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On the economics of project-induced displacement: A critique of the externality principle in resource development projects

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ABSTRACT

Externalities form in market economics because of an assumption that there is no essential relationship between the industrial activity and the host environment. Population displacement caused by resource development projects is a particularly difficult phenomenon to deny responsibility for, given that the originating need for displacement is grounded in an activity endorsed by the nation, for its collective benefit. When developers fail to account for, or "own" the costs of undertaking resettlement work, a large unmeasured portion of this cost is often transferred into the external environment. In this article we argue that in mining, externalisation involves a deferral of risk and financial liability throughout the lifecycle of projects. The high-upfront investment required under the World Bank policy framework is structured to reduce the immediate shock of displacement and provide affected people with the necessary means to rebuild their lives. This stands in clear contra-distinction to the high externality model of financing employed by developers which focuses on securing land access and subsequently deferring resettlement related costs until they reach crisis point. The authors construct a conceptual model to explain the linkages between resettlement financing, project lifecycles and the paucity of outcomes experienced by displaced populations.

1. Introduction

In the opening chapter to his edited volume on the *Economics of Involuntary Resettlement*, Michael Cernea (1999), p.9) writes:

> Despite the better social understanding of resettlement, it is dismaying that, in practice, so many resettlements programs still go so wrong in so many places — to the detriment of such large numbers of people.

Cernea's call for greater participation by economists in resettlement research is grounded in what he identified over a decade-and-a-half ago as a "shortage of specialized methods or techniques to be used in the economic and financial analysis of resettlement operations at project level" (ibid). These conclusions drawn from Cernea follow an extensive review of World Bank projects (1996) in which vast numbers of people had been displaced without due planning or resourcing to secure their long-term wellbeing. Cernea suggests that one barrier to extending the resettlement "conversation" is the wide spread belief that resettlement is ostensibly viewed as a "social problem".

For mainstream economists, and indeed for corporations, social problems are theoretically constructed as pre-existing issues or indirect consequences that the business cannot or does not want to bear responsibility for. This type of externality forms in market economics because of the assumption that there is no interdependency or essential relationship between the industrial activity and the host environment, or in other words, the effect sits external to the proposed activity as it is conceptually defined (Vatn and Bromley, 1997). Population displacement caused by development projects is a particularly difficult "social problem" to deny responsibility for, given that the originating need for displacement is grounded in an activity endorsed by the nation, and supposedly for its collective benefit. Indeed, in some cases, where resettlement occurs due to 'nation building projects', developers may make the utilitarian claim that the negative impacts of resettlement are offset

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by the broader benefits to the country, even if the dis-economy can be directly attributed to the project (Cernea, 2008). The case for compensation, or indeed a greater share of project benefits is all the more prescient, according to Cernea, because of the risk potential carried in these developments.

Where population displacement is induced by private sector actors, these issues take on new dimensions. The theoretical problem noted above becomes a real issue for policy makers. Not only is resettlement a complex "social problem" for the mining industry, but because the proximate cause of displacement is associated with a private developer acquiring or utilising land as part of its "core" business activity, the utilitarian argument for externalising issues is harder to sustain. This is true for the local people who are directly affected, and for the nation overall. Research indicates that mining companies struggle to make sense of obligations that sit outside of its "core" activity, even when those obligations arise as a direct result of core business (Kemp and Owen, 2013). This issue is further compounded by the fact that the profit share of projects is heavily skewed toward the interests of the developer, far exceeding the benefit accruing to the state or to individuals residing in the project area. Moreover, the externalities that result from the project are not calculated to offset the profit share of the state, and these costs are often left to multiply in-situ. In this article, we argue that determining, and countering, the effects of project externalities should take normative priority over other distributive mechanisms, such as compensation or benefit sharing, due to the conditioning nature of externalities. While compensation can, in principle, arrest certain harms emanating from the displacement process, the wider concern is the structural consequence formed through project-induced externalities for which compensatory measures may or may not be effective.

Research on development induced displacement and resettlement (DIDR) is extensive, but insufficient effort has been made to distinguish patterns between industries, such as hydropower and mining. Few examples exist, demonstrating the unique effects brought about by different financing regimes, or the positive or negative influence that a mature industry or policy environment can have over final outcomes (cf. Webber and McDonald, 2004; Wilmsen and Wang, 2015). There are dynamics present in the mining industry that are either unique or not prominent in other industrial sectors, including the volatile nature of the commodity market for metals and minerals, incremental project expansions and contractions, and mine-community inter-dependencies that form due to the possibility of co-habitation within project concession areas (Owen and Kemp, 2015).

The paucity of financial and economic planning in resettlement programs is likewise well established, both in the academic literature and in the myriad of failed resettlements world-wide. Cernea (2008a), p.33) argues that there is a strong causal relationship between organisations lacking a defined set of economic evaluation tools and the "recurrent failures of design and execution of projects with resettlement". Disclosure by mining companies is a barrier to identifying persistent causes and patterns of resettlement failures across the industry. We agree with Cernea's analysis, that because developers fail to comprehensively account for the costs of undertaking resettlement work, a large and often unmeasured portion of this cost is transferred into the external environment. The theoretical basis of this claim is that transference stimulates disintegrative effects and has implications for both physical and social environs (Schmidt-Soltau, 2003; Daly, 2004). In many respects, this feature of corporate mal-responsibility, or government under-regulation, is mainstream, and is not particular to the mining industry or to the problem of resettlement generally. Throughout this article we argue that in mining, externalisation involves a deferral of risk and financial liability throughout the lifecycle of projects that is transferred on to the affected population. The high-upfront investment required under the World Bank group of standards is structured to reduce the immediate shock of displacement and provide affected people with the necessary infrastructure, services and resources to rebuild their lives. This stands in clear contra-distinction to the high-externality model of financing employed by mining companies which focuses on securing land access and subsequently deferring resettlement related costs until they impact directly on operations (Wang et al., 2020). Because displaced populations have limited capacity to absorb externalised costs, there is a propensity to transfer the financial burden back to mining companies. A similar pattern of risk transference in the mining sector has been observed by Kemp et al. (2017). In this article, we present low-externality and high-externality models of resettlement financing, critiquing the latter, as used predominantly by mining corporations. We offer a conceptual model for examining the inherent linkages between mine project lifecycles, resettlement financing, and the paucity of outcomes experienced by displaced populations.

2. Contemporary models of resettlement costing and financing

International standards on involuntary land acquisition and resettlement, such as those prescribed by the International Finance Corporation (2006, 2012), outline an approach that places the onus of meeting project costs onto developers. In the main, this translates into a model that aims to reduce the financial cost to affected people and for governments. The following text from the standard is typical: "When displacement cannot be avoided, the client will offer displaced communities and person's compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods". In each domain of activity, or element of resettlement planning the developer is advised of the need to establish alternatives at full replacement cost, with the view to not only restoring for loss, but to improve where possible. The term 'full replacement cost' means that all costs should be met by developers in providing replacement assets, irrespective of changing market conditions or price variability between the old and new location. For our purposes, we regard contemporary standards as advocating "low-externality" approaches to displacement and resettlement because the emphasis carried in the standards is on developers investing significant capital upfront to offset risks that are known to fall on the affected population.

The major cost elements referred to in the international standards focus on the physical aspects of relocation (Cernea, 2003). These components also provide the strongest basis for operational access for development projects, such as hydropower dams, factories, or mines. In a voluntary system of compliance, such as through the IFC Standards, it can be argued that a direct link to securing land access for the developer is the best form of assurance for affected people. Once affected people have been displaced and land use rights are transferred to the developer, the leverage available to affected people diminishes greatly. Livelihood restoration is one cost element that is triggered post-displacement, and is routinely demonstrated to be under-resourced or poorly executed by developers. Fig. 1 below outlines the cost elements *commonly met*, costs *occasionally met* and costs *externalised* in resettlement programs. The elements presented in Fig. 1 are captured throughout the IFC Performance Standards and Guidance Notes and the extensive body of resettlement literature. Costs *commonly met* refers to the most basic requirements of compensation that industries undertake in order to achieve vacant possession over the project footprint area. Mainly these include

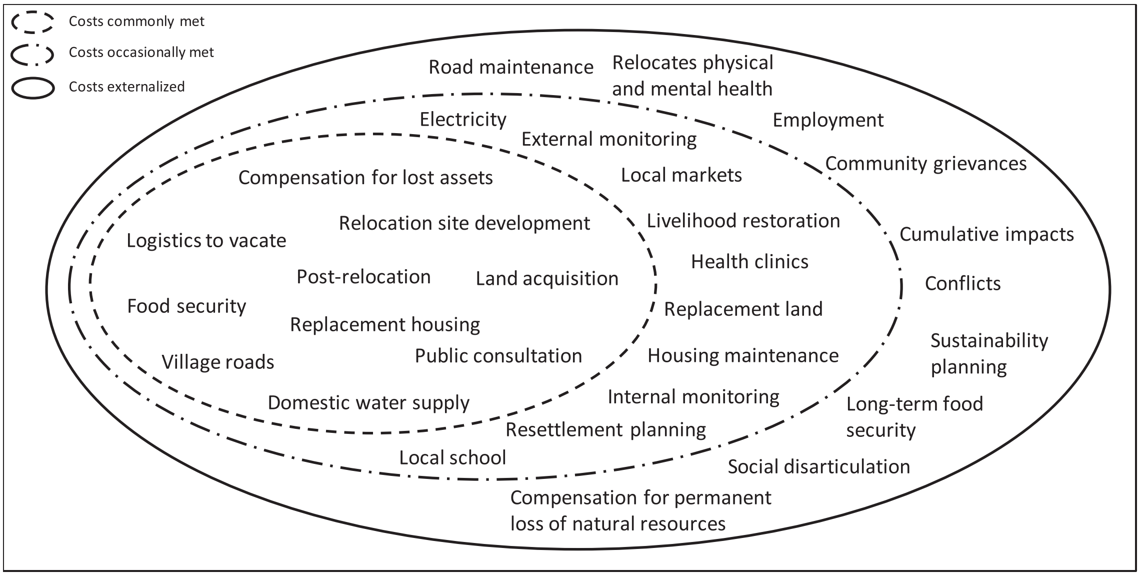

Fig. 1. Summary inventory of resettlement costs.

replacement housing, village roads, compensation for lost assets and land acquisition and the logistics support needed to move people out of the project's area of interest. Costs *occasionally met* generally cover civil infrastructure: electricity, health clinics, local schools, housing maintenance and local markets. These elements are either offered to replace infrastructure that is lost to the project footprint, or presented as "benefits" to affected people in exchange for their land dispossession. *Externalised* costs are those elements that developers consider as sitting outside of their immediate purview and which can be constructed as state responsibilities. Coverage of cost elements varies across jurisdictions but the key point is that developers operate within their own organisational mandates, and principal among these is the notion that companies should not voluntarily exceed their financial obligations, particularly where responsibilities can be attributed to other parties.

The implication is that developers will more readily internalise those costs that are immediately necessary to conducting business activities. This includes instances where cost elements exceed the preferred boundary of responsibility but are nonetheless critical to securing operational access. Land acquisition, as noted above, alongside with costs of removing people and property from an area of interest will typically be met by companies. As cost dimensions appear less relevant to core business activities, or what a developer may internally regard as existing within its statutory obligations, the more likely the developer will default on that component. This is both the central challenge, and limitation of the international standards. Despite employing a project risk orientation, i.e. a mode of explanation that highlights project risk, as a means for convincing developers of the merits of a low-externality approach, companies are nonetheless not required, except in lender-borrower arrangements, to comply with international standards on involuntary land acquisition and resettlement. Recent efforts at transferring international standards into 'country level systems' suggests that in future developers could be compelled through national legal processes to invest more fully in offsetting the impacts of their resettlement activities (Owen et al., 2019). Critics argue that while nationalising safeguards is an important step toward making provisions justiciable in law, there is the dual problem of countries either adopting elements of the international standard and not the entire architecture, or being unable to give meaning to safeguard principles due to institutional constraints in actioning laws (Tagliarino, 2018; Jayewardene, 2019).

3. Persistence of externality in displacement events: an explanatory model

In this section we provide an outline of financing models used to support resettlement projects. Following Shaojun (2018), our emphasis is on the decisions made with respect to the level of externality carried by project affected people. While we have noted that the current suite of international standards strongly preferences a "low externality" model of resettlement financing, the economics of this model are not explicit in the standards themselves. Our contention is that mining companies, despite committing to the international standards, consistently opt for a "high externality" model in the design, planning and execution of resettlement projects. This means that over time, the cost of meeting the elements in Fig. 1 falls disproportionately on the displaced population. Fig. 2 below depicts the range of scenarios available to developers and affected people in negotiating the carriage of costs resulting to involuntary displacement.

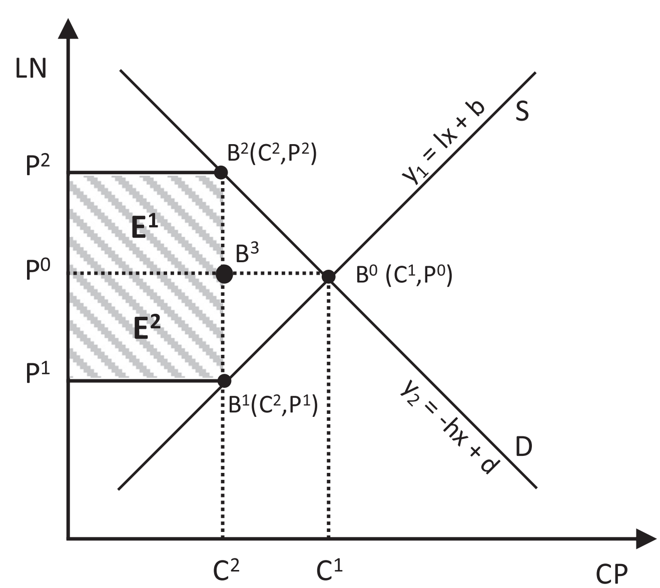

Fig. 2. Supply and demand curve of "Rights" acquisition.

To illustrate the logic behind these scenarios we model trade-offs between two basic factors. The first factor is the land holding of the displaced population. In this model, we use *LN* to capture the amount of loss that the displaced population can absorb in its dealings with the developer. The second factor is the level of investment that developers are prepared to make in compensating the affected population for the loss they incur. This is represented in Fig. 2 as *CP*. In practice both of these factors are difficult to calculate. On the one hand, the value of community goods are not easy to quantify. While on the other, companies rarely disclose the final cost of their resettlement efforts.

In our model, to overcome this basic, but ultimately very real barrier, we conceptualise these costs in terms of the supply and demand of “rights”. S represents the supply of rights available to the affected population, and D represents the level of demand placed on those “rights” by the developer. The model indicates that, all things being equal, when the investment by companies is greater, the affected population can bear a higher level of cost. Conversely, for the developer, the higher the investment price, the less they can bear. For our purpose, the process of reaching a decision point ($B0$) is treated as a negotiation between the parties. In game theory terms, this process is a multi-stage sequence with actors engaging based on incomplete information with respect to the ultimate interests or needs of the other party. The initial parameters of the game are determined by the slope of the “rights” curve described above.

This representation assumes:

1. Point $B^3(C^2, P^0)$ is dynamic and presented as the result of a cost negotiation process between the developer and the displaced population.
2. C^2 is a given investment value determined by the developer.
3. Marginal utility is unchanged.

In this case the “rights” supply function is expressed as:

$$y_1 = lx + b, (x > 0, b < 0) \tag{1}$$

The “rights” demand function as:

$$y_2 = -hx + d, \left(0 < x < \frac{d}{h}, d > 0\right) \tag{2}$$

The slope of the “rights” supply function:

$$l = \frac{P^0 - P^1}{C^1 - C^2} \tag{3}$$

The slope of the “rights” demand function:

$$h = \frac{P^2 - P^0}{C^1 - C^2} \tag{4}$$

To articulate the potential for externality we utilize areas E^1 and E^2. E^1 is the cost externalised by developer, which is transferred to or absorbed by the displaced population. This is expressed as: $E^1 = (P^2 - P^0) \times C^2 E^2$ represents the amounts at which the affected population is unwilling to absorb the externality (E^1, or part of E^1). We describe E^2 as a “rebound cost” or a transfer of externality from the displaced population back to the developer. This is expressed as: $E^2 = (P^0 - P^1) \times C^2$

We can see that: $P^2 = -hC^2 + d, P^1 = lC^1 + b, P^0 = \frac{ld+hb}{l+h}, C^1 = \frac{d-b}{l+h}$

Therefore,

$$E^1 = \left(-hC^2 + d - \left(\frac{ld + hb}{l + h}\right)\right) \times C^2$$

$$E^2 = \left(\frac{ld + hb}{l + h} - l\left(\frac{d - b}{l + h}\right) + b\right) \times C^2 = \left(\left(\frac{hb + lb}{l + h}\right) + b\right) \times C^2$$

The externality cost is determined by $C^2, l \text{ and } h$, which represent the respective willingness of the two parties to trade-off rights. The level of the slope directly influences the externality cost carried by the developer or the displaced population.

Fig. 2 demonstrates that the amount of external cost carried by either the developer or the displaced population depends on the location of B^1, B^0, B^2. Here B^0 represents the balance of supply and demand without the impost of externalised costs.

Points B^1 and B^2 represent the imbalance of supply and demand, resulting in the existence of externalised cost, which is also the skew rate of supply and demand function.

The state of supply and demand is the result of the actions (slope) taken by both parties. This requires considering the strategies between the two parties during the actual compensation negotiation process. From the perspective of game theory, the outcomes are conditioned by the uncertainty of the other party's feasible strategy, payment function and other game parameters. Generally speaking, the result of the game in the previous stage becomes the base condition of the game in the next stage. The working assumption is that each party will aim to maximize their own benefit while incurring the minimal amount of cost. The problem of externality (E^1), and externality transfer (E^2) arises from the simple fact that both the developer and the affected population are prepared to invest limited resources in the process of resettlement. We construct the model as a multi-stage game because over the life of a mining project, many of the variables affecting the ability of parties to accept externalised costs will change.

3.1. Model description

In this model, the action strategies of the two parties are considered over a series of stages. There are K stages in total. In each stage, the developer and the displaced population determine their own and the other's feasible actions according to resource constraints, and modify the probability distribution of the other side (the developer or the displaced people) according to Bayesian law by observing the actions chosen by the other party. The outcomes derived through the model are based on six aspects: state vector, action strategy, interaction between action strategy and state, resource constraint, type space, action and action space.

3.1.1. State vector

The state vector of κ stage ($1 \le \kappa \le K$) is $s^{(\kappa)} = (s_1^{(\kappa)}, \cdots, s_{m_\kappa}^{(\kappa)})$, the final stage state vector is $s^e = (s_1^e, \cdots, s_{N_e}^e)$.The state vector of κ stage is not only the precondition of the action in the κ stage, but also the effect of the action in $\kappa - 1$ stage. Each one-dimensional component of the state vector is $\{0, 1\}$ variable. 0 means that the situation does not occur, and 1 means that the situation occurs.

3.1.2. Action strategy

The action strategy is the most basic means of negotiation. At every stage of the negotiation process, both parties have action strategies to choose from. During the negotiation process, different slope of “Rights” supply-demand curve is the result of different action strategies taken by two parties. In stage κ, the developer has a total of h_κ options $\{a_{r,1}^{(\kappa)}, \cdots, a_{r,h_\kappa}^{(\kappa)}\}$, the displaced population have a total of l_κ options $\{a_{b,1}^{(\kappa)}, \cdots, a_{b,l_\kappa}^{(\kappa)}\}$.

3.1.3. Interaction between action strategy and state

When the state vector of κ stage is $s^{(\kappa)}$, the probability of success of the i action strategy of the developer is $p(a_{r,i}^{(\kappa)} \big| s^{(\kappa)})$. The probability of success of the j action strategy of displaced people is $p(a_{b,j}^{(\kappa)} \big| s^{(\kappa)})$. The action of the developer is $\phi_i^{(\kappa)}$, the action of displaced people is $\Psi_j^{(\kappa)}$, the probability of the t dimensional under state vector $s_t^{(\kappa+1)}$ in the stage $\kappa+1$ is $p(s_t^{(\kappa+!)} \big| \phi_i^{(\kappa)}, \Psi_j^{(\kappa)})$.

① The success probability of the displaced population of the i action strategy in the stage κ is as follows:

$$p\left(a_{b,j}^{(\kappa)} \middle| s^{(\kappa)}\right) = \begin{cases} p\left(a_{b,j}^{(\kappa)}\right) + hb_i(s^{(\kappa)})\left(1 - p\left(a_{b,j}^{(\kappa)}\right)\right) \; if \; hb_i(s^{(\kappa)}) \in [0,1] \\ p\left(a_{b,j}^{(\kappa)}\right) + hb_i(s^{(\kappa)}) p\left(a_{b,j}^{(\kappa)}\right) \; if \; hb_i(s^{(\kappa)}) \in [-1,0] \end{cases} \quad (5)$$

② In the stage κ, the action strategy of the displaced population is $(a_{b,1}^{(\kappa)}, \cdots, a_{b,l_\kappa}^{(\kappa)})$, and the action strategy of the developer $(a_{r,1}^{(\kappa)}, \cdots, a_{r,h_\kappa}^{(\kappa)})$ is $a^{(\kappa)}$. The influence parameter of $a^{(\kappa)}$ on the t dimensional of state vector is $gs_t^{(\kappa)}(a^{(\kappa)})$, and the probability of $s^{(\kappa)}$ is:

$$p(s_t^{(\kappa)} | a^{(\kappa)}) = \begin{cases} p(s_t^{(\kappa)}) + gs_t^{(\kappa)}(a^{(\kappa)})(1 - p(s_t^{(\kappa)})) if \, gs_t^{(\kappa)}(a^{(\kappa)}) \in [0,1] \\ p(s_t^{(\kappa)}) + gs_t^{(\kappa)}(a^{(\kappa)}) p(s_t^{(\kappa)}) if \, gs_t^{(\kappa)}(a^{(\kappa)}) \in [-1,0] \end{cases} \frac{1}{n} \quad (6)$$

3.1.4. (iv) resource constraint

In the actual compensation negotiation process, the resources that both parties can use are limited. In the stage of κ, the resources of the displaced population are $\{s_{b,1}^{(\kappa)}, \cdots, s_{b,c_\kappa}^{(\kappa)}\}$. The resources of the developer are $\{s_{r,1}^{(\kappa)}, \cdots, s_{r,d_\kappa}^{(\kappa)}\}$. Displaced people demand for the y resource in the j action strategy under κ stage is $bn_{jy}^{(\kappa)}$, and the developer demand for the y resource in the i action strategy under κ stage is $rm_{iy}^{(\kappa)}$.

3.1.5. Type space

The type spaces of the developer and displaced people are respectively $\Theta_r = \{\theta_{r,i}\}$, $\Theta_b = \{\theta_{b,j}\}$, $i \in N, j \in N$. Given type space $(\theta_{r,i}, \theta_{b,j})$, joint probability distribution $P(\theta_{r,i}, \theta_{b,j})$, the developer can infer the probability distribution of the types of displaced people according to their own types $P(\theta_{b;j} \big| \Theta_r)$, Θ_r is the actual type of the developer. In the same way, displaced people can also infer the type distribution $P(\theta_{r,i} | \Theta_b)$ of the developer according to θ_b. The belief of the developer in the type of displaced people in stage κ is$P_r^{(\kappa)} = (P_{r,1}^{(\kappa)}, \cdots, P_{r,i}^{(\kappa)} \cdots, P_{r,N_b}^{(\kappa)})$, the belief of displaced people in the type of the developer is$P_b^{(\kappa)} = (P_{b,1}^{(\kappa)}, \cdots, P_{b,i}^{(\kappa)} \cdots, P_{b,N_r}^{(\kappa)})$.

3.1.6. (vi) Action and action space

① The action of mining industry in stage κ refers to selecting n $(0 \le n \le h_\kappa)$ of h_κ action strategies to meet resource constraints, define it as vector $(a_{r,1}^{(\kappa)}, \cdots, a_{r,h_\kappa}^{(\kappa)}$. Each one-dimensional component of the state vector is $\{0,1\}$ variable. 0 means the action policy item is not executed, 1 means the action policy item is executed, here is $\phi_i^{(\kappa)}$. All feasible actions of the developer constitute the action set of the developer in stage κ, is $\Phi^{(\kappa)} = \{\phi_1^{(\kappa)}, \phi_2^{(\kappa)}, \cdots \phi_{f\kappa}^{(\kappa)}\}$ $f\kappa \le 2^{h_\kappa}$. For the same reason, the action of displaced people is $\Psi_j^{(\kappa)}$, and all feasible actions of displaced people constitute the action set of displaced people in stage κ is $\{\Psi_1^{(\kappa)}, \Psi_2^{(\kappa)}, \cdots \Psi_{g\kappa}^{(\kappa)}\}$, $g\kappa \le 2^{h_\kappa}$.

② The action set of the developer in stage 1 and stage κ is $\Phi^{(1)}$ and $\Phi^{(\kappa)}$ respectively, and Cartesian product is $\Phi^{(1)} \times \Phi^{(2)} \times \cdots \Phi^{(\kappa)}$ which constitutes the action space of the developer. Defining the space of action of displaced people in the same way Ψ and $\Psi = \Psi^{(1)} \times \Psi^{(2)} \times \cdots \Psi^{(\kappa)}$.

3.1.7. (vii) Mathematical model

To sum up, six tuples can be used to express the compensation negotiation process.

$G = W, \Omega, U, \Theta, \mathrm{P}, H$, among them:

① $W = \{R, B\}$. It refers to both parties;
② $\Omega = \{\Phi, \Psi\}$. It refers to the action space of both parties;

3.1.7.1. $\Phi = \Phi^{(1)} \times \Phi^{(2)} \times \cdots \Phi^{(\kappa)}$. Any feasible action of $\Phi^{(\kappa)}$ in $\phi_m^{(\kappa)}$ should meet resource constraints:

$$\sum_{i=1}^{h_\kappa} ra_i^\kappa \times rm_{iy}^{(\kappa)} \le rs_y^{(\kappa)}$$

$$m = 1, \cdots f_\kappa; y = 1, \cdots d_\kappa; \kappa = 1, \cdots \mathrm{K}$$

3.1.7.2. $\Psi = \Psi^{(1)} \times \Psi^{(2)} \times \cdots \Psi^{(\kappa)}$. Any feasible action of $\Psi^{(\kappa)}$ in $\Psi_n^{(\kappa)}$ should meet resource constraints:

$$\sum_{i=1}^{l_\kappa} ba_i^\kappa \times bn_{jy}^{(\kappa)} \le bs_y^{(\kappa)}$$

$$n = 1, \cdots g_\kappa; y = 1, \cdots c_\kappa; \kappa = 1, \cdots, \mathrm{K}$$

③ $\mathrm{H} = \{\mathrm{H}_r^{(\kappa)}, \mathrm{H}_b^{(\kappa)}\}$, Indicates the action history of stage κ, it means the actions actually executed by both parties during the negotiation. $\mathrm{H}_r^{(\kappa)} = \{\phi^{(1)}, \phi^{(2)}, \cdots, \phi^{(\kappa-1)}\}$, $\mathrm{H}_b^{(\kappa)} = \{\psi^{(1)}, \psi^{(2)}, \cdots, \psi^{(\kappa-1)}\}$, $1 < \kappa \le \mathrm{K}$

④ $\Theta = \{\Theta_r, \Theta_b\}$ Refers to type space, it means possible types of integration between the parties, the developer has N_r type space, the displaced population have N_b type space: $\Theta_r = \{\theta_{r,1}, \theta_{r,2}, \cdots, \theta_{r,N_r}\}$, $\Theta_b = \{\theta_{b,1}, \theta_{b,2}, \cdots, \theta_{b,N_b}\}$

⑤ $\mathrm{P} = \{\mathrm{P}_r^{(\kappa)}, \mathrm{P}_b^{(\kappa)}\}$, $\mathrm{P}_r^{(\kappa)}$ is the belief of the developer in the type of displaced people in stage κ.$\mathrm{P}_b^{(\kappa)}$ is the belief of displaced people in the type of the developer. Belief needs to be updated according to the information obtained during the negotiation and action stages;

A. $\kappa = 1$: $P_r^{(1)} = (p_{r,1}^{(1)}, \cdots, p_{r,i}^{(1)}, \cdots, p_{r,N_b}^{(1)})$ $P_b^{(1)} = (p_{b,1}^{(1)}, \cdots, p_{b,j}^{(1)}, \cdots, p_{r,N_r}^{(1)})$, $p_{r,i}^{(1)} = P(\theta_{b,i} | \theta_r)$, $p_{b,j}^{(1)} = P(\theta_{r,j} | \theta_b)$, $i = 1, \cdots N_b$, $j = 1, \cdots, N_r$

B. $1 < \kappa \le K$: $P_r^{(\kappa)} = (p_{r,1}^{(\kappa)}, \cdots, p_{r,i}^{(\kappa)}, \cdots, p_{r,N_b}^{(\kappa)})$ $P_b^{(\kappa)} = (p_{b,1}^{(\kappa)}, \cdots, p_{b,j}^{(\kappa)}, \cdots, p_{b,N_r}^{(\kappa)})$, $p_{r,i}^{(1)} = P(\theta_{b,i} | \theta_r, H_b^{(\kappa)})$, $p_{b,j}^{(1)} = P(\theta_{r,j} | \theta_b, H_r^{(\kappa)})$, $i = 1, \cdots N_b$, $j = 1, \cdots, N_r$

⑥ represents a payment function, determined by type combination and strategy of both parties;

$$U = f\left(\alpha_{i_1}^{(\kappa)}, \beta_{j_1}^{(\kappa)}, \theta_{r,i_2}, \theta_{b,j_2}\right), \kappa = 1, \cdots, K, i_1 = 1, \cdots, (\Delta r_\kappa)^{N_r}, j_1 = 1, \cdots, (\Delta b_\kappa)^{N_b}, i_2 = 1, \cdots, N_r, j_2 = 1, \cdots, N_b$$

4. Limitations of the industry financing model

In this section, we apply the model to resettlement planning in the mining sector paying particular attention to the dynamic relationship between planning failures and the externalisation of resettlement costs. Physical relocation, replacing land and assets, and reconstructing social networks and livelihood activities all come at a significant cost (Vanclay, 2017). Our model suggests a direct correlation between the quantum of upfront investment (C^2) and the shape of the rights supply-demand curve (S and D). This in turn determines the externality parameters, and the negotiation and action strategies of the respective parties, and the distribution of burden over time. Publicly available sources suggest that companies prefer to minimize their financial obligations by either applying the narrowest reading of social safeguards or by spreading costs over several years. This is consistent with our model described above where a low-level of upfront investment by the developer is progressively countered by the reduced willingness of displaced people to absorb the externalised cost. We argue that this dynamic results in a game-type pattern of risk and cost transference that is enacted by the parties across the life of the mine.

The available evidence from the case literature strongly suggests the following:

1. Companies do not use full cost accounting methods for determining responsibility and exposure for resettlement events.
2. Companies do not structure their program investment with the aim of meeting the full cost of resettlement liabilities.
3. The scope of the international standards applies most immediately to Point B^0.
4. There is no obvious financial incentive at Point B^0 to change practices 1 and 2 above.
5. Displaced people bear considerable externalised costs as the difference between company investment (CP) and incurred loss (LN) grows (Point B^2).
6. There is presently no methodology available to either companies or external stakeholders for determining the full extent of resettlement costs or the distribution of unmet costs (E^1, E^2) over time (B^3).

To highlight the dynamic interplay of cost transference over time it is important to consider resettlement projects in a life of mine context. The consequences of high-externality finance regimes are most evident in the medium to longer term when displaced populations exhibit increasingly less appetite for absorbing costs, and when the initial capital available to mining companies (C^2) is exhausted. Fig. 3 below presents the phases of a resettlement project based on the programme logic depicted in the international standards. This is a representation of activity assuming that the mining company is attempting to pursue a low-externality approach to resettlement. The process begins with an organisation making internal plans and judgements about its land requirements, the implications for the business and the community in proceeding with a displacement event, followed by engagement with external parties to build awareness, to commence negotiations and to secure consent about the resettlement (Van der Ploeg and Vanclay, 2017). The remaining steps see the displacement enacted with activities undertaken to move affected people from their existing places of residence to resettlement sites, where programmes are designed to re-build livelihoods and to normalise the new socio-economic conditions for all parties involved in the process. The final three stages are explicitly concerned with the project closing out its obligations. In this Fig. 3 we see the company's engagement with external parties (relocation families, receiving communities and government agencies) ramp up in the second phase as it negotiates land access, peaking at the point at which the project acquires land and displaces the host population. Based on our model, this is the point at which all parties are at their most vulnerable and defaulting on commitments has its greatest effect.

As Flynn and Vergara (2015) demonstrate, the work activities associated with securing land access for mining projects is extremely intensive. Land access teams face extra-ordinary pressure from within the company to deliver vacant possession in a timely and cost-effective manner, while at the same time, trying to manage the expectations and immediate consequences that come from negotiating land dispossession with the host population. Timeframes vary considerably, but in some cases, negotiating land acquisition outcomes that can deliver workable tenure arrangements for people and the project have extended over decades (Kemp and Owen, 2015). The period up until the mine has secured exclusive access, and the land is vacant is typically marked by high-levels of intensive, almost daily engagement between company personnel and members of the community (see Fig. 3).

Once land has been formally acquired and the project has security of access, the level of engagement with external parties tends to fall away. It suggests that companies (i) are actively minimising their upfront exposure, (ii) do not understand their full obligations under the international framework or (iii) that companies are unable to conceptualise their role beyond effecting the process of physical displacement (Esteves, 2008; Garvin et al., 2009).

Recent case examples, in addition to a global survey of resettlement specialists in the mining sector, indicates that businesses rarely develop a comprehensive understanding around the cost of effecting the resettlement (Patel et al., 2015; Kemp et al., 2017a). Similarly, companies are not defining the long-term costs of resettlement activities where risks and burdens are transferred back to the business. At project permitting, where the international standards are primarily focused, the assumption is that the obligations for securing land and displacing the resident population will be met through a once-off capital cost. The limitations of this approach become evident when capital funds are spent and a fixed operating budget is required to service emerging and uncosted issues brought about by the project. By and large, the upfront cost (but not the process) of securing land is generally well understood; that is for purchasing or leasing land, building replacement houses, or logistical support from the company to move families away from the area of interest. For the most part these activities fit within the conceptual envelop of "construction". Outside of a company's

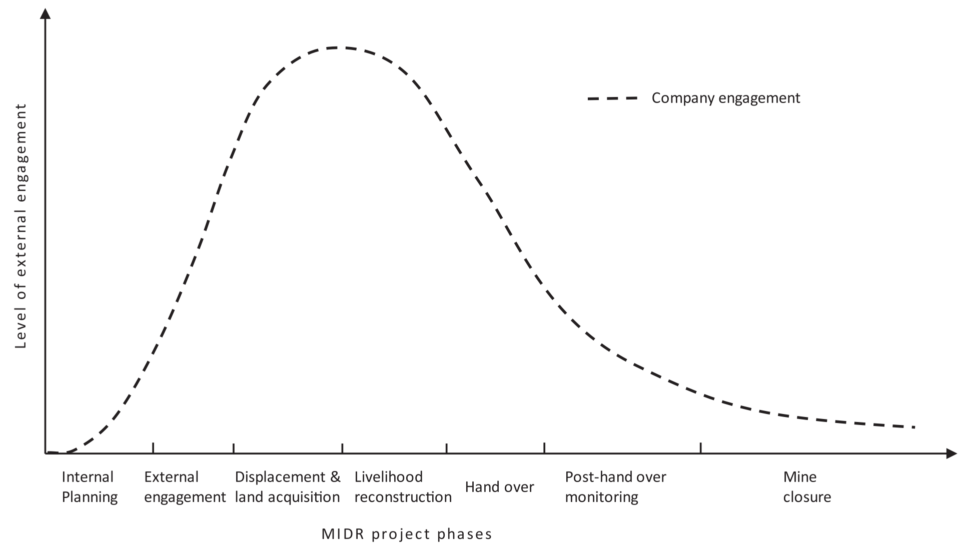

Fig. 3. Levels of external engagement by resettlement planning phases.

immediate interest of securing land, the obligations and responses to issues that affected the displaced population are opaque.

Research shows that post-relocation impacts or effects are often not reflected in capital budgets. Rather than follow the low-externality model espoused in the international standards, companies favour an approach that deals with the displacement on a piecemeal basis, funding the dispossession and acquisition of land as a first-order priority and then deferring livelihood and resettlement programs for as long as the situation will allow. In deferring, denying or deflecting responsibility, companies create fertile ground for legacy issues to set root and progressively grow. Once established legacies can add a hefty premium to the cost of doing business. The presence of legacies also detracts from the so-called "trust bank" that companies sometimes refer to when describing the importance of good relationships with its nearby stakeholders. Numerous studies, from as diverse as history, political science, sociology, finance and economics, have detailed the positive effects of "trust" in mediating commercial transactions, and in particular, its role in reducing the cost of doing business between parties (Michalos, 1990; Zaheer et al., 1998; Rothstein and Uslaner, 2005; Tilly, 2005; Mouzas et al., 2007). A recent survey of mining conflicts by Franks et al. (2014) indicates that failing to secure good relationships can cost mining companies severely.

Despite evidence suggesting that legacy type issues can impose high-levels of cost on the enterprise, companies can elect to "grind through" the issues. In other words, to invest in a series of partial interventions to maintain land access accepting the level of residual risk imposed on both the company and the community. We use the word 'partial' not only because companies (and consultants) fail to properly account for the cost-burden that other actors will experience, but also because the current costing practice does not properly identify all of the immediate and future cost scenarios for the business itself (Gomes et al., 2014).

Failing to incorporate resettlement costs into capital and ongoing operational budgets results in cost pressures being transferred 'outside the fence'. In other words, externalised to parties beyond the operational perimeter of the mine. We refer to this process as 'burden transfer'. Internally, this practice manifests when companies elect to push the cost of meeting immediate social and compliance requirements out to a future and potentially never to be realised date. Taken together, the combination of 'burden transfer' and cost deferral provides the conditions for risk and cost rebounds; elsewhere described as the 'the rebound effect'.

Building on Fig. 3, which outlined engagement patterns by resettlement planning phase, Fig. 4 illustrates the relationship between engagement, legacy and cost. The assumption is that the impact of potential legacy issues can be mitigated through direct and positive engagement with resettlement communities. In Fig. 4 the legacy line sits beneath the engagement line up until the point at which the company winds down its engagement activities.[1]

The time at which direct and intensive engagement is most likely to reduce is immediately following the project's acquisition of land. At this point, the project is able to focus on developing or expanding the activities of the mine. Where projects have failed to meet obligations or curtail and manage emerging risks, this is the stage at which displacement activities begin to generate externalities. In the main, the point at which legacy exceeds engagement can be characterised by five (5) factors:

1. The internal impetus for external engagement is lessened following the acquisition of land.
2. The resources for sustained engagement do not form part of the initial land acquisition and relocation budget.
3. The compensation monies provided to relocation families have been spent; either through misuse or in order to make up for short-falls in the company's livelihood programming.
4. Weaknesses in or the absence of a livelihood program come into full affect.
5. The social function of the mine are no longer at the centre of planning and implementation activities.

5. Implications

Our contention is that the high-externality model is key to understanding the development and entrenchment of legacy issues. These are issues that emerge outside of the planned schedule of costs and eventually appear in the domain of unplanned costs. As the mining project ramps up and direct engagement winds down,

[1] For the purposes of illustration this diagram is fashioned around a single resettlement event. It does not account for multiple or intergenerational resettlement scenarios, such as those at Rio Tinto's La Granja project in Peru.

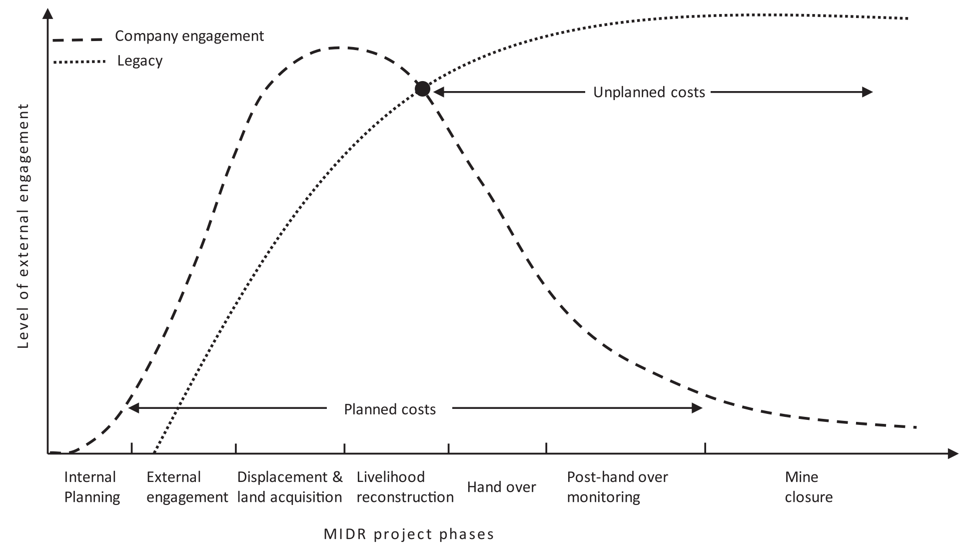

Fig. 4. Engagement, resettlement phases, legacy and the rise of unplanned costs.

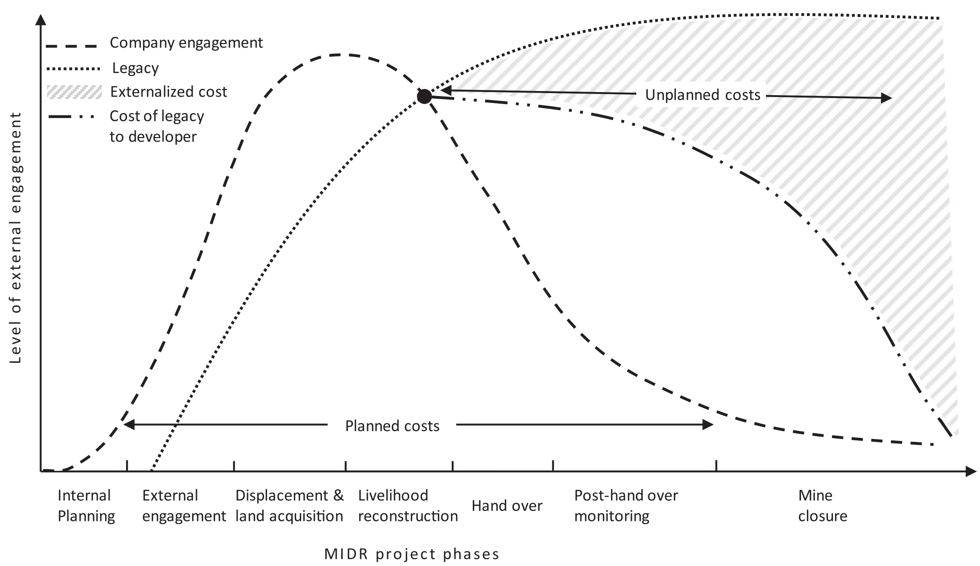

Fig. 5. Engagement, resettlement phases, legacy and externalised cost.

the company's ability to contain legacy issues diminishes. This is illustrated in Fig. 5. A gap is created on both the cost and engagement front as issues ferment and resourcing is diverted away from managing resettlement related issues. As needs from the resettlement continue to surface and the relationship with the project becomes less of an internal priority for the company, legacy issues compound and intensify. In some instances these issues will reach the company in the form of an increasing set of financial demands. The assumption is that as legacy issues develop over time, the gap between the available budget and the financial cost of closing the issue out will widen.

This widening gap has been clearly explained in our model above. As shown in Fig. 2, E^1 represents the externalised cost felt by the affected population. E^2Is the rebound cost, when the displaced population refuses to accept the burden transfer at E^1 (or part of E^1). The temporal consequences of the low-externality and high-externality financing models are demonstrated below in Fig. 6.

The phases marked on line *LE* correspond with the programming logic contained in the suite of international standards. A programmatic approach would imply the following features:

1. Cost to affect the resettlement is budgeted at the front end of the project capitalisation process.
2. The resettlement is itself managed as a project; with clear budget requirements and stage specific milestones.
3. Handover assumes that the responsibility for sustaining the resettlement does not sit solely with one party.
4. Close out assumes that the outcomes will be sufficiently positive that each of the parties can agree to conditions being acceptable.
5. That this approach is systematic, ordered and above all, less costly and chaotic than pushing costs to the back end of the process.

Despite endorsing international standards and receiving Equator Principle finance, our contention is that mining companies do

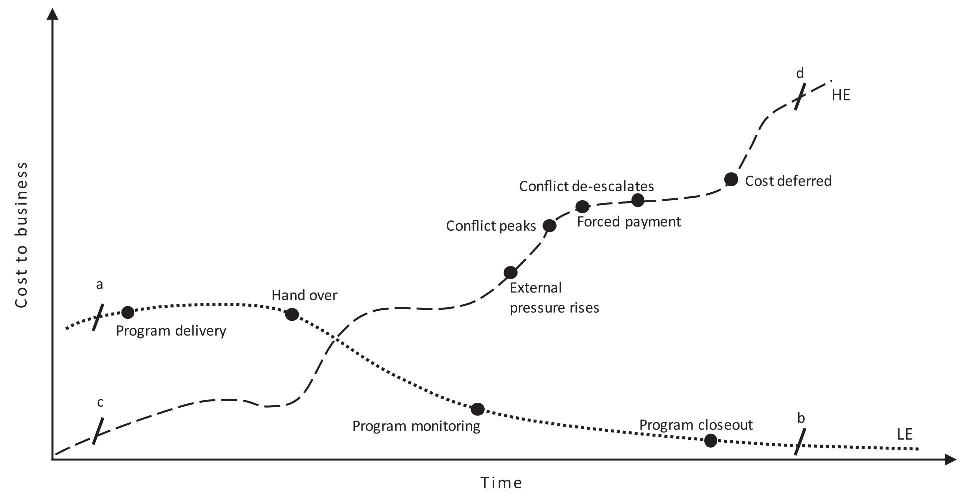

Fig. 6. Temporal patterns associated with low and high-externality models of resettlement financing.

not plan, invest or operationalise their resettlement activities using the approach depicted by line *LE*. By attempting to minimize the level of upfront investment, companies impose an entirely different logic on the resettlement planning and budgeting process. One key distinction is that the two costing logics have fundamentally different drivers that determine how and when finance is released to the project. We regard the high-externality model as having the following characteristics:

1. Less emphasis on front end planning which then corresponds with investment levels and integration between the social and "technical" dimensions of mining projects.
2. Land access occurs through physical displacement. From the vantage point of the company, physical displacement is the primary "project". Resettlement is a consequence and a cost that is managed thereafter.
3. The dominant cost control is to defer payment until it can no longer be avoided. For instance, when operational access or major reputational damage is threatened due to human rights allegations.
4. Due to the characteristics noted immediately above, the resettlement is not structured as a coherent project that can be handed over or closed out.
5. Costs rise as issues intensify. Each new payment establishes a cost precedent (see Bury, 2005 p233 on land costs).
6. Payments do not "close-out" obligations. Instead payments de-escalate pressure to enable the operation to continue in the short-term, while increasing the scope for future negotiations over the remaining life of mine.

In 1999, Manhattan Minerals developed plans to establish an opencast mine 3 km in diameter in Peru's Tambogrande area, a proposal that would result in the relocation of 8000 people. However, the local population opposed the project calling a general strike culminating in affected people occupying and later destroying the offices of the company (Haarstad and Fløysand, 2007). In 2007, over 3000 residents were displaced from their ancestral lands in Kwale to pave the way for a titanium mining project. The local community entered a period of protracted conflict with the Kenyan government and the company due to the loss of homes, livelihoods and severe food insecurity (Abuya, 2016). These examples highlight the local risk dimensions feeding into what we call the 're-bound effect'. The re-bound effect develops out of the following pattern of behaviour:

1. When the company fails to manage the key dispossession risks, a transfer of burden occurs. This is the essence of E^1 or company-induced externality. The cost and effects of non-mitigation are transferred to the displaced population.
2. In most instances, neither the displaced population nor the host government are able to shoulder the additional burden and have no planning, management or financing mechanisms to carry the externalised cost.
3. Left un-mitigated the effects of the burden accumulate in the displaced population, who reside in near proximity to the mining operation.

Following line *HE*, the instability caused by this dynamic is shown to peak. This represents a point at which external burdens have stretched beyond what either the local community or the government can carry. This is also known as 'social stability risk' (Shengping et al., 2019). Research shows that these are tipping points, or risk transfer points (Kemp et al., 2017), where the externalised financial burden translates into social and operational risks that require a direct response from the company.

Fig. 7 demonstrates the determining relationship between the (i) the investment level at C^2, (ii) the balance of rights between the company and the displaced population denoted by *l*(slope of supply curve) and *h* (slope of demand curve), and the size and distribution of externality captured at E^1 and E^2. Four different scenarios show the net effects of the temporal patterns described above. Fig. 7a reflects position *a* in Fig. 6, or the upfront investment by a company following a low-externality model. The slope of the supply and demand curve favours the rights and interests of the displaced population. Fig. 7b is the end result of low-externality based programming and investment. The overall quantum of externality is reduced, including that component driven by displaced persons rejecting the 'transfer of burden' from the developer. A greater net positive effect is realised at B^3 where the cost to the company at C^2 is significantly lessened, and the extent of needs met on the part of the displaced population at P^0 is improved. This corresponds with handover point *c* in Fig. 6. Fig. 7c and d by contrast show a progressive deterioration in the bargaining interface at B^0, B^3 between the company and the displaced population. The reduced level of investment guarantees a markedly higher level of externality carried by the affected population in 7c, and then a discernibly higher cost distribution of externality in 7d that impacts both parties. Unlike the low-externality model shown in 7a and 7b, the high-externality approach has the strong tendency toward

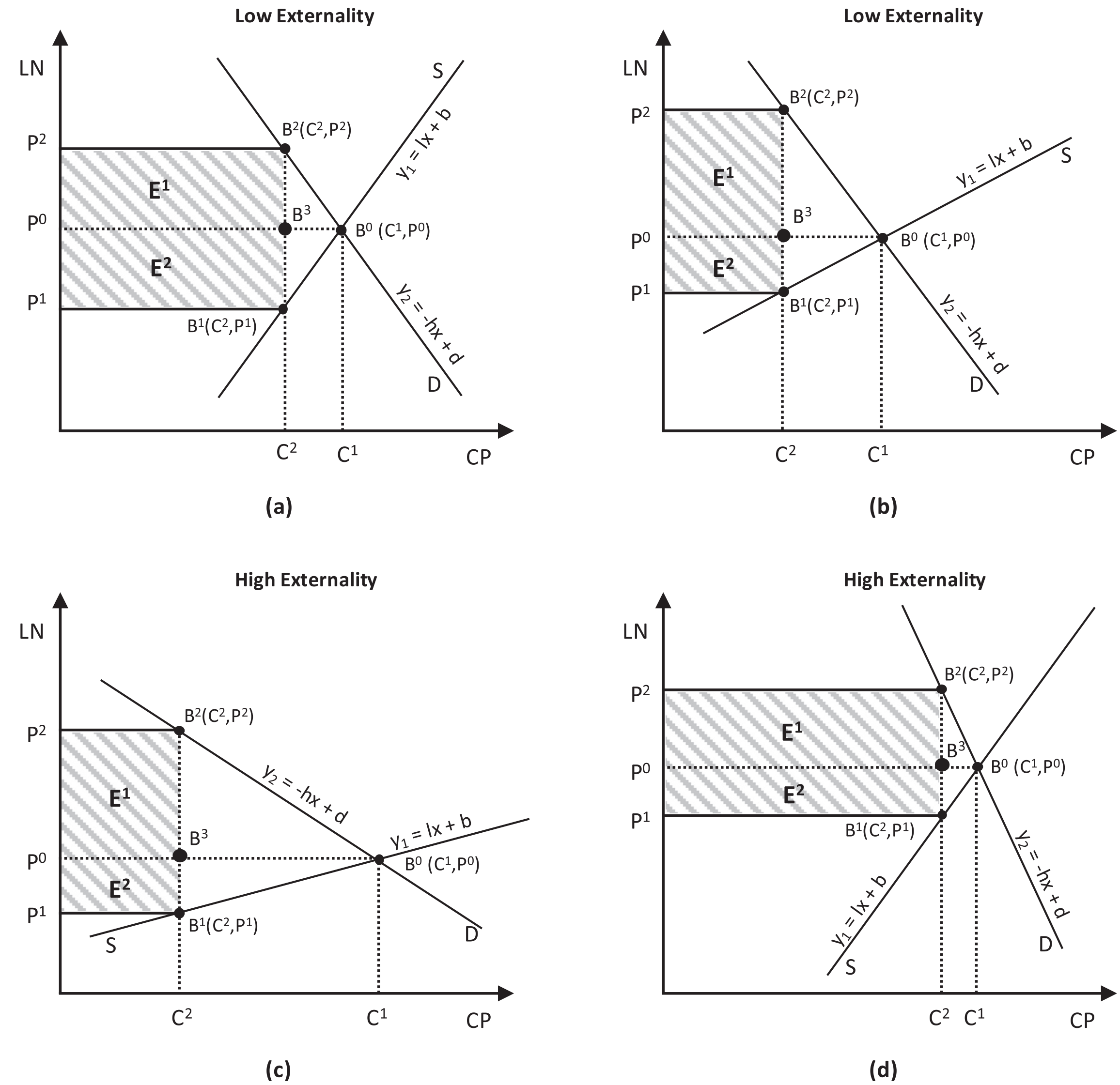

Fig. 7. Cost-burden outcomes across low and high-externality models of resettlement financing.

exacerbating the costs and externality profile of resettlement events with poor prospects for close-out. In Fig. 7b under the low-externality model, B^3 can be read as the cost-conclusion with the final balance of rights and accrued residual risk at close-out. For the high-externality model shown in Fig. 7d, B^3 represents a negotiation point between mutually unwilling parties with near certainty that further burdens will be generated and transferred into life of mine.

6. Conclusion

Analysis of the temporal patterns of resettlement financing in mining indicates a major divergence from investment and safeguard norms as articulated in the international standards. While esteemed scholars, such as Michael Cernea and Julie Maldonado (2018), have recently critiqued the World Bank Group's policy framework on involuntary land acquisition and resettlement, the substance of the safeguards continues to preference a low-externality model of financing. This stands in clear contradistinction to the model of high-externality financing deployed by mining projects over their life course. In this latter model, externalised costs progressively accumulate with the burden transferred unevenly between parties. Disputes are inevitable and the rights enjoyment of the displaced population diminishes over time. Rebound costs, as displaced people reject the imposition of externalities, erode at the economic viability of the project through increasingly liabilities and legacy issues. To effectively understand the potential social costs stemming from resettlement financing we must first establish what *all* the costs are. An outline of these costs, and the propensity for developers to meet obligations against these items is presented in Fig. 1. The extent to which developers fail to meet costs arising out of displacement events forms the basis of externalities. This is perhaps the major limitation of the existing model. In our theoretical model, Fig. 2 shows the relationship between investment levels, and the encroachment of externality on the rights enjoyed by displaced people. These factors combined provide explanatory insight into how negotiations between mining sector proponents and displaced populations can result in untoward outcomes.

Programming efforts can likewise be viewed through the dual lens of externality and the mining life course. In Figs. 3–6 we describe specific risk transfer points in mining developments, where these intersect with resettlement budgets and how they limit the effectiveness of safeguard policies. The temporal dimensions of resettlement in mining are unique given the potential for communities to both live within the immediate impact footprint of operations, and for displaced people to be re-displaced as footprints evolve in response to market demands. Figs. 4 and 5 illustrate the risk initiated by companies in under-resourcing resettlement projects and the pattern of externality growth that follows as a result. Fig. 6 depicts the principal cost differences between the two models of financing and the manner in which these apparent differences structure the economic relationship between companies and displaced people. Aside from the obvious tendency toward conflict marked in Fig. 6, the high-externality approach has the distinct disadvantage of trending further away from “hand over” or “close out” over time. Each successive development in the high-externality approach suggests new cost precedents, either in terms of meeting immediate demands, or in the continuing proliferation of liability.

The risk dynamics implied in Fig. 6 are similarly alarming. In short, the risk liability is uncontrolled in two substantive ways. First, the liability formed through growing externality crosses a major threshold point once the planned capital is fully expended. This typically occurs well before commitments are realised meaning that soon after populations are physically displaced, but prior to commencing the long process of reconstructing their lives, the financial short-comings become evident. Second, the stage at which displaced people re-direct unwanted risk to the company, manifesting in what we call a “rebound cost”, cannot easily be predicted. We argue that this is due, in part, to the internal carrying capacity of the displaced population and its ability to absorb risk and to the creation of additional burden by the mining through its operating activities.

The willingness of mining companies to devise accurate cost projections for resettlement programs is a basic blockage to success. A secondary blockage is the absence of knowledge and organisational structures to ensure that full replacement costs are capitalised into feasibility propositions. At present none of the respective parties is operating on realistic terms with regard to the overall balance of risk and cost. For any notable, material improvement to occur in the safeguarding of displaced people’s rights, fundamental changes are needed such that governments and communities can prepare for, or ultimately reject proposals for resettlement on financial grounds when investment levels are inadequate, and where developments do proceed, formal mechanisms are available to transfer the externality back to its point of origin.

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Ethics approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent

Not applicable.

CRediT authorship contribution statement

John R. Owen: Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Supervision. **Ruilian Zhang:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **Andrea Arratia-Solar:** Writing - review & editing, Visualization.

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 paper.

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