic nature of what has become the most important factor of production in the knowledge-intensive economy, and is progressively increasing the costs of innovations and limiting the scope of investments in new knowledge production, with obvious consequences in terms of overall performance of the economy (Pagano, Rossi 2009). The same forces that block the changes of property rights are also inhibiting investments and widening the global imbalances between savings and investments, which, as we will try to show in this paper, are mainly due to the deficiency of the latter.

Our main policy suggestion is that an exit from the current crisis is related to a transformation of property relations and to a reduction of inequality. The public sharing of essential knowledge has desirable inequality-decreasing consequences and makes it viable the existence of small (and possibly democratic) firms, which can all use simultaneously this non-rival good. Furthermore, moving essential knowledge from the private to the public sphere can contribute to re-launching the economy, creating the conditions for a sustained development. In a knowledge economy, it is possible to set in motion a *super-multiplier* coupling the traditional expansive effects of Keynesian spending in time of crisis with the multiplying virtues of non-rival human knowledge: even in the short run, a buy-out of private (that is, monopolised) knowledge may have effects that go well beyond the traditional policies of public spending. On the one hand, the former monopolist, having received fresh money and facing more competition, is induced to increase his investments. On the other hand, the new public knowledge induces all of its competitors to increase their investments.

We structure our paper in the following way. In the next section we consider in detail the nature of the "property right paradox" characterizing contemporary knowledge intensive economies. In the second section we argue that the paradox arises from two sets of alternative institutional complementarities: the first tightening together closed science and

closed markets and the second linking open science and open markets. We argue that the global economy is increasingly favouring the first set of complementarities. In turn, these complementarities cause growing inequalities among individuals, firms and countries and, at the same time, inhibit the development of the world economy. In our view, the rise as well as the present crash of the knowledge economy, is related to a dramatic shift in balance from open science and open markets to closed science and closed markets.
In the last section, we focus on the policy suggestions stemming from our analysis which have the twofold purpose to democratize the global knowledge society and re-launch the global economy.

THE "PROPERTY RIGHT PARADOX" OF THE KNOWLEDGE ECONOMY.

Physical capital-intensive economies have traditionally been characterized by capitalist ownership of the means of production. This prevalence of the "capital-hiring-labour" solution does not find an adequate explanation in the standard neoclassical theory, which a-critically and implicitly assumes a double form of neutrality: of technologies with respect to property rights allocations and vice-versa. In other words, according to standard neoclassical thinking, the various technologies and productive forces have no influence on the efficiency of the various kinds of ownership arrangements and, at the same time, the various kinds of ownership arrangements (for example control of the firm by workers or capitalists) have no influence on the nature of the productive forces and on the type of technology used. A famous dictum by Samuelson (1957, p. 894) states this dual neutrality of the neoclassical theory very clearly: "*In a competitive economy it really doesn't matter who hires whom*".

This two-fold neutrality crucially depends on the assumption of nil transaction costs and complete and perfectly enforceable contracts. When this assumption holds, non-owners do not face any risk of opportunistic behaviour, since contracts will protect agents' investments whether or not they have property rights over the means of production. Thus, a competitive equilibrium with complete contracts will in any case entail the efficient organization of production, both when the capitalist employs the workers, and when the contract provides for the workers to rent the means of production from the owner. The nature of the resources employed in production does not tend to favour particular property rights, and accordingly is neutral.

Discarding the hypothesis of nil transaction costs has profound effects on the neoclassical edifice. It eliminates the twofold neutrality of rights with respect to technologies, and of technologies with respect to rights. The mechanisms identified by neo-institutionalists – Oliver Williamson (1985), for example – have cast serious doubts on the hypothesis that technologies are neutral in regard to the nature of property rights and allocation of control over firms.

Indeed, in presence of positive transaction costs and incomplete contracts, when inputs are specific (i.e. when they cannot be put to other uses without losing some of their value), those who invest in specific resources are made vulnerable by the possible loss of value of their investment due to the absence of alternative uses, and will therefore have greater incentives to invest if protected by the ownership of the means of production (see, e.g., Hart 1995). The allocation of property rights to the agents that can make the most specific investments is more efficient than alternative property rights allocations because it allows to save transaction costs and it enhances investment.

Similarly, in presence of information asymmetries, the technologies employed determine the distribution of information among agents. In this case, the allocation of ownership rights to the agents difficult to control (and/or controllable at very high costs) is more efficient because they possess a greater amount of concealed private information.[ii]

In both cases, Samuelson's proposition no longer holds, because in this situation "who hires whom" becomes important. In other words, the characteristics of the productive forces influence the attribution of control rights because the most specific and difficult to monitor agents can save the greatest amount of agency costs when they control the organization.

The reasoning of radical economists[iii] has undermined also the second part of the neoclassical neutrality assumption, contributing to understand the prevalence of the "capital-hiring-labour" solution in physical capital-intensive economies. Radical thinking can be interpreted as implying, in situations of contractual incompleteness, that those with control rights over a firm have relatively fewer inhibitions about developing resources specific to that organization and that they will tend to adopt technologies that shift information asymmetries in their favour. In other words, the agents to which ownership is attributed will tend to become the most specific and difficult to monitor. This implies that the attribution of rights is by no means neutral, and it influences the nature of the productive forces employed[iv].

Summing up: while who-hires-whom does not matter in a world of zero transaction costs, it matters in a world of positive transaction costs. Even if technology is partially endogenous, one could argue that developments that go in the direction of making it convenient a high intensity of non-human capital should also make the capital-hiring-labour solution more appealing, especially when capital is specific and difficult-to-monitor (in the sense that its user-induced depreciation cannot be easily assessed by observing the state of a machine and a relevant informational asymmetry exists between users and absentee owners of machines). In these conditions, the labour-renting-capital solution becomes prohibitively costly and also other solutions (such as labour borrowing capital and buying machines) involve very high agency costs. Perhaps a limited multiplicity of alternative technologies is

available (and more could have been developed in the case of widespread labour-owned firms). However, one can argue that the intense use of physical capital has acted in favour of the capital-hiring labour solution.

The central question here addressed is whether the intense use of knowledge in production should imply a radical departure from the organizational forms which have characterised the age of intensive use of physical capital. Two features of knowledge should, at first glance, imply that the advent of the knowledge economy should coincide with an increasing comparative advantage of labour-hiring-capital firms with respect to the capital-hiring-labour firms. First, knowledge is often embodied in human beings and in a knowledge-intensive economy one should expect for this reason that the labour-hiring-capital solutions should often be advantageous because it implies lower agency costs. Second, the knowledge that is not embodied in human beings can be made available to additional members of society without depriving the former users of its availability. Unlike a piece of physical capital, an idea can be used simultaneously by many people without being warn out (indeed, the opposite is true: the use of ideas helps the memory and the improvement of ideas). Since the marginal cost of using disembodied knowledge is zero, these firms should not face the renting and borrowing agency problems, which do usually upset the labour-hiring-physical-capital firms.

However, while the trends of some sectors seem to confirm this prediction, on the whole modern capitalism does not seem to show a great deal of discontinuity with its recent past. One could "save" the predicted discontinuities by arguing that the knowledge-intensive economy is not yet sufficiently intensive to produce widespread institutional changes. The other possibility is that some important elements of the characterization of knowledge are missing in the above reasoning and may help to solve the *property right paradox* which characterises our economy.

The hypothesis that the knowledge-intensive economy may involve a fundamental discontinuity in the organization of the economy relies on the fact that, unlike physical goods, knowledge is a public good in the sense that there is no cost involved by increasing the number of its users. However, pure public goods are a mix of two ingredients: non-rivalry in consumption and impossibility of exclusion from consumption. While the first feature surely attaches to knowledge, the second does not necessarily characterize it. Knowledge is a public good in the sense that it is a non-rival good but exclusion of others from intellectual ownership is well possible.

Indeed, not only excludability of knowledge is possible, but it also has broader and more profound consequences than it is the case for physical objects. In the latter case, both the definition and the enforcement of private property are specified at the local level and they are unlikely to have any relevant implication in distant locations. The legal positions

defining the private ownership of knowledge have, by contrast, often a global nature. They may involve restrictions for many individuals at various country locations and potentially for all the individuals of the world. Intellectual property rights, such as they are currently defined by the TRIPs agreement and enforced by the WTO, have this nature. Their ownership by some individuals involves restrictions for all the other individuals.

This is not the end of the story, for knowledge privatization also influences the relative profitability of alternative property rights allocations within the firm, i.e. of the "capital-hiring-labour" solution vis-à-vis the "labour-hiring-capital" solution. This is for at least three reasons. First, if agents can hold exclusive monopoly rights on knowledge, the use of the latter is going to be rather expensive and it is likely to increase the agency costs of labour-hiring-capital firms even in comparison to those which make an intensive use of physical capital.

Second, when knowledge is privatized, the size of the firm matters: each unit of proprietary knowledge can be used an infinite number of times, involving a dramatic form of (firm-level artificially restricted) increasing returns. Moreover, each additional unit of knowledge which is owned produces more than proportionally opportunities to exploit the complementarities with the other units in the never-ending production of new knowledge and makes it even more valuable to produce or acquire from small firms additional knowledge. And size matters also in another crucial respect: the greater the concentration of knowledge, the lower the unit cost of defending the exclusive ownership rights on each unit of knowledge, which each other competitor could independently discover or imitate. Here the *property right paradox* of the modern knowledge economy becomes particularly evident: the non-rival nature of knowledge, which could in principle favour small and even self-managed firms, produces artificial economies of size and makes the acquisition and the defence of property rights so difficult that only big firms can effectively afford it.

Third, knowledge privatization may inhibit investment in human capital. Absent knowledge privatization, the need to provide incentives to invest in human capital would be an argument favouring the labour-hiring-capital solution. As explained above, when markets are characterized by positive transaction costs and individuals are wealth-constrained, the owners of the means of production have greater incentives to develop their capabilities and, for this reason, tend to become the best owners. This incentive effect of ownership is much stronger for intellectual property because the right to exclude involves a restriction of the liberty of all the other individuals to replicate similar means of production (Pagano and Rossi, 2004).

In the case of a machine, an individual, who has learnt to work and possibly to innovate with skills that are partially specific to the machine, is only partially damaged if he is deprived of its use. He keeps the liberty to work with other machines or to build identical

machines. The damage is more relevant in the case in which an individual has acquired skills that are specific to a piece of intellectual property and he is denied access to this asset. The nature of intellectual property implies that he does not keep the liberty to work with or to "re-discover" a similar piece of knowledge. IPRs involve a global right to limit the access of all individuals to the use of all the similar pieces of knowledge, including those that are independently developed. Turning a public good like knowledge into a private good transforms a universal unlimited liberty into an asymmetric legal position limiting non-owners' freedom well beyond the restrictions that stem from the property rights defined on traditional rival goods.

For some individuals, the monopolistic ownership of intellectual property encourages investment in the skills necessary to improve the knowledge that one owns and the skills that are developed make it even more convenient to acquire and produce more private knowledge. By contrast, other individuals may be trapped in vicious circles of under-investment in human capital where the lack of intellectual property discourages the acquisition of skills and the lack of skills discourages the acquisition of intellectual property (Pagano and Rossi 2004). The interaction between the accumulation of privatized knowledge has self-reinforcing properties: it generates vicious and virtuous circles of cumulative causation, leading to asymmetric, and increasingly divergent, investment patterns in human capital.

For these three reasons, the typologies of firms that tend to prevail in the knowledge economy will crucially depend on the role and the relative weights of the institutions of open science and the degree of private intellectual property rights protection. Greater knowledge privatization tilts the balance in favour of the "capital-hiring-labour" solution, in spite of the fact that the property of non-rivalness of knowledge and its embodied form would suggest the optimality of the "labour-hiring-capital" solution.

In the contemporary knowledge economy, the role of open science appears much less prominent than it used to be at the time when its very seeds were developed. This is reflected in the tendency to protect upstream knowledge through private property rights to an extent unimaginable in earlier times and to reduce the extent of publicly funded open science. The absence of an adequate provision of public knowledge and the over-upstreaming of private intellectual property is a likely result of the absence of adequate global institutions for funding public research and the rent-seeking activities of the firms which seek monopoly power on their products and the technology that they use.

The reasons for these developments will be explored in the next section. For the moment we limit ourselves to highlight that, in this environment characterized by an institutional complementarity between closed markets and closed science, the selection of firms will be biased in favour of the capital-hiring-labour solution and that it is very doubtful that the

advent of the knowledge intensive economy will involve a substantial move to the labour-hiring-capital organizational form. The hypothesis that the intense use of non-rival disembodied knowledge capital would imply a substantial decrease of the agency costs in comparison to firms making an intensive use of physical capital holds true only if much knowledge is produced using the institutions of open science.
Under the present global economic regime, this direction of causation, flowing from technological change towards a mutation of property rights regime, may well be overcome by the opposite one. The prevailing regime of standard capitalist rights shapes the new knowledge technologies and consolidates its dominant position. If much knowledge is privatised, the knowledge-intensive economy may turn out to be even more unfriendly than the physical intensive economy to stronger organizational rights for the large majority of the individuals. They do not enjoy the freedom of a world of open science and open markets. Instead, together with the overall performance of the economy, they suffer the limitations of the unhealthy alliance between closed science and closed markets.

THE RISE AND FALL OF THE KNOWLEDGE ECONOMY

The same sort of institutional complementarities that block the micro-level change in the property rights structure of firms crystallize a property rights equilibrium at the macro level, i.e. in the allocation of property rights among countries, again with profound impacts on investments. This state of affairs, in turn, tends to deepen global imbalances in the allocation of intellectual capital that may have enduring effects on the ability of the economy to recover from the crisis. We will claim that both the rise and the current fall of the knowledge economy can be by reference to the gradual emergence of a "closed science/closed markets" production model. Thus, an important background question to be asked concerns the reasons for the emergence of a global institutional framework of knowledge production characterized by strong property rights and an extremely limited role attributed to “open science”.

The end of the Cold War implied a significant technological "shock" for the US economy, due to the lifting of the veil of secrecy that had for long wrapped defence-sponsored innovations (Visco 2009). For almost half a century, starting at the end of WWII, technological developments were led by the extraordinary military effort linked to the Cold War. New knowledge (ICT technologies, materials, mechanics) developed to contrast Soviet power, was held secret and the extent to which it was put to use in civilian activities was rather limited. With the end of the Cold War, at the beginning of the 1990s, these technological developments could find their way to the market and trigger further investment. Indeed, the free circulation of the relevant stock of knowledge developed for military purposes ensued to the break up of the Berlin Wall can be considered at the origin of the boom of the "new economy". The ICT revolution of the beginning of the '90 has tremendously benefitted from such a "peace dividend", which has undoubtedly played a role in the reversal of the productivity trend in the US (gone back to high rates of growth in the second half of the 1990s).

The end of the Cold War meant also that the relevance of new knowledge and new technologies was rising for the US economy at a time in which markets were becoming increasingly integrated, absent traditional geo-political barriers. The political allies of the Cold War period were rapidly becoming economic rivals, in a context in which the most important productive assets had the nature of intangibles easily appropriable by firms and countries that had not paid the cost of their development. Hence, a private need to restrict access to such crucial assets arose exactly at a time when the public and private benefits from their unrestricted circulation were becoming most apparent.

It is, indeed, in this period, that the most radical change in the institutional environment for knowledge production has started taking place, under the evident impulse of the United States. In particular, such change has taken the form of the institution of a global and harmonized set of (minimum) rules for the protection of intellectual property rights that States are free to apply in more stringent terms. These rules have been agreed upon in 1994, in the context of the Uruguay Round of WTO negotiations, under the name of the TRIPs agreement. The true institutional novelty of the system resided in the creation of an enforcement system capable of being applied globally.

Within this global legal framework, and given the increasing degree of integration of the world economy, developed countries' governments have found in their interest to move the line drawn in the choice between more upstream knowledge produced and freely transmitted by Universities and more downstream knowledge that can be privately owned by its discoverers. While a World Government (or, in a similar way, a State isolated from the World Economy) could try to draw the line between the production of “open access knowledge” (funded by tax revenue) and the production of “closed access knowledge” (that is left to the profit-motive of private firms) so as to maximize the benefits accruing to its citizens, in an increasingly integrated economy this choice is necessarily affected by the relevant externalities connected to knowledge production.

Given the presence of knowledge externalities, each national State realizes that its citizens get only a fraction of the benefits of investments in public knowledge while some of them (and all through national taxation) can gain the full benefit of the investments in privately owned knowledge because the benefits from the latter are not shared with the citizens of the other countries. Thus, in an integrated world economy, characterized by internationally enforced IPRs, national states have an incentive to increase the number of “closed access science” research projects over which private property rights are defined and to move upstream the line that separates them from the “open access science” research projects.

Institutions producing and diffusing public knowledge are increasingly seen as a “waste of money” and there is a widespread tendency to decrease their funding. For the same reason, the same institutions (Universities, in the first place!) are also under severe pressure to betray their nature of organizations mainly dedicated to the production and diffusion of public open-access knowledge and are pushed towards the production of private intellectual property.

While, in absence of global funding for research, the over-privatization of knowledge could have directly followed even from the behaviour of benevolent national governments acting in the interests of their citizens, the tendency to over-privatize could count on additional factors: unfortunately, national states are easy targets for the rent-seeking activities of global companies while international organizations are, in turn, easy targets for both national states and global companies. A new enclosures movement developed and, in this case unfortunately, the new commons which were privatized were not lands but the non-rival products of human intellect.

Last but not least, to the prevalence of an institutional framework characterized by strong and upstream IPRs and a limited role for open science, may have contributed also the diffusion of a misleading property rights rhetoric that, on one side, implicitly assumes a linear relationship between the degree of "closeness" (i.e., appropriability) of knowledge and investment in new knowledge production and, on the other side, assumes that the institutions of open science work for free. In other words, all too often the losses due to the conflict between closeness and the non-rival nature of knowledge are easily discarded as a necessary evil amounting only to a loss in static efficiency, thus ignoring the negative implications in terms of ability/incentives to develop new knowledge.

A significant part of the economic literature, along the lines of the Solow growth model, has for long assumed that the growth of technological knowledge is exogenous, costs nothing and is available to all. While the models of endogenous growth have usefully removed some of these assumptions, few contributions have explicitly dealt with the role of the institutions of open science, thus leading to downplay their role in the economy.

Whatever the precise origin of the marked shift towards knowledge privatization and away from open science observed in the past two decades, it is our contention that the balance between privatized and publicly available knowledge has gone too far to preserve adequate incentives to invest in new knowledge development. Far from being linear, the relationship between the degree of closeness and investment is more likely to be described as an inverted-U. For low degrees of "closeness", short-term incentives to invest increase because of the increased appropriability of the benefits from one's innovation. However, as the degree of "closeness" increases, the extent of blockage to the productive utilization of knowledge also increases, with the result that investment may be hampered.

IPRs may constitute an important means to appropriate the benefits from investment in new knowledge and a precondition for the market exchange of intangibles but they should not be considered as an unambiguously superior policy tool nor as the best instrument apt to stimulate investment in any innovation context. The many limits to the working of IPRs as incentive and transactional tools have been amply acknowledged by the economic literature (see, for instance, Bessen and Meurer, 2008; Boldrin and Levine, 2008; Jaffe and Lerner, 2006; NRC, 2004). They follow, on one side, to the intrinsic transactional problems arising from the multiplication of veto powers connected to the fragmentation of property rights over knowledge resources - a phenomenon often described as "tragedy of the anticommons" (Heller and Eisenberg, 1998). On the other side, they follow to the strategic use of IPRs that appears to be a feature of many innovation domains (even of those where IPRs incentive function is considered to be crucial, such as pharmaceuticals, as recently shown by the DG Competition Sector Inquiry on the pharmaceutical sector). Patents and other IPRs are amply used to block competitors (Cohen et al., 2000), accumulated in order to defend a given technological area from competing innovations through so-called "*patent fences*" or "*patent flooding*" strategies.

The present institutional framework makes the accumulation of private property rights over intangible knowledge a dominant strategy especially for those who have a relatively higher “initial endowment” of privatized intellectual assets and a comparative advantage in the production of knowledge easily amenable to intellectual property protection.

This produces a particularly unequal allocation of intellectual resources among countries a that is as self-reinforcing as the firm-level allocation of property rights described in the previous section. Indeed, countries enjoying a relatively greater endowment of IPRs face reduced obstacles to invest in new knowledge, given that they need to incur lower licensing costs to access existing knowledge inputs and that they are exposed to a lower risk that their investments be blocked by refusals to license or in any case by costly IPRs negotiations. This favours further accumulation of IP-protected intellectual assets, deepening inequalities.

The globalization of IPRs, and the reduction in the extent of publicly available basic knowledge, do not only limit the specialization possibilities of each country but also the overall investment opportunities of the whole World economy. In this sense, they have to be included among the factors that have contributed to the present global crisis.
Imbalances in the global accumulation of intellectual capital may have played a role as long-term causes of the crisis and may have even deeper consequences in the future than the balance-of-payments disequilibria on which most of the attention has been focused in the years immediately preceding and immediately following the global crisis.

An explanation for the existence of global imbalances may reside, indeed, in the vicious/virtuous cycles of investment and accumulation of IPRs just described and in the inverted-U relationship between the degree of knowledge "closeness" and innovative investment. If exclusion from access to IPRs tends to generate vicious circles of underinvestment, as it arguably is the case, then the scant investment performance observed in the second half of the 1990s in East Asia, Japan and Europe - countries with a limited initial IPRs endowment and a knowledge base characterized predominantly by bottom-up knowledge - may be rationalized as a consequence of lack of access to IPRs (though, of course, other factors have also played a role). If, on the other hand, an inverted-U relationship does exist between knowledge "closeness" and investment, it is possible to explain also why investment in the most IP-rich country - the US - has started to decline as well in the new millennium, in spite of a secularly low cost of capital.

Taken together, these two phenomena may explain the slump in investment experienced, first, outside of the US, in particular in Japan, East Asia and Europe, and later in the US. This substantial decrease in investment, in turn, explains the existence of global imbalances better than the hypothesis of a "saving flood" on which much emphasis has been placed, in that it is more consistent with the available data. Data from the IMF (IMF 2005) show, indeed, that savings have been rather constant in countries outside of the US, excluding China, in the past two decades. Investment rates, by contrast, have substantially decreased. In particular, in the East-Asian area, aggregate investment rates have decreased by 10% in the second half of the nineties, subsequently increasing only by virtue of a strong public investment[v].

The interpretation we propose thus suggests to look at some roots of the present crisis that are deeply embedded in the current institutions of the knowledge economy. It follows that, in considering the way out of the crisis, the role of policies that may redress the balance between public and private knowledge should be considered. It is to these policies that we now turn.

OVERCOMING THE CRISIS: PUBLIC KNOWLEDGE AND THE "SUPER-MULTIPLIER".

While the present institutions of the global economy are likely to contribute to a prolonged stagnation, the knowledge-intensive economy offers great opportunities for more effective Keynesian policies. Instead of being used inefficiently to nationalize the assets of firms producing private goods, public funds could be used to decrease the monopolization of knowledge and to efficiently transfer knowledge from the private to the public sphere. The institution of a strong WRO (World Research Organization) should balance the WTO, which has increased the relative convenience of intellectual private property to such a great extent. A WRO should create the conditions in which public intellectual property is feasible whenever it is able to foster development. All governments should acknowledge

that knowledge is a non-rival (or even an anti-rival) good which should be treated as the most precious and specific global common of humankind.

Anti-crisis policies should include the funding of public research infrastructures which help to solve the property right paradox we have considered in the second section. It would be extremely helpful for this funding to be coordinated at the supranational level in order to prevent the free riding problems among countries which are presently fettering investment in public research. In the long run, a new economic structure based more on the binomial open science/open markets than on the closed science/closed markets one may arise. Overcoming stagnation and democratizing the economy are complementary policy objectives. In the long run, development requires free access to knowledge and the flourishing of many firms whose property structure allows workers to enhance their skills without fear of being expropriated of the results of their investment in human capital.

The transition to this new property right structure offers great opportunities for Keynesian policies. In the current crisis, public funds should not only finance new research projects but should also be used to acquire well-established IPRs from private firms. The effects of this policy would have immediate effects and would go well beyond those entailed by many current anti-crisis measures.

First, this form of public funding does not involve nationalization of the firm or the use of taxpayers money without any returns on it. By contrast, while the IPR is paid at its private value, it is transferred into the public arena where it has a greater public good value and decreases costs for many producers.

Secondly, financial support is granted to firms who have proved to be innovative. A powerful stimulus for new investments is given to the most efficient firms. On the one hand, these firms receive fresh funds but, on the other, having sold the old intellectual property rights, they face tough competition. Therefore, they urgently need to invest in the production of new intellectual assets, which boosts aggregate demand.

Thirdly, a monopoly price for the intellectual asset is replaced by the lower (zero) competitive price, which again has a positive effect on aggregate demand.

Finally, the “anti-commons” problem is eased; everyone can now invest in new knowledge being aware that complementary pre-existing knowledge is less likely to be owned by other firms and involve costly future negotiations, which may often fail (Pagano, Rossi 2004). Moving IPRs into the public domain makes it unnecessary to undertake future risky transactions to benefit from the fruits of innovation. While the immediate funding goes to

incumbent innovative firms, which may often belong to the richer countries, new knowledge becomes freely available to everyone and yields widespread beneficial effects, thereby contributing to the overall development of the world economy.

The multiplicative effects just outlined are stronger than those traditionally associated with standard Keynesian policies: they are more powerful both on aggregate demand and on the level of efficiency of the economy. An investment "super-multiplier" can be made to work in knowledge-intensive economies. It can couple the standard advantages of Keynesian spending in time of unemployment with the efficiency effect of moving a non-rival good such as knowledge from the private to the public sphere.

Owing to the long-standing academic dominance of neo-liberal ideology, in the present crisis state intervention is seen as a necessary short-run evil which will necessarily produce serious long-run problems. By contrast, redressing the balance between public and private knowledge would not only have strong short-run multiplicative effects; it would have long-run benefits as well. A new democratic economy, based on open markets and open sciences, and Keynesian policies of public investments in public research are both necessary to overcome the present global crisis. We do not simply need better regulations to protect savings. We do also need those investments and work opportunities that cannot blossom in a world of closed science and closed markets. We must give the present crisis a chance to be the first and the last major crisis of the new knowledge economy.

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[i] On the notion and significance of "open science" see, for instance, David (2004).

[ii] This point was first made by Alchian and Demsetz (1972). See also Alchian (1987).

[iii] Initially developed by Marx in the first book of *Capital*, this point has been taken up by numerous 'radical economists': for instance Braverman (1974), Marglin (1974), Rowthorn (1974), Edwards (1979), and Bowles and Gintis (1999).

[iv] The integration of the radical and neo-institutional arguments implies the possibility of multiple organizational equilibria (Pagano and Rowthorn 1994). The two directions of causation are estimated in Earle, Pagano, Lesi (2006) where it is shown that the radical direction of causation is stronger than the new institutional one. Pagano (2007) considers the relation between the multiplicity of capitalism varieties and globalization with particular reference to IPRs and the accumulation of "intellectual capitalism".

[v] These arguments are articulated further in Pagano and Rossi (2009).