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How do population movements fit within the framework of systemic risk?

Serena Tagliacozzo [a,*], Lorenzo Guadagno [b], Sonja Ayeb-Karlsson [c,d]

[a] Institute for Research on Population and Social Policies, Italian National Research Council, Address: Via Palestro 32, Rome, Italy
[b] Former IOM, 17, Route des Morillons, 1211 Genève, Switzerland
[c] Institute for Risk and Disaster Reduction (IRDR), University College London (UCL), South Wing UCL, Gower Street, London WC1E 6BT, UK
[d] United Nations University Institute for Environment and Human Security (UNU-EHS)

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ABSTRACT

Population movements are key elements shaping today's complex and interconnected societies. Movement of people underpins the circulation of capital, knowledge, ideas, culture, values and resources with systemic benefits but it also produces diverse risk implications. The varied and complex implications of human mobility (and immobility) are still poorly understood by existing systemic risk approaches. This literature review approaches human mobility from a more comprehensive and complex standpoint to understand how it fits within a wider framework of systemic risk.

In this article, we explore the complementary ways in which movements matter for systemic risk considerations, namely as: 1) a dynamic force that shapes exposure, vulnerability and resilience to disasters across places and scales; 2) a feature and consequence of disasters that has the potential to amplify, extend and prolong the impacts of hazards, and 3) a lifeline for people and societies worldwide, whose disruption has significant implications on systemic risk globally.

These considerations have important theoretical consequences for the integration of population movements in systemic risk frameworks, and they propose practical lessons learned for the disaster risk reduction arena. We conclude that human mobility should not be understood as a negative impact that must be prevented and mitigated but as a positive phenomenon which enablement and protection a will lead to positive resilience outcomes and the reduction of risks.

1. Introduction

Modern societies are highly interconnected, complex and differentiated. These characteristics yield functional and organizational benefits, and have enabled rapid economic growth and social transformations over the last decades [78]. However, these very features also magnify and diversify risk. The high interdependency between societies and among their components enable the impacts of hazards to propagate rapidly across locations, societal sectors, and escalate into tipping points [65]. Risk is a pervasive, ubiquitous and systemic feature of today's globalized society.

Originating in the financial domain [60], the concept of "systemic risk" has become increasingly prominent in the last decade among scholars and policymakers to assess and interpret threats and impacts from a diversity of hazards. Features that define systemic risks include complexity and interdependency, transboundariness, non-linearity between causes and effects, the potential to generate tipping points and a time and space lag between a risk source and its impacts [66].

Population movements are a key social process through which systemic risks are constructed: they contribute to making societies more interlinked and interdependent, while also underpinning translocal connections through which the impacts of hazards can spread across places and time. At the same time (and not unlike other factors that determine how systemic risks arise and expand), population movements are dynamics that produce individual and collective opportunities for resilience and wellbeing. They deserve comprehensive attention in systemic risk frameworks and approaches.

At a global level, the circulation of people enables capitals and knowledge movement that produces positive benefits in terms of consumption, production and economic growth [27,31,40,41,85]. Effective allocation of workforce at global level, cultural vitality and innovation, transfers of material resources and ideas would not be possible at the present scale without sustained population movements.

For societies that face shocks and crises, the presence of migrants and

* Corresponding author.
E-mail addresses: Serena.tagliacozzo@irpps.cnr.it (S. Tagliacozzo), lorenzo.c.guadagno@gmail.com (L. Guadagno), s.karlsson@ucl.ac.uk (S. Ayeb-Karlsson).

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their translocal networks can be a factor for resilience and stability, as more diverse pools of (local and distant) capacities and resources support improved prevention, preparedness and recovery [33,34,46,51,58,59,82]. At the same time, translocal ties also interconnect crises: the impacts of hazards affecting migrants (and more broadly migration) are also felt across their networks, in places of origin and transit, and well beyond the directly affected areas [3,26,37,43,46,48].

At individual and household levels, moving is often a key component of resilience strategies. It allows people to leave fragile and at-risk ecosystems and to reduce (or at least diversify) hazard exposure of people and their livelihoods. It may allow them to improve their access to resources needed to anticipate, cope with and recover from chronic, everyday stresses and more acute shocks [44,68].

At the same time, people on the move can end up being exposed to different and new hazards, through, for example, living conditions that make them more vulnerable to their impacts. Moreover, the aggregate demographic, social and economic impacts of population movements reproduce local and global landscapes of risks to all kinds of disasters [34,63].

Accounting for human mobility should be a key concern for the upcoming research looking at systemic risks: population movements have complex (and often simultaneous) risk creation and risk reduction implications across places, scales and time, both enabling development and resilience, while also producing marginality, vulnerability and risk externalities. However, as shown in the following sections, the emerging literature on systemic risks almost exclusively considers population movements as a (negative) consequence of other risks (e.g., food insecurity generating 'mass' migration). This article seeks to expand this perspective, framing population movements as: 1) a key demographic, social, cultural, political, economic and environmental dynamic that diversify interconnected, positive and negative risk outcomes; 2) a consequence of disasters that has the potential to expand, prolong and multiply their negative impacts; and 3) a determinantfor wellbeing in today's societies – a feature so essential that its interruption or reduction threatens the very viability of our socio-economic systems.

Building on the evidence gathered through the literature on migration and development, forced population movements, disaster risk reduction (DRR) and systemic risk management, the following sections will seek to highlight the full relevance of human mobility for the frameworks that assess and address systemic risk. The article is not intended to be a systematic literature review of systemic risk and population movements, rather, its sections will build arguments for the need tobetter incorporate mobility issues into the systemic risk scholarship. The article also outlines the shortcomings of the current systemic risk frameworks that portray population movements with strong negative connotations. To this end, the article considers the full spectrum of human mobility (HM), looking at both voluntary and forced forms of movements [63] and accounting for diverse associated interconnected, interacting and cascading risks [61] and resilience outcomes.

2. Population movements in existing approaches to systemic risk

Systemic risk offers natural hazards research a useful heuristic tool to investigate the interplay between natural and anthropogenic hazards and disasters [77]. The concept of systemic risk has been used to analyse the far-reaching impacts of climate change, pandemics, food and water insecurity, and droughts [[64]22,66,87,88].

However, this literature has accounted for HM only rarely and in a limited manner, despite the increasing centrality of migration and displacement considerations for disaster research, policy and practice. When population movements are accounted for, they are usually portrayed either as one of the cascading impacts of other systemic risks, or as a driver of social vulnerability.

The GAR 2019 dedicated an entire chapter to the concept of systemic risk but only a short section to human mobility, mainly looking at the example of disaster displacement [87]. It acknowledged the relevance of population movements as a dynamic amplifying and extending the impacts of hazards and potentially creating new risk, noting how they often have "severe and long-lasting social, economic and legal impacts, particularly in protracted contexts" (p. 232).In this way, itdraws attention to the risks connected to informal settlements in hazard-prone areas. Urban mobility dynamics and the diversity of risks that people face when settling in their destinationareas are also receiving increasing attention [2,4,21,24,73]. In particular, literature on climate-induced rural-to-urban migration provides a rapidly growing body of evidence on this topic [14,28].

Systemic risks analyses focusing on the impacts of climate change ([17]; Hui-Min et al., 2021 [93]; [23]) tend to focus on climate (and associated risks) as drivers of movements. Droughts and extreme weather events can result in large-scale movements of people, including through their impacts on environmental degradation, food and water insecurity, and economic hardship (Global Risk Report, 2020 [95] and 2021 [94]; [70]; GAR, 2021 [96]). In the absence of effective mitigation and adaptation measures, climate change is anticipated to trigger or amplify population movements through a variety of direct and indirect adverse impacts [9,11,23].

Other approaches focusing on the etiology and assessment of risks tend to frame population movements as drivers of vulnerability. The Social Vulnerability Index https://data.cdc.gov/Vaccinations/Social-Vulnerability-Index/ypqf-r5qs), for instance, factors in population movements for their negative outcomes on demographic growth, presence of culturally diverse individuals, job insecurity and poverty, and social and political marginalisation [16]. Similarly, the Inform Risk Index looks at displacement as a dynamic creating unmet needs for affected persons [54]. The Fragile State Index, instead, accounts for large scale inflows of displaced persons as an element of complex humanitarian emergencies, and the brain drain associated with the emigration of qualified individuals as an element of instability [84].

While all these elements are relevant to integrating mobility considerations in systemic risk approaches, several key reflections are missing, and deserve to be articulated. Firstly, there are significant individual and systemic benefits linked with population movements, as moving underpins socio-economic wellbeing and resilience, and people's very survival in the face of hazards. Secondly, population movements are so essential to the viability of our societies that any mobility restrictions create profound risks to interconnected systems in people's places of origin, transit, destination and beyond[7]. Lastly, changes to the fabric of societies are shaped by population movements and determine how disasters propagate: hazards produce impacts across the translocal networks that mobility creates and enables [3,20].

In the last couple of years, the literature body on the COVID-19 pandemic has contributed to expanding and nuancing our understanding of the relationship between human mobility and systemic risk. Restrictions to local and international mobility increased risk for immobile labour migrants all over the world [7]. They also generated global ripple impacts for economic growth and industrial production, food and water security, and health through the shortage of workers in essential services and the decrease of global remittances [1,27,46,72,80]. Other environmental, health and livelihood security impacts were produced through the forced return of migrants in their locations of origin [26,73] The propagation of these risk effects to a systemic level (i.e. at a global scale and across sectors) was largely mediated by the lack of recognition and protection of migrants' rights, and by the additional insecurity migrants faced following border closures, movement restrictions and economic downturn [35,36,46]. The resilience of interdependent systems also depends on the fragility their most vulnerable components.

To some extent, these diverse systemic implications of human mobility were already captured in key DRR policy documents; "*The Sendai Framework pays due attention to the systemic complexities of population movements as drivers of risk, but also as opportunities for strengthened*

resilience. It highlights consequences of disasters in terms of displacement, but equally acknowledges the contributions that migrants can make – through remittances, networks, skills and investments – in addressing root causes and promoting resilience" ([87] p. 232). Despite this high-level acknowledgement, a comprehensive analysis of how human mobility fits within systemic risk frameworks is still missing. The following section attempts to begin this analysis.

3. Human mobility and systemic risk

The multidimensionality of the nexus between human mobility and risk is not fully reflected in most systemic risk frameworks. As a first step towards addressing this gap, the present section interprets population movements through the criteria laid out by Renn et al. [66] to define and describe systemic risks.

- *Complexity and interdependency:* Human mobility is an inherently complex feature of our societies, determined by multiple drivers and with diverse consequences for people and their peers. The circulation of people, over short and longer distances, lasting short and long periods, is always the result of different, interconnected demographic, economic, social, political and environmental factors, which contribute to countless individual decisions and shape collective patterns and trends [28,62]. At the same time, people's movement and resettlement generates a diversity of secondary outcomes, for those moving, their families, and members of their communities [34].
- *Trasboundariness*: Migration and displacement are inherently translocal (and often transnational) dynamics, including in the context of hazards and disasters. Population movements tie together communities and societies within and across nations and regions [63]. Personal ties, economic and commercial flows, exchanges of ideas and knowledge, dependency on manpower increase the interdependency of societies beyond administrative and political boundaries. Even short-distance and short-term movements generate pervasive social, economic and environmental effects that can have transboundary implications [19].

- *Non-linearity between causes and effects*: Human mobility is a social dynamic with complex social and environmental implications. Where, when and how people move determines where people live, what opportunities they can access and what risks they face [76,81]. Population movements affect all the components of disaster risk (exposure, vulnerability, capacities), through the production of (often simultaneous) risk reduction and risk creation outcomes for different people (Uekusa & Matthewman, 2017 [97]). In other words, the influence of mobility patterns and trends on risks and impacts is not well represented through linear causal chains, but should rather be visualised through interlinked feedback loops. The different risk and wellbeing outcomes of human mobility are largely determined by contextual factors (i.e. the environmental, social, economic and political features of the system in which people move) [18,28,56]. Human mobility is a complex object of study for DRR.
- *Time and space lag between risk source and risk impacts:* The impacts of mobility patterns can manifest over long periods and in different, more or less distant locations. Population movements can stimulate social transformation and technological developments in people's places of origin, transit and destination. They can result in demographic change and pressures on socio-environmental systems of destination. The positive and negative risk implications of all these processes are often only visible over time, as relevant dynamics play out over months, years and generations. Moreover, all these factors further influence other mobility decisions, with cascading impacts across times and places.
- *Existence of tipping points:* Individual mobility decisions (and ensuing population movements) are often associated with the crossing of social and environmental tipping points. In fact, migration and displacement are increasingly being investigated as one of the symptoms or potential consequences of the loss of habitability of ecosystems [38]. At the same time, population movements also generate profound transformations ecosystems and societies, disrupting their balance, or shifting them towards new settings in hard-to-reverse manners.

Despite possessing all the properties of systemic risks, population movements do not fully belong in the same category as other factors that are considered in most systemic risk frameworks. Fragile infrastructure, environmental degradation, poorly managed urbanization have primarily or exclusively negative risk outcomes, whereas population movements produce numerous risk reduction benefits. This has significant theoretical consequences for the framing of human mobility in systemic risk frameworks, as well as practical consequences for DRR. Population movements cannot only be understood as a problem to be prevented or managed. They also are productive phenomena that need to be enabled and leveraged.

The next section explores the different risk reduction and risk construction implications of population movements – a precondition to appropriately situating human mobility within systemic risk frameworks and approaches.

3.1. Complex impacts of movements on risk construction and risk reduction

People move between *riskscapes*, i.e., contexts characterised by specific sets of hazards. At the individual level, moving entails a risk tradeoff: people leave a place featuring specific threats and constraints (but also social ties, known resources and characteristics) to access a new set of opportunities (but also may face a new set of hazards and challenges). At the aggregate level, the population flows that result from mobility decisions shape how population and capital are distributed, and redesign global and local risk landscapes [34]. Whenever people move, different (positive and negative) risk implications will manifest across spaces.

Population movements, for instance, are one of the global determinants of ongoing urbanization trends. Large share of urban migrants, especially in sprawling cities, end up living in hazard-prone locations and in unprotected structures, where they face the impacts of sea-level rise, weather extremes and geophysical hazards (Black et al., 2012 [11]; [25,30,49,57,2]). A decade ago, it was estimated that some 40% of Dakar's incoming residents were settling in hazard-prone areas [10]. In Bangladesh, people displaced by disasters and environmental degradation tend to move towards areas recurrently affected by floods, standing water and freshwater insecurity ([4]; Islam & Shamsuddoha, 2017 [98]; [2,92]). Moreover, newcomers often have no alternatives to living in informally-built homes, with no security of tenure and in informal settlements where they may have limited access to livelihood opportunities, basic facilities and services, and risk reduction investments. The inflow of migrants and people displaced by conflicts and disasters have fueled the growth of urban 'slums' or informal settlements around the world. Many of those moving, however, may have left marginal ecosystems, such as drylands and mountain areas, highly vulnerable to hazards and the adverse impacts of climate change [91]. For many migrants, moving out of their areas of origin also means being able to access livelihood opportunities that are less dependent on fragile natural resources, and less threatened by natural cycles and hazards [24].

Population movements also shape the pressures people put on natural resources and ecosystems in areas of origin and destination [92]. Emigration reduces the human footprint on a given location, and strategies like transhumance of pastoralists and seasonal migration have been used for millennia to preserve limited water and land, and manage risks related to their scarcity [40,71]. However, abandonment of places

can also have negative environmental impacts, especially in "cultural landscapes" (i.e., ecosystems that have been shaped over centuries by human activities). Depopulation might result in the degradation of the local environment, as labour-intensive practices and infrastructure that preserve the stability of slopes, water catchments and forested areas can be no longer maintained. Biodiversity loss and proliferation of invasive species, increased incidence of landslides, floods, fires, avalanches, soil erosion and desertification may follow depopulation, leading to reduced food, water and livelihood security for the people staying behind (Rey [[102],6,53,79]).

At the same time, population movements may result in altered occurrence of natural hazards in areas of destination. Over time, the arrival of a large numbers of people (especially if unplanned for) could translate into added pressures on land, water and natural resources. Deforestation, water scarcity, loss of fertile soil, increased pollution and loss of biodiversity can ensue [12,29,92]. The increased environmental degradation may createconditions in which landslides, floods and fires could become more frequent and intense

Population movements also have profound social impacts on places of origin and destination. Demographic pressures might translate into reduced access to resources, services and opportunities for people in the destination areas. When unassisted, these changes have also contributed to conflicts and tensions among and within groups. Migrants are often among the most marginalized members of societies, those least able to access services and opportunities, and often the people least able to anticipate, cope with and recover from the impacts of hazards. As a result of lacking entitlements and local knowledge, cultural barriers, and the discrimination or social stigma that they may face upon arrival, they routinely face reduced access to material resources, information, and assistance – all of which makes them specifically vulnerable in the event of a disaster [13,35,55,89].

Despite the potential negative outcomes that are inherent in moving, for most people the decision to leave is a rational life-saving and/or wellbeing enhancing choice – overall- population movements result in positive systemic outcomes. Most migrants, and their family members and peers, will improve their access to services, food security, financial and social opportunities ([86]; IOM, 2013 [99]). At a collective scale, population movements underpin positive social transformations. Mobility opens up opportunities to acquire new skills in different professional and social contexts, and people who move have in general better access to income and education opportunities than those who stay behind (IOM, 2013). The circulation of ideas and knowledge that movements can enable people to challenge traditional social roles and constraints, and can in this way empower marginalized individuals and groups. Left behind families and communities may also benefit from these expanded opportunities. For example, rural-to-urban migration of parents often generates educational, behavioral and health advantages for children remaining behind due to the improvement of collective socio-economic conditions [90]. Likewise, a panel study conducted on 2054 Vietnamese households showed positive outcomes of migration for the wellbeing of children aged 6 to 15 years in remittance-receiving households [8].

The consequences of population movements are profound, and encompass all dimensions of socio-environmental systems. They are also highly diverse and interdependent, often translating in simultaneous positive and negative outcomes for different people, in different locations, and across different timescales. These diverse implications make it particularly difficult to situate human mobility within systemic risk frameworks. Population movements may be associated with increased hazard occurrences, exposure and vulnerability, but their systemic risk reduction impacts and outcomes are more complex, and difficult to disentangle.

3.2. Movements in the context of crises and their cascading impacts

Positive and negative risk outcomes are inherent to all kinds of population movements, whether concentrated or diluted in time, and regardless of their triggering factors. Particular challenges can however be associated with large-scale population movements, such as those that originate in the context of crises. Displacement and forced migration are among the most visible consequences of hazards, and a key concern for emergency preparedness, response and recovery efforts. The significance of these occurrences is shown in annual figures and future projections [41], and their relevance is adequately reflected in many systemic risk frameworks, as discussed above.

Risks and losses are inherent to forced mobility decisions: displacement is often associated with heightened exposure to deprivation, violence, livelihood insecurity and poverty, reduced access to services, and ill health. These negative effects manifest both for people on the move and for other affected populations, including in areas not directly impacted by a given disaster (Sherwood et al., [100]). Societies suffer significant financial losses due to displacement. For example, the IDMC and IIASA [42] estimated that the economic costs that Yemen may have to bear due to the displacement related to their average earthquake exposure: calculated as an event with a 10-year return period that could displace around 15,000 people would cause the financial loss of $4.65 million per year. Global estimates point to displacement generating a total economic impact of at least $20 billion each year [41]. These estimates account only for direct financial losses linked to livelihoods and direct service provision. The full social impacts of displacement (including due to non-economic losses, such as lost wellbeing and development opportunities, as resources are diverted towards humanitarian response) are much more significant, far-reaching and long-lasting. Disaster impacts are multiplied, prolonged and extended whenever displacement is not addressed rapidly and effectively.

As a consequence of these factors, people moving in the context of crises are often particularly at risk of other disasters. This translates into increased likelihood of experiencing additional impacts, including secondary displacement [41].

Addressing movements in the context of disasters and climate change is therefore central to policy objectives in different thematic areas. The Sendai Framework for Disaster Risk Reduction (SFDRR) clearly articulates its relevance for disaster preparedness, response and recovery in particular in articles 33.h (on establishing area-based systems to prepare for evacuations); 33.j (on promoting DRR in displacement settings); and 30.l (on addressing disaster-induced mobility). Indicating ways to avert, minimize and address the economic and non-economic losses and damages associated with such population movements are also the rationale behind the establishment of the Task Force on Displacement under the Warsaw International Mechanism of the UNFCCC. It is also identified as a priority in the report of the High-Level Panel on Internal Displacement and it is on the Agenda for Humanity, the Platform for Disaster Displacement and the Global Compact for Migration. Integrating population movements appropriately in risk reduction and planning, emergency preparedness, response and recovery work, will be essential to mitigate the cascading impacts and systemic risks related with human mobility.

3.3. Systemic implications of population movements

An additional layer of complexity in exploring population movements from the perspective of systemic risks, lies within their nature as lifelines in modern and globalized societies. Wellbeing and viability of communities and societies (at origin and destination) depend on the presence and movement of migrants. Human mobility is a precondition for the material and immaterial exchanges that sustain their economic and cultural development [19].

Migration underpins remittance transfers, a key source of income for households of origin, particularly when facing risks and shocks [51,82]. Remittances also contribute to economic growth, as they increase and free up resources that can be used for investment purposes [47]. Immaterial remittances (i.e., ideas and knowledge that travel across

migration routes) strengthen human capital, by multiplying skills and enhancing practices. The society-wide benefits of these phenomena are significant, and they include the improved availability of capacities, infrastructures and systems that are key for resilience and risk reduction [5,52,58].

At the same time, the presence of migrants benefits economies of destination by sustaining consumption, increasing demand, and expanding fiscal revenues. In many advanced economies, the viability of key productive sectors rely on the movement of specialised and skilled workforces, both high and low-paid [27,31,32,45,46,85]. As recently shown by the COVID-19 pandemic, migrants represent a large share of the workforce in essential sectors such as social care and agricultural production in most countries of the Global North [15,39]. In many of these sectors, human mobility is also associated with innovation, as migrants transfer different approaches and practices. For example, Rockenbauch et al. [69] showed the positive impact of migration-related translocal networks in fostering bottom-up innovations in a small-scale farming community in Northeast Thailand.

Population movements and their impacts tie places together by creating interdependencies and feedbacks. Binci [8], for instance, highlighted the benefits of Tunisian migration towards Italy, for the migrants, their country of origin and destination. Many migrants earned and saved money that they invested in open businesses back in Tunisia. At the same time, thanks to tax exemptions offered by the Tunisian government to attract foreign investments, many Italian companies decided to relocate their factories to Tunisia and contracted the Tunisian factory workers that had used to work for them in Italy.

These translocal ties are also key to the wellbeing, safety and resilience of people at both ends. Migrants rely on their families and social networks at home to care for their dependants, to protect and manage their assets, and to provide the material and immaterial support needed to overcome challenges after arriving, including to cope with the impacts of hazards ([46], Long, 2008 [101]). Migrants also help reduce and manage risks in their home countries. Scheffran et al. [75] showed how material and immaterial resource transfers from West-African migrants contribute to climate action in places of origin, and how migration may be deployed as an adaptation strategy.

The beneficial outcomes of population movements have been on full display during the COVID-19 pandemic. Mobility restrictions adopted to contain the spread of the virus brought international and internal movements to a halt, and even reversed traditional patterns of migration, forcing returns and disrupting existing translocal and transnational networks. The systemic implications of this involuntary immobility have been diverse and pervasive [36,46,73]. In places of origin, migrant families lost the limited incomes that they relied upon, with significant poverty and security implications. Large-scale returns of people resulted in overwhelming pressures on local environments, services and livelihoods in fragile areas of origin [26]. In places of destinations, lack of workforce due to the reduced arrival of migrants resulted in limited capacity to ensure provision of basic services, failure of whole productive sectors and even food insecurity – including in affluent societies [83].

These translocal impacts, while felt in uniquely pervasive and geographically extended manners due to the COVID-19 pandemic, are a common feature of crises in our interconnected world. Crises of any kind anywhere in the world will hit migrants, and whenever migrants face risks and suffer their impacts, repercussions occur across their social networks, affecting their places of origin and destination [37,43,48].

4. Discussion and conclusions

The notion of systemic risk highlights the complexities of, and the interconnections between, social phenomena and factors that often make it difficult to piece together linear causal chains that lead to specific impacts [50,67]. Risk outcomes interact with one another, by amplifying or attenuating their effects through negative or positive feedback loops across all interconnected, independent components of a system.

Population movements powerfully shape the dense, complex network of feedback loops that contributes to risk in our global system. Human mobility has diverse, profound and far-reaching risk reduction and risk creation implications. However, people move in very diverse manners and contexts, dependent on a variety of demographic, social, political, economic, psychological, and environmental factors, which are all shaped by population movements. This makes italmost impossibile to draw deterministic links between specific drivers of movement, specific mobility decisions and specific risk creation or reduction effects, at local and global scales. Mobility decision-making is multi-causal and highly subjective, while its direct and indirect implications on risks are diverse, and often produce opposite effects across places and time.

Migration and displacement can be the result of hazards or other shocks and stresses. Human mobility can trigger abrupt changes in social and environmental systems of origin and destination. If not appropriately assisted and supported, these population changes can compound into risk drivers that amplify and extend hazard exposure and vulnerability. As shown in this article, human mobility is also a fundamental, positive dynamic of our historical and modern societies. It contributes to shape their demography, economy, culture, social values, ideas, knowledge, wellbeing and resilience, with short and long-term benefits for people all over the world, including migrants and their communities in origin and destination areas.

Systemic risk frameworks need to account for the complexity of human mobility and reflect its positive and negative risk outcomes across time and places. DRR practices need to reflect this more nuanced understanding, in order to minimize the potential negative impacts associated with population movements, and leverage their risk reduction outcomes in places of origin and destination.

CRediT authorship contribution statement

Serena Tagliacozzo: Conceptualization, Methodology, Writing – original draft. **Lorenzo Guadagno:** Conceptualization, Formal analysis, Writing – original draft. **Sonja Ayeb-Karlsson:** Validation, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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