Title: Hybrid Practices in Cord Blood Banking. Rethinking the Commodification of Human Tissues in the Bioeconomy

Abstract: The STS and bioethical literature on umbilical cord blood (UCB) banking nowadays discusses the field as divided into opposite institutional arrangements, public versus private banking. Public banks represent a model sharing economy, private banks a market economy that capitalizes hopes and tissues, and new hybrid forms that are emerging. We challenge that this distinction is analytically valuable for understanding the various forms of marketization, commodification and biovalue production that mark the UCB economy. Our analysis of current UCB banking practices, especially hybrid one's, and their inherent visions of the future, shows that hybrid UCB banking criss-crosses the different economic models and concepts of commodification. The private, public, hybrid distinction is thus inadequate for a critically analysis of the complex UCB bioeconomies. Drawing on the perspective of social welfare systems analysis, however, the tripartite distinction emphasises an important ethical and biopolitical commitment to equality in current and future health care.

Introduction

After the first successful transplantation of umbilical cord blood (UCB) in 1988 (Gluckman et al. 1989), the clinical use of UCB-derived stem cells for treating haematological malignancies, bone marrow failures and inherited metabolic disorders has increased to an estimated 30.000 UCB transplantations performed worldwide (Ballen, Gluckman and Broxmeyer 2013). In order to be used as a source of haematopoietic stem cells, UCB must be collected, processed and cryopreserved in biobanks. During the 1990s, national public UCB banks were established in increasing numbers, beginning in the US, France, the UK,

Germany, Italy and Spain (Gluckman 1996). Nowadays, according to Bone Marrows Donor Worldwide, more than 600,000 UCB units are stored in public banks and other participating registries (BMDW 2015). A competing sector of private or family banking emerged in the same period – among the first such banks were Cryo-Cell in Oldsmar, Florida, founded in 1989 (Cryo-Cell 2015), Cord Blood Registry in San Bruno, California, 1992 (Cord Blood Registry 2015), ViaCord in Boston, Massachusetts, 1993 (ViaCord 2015), and Vita34 in Leipzig, Germany, 1997 (Vita34 2015a). They offer mother or prospective parents storage of the UCB at birth for future autologous or family-related uses. Parent's Guide to Cord Blood Foundation (2015) reports there are more than one million UCB units stored in family banks in the US alone.

UCB banking represents an important element in the scholarly analysis of "tissue economies" (Waldby and Mitchell 2006), not least because scholars compare two distinct biobanking models: a system of public UCB banks collecting freely donated tissues that are distributed for use in haematological clinical applications when and where needed; and a sector of commercial banks selling a private storage service and thus ownership of the tissue. The bioethical and biomedical literature describes these banking services as two different economic regimes: public biobanks work in a gift or redistributive economic logic of public health, whereas private biobanks provide a service in a competing commercial health economy, they sell the "personal UCB account" (Waldby and Mitchell 2006). Put simply, this literature establishes two equations: public = redistributive and private = market economy. The UCB economies in these two institutional arrangements are linked to different ethical and economic regimes and seen as carrying opposite societal and cultural implications.

Recently a particular UCB banking model has been descried that challenges this dual opposition, namely hybrid UCB banking. Hybrid banking models is an umbrella

term for banking practices that show a participation of private UCB banks in the public redistributive economy. The emergence of such business practices has attracted the attention of scholars, both in the field of medical ethics (O'Connor et al. 2012), and in Science and Technology Studies (STS), because it highlights the "fluid boundaries separating sectors" (Martin et al. 2008, 132).

Building on STS literature on the wider bioeconomy and UCB banking, we critically examine the involvement of different economies in the two seemingly separate institutional arrangements. Thereby we do not wish to negate that crucial differences exist between the public and private sector in UCB banking. However, we argue that the opposition between bioeconomies is less one of institutional arrangements in tissue banks but how banking practices do or do not commodify UCBs and thus support different forms of capital and moral value investment into the tissues. This article adopts the perspective of bioeconomic analysis. Bioeconomy refers to how biological materials (organs, tissues, cells, and gene sequences) "are increasingly inserted into projects of product-making and profit-seeking" (Helmreich 2008: 464). A more general definition by the Organization for Economic Cooperation and Development (OECD) designates bioeconomy as the "… set of economic operations in a society that use the latent value incumbent in biological products and processes to capture new growth and welfare benefits for citizens and nations" (OECD 2006; 1). This definition acknowledges that bioeconomy is not a concept limited to a capitalist market economy. It invites exploration of the different socio-economic systems of production, circulation and exchange, their structure and also their societal implications. A fundamental notion for such an analysis is "biovalue". Catherine Waldby has defined biovalue as "the yield of vitality produced by the biotechnical reformulation of living processes" (Waldby 2002, 310).

We use the notion 'hybrid banking models' when referring to the emerging literature and introduce the expression 'hybrid banking practices' when analysing the concrete effects of hybrid or cross-sector engagements between the public and the private UCB banking services. We point that in cord blood economy the notion of hybridity does not refer exclusively to particular banking models, but to a set of practices. Focussing on banking practices instead of institutional arrangements allows exploring different regimes of biovalue exploitation that may or may no longer fit the simple and static opposition between a public and a private sector. In particular, we focus on how hybrid banking practices redefine notions of de- and commodification and thus how these banking practices decouple the equations public = redistributive and private = market economy. In order to make this argument, we draw on two different understandings of de- and commodification. One is commonly found in the STS literature on bioeconomies; there commodification refers to the transformation of body parts into objects that can be exchanged and capitalised. The other has been developed in social science studies of welfare systems. There commodification and de-commodification refer to the role of the market in the provision of social and healthcare services. Adopting a bioeconomy perspective, we show in the next section that the issue of whether or not tissues are commodified are more complex than the bioethical, biomedical and STS literatures suggest when they operationalise the distinction between public and private banks. We demonstrate that commodification takes place also in public UCB banking, and that, contrary to common interpretations, the private sector can be seen as not commodifying UCBs. The UCB banking sector is a hybrid of different bioeconomic regimes where redistributive and market economy (see Hauskeller and Beltrame 2016), commodification and de-commodification processes coexist and overlap in complex configurations. We investigate these hybrid practices both in conventional banking models and, especially, in the so-called hybrid models

where the complexity of commodification processes at work is particularly apparent. In this analysis we extend the notion of hybridity to practices affecting the whole field of cord blood banking, and not only to particular banking models.

To emphasise our main argument, we adopt the heuristic distinction between a regime of truth and a regime of hope (Martin et al. 2008). The public and the private sector are involved in different ways in both current haematological applications (regime of truth) and in future promises of regenerative medicine (regime of hope). On the one hand, this rethinking of the truth-hope distinction serves us to stress how untenable the simple public and private opposition is for capturing current biomedical uses of human tissues. On the other hand, we conclude that hybrid banking practices blur the boundaries between public and private sectors as the literature states, but they moreover relocate differences in the ways in which human tissues are commodified or not.

Methods

This article is a critical reflection on UCB banking practices, especially hybrid practices, and their implications. We talk about hybrid banking practices since the commonly used expression "hybrid banking models" takes implicitly the perspective of a basic and static private-public division of institutional arrangements and forms of business organization. It thus conceptually precludes the relevancy of the hybrid phenomena and with that the systematic critique of the bioeconomic implications and societal effects of current banking practices. These we aim to analyse here. Focusing on banking practices we can analyse the concrete entanglement between public and private banking arrangements and between redistributive and market economies involved. Hybrid UCB banking models are in most cases ways in which private banks manage special banking programmes within

their range of conventional commercial services. Shifting the analysis from banking models to these concrete practices opens up a conceptual space to consider their bioeconomic implications.

This critical analysis of hybrid banking practices draws on the STS literature on UCB bioeconomies and on the secondary analysis of our empirical fieldwork in the UCB banking sector. Since 1998 Christine Hauskeller has been conducting research on stem cell scientific practices, including an empirical study on cord blood banking with fieldwork observation and interviews with women and professionals at obstetric and child leukaemia clinics, and staff at private and public UCB banks in Germany in 2001/2002. Since 2013, Lorenzo Beltrame has been conducting extensive systematic document analysis of the literature on UCB banking and documents produced by both institutions operating in the UCB sector (Bone Marrow Donors Worldwide, Eurocord, NetCord) and bioethical and medical professional advisory bodies (American Academy of Pediatrics, 1999; Royal College of Obstetricians and Gynaecologists, 2006; European Group on Ethics in Science and New Technologies, 2004; ACOG Committee on Obstetric Practice, 2008).

In this article we examine the implications of UCB banking practices building on a review of the previously published research material. We do not present new empirical research findings but our reflection on the implications of hybrid banking practices in light of the STS literature and our previous research findings.

The bioeconomy of UCB banking and clinical application

Public and private UCB banks are motivated by different medical rationalities. Public

banks manage the collection of voluntarily donated UCB units for use in current haematological and oncological therapies, mainly in unrelated allogeneic settings. By contrast, private banks promote UCB banking for autologous or family use. The underwriting medical rationalisations for this private service are that the rate of success in UCB transplantation rises in family-related settings[1] (Hollands and Mccauley 2009), and that the privately owned UCB account reduces the time and the risks associated with the search for compatible UCB units. Moreover, private storage is advertised with an emphasis on the future development of biomedicine. Private banks' advertising cites research and clinical trials using UCB-derived stem cells (Bardelli 2010) for treating cardiac and neurological diseases, and the discovery of mesenchymal and other pluripotent stem cells in placenta and in the umbilical cord tissue (Hollands and Mccauley 2009). Private banking locates itself as part of the emerging sector of personal regenerative medicine and novel stem cell-based cures.

Martin and colleagues have described these opposing medical rationalities with the heuristic distinction between a "regime of truth" and a "regime of hope" (2008). The former is based on "current present-oriented 'evidence-based' support for existing applications of CB stem cells" (p. 136); the latter is oriented toward future stem cell therapies. According to them public banks operate only in the regime of truth, whereas private banks relate their services to both the regime of truth and the regime of hope. This distinction can be made relevant for studies of the bioeconomic and social implications of UCB banking, and for analyses of concrete banking practices, especially an understanding of deviations from the public-private distinction in hybrid banking models.

The dominant bioethical and biomedical discourse associates the "redistributive tissue economy" (Santoro 2009) of public UCB banking with particular ethical and social values and sentiments of belonging to a national community (Santoro 2011; Beltrame

2014). As Waldby noted, public UCB banking evolved using the established blood services as its logistic basis. It thus also claimed the blood service's moral justification, systematized famously by Richard Titmuss *The Gift Relationship* (1970). Voluntary tissue donation would promote both civil inclusion in the polity and "the redistributive ethics of the welfare state" (Waldby 2006, 57). To confirm this, we mention as an example that the European Group on Ethics in Science and New Technologies (EGE) stated in *Ethical aspects of umbilical cord blood banking* (EGE 2004, 18) that public UCB banking "implies an act of solidarity or generosity [and] contributes to the social cohesion". Medical ethicists define donation as "altruistic", "philanthropic" and as promoting "the common good" (Sugarman *et al.* 1995; Annas 1999).

In stark contrast, private banking is criticized as "running for profit" and as selling "a service, which has presently, no real use regarding therapeutic options" and promising "more than they can deliver" (EGE 2004, 20). In the bioethical and biomedical literature generally, private banking is associated with a negative image of commercialization in biomedicine that exploits the emotional vulnerability of new and prospective parents, commodifies human body parts and damages the public health sector by diverting resources and reducing the pool of donors (the American Academy of Paediatrics 1999; Royal College of Obstetrician and Gynaecologist 2006; ACOG Committee on Obstetric Practice 2008). Private banking is depicted as a service within the market economy that drives to capitalize and commodify tissues based on "self-interest" and "individual benefits" (Ecker and Green 2005). In other words, the private sector is seen as substituting valued social relations of civic inclusion with individualist values and profits in emerging tissue markets.

We have called this framing of the UCB banking economy "narrative of opposition" (Hauskeller and Beltrame 2016) since it is based on a set of juxtapositions that create

a rigid divide between the public and the private UCB banking sectors. The narrative of opposition is a discourse – that is a practice that forms the objects of which it speaks (Foucault 1972, 64). This discourse structures 'areas of knowledge and social practice' and 'social entities and relations' (Fairclough 1992, 3). It constitutes what has been called a hegemonic model or paradigm of medical innovation (Salter et al. 2015). The paradigm model is a linear innovation process that progresses from basic research via clinical experimentation, product development, clinical trials and product approval to clinical applications. This path of innovation aims at the parallel advancement of both generalizable knowledge and proven, safe clinical application (pp. 156-157). It gains hegemony through the alliance between 'science, medicine and industry' that propagate it and the set of 'national and transnational institutions of governance that protect it' (p. 157). Finally, Salter and colleagues point out that official bioethical institutions – bioethicists as 'experts in legitimizations' – provide the normative and ideological justification for this model pathway.

In a similar fashion the narrative of opposition has been adopted by biomedical experts in relation to UCB banking, science and clinical application, (e.g. Gluckman 2000) and institutions governing the field (e.g. Bone Marrow Donors Worldwide, European Group for Blood and Marrow Transplantation, Eurocord, NetCord, the U.S. National Marrow Donor Program). It is being propagated by medical organizations (e.g. the American Academy of Paediatrics 1999; Royal College of Obstetrician and Gynaecologist 2006; ACOG Committee on Obstetric Practice 2008) and legitimized by bioethicists (e.g. Sugarman *et al.* 1995; Annas 1999) and the policy advice documents of bioethical institutions (e.g. Comitè Consultatif National d'Ethique 2002; EGE 2004). Salter and colleagues (2015, 157), adopting Gramsci's terminology, define *blocco storico* (historical block) the alliance of social forces that sustains the process of hegemony. In the case of

UCB banking, the narrative of opposition is the legitimizing discourse of the above described set of professional and institutional actors who perform as an "epistemic community". An epistemic community has been defined as "a network of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy relevant knowledge within that domain or issue-area" (Haas 1992, 3) that aims to influence national and international regulations according to the biomedical and ethical logic underpinning the public system of UCB banking and clinical application.[2]

The narrative of opposition is profoundly inspired by Titmuss' *The Gift Relationship* with its accent on the moral primacy of voluntary donation, its call to social solidarity, cohesion and community bonds. Similarly to the criticism that economist Kenneth Arrow brought forth against Titmuss, calling this narrative "a passionately informed commitment to an ideal social order" (Arrow 1972, 360, quoted in Steiner 2003, 149) we judge it inadequate concerning its understanding of how the economic mechanisms operate and are mixed up. Also, from the point of view of social sciences' and STS analyses of the wider bioeconomy, the opposition narrative of the public-private distinction is untenable. It does not provide an adequate account of the concrete socio-economic systems of circulation, exchange and production of biovalue in UCB banking.

Whilst dealing with the increasing commercialization and capitalization in the life sciences and biomedical sectors, STS scholars have explored the concrete structuring and the articulations of different regimes of biovalue exploitation beyond the static categories of redistributive and market economy to fixed institutional sectors. Biotechnologies extract a surplus value from biological fragments which are then capitalized through their mobilization in circuits of exchange, patenting and/or licensing in a regime of intellectual property rights and in speculative stock market investments (Waldby 2002; Sunder Rajan 2006; Cooper 2008). This implies socio-economic dynamics that are more complex than

the thesis of de-humanizing commodification of body parts in a pure market economy suggests (Andrews and Nelkin, 2001). As Sunder Rajan (2003, 87) noted, biocapitalism operates through "shifting and variable use of market commodification versus public commons or public goods formation" and therefore market logic "is often most at stake in the strategic articulations of biocapitalism" (p. 93). At the same time, the circulation of these body fragments takes place in complex bioeconomies. The adoption of market forms does not necessarily imply the severing of social ties, but creates new kinds of relationships (Waldby 2002).

Commodifying tissues or services? Introducing concepts from social welfare studies

In what follows, we show how STS analyses of the UCB bioeconomy can be mobilized to challenge the dominant narrative of opposition, by showing how the two main sectors cannot be simplistically encapsulated into rigid distinction of redistributive versus market economy, commodification versus de-commodification and regime of truth versus regime of hope. On the contrary, UCB circulates in hybrid configurations blurring the boundaries between institutional arrangements and traditional UCB economies (Hauskeller and Beltrame 2016). This emerging hybridity reflects not only on the cultural, ethical and biopolitical implications of the different UCB bioeconomies, but also on the implications of what scholars call hybrid banking models.

Private UCB banking is a paradigmatic case to study the complexities of emerging bioeconomies. Its forms of biovalue cannot easily be reduced to a simple notion of commodification. Private banking is legitimised through a promissory discourse rotating around notions of "investment" and "biological insurance" (Waldby 2006). Through pri-

vate banking, UCB becomes "a form of property whose value is oriented toward the biological future" (Waldby and Mitchell 2006, 125), including both possible future diseases and a future regenerative medicine. It has been shown that the personal or family account severs the question of property from that of commodification (Waldby 2006; Waldby and Mitchell 2006).

This future-oriented value of UCB would be lost if exchanged as a commodity in market transactions. In fact, in the logic of private banking, UCB is an asset not a commodity, because a commodity acquires its value in exchange, while an asset has value also as property (Birch and Tyfield 2012, 302). In this sense, Fannin (2011) has suggested that private stem cell banking is less about the calculative rationality of investment and more about the economic practice of "hoarding". Investment implies the circulation of commodities and resources in order to increase their value through transactions. UCB in private accounts is hoarded, set aside from circulation, waiting for a future in which its regenerative potential will be more developed and its value increased.

The absence of a direct commodification of privately stored UCB does not mean that other forms of commodification and/or capitalization are not in operation. Private banks capitalize on selling a service of proprietary control on a biological asset. The market of private banking is a market of storing services, not a market of exchanged commodities.

At this point, the notion of commodification as it is employed in social science studies of welfare systems (Esping-Andersen 1990) adds valuable insight. From this perspective, private UCB banking commodifies a biological service, the provision of which relies on the market, and access to it depends on the market performance of individuals:

> … decommodification refers to the extent to which an individual's access to health care is dependent upon their market position and the extent to which a country's provision of health is independent from the market (Bambra, 2005, 201).

From this perspective, private banking is associated in the literature with "neoliberal forms of health entrepreneurship" (Waldby 2006, 59) involving novel forms of "neoliberal medical subjectivity" (ibid. p. 67) and "biological citizenship" (Rose and Novas 2005). These bioeconomic notions present the individual as managing her own health (or that of her family members) by negotiating in a market of biological services (Santoro 2011; Fannin 2013; Beltrame 2014).

This privatised market does not take place in a void of social relationships – as bioethical and medical professional bodies seem to suggest. Private UCB banking establishes a link between good parenting and biomedicine. Since kinship duties and family ties are involved in private and family UCB banking. The industry of commercial UCB banks capitalizes on aspirational emotions, affectivity, and future health risks (Brown and Kraft 2006, 316). But while bioethical and medical bodies see this as an exploitation of the emotional vulnerability of parents (American Academy of Pediatrics 1999), Brown and Kraft stress what they call a "techno-moral entry point" in the articulation of parenting and kinship responsibility (2006, 325). Looking after the future health of the family might entail responsibly reflecting on how the UCB should be used.

Commodification in the public banking sector

The commodification versus decommodification conundrum also affects public UCB banking. The ideal of a gift-redistributive economy that refutes any logic of economic profit is called into question by analyses of the bioeconomic practices public banks engage in. Defining UCB as medical waste if it remains outside the UBC economy imposes the "moral junction not to squander something potentially precious" (Brown 2013, 98) and attaches a value to the tissue that enables its economic exploitation. Practices related to cord blood and human placenta have a long and complex genealogy (Santoro 2011).

Before the discovery of stem cell in UCB, this tissue was used for epidemiological research and sold to cosmetic industries (Waldby and Mitchell 2006). But UCB could be capitalized also in other processes of commodification. In an interview study from 2001, Hauskeller and Manzei found that public UCB biobanks released and sold discarded UCB samples to research groups and biotech companies for a surplus (Hauskeller 2002; 2005; Manzei 2005). Manzei has shown, moreover, how public banks in Germany are run by private companies or closely connected with University spin-offs involved in developing medical innovations from UCB, concluding that "public banks also place the marketability of stem cell preparations at the centre of their activity" (Manzei 2005, 58, translation CH). In other words, public banks, too, are part of the value production and exchange system that exploits the biovalue of UCB for the future development of regenerative medicine and stem cell therapies.

These points illustrate that processes of commodification take place in public UCB banking. Even if the bioethical and biomedical discourses link public UCB banking to a redistributive economy committed to the shared future of a national community, public banks' repositories are connected worldwide through international registries, in which the UCBs are traded and service costs added to be paid for by the buyer. The international exchange serves to facilitate the search for compatible UCB units that is necessary to secure best clinical outcome because of the different human leucocyte antigen (HLA) phenotypes. UCB and its HLA-typisation thus enters the flow of the globalised "economies of signs and spaces" that reconstitute communities and subjectivities and open up possibilities for the heterogenization of space (Lash and Urry 1994, 3). Accordingly, public banks do not simply operate within the limits of the nation state. Through international registries, computer databases and search engines, HLA-typisation of the UCB allows the

transnational flow and the global circulation of UCB units, too (Beltrame 2014, 78). Redistribution of UCBs for transplantations thus takes place on an international scale, beyond the limits of national or local political community organisations in which the dominant bioethics discourse encloses it. This redefinition of the space has relevant bioeconomic implications. Brown and colleagues (2011, 1115) have explored how the global circulation of UCB is implicated in a "capitalisation of immunity" where this tissue becomes a sort of currency in an international economy. Within and across the health care economy, UCB units are exchanged at a price greater than the cost of collection, processing and storage, which generates income for public banks. The global redistributive economy of UCB operates through a market model, where "public banks compete for advantage in an international marketplace that places a premium" on being able to capitalise on quality UCB units for transplantations (Brown 2013, 99). The marketability of UCB today and internationally confirms what Hauskeller (2005) and Manzei's (2005) found in their Germany-based study.

This does not mean that the international circulation is aimed at profit making. As Hoeyer (2009) has shown, the moral ideal of keeping the human body apart from trade formatted a particular kind of market, where pricing strategies are described as following a logic of "compensation of expenses". However, even if the notion of commodification of the UCB is refuted, body parts circulate as commodities in a system of exchange that produces both prices and profits. Because a commodity is defined by being bought and sold, it would seem that in the public banking system UCBs are commodified. More concretely and presently so than may be the case in private UCB banking, where UCB is a speculative asset with potentially rising future value.

As noted by Waldby (2002), the ideal gift-redistributive economy posited by Titmuss (1970) – and adopted in the bioethical and biomedical account of UCB banking –

no longer describes the complex bioeconomies involved in the circulation of human tissues. We do not doubt the existence of important differences between public and private UCB banking and their societal and cultural implications. However, static economic categories seem less and less analytically useful when mapping the redistributive and market dynamics involved in UCB economies. Similarly, labelling whole institutional sectors as either inspired by ethical considerations of sharing or by economic profit-seeking reasons does not enable a good understanding of the societal effects of UCB banking models. We argue that it is time to decouple the equations public = redistributive economy and private = market economy. Our systematic analysis of the concrete practices of UCB banking shows an interlocking and entanglement between and across economic regimes and institutional sectors. Below, we explore hybrid banking models, and introduce and build on the concepts of commodification and de-commodification as developed in welfare system analyses to discuss some implications of hybrid practices in UCB bioeconomies and what they mean.

The challenge of hybrid UCB banking practices to de-commodification

Hybrid UCB banking models are considered the main biomedical space in which the public-private distinction has previously been challenged. In this context, the term hybrid indicates an array of UCB banking practices in which private banks make UCB units available to public healthcare institutions. Through these hybrid practices, private banks contribute to the redistribution of the human tissue for transplantation in public healthcare institutions. In other words, hybrid models are nothing but UCB banking practices usually located in the realm of public banks – according to the established public-private distinction – but actually undertaken by private and commercial UCB banks. This contribution to the public sector is included in the business of private banks, and it is motivated either

by ethical or marketing intention or, in other cases, is instigated by local regulatory conditions of UCB banking operation.

We list the major hybrid practices here. The most established form are donation programs and dedicated family storage for families at special health risk managed by private banks and without charge at the point of UCB collection (Wolf 1998). A second type of hybrid banking models is promoted by national laws (e.g. in Turkey and Spain) that stipulate that private banks make available part of their repository to the public healthcare systems (O'Connor et al. 2012). A third form has been developed by the UK's Virgin Health Bank, where each stored UCB sample is split: 20% of the sample is stored for private use and 80% for public use (Lancet 2007; Martin et al. 2008). Finally, the most interesting form of hybrid practice for our argument is "donatable family banking", described by Hung-Chieh Chang (2014). Parents pay a fee for private storage in a UCB bank, but the UCB unit is made available for search in the international UCB transplant registries. Should the UCB unit be flagged as HLA-matching for a particular patient, the customers of the private bank and owners of the UCB can decide whether they want to keep it, sell it, or donate it for the treatment of this patient.

According to O'Connor and colleagues (2012), the emergence of hybrid banking models reflects the influence of both market forces and public sector policies. In face of restrictive regulations that prohibit private banking in some countries, offering privately stored UCB as potentially available in the public system is a strategic move to "weaken the warrant for legislation or regulatory controls" limiting or hampering the business of private UCB banks (p. 515). However, these hybrid practices are economically profitable. They entail new articulations of the market logic, which shift the relation between market commodification and public commons (Sunder Rajan 2003, 87) that structures the distinction between a public and a private sector.

Hybrid models capture the active participation of private banks in the public redistributive UCB economy. Private banks perform functions that would be carried out by the public UCB banking system only, according to the opposition narrative. Therefore, the dynamic de- and commodification in the healthcare service of UCB banking and clinical application cannot be captured in terms of an opposition between a public and a private sector. Our analysis of *hybrid practices* enables looking afresh at the established notions of de- and commodification, which reveals some paradoxical implications. Usually, private banking offers a health service in a market framework, that is, it commodifies a healthcare service:

> … the larger the size of the private health sector, in terms of expenditure and consumption, the larger the role of the market and therefore the lower the degree of health decommodification (Bambra 2005, 202)

The participation of private UCB banks in the redistributive economy through hybrid practices undermines the suggested equation of private sector banking with commodification. Donation programmes and/or the part of repositories made accessible for a public healthcare system represent a de-commodification of the UCB storage service. Hybrid practices, thus, also mean that the size of the private sector in UCB banking is not a reliable index of health commodification.

Nevertheless, this de-commodification of the storage service corresponds to processes of commodification and capitalization of the value of the tissue itself. Making available part of their repositories for use by public services, hybrid banking practices participate in the international exchange of UCB units. Thus, private banks, too, can capitalize on export prices that exceed the cost of the storage service. The charge for an exported UCB unit can exceed €20.000, while a service of 20 years of storage is usually offered at around €3000 (Vita34 2015b). Thus, if a donated UCB is sold, the revenue is

higher than the profit from private storage. While in the private account UCB is kept apart from circulation, hybrid practices turn the UCB into a tradable object, a commodity circulating in an international market. What seems an ethical commitment to the moral redistributive economy instead follows the logic of this particular market economy.

This dynamic gains a new and hitherto not described feature in the case of "donatable family banking" (Chang 2014). In this setting, the account holder ultimately decides whether the privately stored UCB will remain a private asset or become a commodity sold for revenue or a resource donated for the public good. Donatable family banking redraws the boundaries between the good citizen and the neoliberal health entrepreneur as enacted in the parental decision whether to store or donate UCB at birth.

Applying the distinction between a regime of truth and a regime of hope, hybrid banking practices not only blur the boundaries between the private and the public, they restructure and relocate these boundaries. While public banks operate mainly in a regime of truth – using stored tissues for currently required therapeutic interventions – private banks "relate their services to both current applications and the future potential of regenerative medicine" (i.e. regime of hope, Martin et al. 2008, 140). Hybrid banking practices seem to thoroughly conflate the two regimes, first, because they operate simultaneously in the sector of public redistributive UCB economy and in the market of private services, and secondly because they are involved in current clinical treatments and also nurture and economise on the future promise of regenerative medicine. If we look at banking practices and their hybrid intersections in the regime of truth, the literature that speaks of a blurred boundary between public and private would seem confirmed.

Moreover, however, while hybrid models as activities of private banks partake in the de-commodification of UCB banking services for clinical applications that carry the

insignia of the regime of truth – decoupling the public from the monopoly over redistributive economy – things are different in the regime of hope. The privately marketed personal UCB account linked to expectations of future developments in stem cell science and emerging therapies remains a firm and necessary element in the practice of private UCB banking. In this sense, hybrid banking practices accentuate the public-private distinction in the regime of hope and partake in the commodification of personalised regenerative medicine. In other words, on the one hand hybrid practices blur the public-private divide in relation to current haematological application, on the other hand, they reaffirm and thrive on UCB storage and asset management in view of the promise of a future stem cell medicine.

Conclusions

In addressing the public-private distinction in UCB bioeconomies, the STS literature has offered insights that we have mobilized to problematize the equation that public UCB banking operates in a moral economy of redistribution and private UCB banking is a form of tissue commodification in a market economy. Following through with these insights of STS, our analysis shows how the adoption of static categories – such as private versus public, or redistributive versus market economy – does not reflect the complex articulations of different UCB economies. In particular, the equation of public UCB banking with an ideal moral gift-redistributive economy that resists the commodification of UCBs is problematic. Public banking de-commodifies the provision of UCB for transplants, but other forms of commodification of the tissue take place. At the same time, while public banks work mainly in the regime of truth of current haematological applications, they are also involved in creating and stabilising a global value chain that extrapolates biovalue

from UCB as a source of stem cells for future therapies and capitalizes on the commodification of human tissues. Conversely, while private banks commodify the health service of UCB storage, at least for the time being, they actually de-commodify the tissue, turning it into a private asset and thus removing it from the current system of circulation and exchange. The UCB's value is created there as a prospective, future value.

Our analysis of commodification processes in hybrid banking practices shows that the public and the private sector, the redistributive and the market economy, are interlocked and entangled. Yet, this process is more complex than just a blurring the boundary between public and private banking and confusion of the related alignments to forms of biovalue creation. Hybrid banking practices relocate and restructure these notions. On the one hand, indeed, through hybrid banking practices private banks partake in the redistributive UCB economy and thus contribute to the de-commodification of the UCB banking service. On the other hand, this de-commodification of the service implies the commodification of UCB as material, and this commodification is motivated by a market logic of profitability. Donation programs and other free of charge banking options involve the circulation of UCB units for clinical interventions that are financially rewarded in the international exchange of UCB units. Therefore, while private banks continue to generate income from the storage fee in their business of family banking, they also add revenue from providing UCBs for transplantations through contributions to the public banking services. The participation in the public redistributive UCB economy does not simply respond to an ethical commitment on the side of the private banks, it is an articulation of the market logic in which they operate. The equation of the public sector with redistributive economy and the private sector with market economy is decoupled. This analysis of an erasure of the private-public distinction, however, applies only in the regime of truth, the engagement in current medical practice and treatments.

Regarding the hope that future developments in regenerative medicine will add value to UCB assets, hybrid UCB banking practices strengthen the public-private distinction. Private banks adopting hybrid banking practices continue to build a great part of their business on the income generated by the UCB storage fee, which, in turn, is motivated by the expectation of a future medical value of this human tissue for regenerative medicine. This expected future value transforms UCB into a speculative asset and thus increases the commodification of UCB storage service in the private sector. The public UCB banking sector, indeed, is not directly involved in this orientation toward a (medical and economic) future, and hybrid banking practices do not intertwine the public and the private sector in the regime of hope. In other words, in the case of hybrid banking practices, too, the provision of UCB storage for possible future regenerative medicine is dependent on the market in the same way in which individuals' access to this health service is dependent upon their market position.

In its opinion on UCB banking the European Group on Ethics (EGE 2004) stated that "if in the future regenerative medicine developed in such a way that using autologous stem cells became possible… Not everyone may be able to afford the costs of storage. In that case, access would be related to financial resources" (p. 19). EGE added that, if such developments occurred "the storage should not be a service left to commercial banks but should be taken over by the public sector in order to ensure fair access to healthcare services for everybody" (p. 22).

We interpret the ethical perspective represented here with the influential statement by the EGE, as indicating that hybrid practices do not address or solve issues of social justice and fairness of access to biomedical technologies and services. Instead, they move these societal issues from the present to the future, from the field of current haematological application into the hypothetical realm of future cures and applications of stem cells

in the clinic. Hybrid banking practices bring private banks into the public redistributive tissue economy, thus de-commodifying the provision of a healthcare service. But, at the same time, private banks continue to capitalize on future developments in regenerative medicine by selling proprietary control over the UCB as a private asset.

We conclude therefore that the ways in which hybrid UCB banking practices are blurring the boundaries between public and private are more complicated than described in the bioethics literature. The dominant narrative describes a social order founded on solidarity and cohesion, supported by a redistributive tissue economy and threatened by the spread of a commodifying market economy. The presence of hybrid banking practices undermines this view; processes of commodification – those affecting public banking and those involved in hybrid banking models – show that this order is more alleged and deemed desirable than real. Moreover, hybrid practices trouble and destabilise the order in which future medical therapies based on novel uses of human tissues are conceived in expert and lay communities. In this sense, the term hybrid expresses the ethical concern regarding the transition between the public redistributive and the private market economic sphere. A transition that is already permeating the whole cord blood bioeconomy and that makes the opposition narrative untenable for descriptive and analytical purposes. At the same time, however, considering the future of tissue banking and regenerative medicine, the term hybrid still entails the original opposition of economic models and their ethical and societal implications. The use of the term hybrid thus expresses a biopolitical commitment to equality in health care that underlies the opposition narrative.

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[1] UCB can be used in different ways in clinical applications: transplantations from donor to biologically unrelated recipient are called unrelated allogeneic; transplantations between siblings or family members, related-allogeneic; and transplantations where donor and recipient are the same person, autologous.

[2] The role of this set of actors in influencing national and international regulations could be attested through some examples. For example, Eurocord member Manuel Fernandez, in an article reporting the Eurocord position on ethical and legal issues in UCB banking, stated: "Regulations or legislations to be enforced by governments or international organizations should be previously advised and audited by the international community of scientists experienced in CBT. Eurocord group… regards itself as an adequate body to fulfil this role" (1998, S85). Eliane Gluckman was heard as expert both by the French Comité Consultatif National d'Ethique (2002; 2012) and by EGE (2004) – and the Comité Consultatif National d'Ethique recommended decision makers of not "subscribing to the creation of private banks" (2002, 10). In Italy, the regulation prohibiting the establishment of private banks was issued by the then Health Minister Girolamo Sirchia, member of Eurocord and founder of the Milan Cord Blood Banks (Repubblica Italiana - Ministero della Salute 2002). On the role of EGE, and in particular of its opinion on UCB banking, for European Tissue and Cells directive see Mohr et al. (2012).

References

American Academy of Pediatrics Work Group on Cord Blood Banking. 1999. "Cord blood banking for potential future transplantation: subject review." *Pediatrics* 104(1 Pt. 1): 116-118.

American Congress of Obstetricians and Gynecologists (ACOG) Committee on Obstetric-Practice, 2008. "ACOG Committee Opinion number 399, February 2008: Umbilical cord blood banking." *Obstetrics and Gynecology* 111(2 Part. 1): 475-477.

Andrews, L., and Nelkin, D. 2001. *Body bazaar: The market for human tissue in the biotechnology age*. New York: Crown Publishers.

Annas, G.J. 1999. "Waste and Longing – The legal status of placental-blood banking." *The New England Journal of Medicine* 340(19): 1521-1524.

Arrow, K. J. 1972. "Gifts and Exchange." *Philosophy and Public Affairs* 1(4): 343-362.

Ballen, K., Gluckman, E., and Broxmeyer, H.E. 2013. "Umbilical Cord Blood Transplantation: The First 25 Years and Beyond." *Blood* 1224(4): 491-498.

Bambra, C. 2005. "Cash Versus Services: 'Worlds of Welfare' and the Decommodification of Cash Benefits and Health Care Services." Journal of Social Policy 34(2): 195-213.

Bardelli, S. 2010. "Stem cell biobanks." *Journal of Cardiovascular Translational Research* 3(2): 128-134.

Beltrame, L. 2014. "The bio-objectification of umbilical cord blood: Socio-economic and epistemic implications of biobanking." *Tecnoscienza* 5(1): 67-90.

Birch, K. and Tyfield, D. 2012. "Theorizing Bioeconomy: Biovalue, Biocapital, Bioeconomics or… What?" *Science, Technology, & Human Values* 38(3): 299-327.

Bone Marrow Donors Worldwide (BMWD). 2015. "Statistic. Cord Blood Registries." Accessed April 27, 2015. http://www.bmdw.org/index.php?id=statistics_cordblood

Brown, N. and Kraft, A. 2006. "Blood ties: Banking the stem cell promise." *Technology Analysis & Strategic Management* 18(3-4): 313-327.

Brown, N., Machin, L. and Mcleod, D. 2011. "Immunitary bioeconomy: The economisation of life in the international cord blood market." *Social Science & Medicine* 72(7): 1115-1122.

Brown, N. 2013. "Contradictions of value: Between use and exchange in cord blood bioeconomy." *Sociology of Health & Illness* 35(1): 97-112.

Chang, H.-C. 2014. "The third way of umbilical cord blood banking." *Nature Biotechnology* 32(4): 318-319.

Comité Consultatif National d'Ethique. 2002. "Umbilical cord blood banks for autolgous use or for research - Opinion 74". Accessed November 2015 http://www.ccne-ethique.fr/sites/default/files/publications/avis074en.pdf

Comité Consultatif National d'Ethique. 2012. "Use of stem cells derived from umbilical cord blood, the umbilical cord itself and the placenta; their storage in biobanks. Ethical issues - Opinion 117". Accessed November 2015 http://www.ccne-ethique.fr/sites/default/files/publications/avis_117eng.pdf

Cooper, M. 2008. *Life as Surplus. Biotechnology and Capitalism in the Neoliberal Era.* Seattle and London: University of Washington Press.

Cord Blood Registry. 2015. "About CBR." Accessed June 25, 2015. http://www.cordblood.com/about-cbr/About-CBR

Cryo-Cell. 2015. "About Cryo-Cell". Accessed June 25, 2015. http://www.cryo-cell.com/about

Ecker, J. L. and Green, M.F. 2005. "The Case Against Private Umbilical Cord Blood Banking." *Obstetric and Gynecology* 105(6): 1282-1284.

Esping-Andersen, G. 1990. *The Three Worlds of Welfare Capitalism*. London: Polity.

European Group on Ethics in Science and New Technologies. 2004. "Ethical Aspects of Umbilical Cord Blood Banking. Opinion no. 19 to the European Commission, 16 March 2004." Accessed May 24, 2015. http://ec.europa.eu/bepa/european-group-ethics/docs/avis19_en.pdf

Fairclough, N. 1992. *Discourse and Social Change*. Cambridge: Polity Press.

Fannin, M. 2013. "The hoarding economy of endometrial stem cell storage." *Body & Society* 19(4): 32-60.

Fernandez, M.N. 1998. "Eurocord position on ethical and legal issues involved in cord blood transplantation." *Bone Marrow Transplantation* 22(S1): S84-S85.

Foucault, M. 1972. *The Archaeology of Knowledge*. London: Tavistock Publications.

Gluckman, E. 1996. "Umbilical cord blood transplant in human." *Hematology and Cell Therapy* 38(5): 393-397

Gluckman, E. 2000. "Ethical and legal aspects of placental/cord blood banking and transplant." *The Hematology Journal* 1(1): 67-69.

Gluckman, E., Broxmeyer, H.E., Auerbach A.D., Friedman, H.S., Douglas, G.W., Devergie, A., Esperou, H., Thierry, D., Socie, G., Lehn, P. Cooper, S., English, D., Kurtzberg, J., Bard, J. and Boyse, E.A. 1989. "Hematopoietic reconstitution in a patient with Fanconi's anemia by means of umbilical-cord blood from an HLA-identical sibling." *The New England Journal of Medicine* 321(17): 1174-1178.

Haas, P. 1992. "Introduction: epistemic communities and international policy coordination." *International Organization* 46(1): 1-35.

Hauskeller, C. (Hg.) 2002. *Humane Stammzellen. Therapeutische Optionen, ökonomische Perspektiven, mediale Vermittlung*. Lengerich: Pabst Science Publishers.

Hauskeller, C. 2005. Introduction. In: *Crossing Borders. Cultural, Religious, and Political Differences Concerning Stem Cell Research. A Global Approach*, edited by W. Bender, C. Hauskeller and A. Manzei, pp. 9-24. Münster: Agenda Verlag.

Hauskeller, C. and Beltrame, L. 2016. "The hybrid bioeconomy of umbilical cord blood banking: Re-examining the narrative of opposition between public and private services." *BioSocieties* advance online publication 11 January 2016.

Helmreich, S. 2008. "Species of biocapital." *Science as Culture* 17(4): 463-478.

Hoeyer, K. 2009. "Tradable body parts? How bone and recycled prosthetic devices acquire a price without forming a 'market'." *BioSocieties* 4(2-3): 239-256.

Hollands, P. and Mccauley, C. 2009. "Private cord blood banking: Current use and clinical future." *Stem Cell Reviews and Reports* 5(3): 195-203.

Lancet 2007. "Umbilical Cord Blood Banking Richard Branson's Way." *The Lancet* 369(9560):437.

Lash, S., and Urry, J. 1994. *Economies of Signs & Spaces*. London, Sage.

Manzei, A. 2005. *Stammzellen aus Nabelschnurblut. Ethische und gesellschaftliche Aspekte*. Berlin: IMEW.

Martin, P., Brown, N. and Turner, A. 2008. "Capitalizing hope: The commercial development of umbilical cord blood stem cell banking." *New Genetics and Society* 27(2): 127-143.

Mohr, A., Busby, H., Hervey, T. and Dingwall, R. 2012. "Mapping the role of official bioethics advice in the governance of biotechnologies in the EU: The European

Group on Ethics' Opinion on commercial cord blood banking." *Science and Public Policy* 39 (1): 105-117.

Organisation for Economic Co-operation and Development (OECD). 2006. *The Bioeconomy to 2030: Designin a Policy Agenda.* Paris: Organisation for Economic Co-operation and Development.

O'Connor, M.A.C., Samuel, G., Jorden, C.F.C. and Kerridge, I.H. 2012. "Umbilical cord blood banking: Beyond the public-private divide. " *Journal of Law and Medicine* 19(3): 512-516.

Parent's Guide to Cord Blood Foundation. 2015. "Cord Blood by the Numbers." Accessed May 24, 2015. http://parentsguidecordblood.org/cord-blood-by-the-numbers.php

Repubblica Italiana, Ministero della Salute 2002. "Misure urgenti in material di cellule staminali da cordone ombelicale". Ordinanza 11 gennaio 2002 del Ministero della Salute, in Gazzetta Ufficiale della Repubblica Italiana n.31 del 6-2-2002 p. 44. Accessed November 2015 http://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2002-02-06&atto.codiceRedazionale=02A01388&elenco30giorni=false

Rose, N., and Novas, C. 2005. Biological Citizenship. In *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems*, edited by A. Ong and S. J. Collier , 439-463. Oxford: Blackwell.

Royal College of Obstetricians and Gynaecologists. 2006. "Umbilical Cord Blood Banking, Scientific Advisory Committee Opinion Paper 2". Accessed May 24, 2015. https://www.rcog.org.uk/globalassets/documents/guidelines/sac2umbilical-cordbanking2006.pdf

Salter, B. Zhou, Y. and Datta, S. 2015. "Hegemony in the marketplace of biomedical innovation: Consumer demand and stem cell science." *Social Science & Medicine* 131: 156-163.

Santoro, P. 2009. "From (public?) waste to (private?) value. The regulation of private cord blood banking in Spain." *Science Studies* 22(1): 3-23.

Santoro, P. 2011. "Liminal biopolitics. Towards a political anthropology of the umbilical cord and the placenta." *Body & Society* 17(1): 73-93.

Steiner, P. 2003. "Gifts of Blood and Organs: The Market and "Fictitious" Commodities." *Reveue française de sociologie* 44(5): 147-162.

Sugarman, J., Reisner, E.G. and Kurtzberg J. 1995. "Ethical Aspects of Banking Placental Blood for Transplantation." *Journal of American Medical Association* 274(22): 1783-1785.

Sunder Rajan, K. 2003. "Genomic capital: Public cultures and market logics of corporate biotechnology." *Science as Culture* 12(1): 87-121.

Sunder Rajan, K. 2006. *Biocapital. The Constitution of Postgenomic Life*. Durham and London: Duke University Press.

Titmuss, R. 1970. *The Gift Relationship: From Human Blood to Social Policy*. London: Allen & Unwin.

ViaCord. 2015. "About ViaCord". Accessed June 25, 2015. http://www.via-cord.com/about/

Vita34. 2015a. "Über Vita34". Accessed June 25, 2015. http://www.vita34.de/ueber-vita-34/

Vita34. 2015b. "Vita Plus". Accessed November 30, 2015. http://www.vita34.com/vita-plus/

Waldby, C. 2002. "Stem cells, tissue cultures and the production of biovalue." *Health* 6(3): 305-323.

Waldby, C. 2006. "Umbilical Cord Blood: From Social Gift to Venture Capital." *BioSocieties* 1(1): 55-70.

Waldby, C. and Mitchell, R. 2006. *Tissue Economies. Blood, Organs, and Cell Lines in Late Capitalism*. Durham and London: Duke University Press.

Wolf, S.A. 1998. "Cord Blood Banking: A Promising New Technology." *Neonatal Network* 17(4): 5-6.