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COMMENTARY

Slave ownership and fossil fuel usage: a commentary

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Abstract In a recent, thought-provoking article, Jean-François Mouhot argues that there are many similarities between historical slave ownership and present-day fossil fuel usage. For that reason, Mouhot believes, members of modern fossil-fuel-dependent civilization should not feel morally superior to slave owners. While it is easy to sympathize with Mouhot's intentions of furthering a transition to sustainable energy use, some arguments made in the article are in need of refinement.

1 Introduction

In his article "Past Connections and Present Similarities in Slave Ownership and Fossil Fuel Usage", Jean-François Mouhot (2011) has recently pointed out what he believes are similarities between historical slave ownership and present-day fossil fuel usage, in order to morally condemn "our" current use of fossil fuels. His aim is to contribute to changing contemporary attitudes towards fossil fuel usage. Mouhot's article is divided into two main, and somewhat unrelated, sections. In the first section, he argues that the (fossil-fuel-based) industrial revolution had an impact on the abolition of slavery. In the second section, he argues that there are important similarities between historical slavery, and present-day fossil fuel usage. This article presents a critique of some of the arguments made in Mouhot's article.

2 Fossil fuels and abolitionism

Many scholars have highlighted various factors as contributing to the historical abolition of slavery. An anti-slavery ideology is one of the factors emphasized by many scholars (see for example Oldfield 1995; Brown 2006; Davis 2006; Drescher 2009), and political and socio-economic factors, as well as the agency of slaves themselves, are other important factors emphasized by other scholars (see for example Eltis 1987; Blackburn 1988; Carrington 2002; Ryden 2009).

According to Mouhot, there is a strong connection between the (fossil fuel) driven Industrial Revolution in Britain and abolitionism:

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> The simultaneous rise of the steam engines and of the abolitionist movement was certainly not accidental. Industrialisation triggered a change in the perception of labour in Britain, which came to be seen more positively. Slavery has also often been portrayed as the easiest solution to long-standing energy shortages in pre-industrial societies, and the improvement in technology diminished the pressure to own bonded labourers (Mouhot 2011, p. 331).

Mouhot primarily emphasizes the argument that industrialization changed the perception of labour. His research on the perception of machines as labour-saving (and thereby also potentially a replacement for slavery) is an interesting contribution to the research on the development of what Christopher Leslie Brown has called an "anti-slavery ideology" (Brown 2006). The argument is, however, not without its problems. Even if, as Mouhot shows, some individuals might have thought that machines could reduce the need for coerced labour, it remains unclear how widespread this idea really was. In practice, various forms of labour coercion continued to be used frequently in both Britain and elsewhere long after industrialization had begun (see for example Steinfeld 1991, 2001; Brass 2011).

Mouhot is not entirely clear if he himself believes that the second part of the argument in the preceding quote—that technological development actually "diminished the pressure to own bonded labour"—is true. He certainly adds the caveat that machines did not take the place of slaves directly (Mouhot 2011, p. 332). Despite such caveats, there remains formulations and arguments throughout the article suggesting that there is a deeper relationship, beyond the perception of labour. In particular, Mouhot airs a fear that slavery might return on a large scale if there is a future energy shortage (Mouhot 2011, p. 339), seemingly indicating that he believes that there is at least some truth to a direct relationship between fossil fuel usage and abolition.

Much of the technological development that was taking place during the British Industrial Revolution was certainly labour-saving. Robert Allen has recently argued that the introduction of many of these new innovations depended on three crucial factors in the British economy: a high-wage economy (giving rise to incentives to economize on labour), cheap energy (allowing for a substitution of energy-driven machinery for labour) and an agricultural revolution (driving up the productivity of agriculture; Allen 2009). The three factors must not be confused. Much of the cheap energy used came from fossil fuels, i.e. coal. Human slaves might, as J.R. McNeill has argued, have been more energy-efficient than animals, and therefore in widespread use under a somatic energy regime (McNeill 2000). In early modern England, however, the importance of somatic energy rapidly declined in relative terms (Warde 2007). One crucial alternative to using coal would have been to continue using heat energy based on organic sources such as burning wood (e.g. in the form of firewood or charcoal). It has been argued that traditional energy sources continued to be used well into the nineteenth century (Radkau 2002, p. 195); it would, however, hardly have been possible to sustain an industrial revolution in this way in the long run. Fossil fuels were already responsible for around half of all energy consumed in England and Wales by the year 1700, and almost 80 % of energy 100 years later (Warde 2007). In an organic economy, access to energy is dependent upon the amount of land available for harvesting (e.g. forestry products for heat energy production, or food products that can then be used for human or animal energy production), and the efficiency with which the land is exploited (see for example Smil 1994, pp 80–84; Wrigley 2010, pp 13–17). The acreage necessary to sustain an industrial revolution, using only organic sources of energy, was, however, just not available in Britain. Cheap fossil fuels relieved the British economy of this "energy constraint", as E.A. Wrigley has put it. Without the existence of cheaply available coal, the resulting price of energy would most certainly have

placed a considerable constraint on further development in Britain. The increase in fossil fuel usage thus enabled the ecological constraints of the old ecological regime to be broken (Wrigley 2010, pp 13–17; see also Pomeranz 2001, pp 264–300; Marks 2007, pp 110–111; Williams 2003, pp 179–193; Malanima 2006).

Energy was on the other hand not a primary constraint in some other parts of the world. While the British economy faced a considerable energy constraint, American societies, for example, on the contrary faced land and energy abundance: by the early nineteenth century, there were still vast stretches of forest covering much of both North and South America, along with widespread use of hydropower (Williams 2003, pp 301 and 371; Nye 1998, pp 43–44).

Did the Industrial Revolution then diminish the pressure to own bonded labourers, as Mouhot claims some contemporaries believed? One of the most influential models that has tried to explain the existence of historical slavery is the Nieboer-Domar hypothesis. Succinctly put, the hypothesis argues that in cases where there is a high land/labour ratio, there are great incentives to introduce some form of coerced labour such as slavery (Nieboer 1910; Domar 1970; see also Evans 1970). If there are large tracts of land available for use cheaply or freely, and they can be used in such a manner as to produce an economic surplus, there is little or no reason for a free individual to accept to work voluntarily for a landlord, thus driving up the reservation wage so that the landlord can make no profit from employing the free worker. In order to exploit the land at a profit, the landlord would have strong incentives to try to coerce labour into working the land. Conversely: if land becomes less abundant relative to the amount of labour available, it becomes easier for the landlord to find someone willing to work for him voluntarily, thereby decreasing the incentives to use coerced labour.

The Nieboer-Domar hypothesis has certainly received criticism from some scholars studying slavery (see for example Baks et al. 1966; Engerman 1973; Gemery and Hogendorn 1974; Patterson 1977; Pryor 1977; Engerman 1992; Brass 1999; Brass 2011). Most importantly, many have argued that it is too simplified, taken on its own, as the sole and universal explanation of slavery. At the same time, a large number of scholars today agree that the essence of the hypothesis is one important (but not necessarily sufficient) factor explaining the existence of much historical slavery. This is certainly the case regarding much early modern slavery—not only the development of the American colonial plantation complex, but also many forms of slavery in other parts of the early modern world (see for example Kolchin 1987, pp 17–31; Feeny 1989; Manning 1990, p 33; Blackburn 1997, pp 168 and 195; Eltis 2000, p. 274; Turley 2000, pp 14–16; Heuman and Walvin 2003, p 78; Davis 2006, pp 97–99; Austin 2009; Boomgaard 2009; Fenske 2011). Surprisingly, Mouhot does not discuss this hypothesis at all.

To the extent that it is possible to find a correlation between the rise of fossil fuel usage and early modern slavery, this ought largely to be attributed to a third, confounding factor: the historical land endowment. A limited land endowment—as was the case in many European nations in the eighteenth century, including much of England—created incentives to increase the use fossil fuels as a complement to, as well as a substitute for, organic biomass (Malanima 2006). Whether fossil fuels actually could become competitive would of course not only depend on the demand for energy, but also on the supply and the extent to which existing stocks of fossil fuels could be put to use (e.g. the cost of producing the coal). In the Americas, on the other hand, land (and thereby organic energy, for example in the form of wood/charcoal, or hydropower) was still abundant throughout much of the nineteenth century. This then had the effect of delaying the introduction of fossil fuels to replace organic energy sources such as wood. According to many scholars writing on American slavery, the high American land/labour ratio had historically also contributed to a demand for coerced labour to work the vast amounts of available land cheaply.

The implication of the historical experience is therefore that there existed strong incentives to utilize coerced labour primarily when and where there was land (and thereby potentially organic energy) abundance, rather than when and where there was an energy shortage. The question for the owner of the capital was not whether to utilize technology *or* slaves. As Tom Brass has argued, "Capital uses *both* (technology and unfree labour) to cheapen, to discipline, or as substitutes for free wage labour." (Brass 1999, p. 9, emphasis added).

3 Energy shortage and modern slavery

As was mentioned earlier, Mouhot airs a fear that slavery might reappear on a grand scale in the event of an energy crisis. The historical evidence does not seem to warrant such a fear. Historical models are however not always applicable for understanding our contemporary world, or for making projections about the future. Modern-day slavery, for example, certainly cannot be explained by the Nieboer-Domar hypothesis, but is most prevalent in some of the most densely populated countries in the world such as Haiti, India, Nepal and Pakistan (Bales 2004; Bales 2005, see appendix 2 therein; ILO 2012). Previous studies that have tried to explain modern slavery have instead primarily pointed to factors such as the level of poverty, corruption and political instability (Bales et al. 2009, pp 55–64; see also Smith 2009).

Can energy shortage then contribute to our understanding of modern slavery? This is tested on macro-level data in a highly simplified analysis of modern-day estimates of slavery, presented in Table 1. The table reports the estimated coefficient for the independent variables from three different regressions using slightly different model specifications. In all cases, the incidence of slavery is the dependent variable. In the first regression, only three independent variables are included—Human Development Index (HDI), population density and energy production per capita—whereas in the second regression, a couple of more independent variables are included (level of corruption and unemployment); in the third regression, the four previously mentioned countries, which to a large extent drive the results in the previous two regressions, are dropped in order to test for any relationship in the rest of the sample.

The data on slavery are rough guesstimates of an illegal phenomenon, so any results from this data must be interpreted with a great deal of caution. The explanatory power of all the estimated models in total is also very limited (the models explain only around 10 % of all variation in the sample), so there are apparently many other contributing factors to modern-day slavery that are not included in these models. As can be seen in the table, only one of the factors shows a consistent, statistically significant relationship with the incidence of slavery: the HDI. The relationship is, as expected, negative—i.e. a higher HDI value is associated with a lower incidence of enslaved people. The estimated effect is substantial: according to the estimated coefficients, an increase in the HDI by just one index point would decrease the incidence of slavery by approximately 90–150 people per 1,000,000 inhabitants in the whole sample (regressions 1–2). Given that the mean incidence in the sample is around 2,700 slaves per 1,000,000 people, and that the standard deviation of the HDI is 19 index points, the factors underlying the HDI (income level, life expectancy and level of education) show a strong negative correlation with the incidence of slavery. The coefficients for population density and energy production are, on the other hand, not statistically significant when the whole data sample is included, and the coefficients are in both cases negligible (regressions 1–2). Somewhat more surprising—given previous qualitative research at the micro-level—other factors such as the level of corruption or unemployment do not show any statistically significant relationship with slavery incidence in the sample (regression 2). The results in previous regressions are to a large extent driven by the four previously mentioned countries—

Table 1 Explaining modern-day slavery

	Mean (SD)	R1	R2	R3
Human Development Index (HDI)	61.5	−89.982	−151.17	−30.96
	(18.6)	(0.001)	(0.007)	(0.033)
Population density	364.4	0.196	0.045	0.017
	(1,694.4)	(0.682)	(0.928)	(0.893)
Energy prod./capita	4719.1	0.022	0.013	0.023
	(12,739.5)	(0.505)	(0.704)	(0.010)
Corruption	−0.03		655.69	207.62
	(1.01)		(0.429)	(0.325)
Unemployment	10.1		−57.93	2.27
	(8.6)		(0.497)	(0.915)
N		83	76	72
Adj. R^2		0.09	0.13	0.09

Dependent variable: incidence of modern-day slavery, per 1,000,000 inhabitants (mean=2,682, SD=11,401)

Note: *p*-values *in parenthesis*

Sources: estimates of slavery from Bales 2005, see appendix 2 therein, the data is here re-calculated relative to the size of the population to achieve an estimate of the incidence of slavery; data on other variables are all the averages for 1998–2002; data on total population, population density, energy production, unemployment and corruption from the World Bank Data 2012; data on the HDI from UNDP 2012

India, Pakistan, Nepal and Haiti. If these are dropped from the analysis (regression 3), in order to test for patterns in the rest of the sample, there is still a strong relationship with the HDI, even if the estimated coefficient is lowered. Furthermore, energy production per capita turns out to be statistically significant in this regression. The estimated model does, however, indicate a *positive* relationship, i.e. higher energy production/capita is correlated with higher incidence of slavery, contrary to what would be expected if slavery was associated with energy shortage. The relationship might be complicated by international trade, so that national energy availability might be different from national energy production because of exports or imports. The relationship could also very well be spurious in that the energy production/capita-variable in this regression acts as a proxy variable for some other factor not included in the regression. Available estimates of contemporary slavery do, however, show little support for the argument that there is any association between modern slavery and energy shortage.

Tom Brass has argued for a crucial objection to the previously discussed Nieboer/Domar hypothesis, which might help us understand some of the differences between contemporary and historical slavery. In order to cheapen the cost of labour, employers might be tempted to try to introduce unfree labour, for example in a setting with a high land/labour ratio, where the price of labour otherwise might be relatively high. But in such a setting, workers can have quite a strong bargaining position, and might try to resist various forms of coercion. On the one hand, labour coercion does not, therefore, automatically follow from a high land/labour ratio. On the other hand, labour coercion might also be a response by capitalists to attempts by the working class to organize in order to improve their economic position, even in the context of a low land/labour ratio. The existence of unfree labour must therefore be understood as an outcome of class struggle, rather than as determined by the land/labour ratio per se. Labour shortage, Brass thus argues, is a term "applied by employers *not to an absolute unavailability* of labour-power (additional workers are needed, yet none exist) but to situations where market

forces or political consciousness permit free workers to act as (and reap the benefits from being) proletarians" (Brass 1999, p. 157, emphasis added, see also Brass 2011).

4 Functional similarities

Jean-François Mouhot is explicit that one aim of his article is to morally condemn "our" current fossil fuel usage (Mouhot 2011:330). In the second section of his article, he therefore argues that there are important similarities not only in the political rhetoric used to defend status quo, but also functionally between historical slavery and modern-day usage of fossil fuels. These similarities are: (1) machines and slaves play(ed) similar economic and social roles, and (2) both fossil fuel usage and slavery cause(d) harm to others.

It is important to note that these similarities go beyond rhetorical parallels. Marc Davidson has previously argued that there are similarities in the rhetorical arguments used by defenders of slavery and the fossil fuel lobbyists, in that it is a reactionary rhetoric—they all want to defend the status quo (Davidson 2008; see also Azar 2007). Jean-François Mouhot, for his part, claims that it is possible to find deeper similarities than just rhetorical ones.

The first similarity, the similar economic and social role of fossil fuel usage and slavery, boils down to the argument that both factors 'externalise' work: "Both slave owners and inhabitants of developed countries relied, and still rely, on work generated from an external source of energy to enjoy their particular lifestyle" (Mouhot 2011:342). Mouhot draws a parallel to the concept of "energy slaves" and argues that the implication of this functional similarity is that in order to enjoy their current lifestyle, without fossil fuels, every fossil-fuel-guzzling consumer in the developed world would need several dozen people as "energy slaves" (Mouhot 2011:343). The concept of "energy slaves" might be a way of illustrating how large a country's energy dependency has become. The dependence has become so large that, should a crisis occur, many societies might experience severe impacts. A return to the treadmill, literally speaking, as an important source of future energy does however seem to be highly unlikely. Returning to a somatic energy regime would soon meet the same (land) constraint as the old, ecological regime did before the fossil-fuel-driven Industrial Revolution. Other energy sources must instead replace much of the fossil fuel used. It will certainly be a great challenge to undertake such a transition completely, not least because of the scale of demand for energy (Smil 2010), but somatic energy would probably not be able to contribute much to meeting that challenge.

The second similarity, according to Mouhot, is that both fossil fuel usage and slavery cause(d) harm to others. The suffering resulting from slavery and fossil fuel usage are furthermore "morally comparable" (Mouhot 2011, p. 329). In the first place, this argument comes down to a philosophical discussion about whether it is possible to not only measure but also compare various forms of suffering at all. This paper will not be concerned with the basic philosophical question. If one believes that such a comparison is possible, however, a long range of practical problems arise such as how to compare the suffering from a life-time of slavery, with the suffering from say increased poverty due to flooding induced by climate change. Another major problem is of course the uncertainties regarding the magnitude of the consequences of fossil-fuel-induced climate change. These problems add up to a quite major hurdle if one actually wanted to compare the suffering seriously. Many of the problems are however avoided by Mouhot.

The comparison is made even more complicated if one, as Mouhot does, equates indirect and direct harm, intended and unintended harm, as well as differing processes of exploitation. One can however question whether the suffering from the direct and intentional exploitation of slaves (as slave holders did) really ought to be compared to the indirect and largely unintended

(if not unknown, any more) negative consequences of the use of fossil fuels. The comparison therefore seems most persuasive when Mouhot introduces the aspect of consumers of slave goods. From the perspective of the consumer, both the negative effects of climate change and the suffering due to slavery can be understood as indirect and unintended (but not necessarily unknown) external effects of his/her consumption of the goods in question. This is, however, an argument Mouhot makes only parenthetically and in passing, and he commonly retreats from such qualifications in favour of more drastic—but perhaps rather misleading—parallels, with rhetorical statements such as "we now behave much like slaveholders" (Mouhot 2011, p. 330).

So-called external effects are, however, in no way limited to the emissions of carbon dioxide from fossil fuel usage, but constitute a more general problem, much studied for example in environmental economics. There are plenty of historical and contemporary cases where one person's economic activity negatively impacts others. It is easy to find examples of sewage emissions into water, the emissions of various pollutants into the air, the destruction of habitats and biodiversity from clear-cutting a forest, the damming of a river for hydropower. If the question is one of third-party suffering from economic activities, why limit a comparison only to fossil fuel usage and slavery? The reason, it seems, is that the parallel is drawn not primarily for analytical clarity, but simply because of Mouhot's wish to morally condemn fossil fuel usage. One way of doing that is through guilt by association. Since there is almost universal opposition to slavery as an institution, guilt by association could, Mouhot argues, strengthen our resolve to move towards more sustainable energy consumption: "if we are convinced that we are behaving like slave-owners (whom we morally condemn), we are more likely to want to act differently." (Mouhot 2011, p. 350).

5 Conclusion

Mouhot's wish to morally condemn fossil fuel usage, because of the potentially devastating consequences it might have, is made explicit in his article. In this article, it has been argued that this leads Mouhot to rhetorically draw some parallels that seem quite dubious and misleading. In essence, it does not seem as if Mouhot makes a convincing case that "we" (whoever this "we" is) necessarily are acting like slave holders when "we" are using fossil fuels. These arguments therefore do not seem to be very helpful in furthering the cause of a transition towards more sustainable energy use.

This critique of some of Mohout's arguments should in no way be interpreted as an attempt to defend the current, unsustainable use of fossil fuels. The production and use of fossil fuels certainly contribute to massive amounts of carbon dioxide emissions, which might lead to catastrophic ecological, and thereby socio-economic, consequences worldwide. The potentially catastrophic effects of climate change ought, however, to be the basis for action on the issue in their own right.

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