The Sustainability of Empire in a Global Perspective: the Role of International Trade Patterns

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Abstract

I construct a model in which a colony trades raw materials for manufactures with the mother country and the rest of the world, and can rebel at the cost of some trade disruption with the mother country. Decolonisation is more likely when the rest of the world is more abundant in manufactures, or scarcer in raw materials: this is because trade policy in the rest of the world is more favourable to a rebel colony, while trade policy within the empire is more restrictive. I use my results to explain the timing of the American Revolution, and the Latin American Revolutionary Wars. I discuss some important implications for the history of colonialism.

JEL Codes: D74, F1, N4

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1 Introduction

When France lost land-abundant Canada and Louisiana in the Seven Years' War (1763), her remaining North American empire became scarcer in food. As a consequence, French trade policy became more open to foreign producers of food, such as the colonial USA. A few years later, in 1776, a coalition of US colonies found that the time was right to rebel against Britain.

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From a trade perspective, they were right: although rebellion brought upon them the cost of British sanctions - which damaged their exports to the British Empire - buoyant exports to the French and other European empires helped them to recover soon after the revolution. These facts suggest that the change of endowments of 1763, and the resulting change in trade policy, created a favourable global environment for the American Revolution. Given the importance of trade for the revolutionaries, this may well help to explain the timing of the revolution.

In this paper, I set up a model that clarifies the forces linking endowments, trade policy, and colonial rebellion. A colony (C^M) trades "raw materials" for "manufactures" with the mother country (M) and a foreign country (F), which has its own colony (C^F). Two key parameters shape the pattern of trade: the relative abundance of raw materials in C^F versus C^M, denoted by θ, and the relative abundance of manufactures in F versus M, denoted by δ. If θ is high, or if δ is low, then F's empire is a competitor of C^M in selling raw materials to M; otherwise, it is a competitor of M in buying raw materials from C^M.

In M and F, trade policy is set to maximise national welfare, while in C^M and C^F it is set by M and F to maximise their own welfare. However, M cannot treat C^M too harshly, since this colony can stage a successful revolution. Crucially, revolution entails a trade cost for C^M, since it is assumed to disrupt trade between C^M and M. In equilibrium, the size of this cost depends on F's trade policy. In this environment, the attractiveness of revolution come to depend on M's trade policy before a revolution, and on F's trade policy after a revolution.

I show that there are two global environments that C^M can find herself in. First, if θ is high (C^F is relatively abundant in raw materials), or if δ is low (F is relatively scarce in manufactures), F's trade policy is hostile towards a rebel colony, since it accommodates the interests of its imperial net sellers of raw materials (who are competitors of net sellers located in C^M). In addition, trade between C^M and F is not very important in this case, and M does not wish to impose strong trade restrictions upon C^M. This implies that C^M finds herself well integrated in world trade before a revolution, but isolated after, making revolution unattractive. Second, when θ is low or when δ is high, F's trade policy is friendly towards the rebel colony, since it accommodates the interests of its net buyers of raw materials. Furthermore, trade between C^M and F is important in this case, and M wishes to impose strong trade restrictions. Thus, C^M finds herself isolated before a revolution, but well integrated after, making revolution more attractive. I combine this economic mechanism with a simple political model of concessions or

repression, and find that the probability of peaceful or violent decolonisation is larger in the second environment than in the first.

The model admits two types of comparative statics: one looking at changes in θ, and one looking at changes in δ. I use results in the two cases to shed light on two important historical episodes. First, from the perspective of the colonial US, the outcome of the Seven Years' War can be seen as a sharp fall in θ. I show that, as predicted by the model, this generated a favourable trade environment for revolution, and particularly so for the US colonies that most enthusiastically supported the revolution. Second, I look at the rebellion of Latin America against Spain and Portugal in 1808-1827. In that case, the external shock was the Industrial Revolution in Britain (now, F), a large increase in δ from the colonies' perspective. I show that, following its industrial take-off, British trade policy became more open towards foreign net sellers of raw materials, and the cost of trade restrictions imposed by Spain and Portugal upon the Latin American colonies increased. Both factors made rebellion a more attractive option.

The paper is related to the literature on the endogenous size of nations (Alesina and Spolaore, 1997; Alesina, Spolaore and Wacziarg, 2000), which finds that globalisation reduces local economic dependence, increasing the equilibrium number of countries. In a similar vein, Martin *et Al.* (2008), find that more bilateral trade decreases the probability of war between countries, while more multilateral trade increases it. I contribute to this literature by constructing a new model of the link between endowments, global trade policy, and revolution. This allows me to highlight the role of trade policy, and to discuss new historical episodes.[1]

Another related paper is Head *et Al.* (2010), who look at the impact of 20th century decolonisation on subsequent trade patterns. Their finding, that conflictual separation led to a faster decline in trade between colonies and colonisers, is in line with my assumption of a trade cost of revolution.[3]

The paper is also related to the literature on customs unions (for a survey, see Ornelas and

[1]In a companion paper (Bonfatti, 2011), I argue that the value of controlling trade policy in the colonies declined in the 20th century, as the rise of intra-industry trade made colonial trade relatively less important. That paper addresses the claim, made by some historians, that some European empires ended in the 1950s because the colonisers lost interest in them. It is complementary to the present paper, which focuses on cases in which the end of empire was driven by colonial rebellion.[2]

[3]On the "empire effect" on trade, see also Mitchener and Weidenmier (2008). The paper is also related to the literature on natural resources and civil wars (see Blattman and Miguel, 2010). While this has focused on fluctuations in world prices, I look at the role of trade patterns, for *given* world prices. This additional dimension allows me to comment on the importance of foreign trade policy for secession.

Freund, 2010). In my model, too, two countries (C and M) may form a customs union, from which the third country is excluded. The difference is that M selects trade policy for both C and M, and it does so to maximise its own welfare.

Finally, the paper is related to the literature on trade and the economic legacy of empire (e.g. Acemoglu *et Al.*, 2005, Nunn, 2008), and to a historical literature on trade and war (e.g. Findlay and O'Rourke, 2007).[4]

The paper is structured as follows. Section 2 describes the baseline model. Section 3 informally discusses two extensions. Section 4 contains the historical evidence. Section 5 discusses some important implications of the paper, and concludes.

2 Baseline model

I first describe the model (Sections 2.1 and 2.2), and then solve for the equilibrium (2.3).

2.1 Trade model

This paper studies the colonial relationship between a colony, C^M, and its mother country, M. There are two other countries: a foreign country, F, and its own colony, C^F. Two goods x and y exist as endowments, and are traded and consumed. National endowments are

$$\begin{aligned} x^{C^F} &= \theta & y^{C^F} &= 0 \\ x^{C^M} &= 1-\theta & y^{C^M} &= 0 \\ x^F &= 1 & y^F &= \delta \\ x^M &= 1 & y^M &= 1-\delta, \end{aligned} \tag{1}$$

where $\theta \in [0,1)$ and $\delta \in [0,1]$. In words, M and F are abundant in y relative to their colonies. I interpret x and y as "raw materials" and "manufactures" respectively, but they could represent any commodity that M and F are competing to buy from, or sell to, their colonies.

Each country is inhabited by a mass of citizens, who can only differ in their endowments. I denote by x^{iJ} and y^{iJ} the endowments of citizen i in country J, and assume that endowments

[4]Other models of colonial rebellion are Gartzke and Rohner (2011) and Grossman and Iyigun (1997). These papers do not consider the role of trade in shaping rebellion, and are therefore very different from mine.

are dispersed enough to make markets perfectly competitive. Preferences are described by

$$u\left(x_d^{iJ}, y_d^{iJ}\right) = \left(x_d^{iJ}\right)^{\frac{1}{2}} \left(y_d^{iJ}\right)^{\frac{1}{2}}, \tag{2}$$

where x_d^{iJ} and y_d^{iJ} denote demand by citizen i in country J.[5]

I use y as the numeraire, and call p^J the price of x in country J. Citizen i in country J then maximises (2), subject to the constraint $x_d^{iJ}p^J + y_d^{iJ} \leq x^{iJ}p^J + y^{iJ}$. Her indirect utility is

$$v^{iJ}\left(p^J\right) = \frac{x^{iJ}p^J + y^{iJ}}{2\left(p^J\right)^{\frac{1}{2}}}, \tag{3}$$

where I have simplified the notation by writing indirect utility as a function of p^J only.

Summing up across citizens, we find national indirect utility (or *welfare*),

$$v^J\left(p^J\right) = \frac{x^Jp^J + y^J}{2\left(p^J\right)^{\frac{1}{2}}}. \tag{4}$$

2.1.1 Autarky equilibrium

Let p_A^J denote the equilibrium autarky price in J. With Cobb-Douglas preferences, the marginal rate of substitution (MRS) equals relative demand, y_d/x_d, which in autarky must equal relative domestic supply, y^J/x^J. But then, consumer optimisation ($p_A^J = MRS$) requires

$$p_A^J = \frac{y^J}{x^J}. \tag{5}$$

It follows that the equilibrium autarky price is 0 in C^F and C^M, δ in F, and $1-\delta$ in M. Using (4), it is easy to see that welfare reaches a global minimum at p_A^J (countries gain from trade).

2.1.2 Trade equilibrium

Trade policy is a stark decision: a country can be either "open" or "closed" to each of the other two countries, and (free) trade takes place between two countries if and only if they are both open to each other. There is then a number of possible *trade outcomes*: one in which all countries belong to the same free-trade bloc (the *integrated world outcome*); four in which

[5] x and y can be alternatively thought of as intermediate goods, and (2) as a production function.

three countries belong to the same free-trade bloc, and the fourth is in autarky; six in which two countries belong to the same free-trade bloc, and the remaining two countries are in autarky; and three in which two pairs of countries belong to two separate free-trade blocs. I use the notation $\{C^M, C^F, M, F\}$ to indicate the integrated world outcome, a notation like $\{C^M, C^F, M, .\}$ or $\{C^M, ., M, .\}$ to indicate outcomes in which one or two countries are in autarky, and a notation like $\{[C^M, M], [C^F, F]\}$ to indicate outcomes in which countries belong to two separate free-trade blocs.[6]

Given the assumption of an endowment economy, the equilibrium price within a free-trade bloc can be calculated as the autarky price of a fictitious country endowed with the sum of endowments of members of the bloc. Thus, in the integrated world outcome, all countries face the price

$$p^J_{\{C^M,C^F,M,F\}} = \frac{y^{C^M} + y^{C^M} + y^M + y^F}{x^{C^M} + x^{C^F} + x^M + x^F} = \frac{1}{3}. \tag{6}$$

Country J's (net) imports of x when facing price p^J can be shown to equal $\left(p^J_A - p^J\right) / \left(2p^J\right)$: the country imports if and only if the price that it faces is lower than its autarky price. Then, when facing $p^J = 1/3$ in the integrated world outcome, C^F and C^M always export, F imports if and only if $\delta \geq 1/3$, M imports if and only if $\delta < 2/3$. As a whole, F's empire (call this $C^F F$) imports if and only if $\delta / (1+\theta) \geq 1/3$, or $\delta \geq (1+\theta)/3$, and M's empire imports if and only if $(1-\delta)/(2-\theta) < 1/3$, or $\delta < (1+\theta)/3$. Figure 1 illustrate this pattern, for the case $\theta = 1/2$. Note that, for low values of δ, F is a competitor of C^M in selling raw materials to M, while for intermediate values it is a competitor of M in buying raw materials from C^M, and, for higher values, it buys raw materials from both C^M and M. Note also that, even for intermediate values of δ, if θ is large enough, F's *empire* is a competitor of C^M in selling raw materials to M.

What is each country's preferred trade outcome? As evident from taking the first derivative of (4), welfare is increasing in p^J for $p^J > p^J_A$, decreasing for $p^J < p^J_A$. Intuitively, an exporter of raw materials gains from an increase in their price, an importer loses. Then, a country's preferred outcome can be found by first identifying its preferred "importing outcome" (if any)

[6] With no transportation costs, not all countries in a free-trade bloc need to be open to all other countries. For example, $\{C^M, C^F, M, .\}$ is realised if C^M and C^F are open to M but closed to each other, and M is open to both.

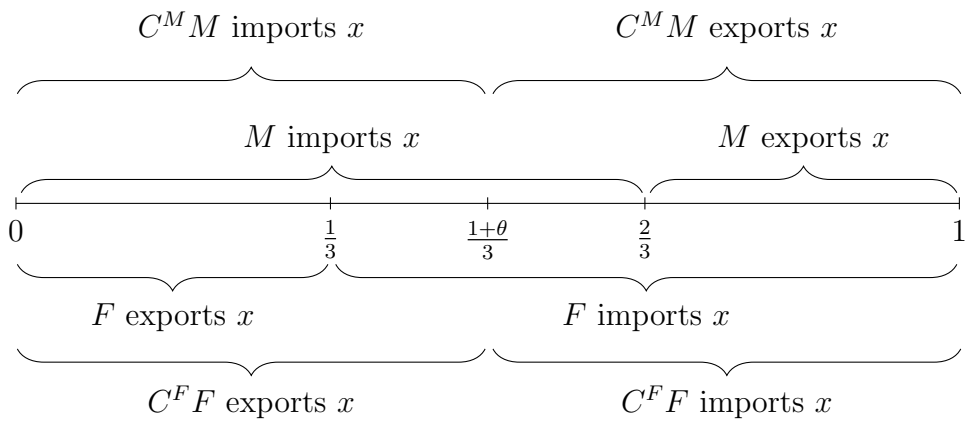


Figure 1: Pattern of trade in $\{C^M, C^F, M, F\}$, as a function of δ (for $\theta = 1/2$). Note that C^M and C^F always export x.

and "exporting outcome", and then comparing the two.[7] Results are reported in Table 1,[8]

$\delta \in$	C^M's first best	$\delta \in$	M's first best
$[0, 1/(3-\theta))$	$\{C^M, \cdot, \cdot, M\}$	$[0, 1/3)$	$\{C^M, C^F, M, F\}$
$[1/(3-\theta), (2-\theta)/(3-\theta))$	$\{C^M, \cdot, M, F\}$	$[1/3, 3/4)$	$\{C^M, C^F, M, \cdot\}$
$[(2-\theta)/(3-\theta), 1]$	$\{C^M, \cdot, \cdot, F\}$	$[3/4, 1]$	$\{\cdot, \cdot, M, F\}$
$\delta \in$	F's first best	$\delta \in$	$C^F F$'s first best
$[0, 1/4)$	$\{\cdot, \cdot, M, F\}$	$[0, \delta(\theta))$	$\{\cdot, C^F, M, F\}$
$[1/4, 2/3)$	$\{C^M, C^F, \cdot, F\}$	$[\delta(\theta), 2/3)$	$\{C^M, C^F, \cdot, F\}$
$[2/3, 1]$	$\{C^M, C^F, M, F\}$	$[2/3, 1]$	$\{C^M, C^F, M, F\}$

Table 1: National first-best trade outcomes.

where

$$\delta(\theta) \equiv \frac{(1+\theta)^2}{2(2+\theta)}, \tag{7}$$

and, for brevity, I have omitted the preferences of C^F. Table 1 has an intuitive interpretation. The two colonies, C^M and C^F, always compete with each other to export raw materials, and also

[7] By this, I mean, respectively, the outcome in which the country is an importer of x and pays the lowest price, and the outcome in which it is an exporter of x, and receives the highest price. For C^M and C^F, there are only exporting outcomes.

[8] For values of δ such that a country is indifferent between two trade outcomes, I use its preferences to the right of that value.

compete with one of the imperial powers if δ is extreme. Then, C^M's preferred outcome is one in which the other colony is excluded from trade, and so is any competing imperial power. As for M and F, for intermediate values of δ, they compete with each other to import raw materials, and their preferred outcome is one in which their competitor is excluded from trade. However for δ low, F is also exporting raw materials: then, this country's preferred outcome is one in which its colonial competitors are excluded from trade, while M's preferred outcome is one in which it can import from all countries. A symmetric case holds for δ high. Finally, the table also reports the preferences of F's empire, which will play a crucial role in equilibrium. When δ is low, $C^F F$ is, as a whole, a competitor of C^M in selling raw materials to M. Thus, the outcome that maximises $C^F F$'s total welfare is one in which it trades with M exclusively. Symmetrically, when δ is high, $C^F F$ is a competitor of M in buying raw materials from C^M, and the outcome that maximises its total welfare is one in which it trades with C^M exclusively.

2.2 Political Model

I model *empire* in a very simple way: while M and F set policy freely, policy in C^M and C^F is set by M and F respectively. Each country sets policy to maximise its own payoff (defined below).

2.2.1 Policy

There are two policy instruments: trade policy, which is set in all countries, and a transfer from C^M to M and from C^F to F, which is set in C^M and C^F only. I discuss these instruments in turn. *Trade policy* is described by a matrix τ, whose element τ^I_J is equal to 1 if I is open to trade with J, to zero otherwise. Mapping from τ to trade outcomes and thus prices, we can write gains from trade as a function of τ,

$$\Pi^J(\tau) = v^J\left[p^J(\tau)\right] - v^J_A, \tag{8}$$

where $v^J_A \equiv v^J(p^J_A)$ is autarky indirect utility.

The colonial powers, M and F may extract wealth from their colonies by appropriately selecting trade policy, but may also be able to impose lump-sum *transfer* T^{C^M} and T^{C^F}, respectively from C^M to M and from C^F to F. Because I focus on the colonial relationship between C^M

and M, I simplify the colonial relationship between C^F and F in two ways, the first of which I now discuss. In the case of C^M, I consider two alternative situations, one in which the above-mentioned transfer is technologically feasible ($\mathcal{T} = 1$), and one in which it is not ($\mathcal{T} = 0$).[9] In the case of C^F, however, I only consider the case in which the transfer is feasible. Later in this section (see footnote 25), I discuss how results would change if the transfer was not feasible.

The transfers T^{C^M} and T^{C^F} can be interpreted as the direct appropriation of colonial wealth, for example through the appropriation of locally raised taxes, or through the reservation of colonial assets or administrative jobs for citizens of the colonial power. In reality, direct colonial extraction was never completely perfect, nor completely ineffective, as the cases $\mathcal{T} = 1$ and $\mathcal{T} = 0$ respectively imply. Indeed, the main reason to distinguish between the two is not so much to allocate colonies to one case or another, but rather to learn about the sensitivity of results across a range of fiscal relationships.[10]

I assume that, as an additional requirement for the transfers T^{C^M} and T^{C^F} to be feasible, the colony and the imperial power must trade with each other. The only role of this assumption is to remove implausible equilibria, existing at the extremes of the parameter space, in which an imperial power opens up only the colony to external trade, while keeping itself in autarky, and then extract the colonial gains from trade through the transfer. The inclusion of such equilibria would not qualitatively affect the results,[11] but would make it impossible to derive closed-form solutions for some of the key thresholds.

2.2.2 Independence, Revolution and Sanctions

Before choosing policy, M decides whether to stick to empire, or to concede *independence*. In the latter case, control of policy is transferred to C^M at no cost for either country. In the former, C^M can stage a successful *revolution*. Revolution also transfers control of policy to C^M, but inflicts two costs on it. The first is a cost $(1 - \theta)\,\mu$, where μ is a stochastic cost capturing the exogenous factors that determine C^M's relative military power (the actual cost to C^M is then scaled by its

[9] Formally, denote by $\overline{T}$ the maximum feasible transfer. If $\mathcal{T} = 1$, then $\overline{T} \to \infty$, whereas if $\mathcal{T} = 0$ then $\overline{T} = 0$. Because indirect utility is linear in income, we can think of T as a transfer of indirect utility from C to M.

[10] In an extension, one could consider the possibility that a share $\alpha \in [0, 1]$ of the colony's wealth can be directly appropriate by the mother country: changes in α would then provide an additional source of comparative statics.

[11] Results would be exactly unchanged in the central range of θ of δ, where the most interesting comparative statics lies.

size, $1-\theta$).[12] The distribution of μ can be described by any positive density function, defined over the entire interval $[0, \infty)$. The second is a trade cost, since the mother country automatically enacts *trade sanctions* against the rebel colony: it sets $\tau^M_{C^M} = 0$.[13]

I introduce sanctions by assumption, because they are not ex-post optimal in this model. This can be justified in two ways. First, "sanctions" may actually capture the deterioration in trade relations that is naturally associated with conflict. For example, if revolution leads to war between C^M and M, trade relations between the two may have to be interrupted, at least temporarily. In the longer run, as found by Head *et Al.* (2010) for 20th century decolonisation, colonial rebelliion may also lead to a more rapid erosion of the trade-enhancing networks of empire. Second, it is easy to think of real-world situations - and corresponding extensions of the current model - in which M finds it optimal to erect higher tariffs against a rebel C^M. On one hand, two independent countries will face issues of co-ordination in trade policy, that will make it harder to achieve free trade. Such issues are well known to the literature on trade policy, and are normally seen as a rationale for political integration (e.g. Alesina and Spolaore, 1997). On the other, M could have multiple colonies, and standard reputation arguments (e.g. Milgrom and Roberts, 1982) could be used to rationalise (ex-post suboptimal) punitive sanctions as a signal to other colonies. Punitive sanctions are often used in the real world, and I provide a very clear example of this in Section 4.

For C^M, there are two advantages of breaking free from empire (either through independence or through revolution). First, it obtains control of policy. Second, it obtains an exogenous benefit $(1-\theta)\,B$,[14] where $B > 0$ is a parameter capturing a preference for self-determination, or a gain due to an overall inefficiency of imperial rule.[15] In this interpretation, the empire does not exist for efficiency reasons (though it may provide *some* efficiency gains), but only to allow M to

[12] Such factors include the emergence of a successful leader or ideology that helps the colonists overcome their collective action problem; or the occurrence of external events that weaken the military power of the mother country.

[13] Results are robust to modelling sanctions in a more continuous way.

[14] $B > 0$ is required for decolonisation to ever occur in equilibrium. Intuitively, if breaking free from empire did not imply an efficiency gain, revolution would necessarily imply an efficiency loss, given a positive cost of revolution. It would then always be possible for M to regulate policy in such a way as to make revolution unattractive. I illustrate this point more explicitly below, when commenting on Figure 2.

[15] A preference for self-determination may be idealistic, or driven by the expectation that, post decolonisation, domestic politics will be more favourable to the revolutionary groups (I thank an anonymous referee for suggesting this last point). Imperial rule would be inefficient if C^M and M had very different preferences, or if the delegation of policy to a faraway capital was technologically inefficient.

extract wealth from C. It should therefore disappear - in an equilibrium where nations are of optimal size (Alesina and Spolaore, 1997) - but it may well not do so because M gains from it.[16] An alternative interpretation of $B > 0$ is that M faces a commitment problem a la Acemoglu and Robinson (2006), and cannot therefore promise to reduce extraction below a certain level.[17]

The second way in which I simplify the colonial relationship between C^F and F is by assuming that, unlike C^M, C^F is a docile colony, which never rebels against F. While this could be captured formally - by assuming that C^F faces a prohibitively high exogenous cost of revolution - I prefer to keep these dynamics in the background.

2.2.3 Timing and equilibrium concept

Denote the three possible states of the colonial relationship between C^M and M (empire, independence and revolution) by $S = E, I, R$. The initial state is empire, $S = E$. The timing of the game is:

1. Nature chooses μ.
2. M decides whether to concede independence, or stick to empire. Then, τ, T^{C^M} and T^{C^F} are simultaneously set. If $S = I$, τ^{C^M} and T^{C^M} are set by C. If $S = E$, they are set by M (τ^{C^F} and T^{C^F} are always set by F).
3. If $S = E$, C^M decides whether to stage a revolution. Otherwise, nothing happens.
4. If $S = R$, τ and T are simultaneously reset, with $\tau^M_{C^M} = 0$. Otherwise, nothing happens.
5. Production, trade and consumption take place. Payoffs are realised.

To get rid of a number of implausible co-ordination failure equilibria, I focus on the Coalition-Proof Nash Equilibria (CPNE) of the policy-setting game: no coalition of countries can be able to improve on the payoff of all its members by co-ordinating on a different policy vector.[18]

[16] To avoid trivial solutions, I assume that B is non-contractible, so that C^M cannot pay its way out of empire. This non-contractibility could originate from the fact that C^M cannot commit to future payments (due after empire has been dismantled), and cannot therefore fully compensate M for the loss of future gains from empire.

[17] For example, suppose M promised to set $T = 0$, but C^M anticipated that, with probability π, M would actually set $T = \widehat{T} > 0$. If $\mu < B = \pi\widehat{T}$, M would only be able to prevent a revolution by conceding independence.

[18] Without this refinement, τ being equal to the zero matrix (all countries being closed to all other countries) could be realised in equilibrium.

2.3 Equilibrium

Because F does not need to worry about rebellion in C^F, it will always set $T^{C^F} = v_A^{C^F} + \Pi^{C^F}(\tau)$, thus extracting the entire value of its colony. I now solve for the rest of the equilibrium using backward induction.

Date 5. Payoffs depend on policy choices as follows:

$$V^{C^M}\left(\tau, T^{C^M}\right) = v_A^{C^M} + \Pi^{C^M}(\tau) - T^{C^M} + (1-\theta)\left[\mathcal{I}(S=I)B + \mathcal{I}(S=R)(B-\mu)\right] \tag{9}$$

$$V^M\left(\tau, T^{C^M}\right) = v_A^M + \Pi^M(\tau) + T^{C^M} \tag{10}$$

$$V^F(\tau) = v_A^F + \Pi^F(\tau) + v_A^{C^F} + \Pi^{C^F}(\tau) \tag{11}$$

where $\mathcal{I}(S=I)$ and $\mathcal{I}(S=R)$ are indicator functions for $S=I$ and $S=R$ respectively. Note that F's payoff is already optimised with respect to T^{C^F}, and does not therefore depend on it.

Date 4. If C^M has staged a revolution, the policy equilibrium is (proofs in the Appendix):

Lemma 1. *If the political state is revolution ($S=R$), in all CPNE:*

- *If $\delta \in [0, \delta(\theta))$, the rebel colony falls into autarky;*
- *if $\delta \in [\delta(\theta), 2/3)$, the rebel colony can trade with F's empire (the trade outcome is $\{C^M, C^F, \cdot, F\}$);*
- *if $\delta \in [2/3, 1]$, the rebel colony can trade with the entire world (the trade outcome is $\{C^M, C^F, M, F\}$);*

where $\delta(\theta)$ was defined in equation (7); and $T^{C^M} = 0$.

Since revolution disrupts trade with the mother country, the rebel colony's trade must depend on trade policy in F's empire. Lemma 1 relates this to endowments. When δ is low, F's empire is relatively scarce in manufactures. It is then an exporter of raw materials, whose terms of trade are best when C^M is excluded from trade. In this case, F's trade policy accommodates its domestic and colonial producers of raw materials, who want C^M isolated in world trade. Conversely, when δ is high, F's empire is relatively abundant in manufactures. It is then an importer of raw materials, whose terms of trade are best when it trades with all exporters of raw

materials. In this case, F trade policy accommodates its domestic producers of manufactures, who want to open up to C^M, and, if δ is very high, to M as well. Note that the threshold $\delta(\theta)$ is increasing in θ, to reflect the fact that, for given δ, F's empire is more likely to be a net exporter of raw materials if it has a large colonial supply. Finally, note that the revolution makes F's empire (and thus F) better off than in the integrated world outcome, since it shifts it to its first-best trade outcome (see Table 1). Intuitively, the revolution generates trade diversion away from C^M and M, and towards F's empire.

Let $\tau(S)$ denote equilibrium trade policy in state S (for $S = R$, this was derived in Lemma 1; for $S = I$ and $S = E$ it will be derived in Lemmas 2 and 3 and Proposition 1 below). Gains from trade can then be written as a function of the state, $\Pi^J(S) \equiv \Pi^J(\tau(S))$.

Date 3. If $S = E$, C^M compares the policy equilibrium that has been realised in period 2 to the one that would be realised after a revolution. It then stages a revolution if and only if its payoff is greater in the latter equilibrium than in the former. Using (9), the condition for revolution not to occur can be written as[19]

$$\Pi^{C^M}(R) + (1-\theta)(B-\mu) \leq \Pi^{C^M}(E) - T^{C^M}(E),$$

where $T^{C^M}(E)$ denotes any transfer imposed under empire. The condition can be re-arranged as,

$$\mu \geq B + \frac{T(E) - \left[\Pi^{C^M}(E) - \Pi^{C^M}(R)\right]}{1-\theta}, \tag{12}$$

which I refer to as the *revolution constraint*. Intuitively, for revolution not to occur, the cost μ must be greater than the benefit B, plus the benefit from getting rid of any imperial transfer, minus the cost from any expected deterioration in trade conditions.

Date 2. To decide between empire and independence, M compares the policy equilibrium that is realised in the two cases. If it concedes independence:

Lemma 2. *If the political state is independence ($S = I$) in all CPNE the trade outcome is $\{C^M, C^F, M, F\}$, and $T^{C^M} = 0$.*

[19] (12) is the relevant condition for revolution to maximise C^M's payoff. If, in addition, I had assumed that C^M's citizens are homogenous (an assumption that would not change any of the results), (12) would also be the condition for revolution to maximise the payoff of each individual citizen of C^M.

When C^M sets trade policy independently, in equilibrium, the world is integrated in trade. To see why, note that, with F acting so as to maximise the empire's total welfare, this is now effectively a three-country world (C^M, M and $C^F F$), where there are always two countries competing to export the same good (C^M and $C^F F$ competing to export raw materials if $\delta < (1+\theta)/3$, $C^F F$ and M competing to export manufactures if $\delta \geq (1+\theta)/3$). The third country must then be open to both - or it would not obtain the best possible terms of trade for itself - and this is enough to lead to $\{C^M, C^F, M, F\}$.

If M decides on empire, it sets τ^M, τ^{C^M} and T^{C^M}, while F simultaneously sets τ^F, τ^{C^F} and T^{C^F}.[20] It is useful to consider first a situation in which the cost of revolution μ is large, so that M can set policy without having to worry about revolution. I call this situation *unconstrained empire.*

Lemma 3. *If the political state is unconstrained empire ($S = E$, and μ large), in all CPNE:*

- *If $\mathcal{T} = 1$, the trade outcome is $\left\{C^M, C^F, M, F\right\}$, and $T^{C^M} = \Pi^{C^M}(E)$.*
- *If $\mathcal{T} = 0$,*
  - *if $\delta \in [0, (1+\theta)/3)$ the trade outcome is $\left\{C^M, C^F, M, F\right\}$;*
  - *if $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$ the trade outcome is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$;*
  - *if $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$ the trade outcome is $\left\{\cdot, C^F, M, F\right\}$,*

  and $T^{C^M} = 0$.

The equilibrium under unconstrained empire depends on the technology of extraction. If $\mathcal{T} = 1$, the world is integrated in trade. Intuitively, this is a situation in which, at the same time, M is technologically able to impose a transfer, and it can do so without fear of revolution. The mother country can then extract the colony's entire wealth, and this makes it act so as to maximise the empire's total welfare. This is then, effectively, a two-country world ($C^M M$ and $C^F F$), where both "countries" benefit from opening up to each other. If $\mathcal{T} = 0$, trade restrictions

[20] Notice that F could set trade policy strategically, in order to trigger a revolution. For example, it could set $\tau_C^F = \tau_M^F = 0$, to create the expectation that only if policy is reset will C get to trade with F. Of course, such a choice of trade policy would be a non-credible threat, since F would like to renege on it should C not stage a revolution. I avoid these implausible complications by assuming that F sets policy with the goal of maximising its payoff under *current* political institutions.

are the only way that M can extract wealth from C^M. If M's empire is a net importer of raw materials, $\delta < (1+\theta)/3$, the world is still integrated in trade. Intuitively, M is itself an importer of raw materials in this case, and opening up to external trade is the course of action that gives it the lowest possible price of raw materials. If M's empire is a net exporter of raw materials, the equilibrium outcome is one in which M's empire is closed to external trade, or, if δ is very low, one in which only C^M is closed to external trade. This is because, in the first case, M is an importer of raw materials, which benefits from keeping its abundant colonial supply for itself. In the second case, M is an exporter of raw materials, which benefits from excluding its colony, a trade competitor, from trade.

The result that M either only imposes a transfer, or only trade restrictions, should not be taken literally. The capacity of colonisers to impose transfers was never neither perfect nor non-existing, as I have assumed here: as a result, colonial extraction was typically implemented through a mixture of transfers and trade restrictions.

In defining unconstrained empire, I have imposed that μ must be high enough. But how high, exactly, does it have to be? To answer this question, it is sufficient to substitute equilibrium policy under unconstrained empire, as derived in Lemma 3, in the revolution constraint (eq. 12). For $\mathcal{T} = 1$ and $\mathcal{T} = 0$ respectively, this yields

$$\mu \geq B + \frac{\Pi^{C^M}(R)}{1-\theta} \equiv \overline{\mu}_1 \tag{13}$$

$$\mu \geq B + \frac{\Pi^{C^M}(R) - \Pi^{C^M}\left(\widetilde{\tau}\left(E|\mathcal{T}=0\right)\right)}{1-\theta} \equiv \overline{\mu}_0. \tag{14}$$

where a tilde identifies equilibrium trade policy under unconstrained empire. The threshold $\overline{\mu}_{\mathcal{T}}$ represents the gain from rebelling against a mother country that treats the colony in the worst possible way. If $\mathcal{T} = 1$, it is simply the benefit B, plus whatever gains from trade the colony expects to receive after a revolution (since, under such a predatory empire, the mother country completely expropriates the colony's gains from trade). If $\mathcal{T} = 0$, it is equal to the benefit B, plus the change in gains from trade associated with revolution (now, the colony may be able to retain some of its gains from trade under empire). Note that it is $\overline{\mu}_1 \geq \overline{\mu}_0$, to reflects the fact that the technology of extraction is more powerful in the former case.

If $\mu \geq \overline{\mu}_{\mathcal{T}}$, the equilibrium under empire must be as described in Lemma 3. If $\mu < \overline{\mu}_{\mathcal{T}}$, however, the mother country will have to make *concessions* in order to stave off a revolution.

Concessions may take the form of a lower transfer, or of a more open trade policy. However, because empire is welfare decreasing (the assumption that $B > 0$), there exist μ low enough that even a zero transfer, and a trade policy as open as under independence (that is to say, one leading to the outcome $\{C^M, C^F, M, F\}$), are insufficient to stave off a revolution. To find such a parameter range, substitute $T(E) = 0$ and $\tau(E) = \tau(I)$ in the revolution constraint, and impose that the constraint is not satisfied, to obtain[21]

$$\mu < B + \frac{\Pi^{C^M}(R) - \Pi^{C^M}(I)}{1-\theta} \equiv \underline{\mu}. \tag{15}$$

As formally shown in the proof to the next proposition, an open trade policy is the most valuable trade policy concession that M can offer to C^M, short of making itself worse off under empire than under independence. Then, the threshold $\underline{\mu}$ represents the gain from rebelling against a mother country that treats the colony in the best possible way. It is equal to the benefit B, plus the change in gains from trade associated with revolution. This is now equal to $\Pi^{C^M}(R) - \Pi^{C^M}(I)$, to reflect the fact that, under such a benevolent empire, the colony enjoys as liberal a trade policy as under independence. Comparing Lemma 1 and 2 reveals that this change is always non-positive, which is intuitive given that revolution entails trade disruption. I refer to this loss of trade as to the *trade cost of revolution*.

Returning to the choice between independence and empire, one would expect that M should stick to empire and impose maximum extraction if $\mu \geq \overline{\mu}_{\mathcal{T}}$; stick to empire but make some concessions if $\mu \in \left[\underline{\mu}, \overline{\mu}_{\mathcal{T}}\right]$; and concede independence if $\mu < \underline{\mu}$. This is confirmed by

Proposition 1. *In all CPNE:*

- *If $\mu \geq \overline{\mu}_{\mathcal{T}}$, M sticks to empire, and policy is as in Lemma 3.*
- *If $\mu \in \left[\underline{\mu}, \overline{\mu}_1\right)$, M sticks to empire, but makes concessions: if $\mathcal{T} = 1$, the trade outcome is $\{C^M, C^F, M, F\}$, and $T(E) = \mu - \underline{\mu} < \Pi^{C^M}(E)$; if $\mathcal{T} = 0$, the trade outcome is $\{C^M, C^F, M, F\}$ if $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, and either $\{[C^M, M], [C^F, F]\}$ or $\{C^M, C^F, M, F\}$ if $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$.*

[21] One potential source of confusion is that M is said to *concede* the trade policy matrix $\tau(I)$, and thus the trade outcome $\{C^M, C^F, M, F\}$; and yet parts of that matrix are in fact set by F. However, it is shown in the proof to Proposition 1 that if M *wants* to obtain the outcome $\{C^M, C^F, M, F\}$ under empire, it can always do so, in the sense that $\{C^M, C^F, M, F\}$ must then realise in any CPNE of the trade policy setting game.

- *If $\mu < \underline{\mu}$, M concedes independence.*[22]

To relate the equilibrium described in Proposition 1 to economic fundamentals, I represent it in (δ, μ) space in Figure 2. The case $\mathcal{T} = 1$ is represented in the left panel, while the case $\mathcal{T} = 0$ is represented in the right panel. The threshold $\underline{\mu}$ is the same in the two cases. It jumps up at $\delta(\theta)$, and is then increasing in δ. By Proposition 1, the probability that M concedes independence, or the probability that $\mu < \underline{\mu}$, also follows this pattern. Intuitively, the probability of independence is low for $\delta < \delta(\theta)$, because the trade cost of revolution is high (since a rebel C^M would find herself isolated in trade): instead, if $\delta > \delta(\theta)$, the trade cost is lower (since a rebel C^M would be able to trade with F's empire), and it is decreasing in δ (as F's empire becomes a more important trade partner for C^M).

The distance between the threshold $\underline{\mu}$ and $\overline{\mu}_{\mathcal{T}}$ can be interpreted as the maximum extraction that the mother country can possibly impose on the colony (see Lemma 3). It is different in the two panels, to reflect the different technologies of extraction. If $\mathcal{T} = 1$, it is equal to the entire value of the colony, which is constant in δ in the integrated world equilibrium. If $\mathcal{T} = 0$, it is only positive in the range where M finds it optimal to deviate from the integrated world equilibrium, $\delta \geq (1+\theta)/3$. It is first increasing in δ, to reflect the fact that to trade exclusively with the mother country, as in $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$, becomes more costly as F becomes a more important trade partner, and it then jumps up to reflect the cost of being relegated into autarky, as in $\left\{\cdot, C^F, M, F\right\}$.[23]

To illustrate the model's comparative statics with respect to both δ and θ, I represent the probability that M grants independence (the probability that $\mu < \underline{\mu}$) in (δ, θ) space in Figure 3. It is easy to show that $\underline{\mu}$ only depends on θ at the discontinuity point $\delta(\theta)$,[24] which as already mentioned is increasing in δ. Then, in the figure, the probability that M grants independence is low and constant to the North-West of the $\delta = \delta(\theta)$ line; jumps up as the line is crossed, and is increasing in δ in the region to its immediate South-East; and is high and constant in the figure's Easternmost region.

[22] A CPNE always exists, with two small exceptions if $\mathcal{T} = 0$ and at the extreme of the parameter range: in particular, in a subregion of $\theta \in [0, 0.03)$ and $\delta \in (0.746, 0.750)$, and in a subregion of $\theta \in [0, 0.19)$ and $\delta \in (0.803, 0.833)$. Full details are provided in the proofs.

[23] The figure confirms that, if $B = 0$, M never concedes independence (it is never $\mu < \underline{\mu}$).

[24] For $\delta < \delta(\theta)$, it is $\underline{\mu} = B - \left\{\left[(1-\theta)\sqrt{1/3}\right]/2\right\}/(1-\theta) = B - \sqrt{1/3}/2$. For $\delta \geq \delta(\theta)$, it is $\underline{\mu} = B + \left\{\left[(1-\theta)\sqrt{\delta/2}\right]/2 - \left[(1-\theta)\sqrt{1/3}\right]/2\right\}/(1-\theta) = B + \sqrt{\delta/2}/2 - \sqrt{1/3}/2$. In both cases, $\underline{\mu}$ does not depend on θ.

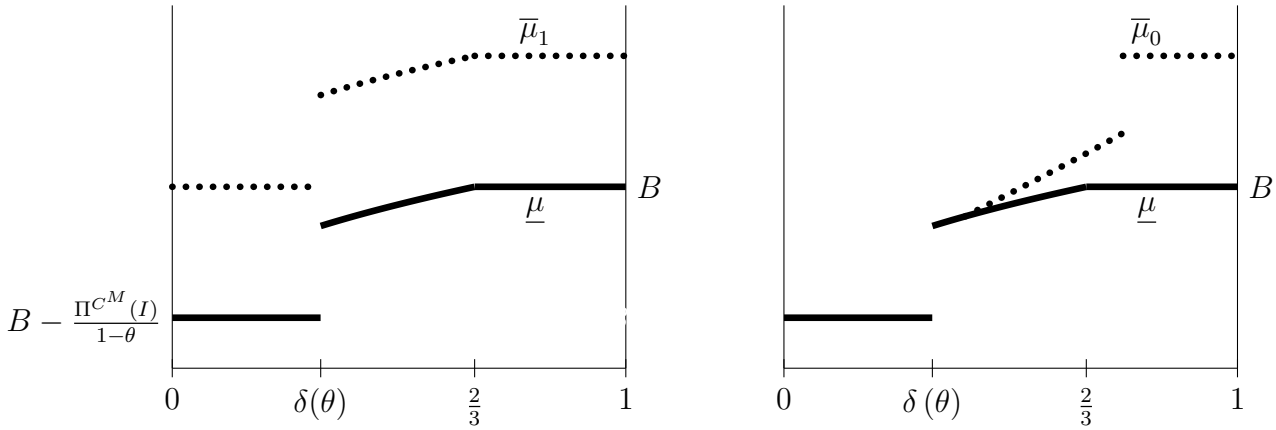


Figure 2: Full political equilibrium as a function of δ, for $\theta = 0.2$. The left panel is for $\mathcal{T} = 1$, the right panel for $\mathcal{T} = 0$.

Figure 3 summarises the main point of the paper. There are two global environments that C^M can find itself in. The first is a "hostile" environment, when F's empire is relatively abundant in raw materials, $(\delta < \delta(\theta))$. In this case, F's trade policy accommodates its domestic and colonial net sellers of raw materials, who perceive C^M as a competitor. This results in F's trade policy being hostile, and in C^M finding herself isolated after a revolution. The attractiveness of revolution is then low, and so is the probability of decolonisation. The second is a "favourable" environment, when F's empire is relatively scarce in raw materials $(\delta \geq \delta(\theta))$. In this case, F's trade policy accommodates its domestic net buyers of raw materials, who perceive C^M as a trade partner. This results in C^M being integrated in trade after a revolution, making revolution attractive and the probability of decolonisation high. This second environment is more favourable the higher is δ, a parameter that captures how important a trade partner F's empire is for C^M. Two changes in economic fundamentals can move a colony from the first environment to the second: a fall in θ, the relative abundance of raw materials in F's empire versus M's empire, or a rise in δ, the relative abundance of manufactures in F versus M.[25]

[25]If the transfer was not feasible in C^F, the line $\delta = \delta(\theta)$ would be a vertical line at $\delta = 1/4$, and the above-mentioned comparative static with respect to θ would disappear. On reflection, this makes sense: F's *own* first-best is to close down to all competing exporters of raw materials if δ is low, to all competing exporters of manufactures if δ is high (see Table 1). With no transfer, F does not internalise the welfare of C^F, and its choice of trade policy does not depend on where external exporters of raw materials are located. Paradoxically, this result indicates how robust my comparative statics is. If the threshold is vertical for $\mathcal{T} = 0$, and upward sloping for $\mathcal{T} = 1$, it will then be upward sloping for all cases in between. In other words, if F internalised C^F's welfare *even just a little* (because it has *some* capacity to tax it), then it would still be less willing to open up to foreign exporters, the more abundant C^F is (the higher is θ). Of course, it is entirely reasonable to assume that a colonial power will have some capacity to tax its colonies (see Section 4 for examples).

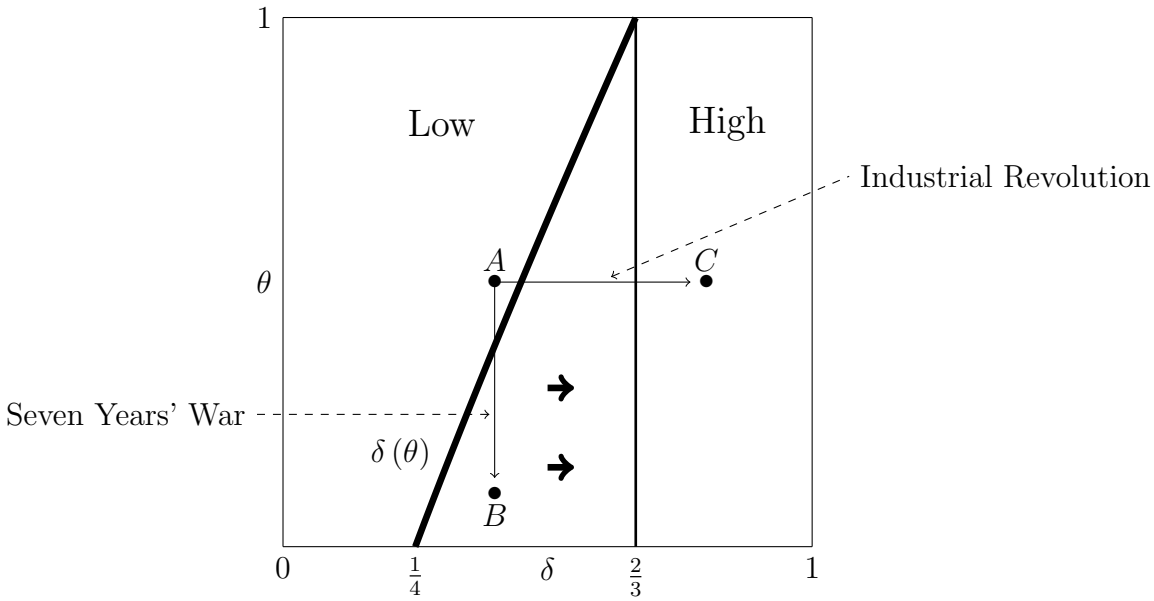


Figure 3: Probability that M concedes independence (probability that $\mu < \underline{\mu}$), as a function of δ and θ.

In my historical analysis, I interpret the Seven Years' War and the British Industrial Revolution as, respectively, a fall in θ and rise in δ, and study their implications for the sustainability of empire. Before going to that, however, I briefly discuss two extensions.

3 Extensions

The role of these extensions is to discuss the robustness of my results, and to generate additional insights. The extensions are discussed informally, while the formal analysis can be found in an Online Appendix.

3.1 Small rebel colony

An important feature of the baseline model is that the rebel colony is large enough to be able to affect its terms of trade. Would the comparative statics of the model become qualitatively different in a more general setting where the colony were allowed to be small, in the sense of international trade? To answer this question, I develop, for the case $\mathcal{T} = 1$, a 5-country extension in which the rebel colony accounts for a portion $\rho \in (0, 1 - \theta]$ of M's empire, while the rest of

the empire is docile. The case of a small rebel colony can then be captured by letting $\rho \to 0$. One attractive feature of this extended model is that it is now possible to change θ without simultaneously changing the size of the rebel colony, a comparative statics that more faithfully represents the case study on the American Revolution.

In the extended model, the two thresholds of Figure 3, $\delta(\theta)$ and $2/3$, are replaced by the functions $\underline{\delta}(\theta, \rho) = (1+\theta)^2 / [(1+\theta+\rho)(3-\rho)]$ and $\overline{\delta}(\theta, \rho) = (1+\theta+\rho)/3$. Both of these functions are increasing in θ, and converge to $(1+\theta)/3$ as $\rho \to 0$. In this extreme case, there are only two regions in Figure 3, one to the North-West of the line $\delta = (1+\theta)/3$, and one to its South-West. In the first region, the colony faces a hostile global environment for revolution, while in the second it faces a favourable global environment. Because the threshold $(1+\theta)/3$ is increasing in θ, the comparative statics of the model is qualitatively unchanged. Intuitively, F's attitude towards even a minuscule colony must still depend on the position of F's empire in global trade: if the empire is a net exporter of raw materials, it will lose from admitting C^M to world trade, while if it is a net importer of raw materials, it will benefit. While these costs and benefits are infinitesimally small, they are strictly different from zero, and switch from negative to positive exactly at the threshold.

The fact that the threshold $\underline{\delta}(\theta, \rho)$ is decreasing in ρ suggest an important insight from the extended model: at least for some parameter values, larger colonies are more likely to face a favourable trade environment for revolution. This implies that we should more often observe rebellion by large colonies, or that small colonies who rebel should then seek to form a coalition acting as one in international trade. I return to this point in Section 4.

3.2 Repression and equilibrium revolution

In the baseline model, I have assumed that M can only reduce extraction or concede independence, and that revolution is always avoided. However, as the historical evidence discussed below well illustrates, imperial powers did use repression, and revolutions did happen. I extend the baseline model to account for this. For simplicity, I only consider the case $\theta = 0$, which forces me to only consider the comparative statics with respect to δ. Faced with a low μ, M can now accommodate colonial requests as in the baseline, or can *unleash repression*. In the latter case, the probability that C^M can stage a successful revolution drops to $r \in [0, 1]$. To scale up

repression has a stochastic cost η to M.[26]

The main result of the extended model is that, if and only if $\mu < \overline{\mu}_{\mathcal{T}}$ (so that C^M advances requests), there exist a second threshold $\overline{\eta}_{\mathcal{T}}$ such that, if $\eta < \overline{\eta}_{\mathcal{T}}$, M reacts to requests by unleashing repression. If both $\mu < \overline{\mu}_{\mathcal{T}}$ and $\eta < \overline{\eta}_{\mathcal{T}}$ hold, then, revolution occurs with probability r. Crucially, the threshold $\overline{\eta}_{\mathcal{T}}$ is, for most parameter values, also increasing in δ. Intuitively, as δ increases, not only M becomes a less important trade partner for C^M (thus increasing $\overline{\mu}_{\mathcal{T}}$), but also C^M becomes a less important partner for M: the latter effect reduces the effective cost of repression for M (because it decreases the cost of trade disruption in case revolution does happen) and so increases $\overline{\eta}_{\mathcal{T}}$. Thus, a similar link exists between δ and the probability that M concedes independence (discussed in the baseline), and between δ and the probability of revolution.

Results for the case $\mathcal{T} = 0$ have important historical implications. As explained above, the probability of revolution is proportional to the probability that $\mu < \overline{\mu}_1$. Unlike $\underline{\mu}$, which is increasing in δ because the trade environment outside the empire becomes more favourable, the threshold $\overline{\mu}_1$ is also increasing in δ because trade restrictions imposed by the empire becomes more costly (see the discussion of Figure 2). There are then two separate channels through which a high δ makes revolution more likely, both of which seems to have been at play in the case of the Latin American Revolutionary Wars.

4 Historical evidence

In this section, I present two case studies to illustrate my comparative statics: the American Revolution and the Latin American Revolutionary Wars. In the first case, I argue that the outcome of the Seven Years' War (1756-1763) can be interpreted as a drop in θ (e.g., from point A to point B in Figure 3), which created a favourable global environment for the Revolution. In the second case, I argue that the British Industrial Revolution can be interpreted as a rise in δ (e.g. from point B to point C), which created a favourable global environment for the Revolutionary Wars.

[26] For example, exogenous factors (such as war elsewhere) may determine the cost of sending reinforcements to the colony.

4.1 The American Revolution (1776)

I begin by stating my argument, and I then turn to the supporting evidence. I conclude by placing my argument in the context of the pre-existing literature.

4.1.1 Argument

The Atlantic world of the mid 18th century can be mapped into the model as follows. The thirteen colonies of the colonial US are represented by C^M, while Britain and the rest of her empire are represented by M. The other European colonial powers - France, the Netherlands and Spain - are represented by F, while their American possessions - including Latin America and the Caribbean (then better known as the West Indies), Louisiana, Florida, large tracts of lands in the US Mid-West, and Canada - are represented by C^F. The foodstuff and raw materials (further described below) that the colonial US exported to the European empires are represented by x, while the goods that it imported from them (manufactures, but also Eastern commodities and African slaves) are represented by y. Revolution was a way for the colonial US to get rid of the British Navigation Laws (M's pick of τ^{C^M}), which I further discuss below, and various other colonial taxes (T^{C^M}).[27] Even more than the burden of taxation, what annoyed the colonists was the principle that Britain *could* impose these taxes (e.g. Conway, 2013; Ferguson, 2004), something that would be captured by B in the model. However, revolution was costly, since a rebel US would suffer losses to life and property ($\mu > 0$), as well as preferential access to some of the markets of the British empire ($\tau^M_{C^M} = 0$).

Did the environment around the colonial US change in the 1760s and 1770s, so that, based on the comparative statics discussed in the previous section, we would predict a higher probability of revolution? Indeed, this seems to have happened. Following defeat in the Seven Years' War - a major war between Britain and France which took place between 1756 and 1763 - France was forced to surrender Canada to Britain and Louisiana to Spain. As a result, the French North American empire was essentially reduced to the French West Indies.[28] For the US North, who competed with Canada to export foodstuff, this amounted to a large fall in θ. According to the

[27] An example of T^{C^M} would be the Stamp Act of 1765, whose purpose was to collect revenues to pay for the British army in North America (Conway, 2013, p. 42).

[28] The French also retained the Canadian islands of St Pierre et Miquelon. Louisiana was briefly returned to France in 1800, before being sold to the US in 1803.

model, such a change should make F's trade policy more favourable to a rebel C^M, thus reducing the trade cost of revolution and increasing its probability.

To make this argument more precise, we need to take a closer look at the trade of the US North in this period. The Northern colonies exported mostly foodstuff: grains and grain products in the Middle Colonies; and fish, livestock, meat, wood products and whale oil in New England.The West Indies, with their large populations of slaves, were by far their most important export market. They absorbed 42% of the exports of the Middle Colonies in 1768-1772, and as much as 63% of the exports of New England. This compared to 23% and 18% for the British isles (McCusker and Menard, 1985, tables 5.2 and 9.3). Although part of the West Indies was British, the French West Indies were by far the richest islands in the region, and a natural export market for the colonial US. But until the 1750s, trade between the US and the French West Indies was outlawed by France, who sought to protect its metropolitan food producers and help Canada to develop into a competitor of the US North as an exporter of foodstuff.[29] In terms of the model, θ was initially high.

Following the loss of Canada, the prohibition for the French West Indies to import US foodstuff become increasingly untenable. Having lost access to any external market in North America, the French West Indies sugar planters saw their terms of trade deteriorate sharply in the second half of the 1760s, resulting in acute economic distress (Goebel, 1963).[30] Even more importantly, the loss of Canada removed part of the rationale for a protectionist policy, since the dream of a self-sufficient American empire was now gone. Not surprisingly, then, the French began to relax restrictions on US imports in the mid 1760s, despite the opposition of metropolitan food producers. In terms of the model, as θ decreased with the loss of Canada, F's trade policy became more benevolent towards C^M. Unfortunately, the impact of this change on US trade cannot be exactly measured, since the data is almost non-existent.[31] Still, anecdotal evidence suggests that

[29]Among the main exports of Canada to the French West indies were commodities in direct competition with the US North, such as grain products, fish and wheat (Mathieu, 1972, p. 488). The French had a grand plan to make the French North American empire self-sufficient in food (Gould, 1939, p. 489; Goebel, 1963, p. 335; and Dewar, 2010, pp. 649 and 651); unsurprisingly, this was opposed by the French West Indies sugar planters, for whom the prohibition to trade with the US implied a higher price of imported foodstuff (Goebel, 1963).

[30]For example, Magra (2006) argues that "...100 quintals of refuse grade dried cod could be exchanged for slightly more than 21 hundredweights of sugar in the British islands, while the same amount of cod could fetch almost 28 hundredweights in the French islands" (p. 162); at the same time, "The shrinkage of available markets made French planters very willing to sell to New England buyers, and such pressures continually drove down the price of French West Indian molasses."(p. 161).

[31]Since US exports to the French West Indies was smuggling from the point of view of Britain, no official data

US exports to the foreign West Indies increased significantly in the second half of the 1760s (see, for example, Greene, 1980, p. 88; Magra, 2006, pp. 161-162).

We now see how the logic of the model applies to this real-world example. Before the Seven Years' War it could be expected that, had the US rebelled against Britain, not only it would have been exposed to retaliatory tariffs in the British West Indies, but it would have also continued to be excluded from the French West Indies, whose trade policy was set, at least in part, in the interest of Canadian producers. In fact, the French might well take advantage of deteriorated trade relations between the US and Britain to sell foodstuff to the British West Indies as well. In terms of the model, the trade outcome would have been $\{\cdot, C^F, M, F\}$. After the war, the US could expect to be able to export to the French West Indies, since the French empire was now scarcer in foodstuff (the outcome would have been $\{C^M, C^F, \cdot, F\}$ or $\{C^M, C^F, M, F\}$).

So, the Seven Years' War created a global environment that was more favourable to revolution in the US North. But what kind of environment did the US South face? According to the model, a clear distinction existed between the Upper South and the Lower South,[32] with the former facing a more favourable global environment for revolution than the latter. The export trade of the US South was dominated by three commodities: tobacco in the Upper South and parts of North Carolina, rice and indigo in the rest of the Lower South. These varied widely in the extent to which they faced competition from foreign producers. At opposite extremes where indigo and tobacco: while large supplies of high-quality indigo existed in the French and Spanish empires (Gray, 1933, p. 589; Garrigus, 1993, p. 26), American tobacco was better than that found anywhere else.[33] As a result, American indigo was entirely consumed in Britain (where it even benefited from a subsidy), while American tobacco was almost entirely consumed in continental Europe, and particularly in France.[34] Somewhere in the middle stood rice.[35] Based on these

was collected.

[32]Lower South: Georgia and the Carolinas. Upper South: Virginia and Maryland.

[33]For example, the tobacco that France imported from Louisiana was a bit expensive and never arrived in sufficient quantities. Tobacco imported from Spain was much too expensive, that imported from Portugal was good only for chewing (Price, 1964, p. 502).

[34]More than 80% of the tobacco sent to Britain was re-exported in 1770-1774 (Schumpeter, 1960).

[35]This commodity was somewhat different from the other two, since its main competitor was not (or not only) rice produced in other colonies, but rather wheat produced in the imperial powers themselves (of which rice was a close substitute). On the one hand, most American rice was consumed in continental Europe on the eve of the revolution. On the other hand, there was a clear upward trend in the importance of retained British imports starting from the mid 1760s (Nash, 1992, p. 691), possibly due to the fact that population growth was much faster in Britain than elsewhere in Europe, making domestic production of cereals relatively more scarce there.

trade patterns, the Upper South's situation must be captured with a low θ, and that of the Lower South with a high θ (perhaps with the exception of North Carolina, who also produced significant quantities of tobacco). While the tobacco planters of the Upper South could expect the European governments to adopt a favourable trade policy after independence, in the interest of their own consumers and fiscal revenues (an outcome like $\{C^M, C^F, \cdot, F\}$ or $\{C^M, C^F, M, F\}$),[36] the indigo and rice planters of the Lower South could expect the Europeans to adopt a protective trade policy, in the interest of their own producers (an outcome like $\{\cdot, C^F, M, F\}$)

I have been talking about the trade cost of revolution, however the model suggests a second channel through which a lower θ may make revolution more attractive: by increasing the cost of trade restrictions under empire (see also the extension in Section 3.2). Indeed, under the British Navigation Laws, a lower θ was typically associated with tighter trade restrictions. The US North was always restricted from trading with the Foreign West Indies, but these restrictions became more strictly enforced after the Seven Years' Wars.[37] Amongst the key exports of the Upper South, tobacco was the most heavily restricted: it had to be exported to Britain first, from which it could be re-exported to continental Europe.[38] In contrast, at least some of the American rice could be sent to Europe directly. As for indigo, it was also required to be sent to Britain first; however this was not a real restriction, since Britain was its only market.

I have focused on the export trade of the colonial US. It is important to acknowledge that the import trade displayed a different pattern, since revenues generated through exports were mostly use to import manufactures from Britain. British manufactures were simply of better quality, and thus preferred by the colonists (Gray, 1933, p. 599). This pattern cannot be captured by a 2-good model, where exports of x to a country must be matched by imports of y from that same country. However to the extent that, in a mercantilistic world, countries worried primarily about their capacity to export, the model should still capture the most salient aspect of the trade cost from revolution, as perceived by the colonists.

In summary, the model suggests that, in the early 1770s, a number of US Colonies (particu-

[36] In many European countries in the 18th century, the tobacco trade was an important source of government revenues. For example, in France, it was a state monopoly farmed out to private interests, and, by the 1760s, a major source of state revenues. The farmers of this monopoly found it very convenient to purchase US tobacco, since it was cheap, versatile, and very much liked by French consumers (Price, 1964, pp. 501-504).

[37] The Sugar Act of 1764 reduced the taxes on trade with the Foreign West Indies, but set out to actually collect them. To the colonists, who had until then largely evaded those taxes, the Act represented a substantial increase in taxation.

[38] This implied additional costs to the Americans, to the benefit of British intermediaries and public revenues.

larly New England and the Upper South) faced a good trade environment for revolution. They were then particularly likely to challenge British extraction, which they soon enough started to do. Failure by Britain to make concessions led to the revolutionary war.

4.1.2 Supporting evidence

If the mechanism of the model was important to understand the American Revolution, one would expect trade costs to be prominent in the minds of the revolutionaries, and colonies with a higher θ to be both less supportive of the revolution, and more severely damaged by it. I now review the evidence in support of these hypothesis.

To begin with: was trade important for the American revolutionaries? If not, the mechanism of the model, even if true, would have necessarily played a small role in the revolution.[39] Reassuringly, Sawers (1992, p. 266) argues that the minority of colonial citizens who led the revolution had, for the most part, a substantial involvement in international trade. There is also evidence that the revolutionaries thought a lot about the trade cost of revolution, and how to make up for it. This emerges both in their private writings (see for example the diaries of John Adams, as reported by Hutson, 1980, p. 30) and in the pamphlets and newspaper articles of pro- (as well as and anti-) revolutionary propaganda, which focused to a large extent on the impact that revolution would have on trade (Setser, 1937, p. 257). There was widespread optimism, based on the perceived importance of the American trade, that the European countries, to whom the revolutionaries sent diplomatic missions in the 1770s, were going to provide substantial commercial support (Hoffman and Albert, 1981, p. 4).

Were colonies whose trade was more exposed less supportive of the revolution? Indeed, despite the common indignation at British extractive policies, the colonies differed quite a lot in their willingness to undertake concrete acts of rebellion, and broadly along the lines that we would expect. An early example of this is the decision to boycott exports to the British Empire, adopted by the First Continental Congress in the fall of 1774. The proposal, put forward by Massachusetts and promoted by Virginia and North Carolina, was quickly approved by the other colonies, with the exception of South Carolina and Georgia. The former fought in Congress to secure an exemption for indigo and rice, on the ground that, being particularly dependent on

[39] In the model, this case would be captured by a very large B, and a very spread-out distribution of μ: any change in $\underline{\mu}$ would then have only a small effect on the probability of decolonisation.

markets of the British Empire, these commodities would bear an unfair share of the cost of the boycott (Weir, 1983, p. 316). The latter did not even send a delegation to the Continental Congress (Gray, 1933, p. 575).

A somewhat similar pattern applies to the decision on independence. Burnett (1941, Ch. 8 and 9) describes the tortuous process which, between February and July 1776, led the Second Continental Congress to declaring independence. Throughout the period, New England and Virginia were always in favour of independence, which they actively promoted to the more hesitant Middle and Lower Southern Colonies. Within the latter group of colonies, South Carolina and Georgia were particularly hesitant. Weir (1983) explains that, in South Carolina, whose representative institutions were dominated by the rice and indigo planters (p. 315), "Following reconciliation with Great Britain, most individuals hoped to retain the reforms contained in the constitution of 1776 [which had asserted greater control over colonial policy]. Beyond this, however, almost no one among the established colonial elite [...] wished to go. [...] The goal, clearly was acceptable terms of reconciliation with Britain, not independence. Yet, as British authorities proved to be intransigent, the logic of the situation seemed to make independence the only alternative to capitulation" (327). Gray (1933, p. 575), explains why "Georgia was the most reluctant of the Southern Colonies to join the Revolutionary movement. It was a frontier settlement that had depended on British military protection; it profited by subsidies form the mother country; it contained a large number of office holders dependent on British authority; and its principal staples enjoyed an unusual prosperity under the British commercial system." In the end, while Virginia declared her own independence months before the joint declaration of July 4th, 1776, Georgia was last in sending her representatives to Congress in June 1776. In the vote on the joint declaration, South Carolina and Pennsylvania were the only two who initially voted against the declaration of independence, while Delaware and New York abstained.

The plausibility of my argument is also evident in the economic background of key revolutionaries. "The most prominent leaders were, for the most part, merchants who dominated the Atlantic trade like John Hancock, and tobacco planters such as Thomas Jefferson and George Washington. Carolina rice planters such as Henry Laurens tended to support the revolution, though not with the same vigour as the Chesepeake tobacco planters" (Sawers, 1992, p. 266). Among the merchants, those who traded with the world outside of the British Empire were fervent revolutionaries, while the others much less so (Tayler, 1986). Also, a strong impetus to

the revolution came from New England's fishing industry, who according to Magra (2006) had greatly benefited from an expansion of activity and foreign markets following the expulsion of the French from Canada.[40]

The revolution brought sanctions which damaged trade with the British Empire, but it also brought new trade opportunities with the rest of the world. During the revolutionary war (1776-1783), Britain sought to blockade all international trade of the rebel colonies. Nevertheless, France, Spain and the Netherlands managed to provide significant trade support.[41] According to Gray (1933), tobacco to Europe and provisions to the West Indies were the colonial exports in high demand, but not indigo, of which the Europeans had their own colonial supplies (p. 589).[42] In the words of the American commissioners in France, tobacco was "the most weighty political engine we could employ with the French court. It is absolutely necessary to the Farmers-General [the monopoly who controlled the tobacco trade], and the farmers are absolutely necessary to the government" (pp. 590-91).

After the war, the new nation faced a number of new restrictions in accessing markets of the British Empire. It lost the subsidy on indigo exported to Britain, where it was also charged a new tariff on rice; it was prohibited from exporting meat and fish to the British West Indies; and it was prohibited from trading anything with the British West Indies on board American ships. The last restriction was not only detrimental to American shipping interests, since once ships had to come from Britain to serve the North American coastal trade, they could as well bring British goods to sell in the islands, to the detriment of American competitors. While restrictions with respect to the trade with the British West Indies were temporarily suspended during the Napoleonic Wars, they were later reintroduced. They were still the main element of discord in Anglo-American commercial relations in the late 1820s, that is a full 40 years after the revolution (Setser, 1937, p. 223-239). This stood in contrast with a favourable trade policy in the non-British West Indies (Bjork, 1964, p. 553; Setser, pp. 241-243).

The aggregate impact of changed trade conditions is examined in Figure 4. The right-hand

[40]Referring to the loss by France of the fisheries of Canada, Brook Watson (an eyewitness called before the House of Commons in 1775) testified "That the most inferior fish is exported to the neutral or French islands, and exchanged for molasses on very advantageous terms, as the French are prohibited from fishing. [...]" Magra (2006, p. 124).

[41]See Gray, 1933, p. 576-591, and Shepherd and Walton, 1976, pp. 397-398. A formal commercial treaty with France was signed in 1778.

[42]The export of rice, a commodity used to feed the army, had been prohibited by the revolutionary governments (*Ibid.*).

panel most clearly shows that, despite sanctions, the US trade with the West Indies bore relatively little cost of revolution: while exports to the British West Indies were severely hit, buoyant exports to the foreign West Indies more than made up for that. The left-hand side panel presents a similar picture, though the fall in exports to Britain must, at least in part, be attributed to a re-orientation of the tobacco trade, which in 1768-1772 had to be transhipped through Britain, while in 1790-1792 could be exported to the rest of Europe directly. Note however that, due to the superior experience of the British merchants as well as to the shrewd decisions by the British government to reduce taxes on trans-shipment after the colony was lost (Gray, 1933, p. 599), much American tobacco continued to be routed through Britain after the Revolution, and this accounts for a large share of US exports to this country in 1790-1792. Of course, the terms of trans-shipment were now more favourable to the Americans. Finally, it is important to acknowledge that Britain remained by far the main source of US *imports* after the revolution, something that the my simple model does not allow for.

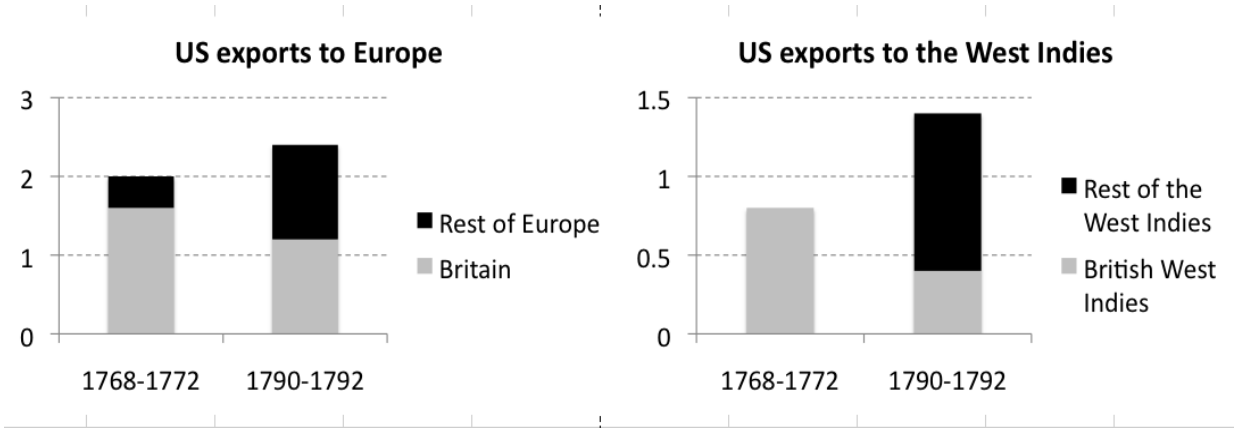


Figure 4: **US exports to the British Empire and to the Rest of the World, 1768-1772 and 1790-1792**. Units: millions of pounds. Source: Shephard and Walton, 1976, p. 406.

Looking now at disaggregated effects, there is clear sense that the burden of sanctions was positively correlated with θ. The Lower South was hit hardest. The loss of preferential access to the British market for indigo, rice and naval stores was one of the reasons why the economy of the Lower South suffered a sharp decline in the 1780s and 1790s (Bjork, 1964, p. 556; Williamson and Lindert, 2008, p. 25).[43] Indigo exports did particularly badly. Outcompeted by other British

[43]The official value of British imports from the Lower South was still far below its pre-war values in 1788 (Bjork, 1964, p. 556).

colonies and finding little respite in external markets, the industry was essentially wiped out by the end of the century.[44] Although exports to Britain were soon to recover due to the boom of cotton, this development could hardly be anticipated in the early 1770s (Shepherd and Walton, 1976, p. 420).[45] In comparison to the Lower South, the Upper South fared much better. There, exporters went through a period of real prosperity in the 1780s, thanks to a high price of tobacco and buoyant exports. In fact, tobacco exports reached an all-time high in 1790-1792 (Bjork, 1964, p. 558; Shepherd and Walton, 1976, p. 411). This should not surprise, given strong demand in Europe and the new, more favourable terms of shipment (Shepherd and Walton, 1976, p. 407). As contemplated in Section 3.3, revolution *improved* the terms of trade of the Upper South.

If the Upper South was "revealed" to face a better trade environment than the Lower South, even more so was New England. Despite the fact that British sanctions were largely targeted at its main exports - fish, meat, whale oil and shipping services - New England's trade recovered very well. In particular, with the exception of whale oil, which decreased by more than half, all of New England's main exports were much higher in 1790-1792 than in 1768-1772 (Shepherd and Walton, 1976, pp. 408-410). Again, external markets - and, in particular, the expansion of trade with the foreign West Indies - were key to such success (Shepherd and Walton, 1976, pp. 407, 412). A very similar pattern applies to the trade of the Middle Colonies, and in particular their exports of grains and grain products (Shepherd and Walton, 1976, pp. 416-17).

4.1.3 Relation to previous literature

My argument is closely related to an historical literature that has linked the collapse of the French North American Empire to the American Revolution (e.g. Gipson, 1950). However this literature has focused on the fact that the demise of the French eliminated a *political* threat to the colonial US. In particular, had the US become independent before the Seven Years' War it would have likely been taken over by the French: thus, the elimination of French colonial power was a necessary condition for revolution (Thomas, 1965, p. 617). This argument is, in a sense, included in mine, since the political implications of the Seven Years' War can be captured with

[44] Mancall, Rosenbloom and Weiss (2008) estimate that indigo exports declined from 488,000 lb in 1790 to only 5,000 lb in 1800.

[45] The innovation that essentially created the Southern cotton economy - Eli Whitney's cotton gin - was only made in 1793. Cotton exports from the Lower South were still less than 5% of indigo exports in 1790-1792 (Shepherd and Walton, 1976, p. 408).

a decrease in μ in the model. In addition, I argue that the Seven Years' War also eliminated an *economic* threat: the French were trade competitors before the war, not so much afterwards. Even though both points may be valid, the evidence presented in the previous section suggests that the second one should not be overlooked.

My argument is also related to the debate on the economic origins of the American Revolution.[46] This literature has been focused on assessing the burden of the Navigation Laws, in order to determine whether it is reasonable to see the revolution primarily as an attempt to get rid of those. While the literature is divided on how best to estimate the burden, it agrees on the difficulty to establish a counterfactual, since the alternative to being in the British Empire was not a world of free trade, but a different mercantilist world.[47] The contribution of my model is to identify that counterfactual, and, crucially, the way in which they changed just before the revolution.

Finally, an alternative explanation for why France supported the American Revolution is that it wanted to weaken Britain, its long-standing 18th century foe. Although I do not dispute this, there is evidence that grass-root economic forces of the sort illustrated in the model contributed to strengthening French support. Goebel (1963) suggests that the French colonials supported the American Revolution for purely economic reasons: "Dependent on the New England trade, the French colonials were to favor the American cause; French colonial officials were to open the island ports to American agents and to urge on the home authorities a liberal trade policy." (p. 372). While it is hard to evaluate the extent to which such urges, as opposed to geopolitics, motivated the actions of the French government, the position of the French colonials must have mattered for US trade on the ground, since it was typically down to colonial officials to decide which goods to admit into their ports.

4.2 The Latin American Revolutionary Wars (1808-1827)

This section follows the same structure as the previous section.

[46] See the literature review by Walton (1971), and Sawers (1992) for a more recent contribution.

[47] For example, Ransom (1968, p. 434) says that "[...] estimating the "benefits" of British colonial rule may be a much more formidable task than the one set forth here. As Thomas correctly asserts, to leave the Empire is to move into a mercantilistic world, not a world of free trade. The confusion following the American Revolution shows how substantial an impact such a move could have. [...] Breaking away from this trading community involved a host of uncertainties, and the "costs" were substantial. The pessimism regarding the economic outlook of the Colonies as late as 1790 shows the magnitude of the adjustments required."

4.2.1 Argument

For the model to fit this second case study, C^M must now represent the Latin American colonies, and M must represent Spain and Portugal. The other European countries with which Latin America traded, and most importantly Britain, are represented by F, while C^F represents those countries' colonies. Latin America, traditionally an exporter of silver, had by the 18th century also become a significant exporter of raw materials (x), which it sold to Europe in exchange for manufactures (y). The Revolutionary Wars of 1808-1827 - a way for the colonies to get rid of the "national monopolies" which regulated colonial trade (M's pick of τ^{C^M}) and various other forms of imperial taxation (T^{C^M})[48] - can be seen as sparked by an exogenous factor, the invasion of Iberia by Napoleon: a decrease in μ in the model. My argument is that we should not be surprised of the effects of Napoleon's invasion, since the Latin American colonies faced a favourable global environment for revolution: just like an increase in δ (e.g. from point A to C in Figure 3), the Industrial Revolution was increasing Britain's need to import raw materials, and thus the trade opportunities that the Latin America colonies faced outside of their empire (as opposed to within). This made revolution an attractive option.

The Industrial Revolution can be adequately captured with an increase in δ, the relative abundance of manufactures in F versus M. The British cotton textile sector grew by 7% per annum between 1770 and 1815 (Crafts and Harley, 1992, p. 713), pushed by an enormous increase in productivity due to mechanisation (Bairoch, 1989, p. 109). European manufacturing was relocating to Britain by the early 1800s: the British share in European manufacturing increased from 15% in 1800 to 28% in 1830, and per-capita industrialisation, which stood at 110% of the European average in 1800, reached 250% by 1830 (Bairoch, 1989, p. 10).

Just like an increase in δ (for example, in Figure 1: from $\delta \in [1/3, 2/3]$, to $\delta \in [2/3, 1]$), the Industrial Revolution had several important effects on contemporary trade patterns. First, Britain increasingly specialised in the export of manufactures and in the import of raw materials, while Spain and Portugal did just the opposite (Figure 5). Second, Spain and Portugal traded progressively less with Latin America, and more with Britain: so, the mother countries converted

[48] By the provisions of the Spanish national monopoly, all colonial trade had to be transhipped through Spain, where it was taxed by the government. This is the sort of trade restrictions that the equilibrium outcome $\{[C^M, M], [C^F, F]\}$ would capture, admittedly in stylised way, in the model. In addition, the Spanish king collected taxes on the silver produced in the colonies, and reserved most top colonial jobs for citizens of the mother country (and example of T^{C^M}).

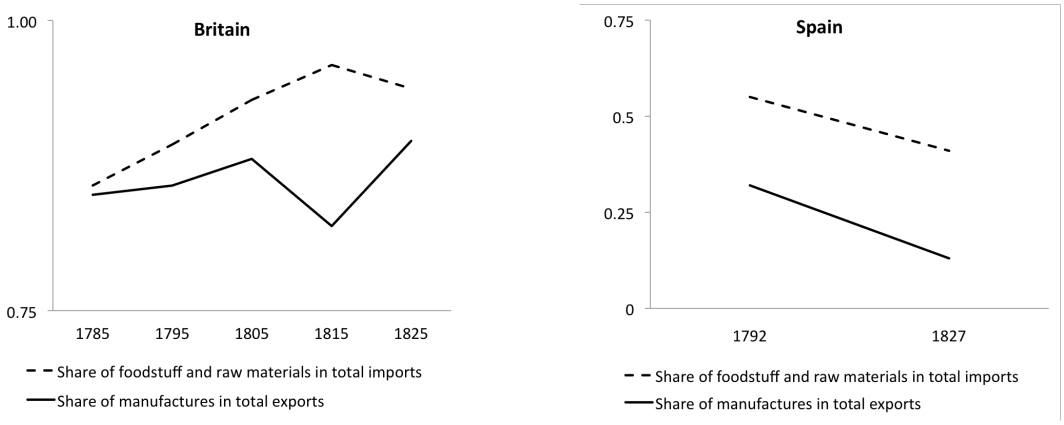


Figure 5: **Pattern of specialization by type of commodity, 1785-1827.** Sources: Davis (1979) and Prados de la Escosura (1984). All data points in the British series are calculated as three-year averages of the values in $t-1$, t and $t+1$.

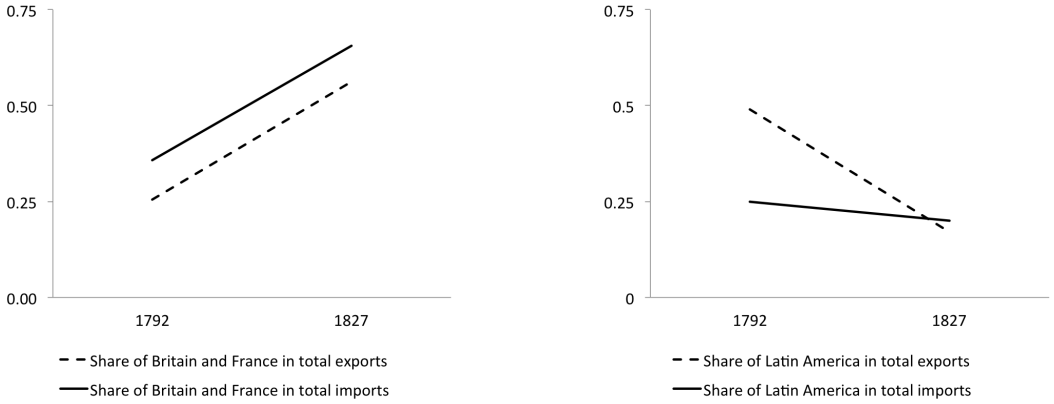


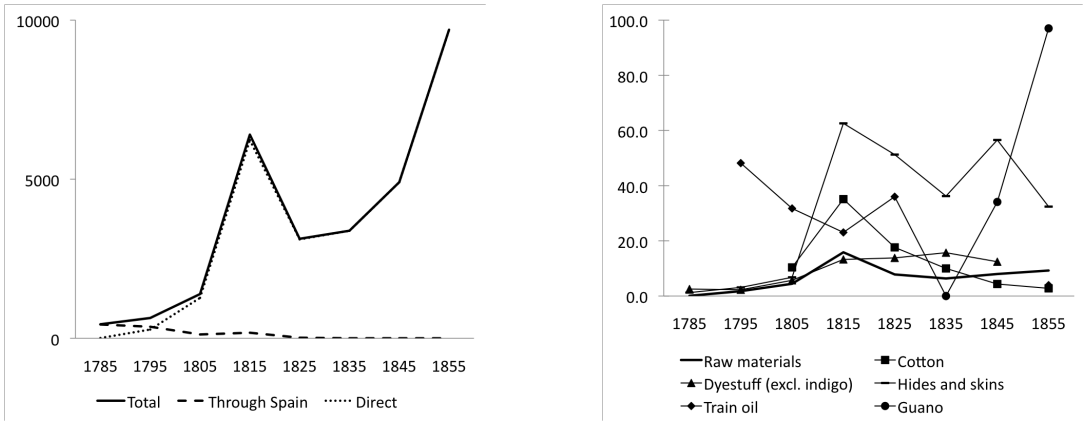
Figure 6: **Spain, pattern of specialization by geography, 1792-1827.** Source: Prados de la Escosura (1984), p. 145.

from being competitors of Britain in selling manufactures to the colonies, to being competitors of the colonies in selling raw materials to Britain (Figure 6).[49] And third, the industrial revolution resulted in a large increase in trade between Britain and Latin America (Figure 7).[50] [51]

[49] Although part of this change can be explained by the Latin American revolutions themselves - which broke the special trade relations between the colonies and the former mother countries - Prados de la Escosura (1984, p. 140) emphasises that its deep causes were Spain's loss of competitiveness vis-a-vis Britain (Prados de la Escosura and Tortella Casares, 1983, pp. 355-356).

[50] The model would actually predict that the share of Britain in the Latin American trade should increase. While the historical evidence overwhelmingly confirms this, lack of disaggregated trade data for the Latin American colonies prevents us from verifying this directly.

[51] Until the early 19th century, when this regulation was relaxed, all Spanish American trade had to be intermediated through Spain. This resulted in a substantial amount of smuggling between Britain and the Spanish American colonies, passing through the British Antilles. According to Prados de la Escosura (1984b, p. 125; see also Graham, 1994, pp. 5-6), the time variation in British imports from the British Antilles provides further



Total imports from LA

Share of LA in total imports.

Figure 7: **Britain, total imports from Latin America and share of Latin America in total imports, 1785-1855.** Unit: thousands of £. Sources: the series for total British imports from Latin America is the sum of direct imports from Latin America as recorded in the British data (Davis, 1979, p. 93) and of the estimate provided by Prados de la Escosura (1984b, pp. 143-144) for imports from Latin America through Spain. The series for the share of Latin American in British imports of raw materials is direct imports from Latin America only (Davis, 1979). All data points are calculated as three-year averages of the values in $t-1$, t and $t+1$.

Also consistent with the model's predictions, the Industrial Revolution made British trade policy more favourable to foreign exporters of raw materials. During the age of mercantilism (1650-1780), the European empires were built with the goal of achieving self-sufficiency, if not export capacity, in key raw materials. In this environment, imperial trade policy was often hostile to foreign producers of raw materials, in the interest of domestic and colonial producers.[52] By vastly increasing her demand for raw materials, the Industrial Revolution forced Britain out of this pattern. As Figure 6 illustrates, the share of British imports coming from the British empire declined continuously between 1773 and 1855.[53] This process went hand-in-hand with

evidence of a boom in British imports from Spanish America in the first two decades of the 19th century.

[52] A good example of this is provided by the experience of the US South after the American Revolution (see the previous section).

[53] The construction of these estimates required making several assumptions. Davis (1979) provides a continuous series for total imports of major/total raw materials/foodstuff in 1785-1855. He also provides the same series for some clearly imperial sources such as Australia, Canada and the West Indies. For other imperial sources, two complications arise: 1) Ireland drops out of the data after 1825, as the British and Irish customs were merged. I have therefore opted to exclude Ireland as an imperial source from the beginning, but the pattern illustrated in the figure is robust also when it is included. 2) Asia is reported as a single block throughout the period, and we don't know what sources are imperial and what not; furthermore, China is included in the series until 1825, excluded thereafter. For consistency, I have included China in the Asia series after 1825 as well. To reflect progressive British expansion in India over the period 1773-1855, I have considered a (linearly) growing share of imports from Asia to be "imperial". For total raw materials and foodstuff, this share rises from 14% in 1773 to 70% in 1855, while for cotton, hides & skins and dyes (excluding indigo) it rises from 20% in 1773 to 100% in 1855. These different trends reflect the fact that China, that was not part of the British empire, was an important source of

the adoption of more outward-oriented trade policies from the early 19th century, culminating in the adoption of free trade in the 1840s and 1850s. Emblematic is the case of cotton, the most important imported commodity of the Industrial Revolution, which the British government had initially wanted to be primarily sourced from the British West Indies but which Manchester manufacturers succeeded in keeping freely importable from all foreign countries (Harlow, 1964, pp. 281-287). In terms of the model, an 18th century mercantilist empire can be captured by point A in Figure 3: it has a sufficient colonial supply of raw materials, and is therefore hostile to a foreign producer like C^M (it chooses $\{\cdot, C^F, M, F\}$). A liberal empire, such as the British Empire became in the 19th century, can be captured by point C: it is starved in raw materials, and it willingly opens up to any external producers (it choses $\{C^M, C^F, M, F\}$). The role of the Industrial Revolution was to move the British Empire from point A to point C, thus improving the trade policy environment faced by the Latin American colonies.

So, the model's prediction for the impact of the Industrial Revolution on trade patterns and trade policy are well born out by the data. But is there any direct evidence that this contributed to creating a favourable environment for Latin American rebellion? To this question I now turn.

4.2.2 Supporting evidence

That the Latin American revolutionaries were greatly helped by economic evolutions in Britain is clear from the fact that received substantial support from both the British government and from the British private sector (both during and after the revolution), and that such support was primarily motivated by trade considerations.

To put things in context, it is important to note that political expedience would have advised Britain *against* providing support to the rebel colonies. On the one hand, by helping the colonies,

raw materials and foodstuff, but almost no cotton, hides & skins and dyes (excluding indigo) were sourced there in this period. For 1773, Davis (1962) only provides imports from a vast "America" aggregate, including the US, Canada, the West Indies, Portuguese and Spanish America and West Africa. For total imports of foodstuff and raw materials, I have used data on US and Canadian exports in 1768-1772 (from McCusker and Menard, 1985) to infer British imports from these colonies, and subtracted this from total imports from America to infer British imports from the West Indies (assuming that direct imports from other parts of the America and West Africa were relatively small in this period). For imports of cotton, hides & skins, and dyes (excluding indigo), I have assumed that the share of US, Canada and the West Indies was the same in 1773 as it was in 1785. This is likely to lead to under-estimation of the relative decline in imports from empire in 1773-1785, because of the trade disruption provoked by the American Revolution. To summarize, imports from empire are then calculated as the sum of imports from Australia, Canada, the US (for 1773 only, excluded thereafter) and the West Indies, and a share of imports from Asia calculated as described above.

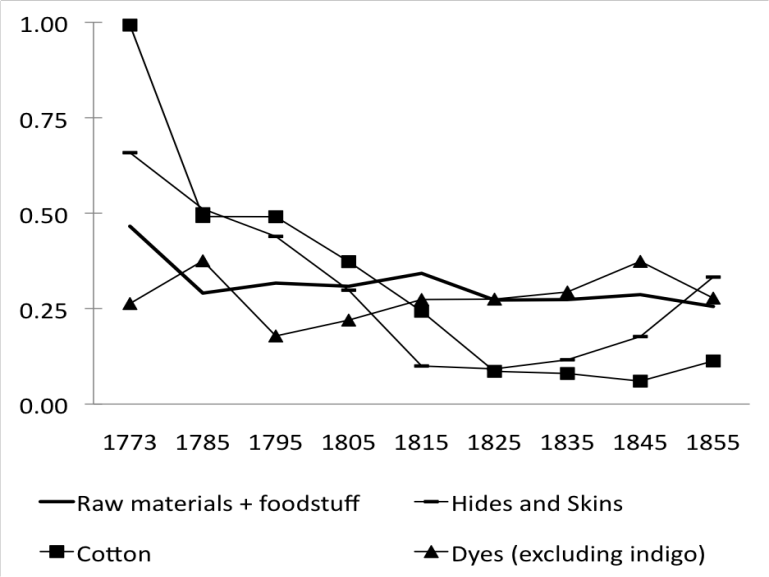


Figure 8: **Britain, estimated share of empire in imports of raw materials, total and selected commodities, 1773-1855**. Sources: Davis (1962, 1979), McCusker and Menard (1985). The construction of these estimates required making several assumptions, described in footnote 53.

Britain risked alienating Spain and Portugal, two war-time allies and important political partners in post-restoration Europe (Miller, 1993; Kaufman, 1951, p. 78). To support a revolution was also deeply at odds with the spirit of reaction that prevailed in Europe, and was feared it could help spread Jacobin principles around the world (Paquette, 2004, p. 75, Harlow, 1964, p. 631). Despite all this, Britain provided substantial support to the rebel colonies. From as early as the late 1790s, it provided a safe heaven for Latin American conspirators, some of whom had access to the top echelons of British government (Harlow, 1964, pp. 642-652; Paquette, 2004, footnote 78). During the revolutions, the British government refused to help Spain and Portugal to restore order, and took various steps to prevent other European powers from doing so.[54] At the same time, the British merchants lent more than £1 million to Simon Bolivar (the liberator of Gran Colombia), contributing to his success after 1816 (Graham, 1993, p. 119). And after independence, Britain was quick to recognise the newly formed republics as independent

[54]For example, the Royal Navy was stationed in the South Atlantic from 1808 onwards, officially to protect British trade but effectively to prevent foreign interventions (Miller, 1993, p. 36). And in two separate occasions in 1817 and 1823, Britain blocked the formation of a European coalition against the colonies (Graham, 1993, p. 112). This policy of indirect support was anticipated by Lord Castlereagh, Secretary of War and the Colonies, who in 1807 declared himself "doubtful [...] about attempting to foment revolt against Spain, although should it occur British forces might act as auxiliaries and protectors" (Miller, 1993, p, 35).

countries.

Considerations about trade were a primary motivation behind British support. Already in 1803, a report put in front of the government by British industrialists had stressed that the needs of Britain and Latin America were complementary, and that there was enormous potential for mutual exchange. The goal of the industrialists was to tilt British policy in the direction of supporting a possible revolution, something that, according to Harlow (1964, pp. 615-662) they eventually managed to achieve. A few years later Lord Castleraigh, Secretary for Foreign Affairs from 1812 to 1822, declared that Britain should direct her policy towards "[...] creating and supporting an amicable and local government, with which those commercial relations may freely subsist which it is alone our interest to aim at, and which the people of Latin America must equally desire" (Winn, 1976). After the revolutions, a key factor that induced Britain to recognise the newly-independent republics was the growth of British industry, and the resulting voracious appetite of the British merchants for Latin American trade (Paquette, 2004, pp. 75-76). Significantly, the very first bilateral treaties signed between Britain and the republics were trade treaties, granting the republics "most favoured nation" treatment on the British market (Palmer, 1990, p. 52).[55]

British actions are easy to rationalise in the context of the model (though the model does not admit that F could support the revolution). As δ increases over 2/3, M's imperial trade policy (leading to either $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$) or $\left\{\cdot, C^F, M, F\right\}$) becomes more restrictive of trade between C^M and F, precisely at a time in which F would like to import more from C^M. As a consequence, the gain to F from revolution in C^M increases. Just as well, the Latin American trade became increasingly attractive to Britain as the Industrial Revolution progressed, as so did the prospect of freeing the Latin American colonies from their increasingly protective empires.

Were the revolutionaries aware of the favourable trade environment, and did this help to motivate them? Clearly, the revolutionaries knew of the importance of their trade with Britain, and used this as a bargaining chip in negotiations. The offer of commercial alliances was a key negotiating strategy used by conspirators in London (Harlow, 1964, 642-644), as well as by the independent governments established after 1810.[56] For example, in 1822, the government of Gran

[55] Already in 1822, Spanish American ships were granted, subject to reciprocity, direct access to British ports, a privilege that no foreign country other than the US had. Commercial treaties were signed with Gran Colombia and Rio del Plata in 1825, with Mexico in 1826, and with Brazil in 1827 (Palmer, 1990, p. 41, 52).

[56] For example, the Venezuelan revolutionary government offered preferential tariffs to Britain while sending emissaries to London to secure diplomatic support (Graham, 1993, p. 89).

Colombia was able to use the threat of commercial sanctions to secure important concessions concerning the right of Latin American ships to land in British ports (Palmer, 1990, p. 41 and 52). At the same time, trade considerations must have had a great importance for the revolutionaries, which were largely the expression of a creole elite with strong interests in the international economy. For example, in Rio del Plata, the cattle ranchers and merchants, who thrived on the trade in hides and skins with Europe (Graham, 1993, pp. 41-42), were among the key supporters of revolution. In Venezuela, the revolution was actively supported by the aristocracy of export-oriented landowners (*Ibid.*, pp. 47, 63). In Mexico, key players such as the coastal planters and the mine owners were all very interested in a strengthening of their trade with Europe (*Ibid.*, p. 52).

Interestingly, for a while after gaining independence, the Latin American colonies sought to unite into larger federal polities such as "Gran Colombia" and "The United Provinces of Rio del Plata".[57] The extension discussed in Section 3.3 suggest one rationale for doing this: newly-independent countries with a larger economic size (higher ρ) are even more likely to be treated favourably by foreign trade policy.

4.2.3 Relation to previous literature

My argument belongs to a historical literature that has emphasised the role of the international environment, and particularly Britain, in explain the Revolutionary Wars (e.g. Dominguez, 1980, p 116). I expand upon this literature by analysing, in the context of a formal model, the economic factors that created this environment. My interpretation is not inconsistent with the view that the Latin American revolutions were caused by the Napoleonic Wars, but it emphasises the importance of the context: had this been different, the Revolutionary Wars may not have happened. This is line with the observation, made by Lynch (1973) in support of a different argument, that Spain did not lose her empire when it was invaded one century earlier, at the time of the War of Spanish Succession (1701-1714).

A strand of literature has linked the Revolutionary Wars to the rise in Spanish extraction towards the end of the 18th century,[58] and particularly to the fact that, due to increasing volumes

[57] Due to their great economic and political heterogeneity, these policies collapsed shortly after being formed.

[58] There is substantial evidence that extraction increased in Spanish America, as the so called "Bourbon reforms" set out to strengthen imperial control over the colonies. Also, the return of the Portuguese king to Portugal after the restoration was associated with an increase in Portuguese extraction (Graham, 1993, pp. 103-104 and 128-

of trade between Latin America and North-Western Europe, imperial trade restrictions, which required all colonial goods to be transhipped through the mother country, became more onerous. This argument is consistent with findings in the model with repression and equilibrium revolution (see Section 3.3): when M chooses to repress, an increase in δ both improves trade opportunities outside of the empire, and increases the cost of trade restrictions within the empire.

Finally, the literature on the optimal size of nations has drawn a link between the movement for independence in Latin America and an increasingly liberal trade policy in the early 1800s (Alesina and Spolaore, 2003, p. 191). My paper formalises this idea, by deriving equilibrium trade policy as a function of economic fundamentals, in the context of a formal model of revolution.

5 Conclusions

This paper has emphasised the importance of trade for the sustainability of empire. If foreign countries are scarce in manufactures relative to the mother country, or their empires are abundant in raw materials, their trade policy is unsupportive of a rebel colony, and empire is more stable. Conversely, if foreign countries are abundant in manufactures, or their empires are scarce in raw materials, their trade policy is supportive, and empire is less stable. I have argued that this simple mechanism may help to explain the timing of the American Revolution (1776) and the Latin American Revolutionary Wars (1808-1827).

My results imply that industrial leaders should be able to retain larger empires, since their colonies will often find that, being in cut-throat competition with foreign countries to export raw materials to the mother country, they should not try to rebel. In terms of Figure 3, if δ is low (so that M is relatively abundant in manufactures), θ may well be low (so that M's empire is large) but the likelihood of decolonisation will remain small. This may explain why Britain was able to construct such a large empire in the 19th century. In comparative terms, it complements Acemoglu, Johnson and Robinson (2005)'s argument on the different trajectories of the British versus Spanish and Portuguese empires. According to those authors, the gains from empire accelerated industrialisation in Britain, while they slowed it down in Spain and Portugal. My results suggest that, in turn, industrialisation helped Britain build such a large and successful empire, whereas lack of industrialisation led Spain and Portugal to lose much of their empires

133).

early.

A second implication of the model is that there is a rationale for colonisers to block industrialisation in the colonies. Suppose that investment can increase the amount of manufactures in C^M, from zero to a positive amount. It is possible to show (and the derivations are available form the author upon request) that even if investment is profitable and M can fully tax it, it may still want to block it. This is because a colony with its own manufacturing base would suffer less from the trade disruption generated by revolution, and would thus be more likely to ask for concessions. This result may help explain widespread anti-industrial policies in the colonies. It may also help explain the rise of pro-independence movements in colonies where, during World War 2, import-substitutions had created groups of industrialists (Findlay and O'Rourke, 2007) who stood to gain from a weakening of the imperial connection.

The model has sharp predictions for the link between economic fundamentals, the pattern of trade, and the probability of colonial rebellion (or secession more in general), as well as the role played by third countries in this process. These predictions could be tested by taking advantage of the fact that, close to the point where F switches from being a competitor of C^M to being a partner, the cost of rebellion falls discretely. One could test whether episodes in which a large country switched from exporting to importing a commodity x, were associated with more secession in regions specialised in the production of x, and the role that the large country's diplomacy played in all this. I keep this and other related work for future research.

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Appendix

For any two outcomes $\{O_1\}$ and $\{O_2\}$, let $p^J_{\{O_1\}}$ and $p^J_{\{O_2\}}$ be the prices that they generate in country J, and let $\{O_1\} \succ^J \{O_2\}$ be equivalent to $v^J\left(p^J_{\{O_1\}}\right) > v^J\left(p^J_{\{O_2\}}\right)$. I use the notation "$\{O\}$" to indicate any trade outcome from a list previously presented.

Result 1. *Suppose that a country J can import at a price $p^J_i = p^J_A/a$, where $a > 1$, or export at a price $p^J_e > p^J_A$. Then, country J is indifferent between the two prices iff $p^J_A = p^J_e/a$; it prefers p^J_i if $p^J_A \geq p^J_e/a$; it prefers p^J_e if $p^J_A < p^J_e/a$.*

Proof. We need to show that J is indifferent between importing at price p^J_A/a, or exporting at price ap^J_A. This follows immediately from

$$v^J\left(\frac{p^J_A}{a}\right) = \frac{\frac{p^J_A}{a} + p^J_A}{2\sqrt{\frac{p^J_A}{a}}} = \frac{ap^J_A + p^J_A}{2\sqrt{ap^J_A}} = v^J\left(ap^J_A\right).$$

□

Derivation of national first-best trade outcomes. Since C^M is always an exporter, its first best must be, among the trade outcomes in which it trades, the one with the highest price. This cannot include C^F, since to do so always decreases the price. Three outcomes are left, $\left\{C^M, \cdot, M, \cdot\right\}$, $\left\{C^M, \cdot, M, F\right\}$ and $\left\{C^M, \cdot, \cdot, F\right\}$. A comparison of prices reveals the pattern presented in Table 1. Since M is always an importer for $\delta < 1/2$, its first best in this range must be, among the trade outcomes in which it trades, the one with the lowest price. This cannot exclude C^M or C^F, since to exclude either of them always decreases the price. Two outcomes are left, $\left\{C^M, C^F, M, \cdot\right\}$ and $\left\{C^M, C^F, M, F\right\}$. A comparison of prices reveals the pattern presented in Table 1. If $\delta \geq 1/2$, M is an importer in some outcomes, an exporter in others. Its first best must be either the outcome in which it imports at the lowest price, $\left\{C^M, C^F, M, \cdot\right\}$, or the outcome in which it exports at the highest price, $\{\cdot, \cdot, M.F\}$. Using Result 1, it is easy to see that M's first best is the former outcome if $\delta \in [1/2, 3/4)$, the latter outcome if $\delta \in [3/4, 1)$. A symmetric pattern holds for F. As for $C^F F$, since it is always an importer for $\delta \geq (1+\theta)/(2+\theta) \in [\delta(\theta), 2/3]$, its first best in this range must be, among the trade outcomes in which it trades, the one with the lowest price. This cannot exclude C^M, since to exclude it always increases the price. Two outcomes are left: $\left\{C^M, C^F, \cdot, F\right\}$ and

$\left\{C^M, C^F, M, F\right\}$. A comparison of prices reveals the pattern described. If $\delta < (1+\theta)/(2+\theta)$, $C^F F$ is an importer in some outcomes, an exporter in others. Its first best must be either the outcome in which it imports at the lower possible price, $\left\{C^M, C^F, \cdot, F\right\}$, or the outcome in which it exports at the highest possible price, $\left\{\cdot, C^F, M, F\right\}$. Using Result 1, it is easy to see that M's first best is the former outcome if $\delta \in \left[(1+\theta)^2/[2(2+\theta)], (1+\theta)/(2+\theta)\right)$, the latter outcome if $\delta \in \left[0, (1+\theta)^2/[2(2+\theta)]\right)$.

Proof to Lemma 1. Note that, since it controls trade policy in C^F, and given $\tau^M_{C^M} = 0$, F fully determines whether C^M and M can trade, and at what conditions. Furthermore, if offered the possibility to trade (as opposed to being in autarky), C^M and M are always better off accepting. It follows that, if $S = R$, no outcome other than F's optimum - that is, the outcome that maximises F's payoff, $V^F\left(\tau, T^{C^F}\right)$ - can be realised in a CPNE, since, from any such outcome, F would be able to deviate to its optimum, either unilaterally or in a coalition where it offers to C^M, M, or both, the possibility to switch from autarky to trade. I next identify F's optimum. Consider first cases in which C^F and F trade with each other. Because F can set T^{C^F} under no constraint, it must set $T^{C^F} = \Pi^{C^F}(\tau)$. Then, F's payoff can be written as $V^F(\tau) = v^{C^F}\left[p^{C^F}(\tau)\right] + v^F\left[p^F(\tau)\right] = v^{C^F F}\left[p^{C^F F}(\tau)\right]$. It follows that, considering only outcomes such that C^F and F trade with each other, F's optimum is the outcome that maximises $v^{C^F F}\left[p^{C^F F}(\tau)\right]$. Next, consider outcomes in which C^F and F do not trade with each other. Then, F's payoff can be written as $V^F(\tau) = v^F\left[p^F(\tau)\right]$. There are two cases: if $\delta \geq 1/4$, $v^F\left[p^F(\tau)\right]$ is maximised by an outcome in which C^F and F trade with each other, if $\delta < 1/4$ it is maximised by $\{\cdot, \cdot, M, F\}$ (see Table 1). It follows that, if $\delta \geq 1/4$, F's optimum is the outcome that maximises $v^{C^F F}\left[p^{C^F F}(\tau)\right]$, if $\delta < 1/4$ it is either the outcome that maximises $v^{C^F F}\left[p^{C^F F}(\tau)\right]$, or $\{\cdot, \cdot, M, F\}$. This establishes that, if $S = R$, the only trade outcomes that can realise in a CPNE are the ones described in Lemma 1. Finally, I show that such outcomes can be realised in a CPNE. If $\delta < 1/4$, and F's optimum is $\{\cdot, \cdot, M, F\}$, any trade policy vector such that $\tau^{C^F}_J = 0\ \forall J$ and $\tau^F_M = \tau^M_F = 1$ (leading to $\{\cdot, \cdot, M, F\}$) is a CPNE, since: C^M cannot unilaterally deviate to a different outcome; M can only unilaterally deviate to autarky; and, given the requirement that $\tau^M_{C^M} = 0$, C^M and M can only jointly deviate to an outcome where they are both in autarky. If $\delta < 1/4$ and F's optimum is $\left\{\cdot, C^F, M, F\right\}$, or if $\delta \in [1/4, \delta(\theta))$, any trade policy vector such that $\tau^{C^F}_F = \tau^F_{C^F} = 1$, $\tau^{C^F}_{C^M} = \tau^{C^F}_M = 0$, and $\tau^F_M = \tau^M_F = 1$ (leading to $\left\{\cdot, C^F, M, F\right\}$) is a CPNE, since: C^M cannot unilaterally deviate to a different outcome; M can

only unilaterally deviate to autarky; and, given the requirement that $\tau_{C^M}^M = 0$, C^M and M can only jointly deviate to an outcome where they are both in autarky. If $\delta \in [\delta(\theta), 2/3)$, so that F's optimum is $\{C^M, C^F, \cdot, F\}$ any trade policy vector such that $\tau_{C^F}^F = \tau_F^{C^F} = 1$, $\tau_M^F = \tau_M^{C^F} = 0$, $\tau_{C^M}^F = \tau_F^{C^M} = 1$ (leading to $\{C^M, C^F, \cdot, F\}$) is a CPNE, since: M cannot unilaterally deviate to a different outcome; C^M can only unilaterally deviate to autarky; and, given the requirement that $\tau_{C^M}^M = 0$, C^M and M can only jointly deviate to an outcome where they are both in autarky. Finally, if $\delta \in [2/3, 1]$, so that F's optimum is $\{C^M, C^F, M, F\}$ any trade policy vector such that $\tau_{C^F}^F = \tau_F^{C^F} = 1$, $\tau_M^F = \tau_F^M = 1$, and $\tau_{C^M}^F = \tau_F^{C^M} = 1$ (leading to $\{C^M, C^F, M, F\}$) is a CPNE, since: C^M and M can only unilaterally deviate to autarky; and, given the requirement that $\tau_{C^M}^M = 0$, C^M and M can only jointly deviate to an outcome where they are both in autarky. ■

Proof to Lemma 2. ***Preliminaries.*** Given $S = I$, there are three independent players: C^M, M, and F. Clearly, it must be optimal for C^M to set $T^{C^M} = 0$, and for F to set $T^{C^F} = \Pi^{C^F}(\tau)$ if C^F and F trade with each other, $T^{C^F} = 0$ otherwise. Then, C^M's payoff can be written as $v^{C^M}\left[p^{C^M}(\tau)\right] + (1-\theta)B$, M's payoff as $v^M\left[p^M(\tau)\right]$, and F's payoff as $v^{C^F F}\left[p^{C^F F}(\tau)\right]$ if C^F and F trade with each other, as $v^F\left[p^F(\tau)\right]$ otherwise. Take any two outcomes $\{O_1\}$ and $\{O_2\}$. If $\{O_2\}$, but not $\{O_1\}$, is an outcome such that C^F and F do not trade with each other, $\{O_1\}$ gives a higher payoff to F iff $v^{C^F F}\left(p_{\{O_1\}}^{C^F F}\right) > v^F\left(p_{\{O_2\}}^F\right)$, which is true if $\{O_1\} \succ^F \{O_2\}$; if both outcomes are such that C^F and F do not trade with each other, $\{O_1\}$ gives a higher payoff to F iff $\{O_1\} \succ^F \{O_2\}$; in all other cases $\{O_1\}$ gives a higher payoff to F iff $\{O_1\} \succ^{C^F F} \{O_2\}$. The proof proceeds in two steps. ***Step 1. No outcome other than*** $\{C^M, C^F, M, F\}$ ***can be realised in a CPNE.*** Not $\{C^M, \cdot, M, F\}$, since it is $v^{C^F F}\left(p_{\{C^M, C^F, M, F\}}^{C^F F}\right) > v^F\left(p_{\{C^M, \cdot, M, F\}}^F\right)$ for $\delta \in [0,1]$ and $\theta \in [0,1)$.[59] Since F can single-handedly obtain $\{C^M, C^F, M, F\}$, there is a viable deviating coalition. Not $\{\cdot, C^F, M, F\}$, since $\{C^M, C^F, M, F\} \succ^M \{\cdot, C^F, M, F\}$ if M is an importer, $\{C^M, C^F, M, F\} \succ^{C^F F} \{\cdot, C^F, M, F\}$ if $C^F F$ is an importer; and C^M and M (F) can jointly obtain this outcome. Not $\{C^M, C^F, M, \cdot\}$, since $\{C^M, C^F, M, F\} \succ^F \{C^M, C^F, M, \cdot\}$, and F can single-handedly obtain this outcome. Not $\{C^M, C^F, \cdot, F\}$, since $\{C^M, C^F, M, F\} \succ^{C^M} \{C^M, C^F, \cdot, F\}$ if M is an importer in $\{C^M, C^F, M, F\}$, $\{C^M, C^F, M, F\} \succ^{C^F F} \{C^M, C^F, \cdot, F\}$

[59] We can write $v^{C^F F}\left(p_{\{C^M, C^F, M, F\}}^{C^F F}\right) - v^F\left(p_{\{C^M, \cdot, M, F\}}^F\right) = (1+\theta)\frac{1}{2\sqrt{3}} - \frac{1}{2\sqrt{3-\theta}} + \frac{\delta}{2}\left(\sqrt{3} - \sqrt{3-\theta}\right) \equiv A$. It is $A > 0$ for $\delta \in [0,1]$ and $\theta \in [0,1)$. To see this, note that, for $\delta \in [0,1]$, the RHS of (**??**) is increasing in δ for $\theta \in (0,1)$, constant in δ for $\theta = 0$. It is also possible to show that, for $\theta \in [0,1)$, the RHS is increasing in θ for $\delta \in [0,1]$. Since the RHS is equal to 0 for $\delta = \theta = 0$, (**??**) holds for all available δ and θ. By symmetry, it is always $v^{C^M M}\left(p_{\{C^M, C^F, M, F\}}^{C^M M}\right) > v^M\left(p_{\{\cdot, C^F, M, F\}}^M\right)$.

if M is an exporter; and C^M (F) and M can jointly obtain this outcome. Not $\{C^M, C^F, \cdot, \cdot\}$, since it is $\{C^M, C^F, M, \cdot\} \succ^{C^M} \{C^M, C^F, \cdot, \cdot\}$ and $\{C^M, C^F, M, \cdot\} \succ^{M} \{C^M, C^F, \cdot, \cdot\}$, and C^M and M can jointly obtain this outcome. Not $\{\cdot, \cdot, M, F\}$, $\{[C^M, C^F], [M, F]\}$, since it is $\{C^M, \cdot, M, F\} \succ^{C^M} \{\cdot, \cdot, M, F\}$ and $\{C^M, \cdot, M, F\} \succ^{C^M} \{[C^M, C^F], [M, F]\}$, and either $\{C^M, \cdot, M, F\} \succ^{M} \{\cdot, \cdot, M, F\}$ and $\{C^M, \cdot, M, F\} \succ^{M} \{[C^M, C^F], [M, F]\}$ (if M is an importer) or $\{C^M, \cdot, M, F\} \succ^{F} \{\cdot, \cdot, M, F\}$ and $\{C^M, \cdot, M, F\} \succ^{F} \{[C^M, C^F], [M, F]\}$ (if F is an importer); and C^M and either M (F) can jointly obtain this outcome. Not $\{C^M, \cdot, M, \cdot\}$, $\{\cdot, C^F, \cdot, F\}$ or $\{[C^M, M], [C^F, F]\}$, since $\{C^M, C^F, M, F\} \succ^{C^F F} \{O\}$, and $\{C^M, C^F, M, F\} \succ^{M} \{O\}$ if $C^F F$ is an exporter in $\{C^M, C^F, M, F\}$, $\{C^M, C^F, M, F\} \succ^{C^M} \{O\}$ if $C^F F$ is an importer; and M (C^M) and F can jointly obtain this outcome. Not $\{C^M, \cdot, \cdot, F\}$, $\{\cdot, C^F, M, \cdot\}$, or $\{[C^M, F], [C^F, M]\}$, since $\{C^M, C^F, \cdot, F\} \succ^{F} \{C^M, \cdot, \cdot, F\}, \{\cdot, C^F, M, \cdot\}$ and $\{C^M, C^F, \cdot, F\} \succ^{C^F F} \{[C^M, F], [C^F, M]\}$; and F can single-handedly obtain this outcome, and so can C^M and F jointly. ***Step 2.*** $\{C^M, C^F, M, F\}$ ***may be realised in a CPNE.*** To see this, suppose $\tau_I^J = 1$ $\forall I, J$, so that $\{C^M, C^F, M, F\}$ is realised. No other outcome can be obtained by a viable coalition. Not $\{C^M, \cdot, M, F\}$: this can only be obtained by a coalition including F; however, as shown earlier in this Appendix, $v^{C^F F}\left(p^{C^F F}_{\{C^M, C^F, M, F\}}\right) > v^F\left(p^F_{\{C^M, \cdot, M, F\}}\right)$ for all $\delta \in [0, 1]$ and $\theta \in [0, 1)$. Thus, such a coalition is not viable. Not $\{\cdot, C^F, M, F\}$: this can only be obtained by a coalition including either C^M, or both M and F; however it is $\{C^M, C^F, M, F\} \succ^{C^M} \{\cdot, C^F, M, F\}$, and $\{C^M, C^F, M, F\} \succ^{M} \{\cdot, C^F, M, F\}$ if M is an importer, $\{C^M, C^F, M, F\} \succ^{C^F F} \{\cdot, C^F, M, F\}$ if $C^F F$ is an importer. Not $\{C^M, C^F, M, \cdot\}$: this can only be achieved by a coalition including F; however it is $v^{C^F F}\left(p^{C^F F}_{\{C^M, C^F, M, F\}}\right) > v^F\left(p^F_{\{C^M, C^F, M, \cdot\}}\right)$. Not $\{C^M, C^F, \cdot, F\}$: this can only be obtained by a coalition including either M, or both C^M and F; however it is $\{C^M, C^F, M, F\} \succ^{M} \{C^M, C^F, \cdot, F\}$, and $\{C^M, C^F, M, F\} \succ^{C^M} \{C^M, C^F, \cdot, F\}$ if M is an importer, $\{C^M, C^F, M, F\} \succ^{C^F F} \{C^M, C^F, \cdot, F\}$ if M is an exporter. Not $\{C^M, C^F, \cdot, \cdot\}$, $\{\cdot, \cdot, M, F\}$, $\{[C^M, C^F], [M, F]\}$: these can only be obtained by a coalition including either C^M and F, or M and F; however it is $\{C^M, C^F, M, F\} \succ^{F} \{C^M, C^F, \cdot, \cdot\}$, $\{C^M, C^F, M, F\} \succ^{C^M} \{\cdot, \cdot, M, F\}, \{[C^M, C^F], [M, F]\}$, and $\{C^M, C^F, M, F\} \succ^{F} \{\cdot, \cdot, M, F\}, \{[C^M, C^F], [M, F]\}$ if F is the importer in the bloc formed by M and F, $\{C^M, C^F, M, F\} \succ^{M} \{\cdot, \cdot, M, F\}, \{[C^M, C^F], [M, F]\}$ if M is the importer. Not $\{C^M, \cdot, M, \cdot\}$, $\{\cdot, C^F, \cdot, F\}$, or $\{[C^M, M], [C^F, F]\}$: these can only be obtained by a coalition including either F, or both C^M and M; however it is $\{C^M, C^F, M, F\} \succ^{F} \{C^M, \cdot, M, \cdot\}$, $\{C^M, C^F, M, F\} \succ^{C^F F} \{\cdot, C^F, \cdot, F\}, \{[C^M, M], [C^F, F]\}$, and $\{C^M, C^F, M, F\} \succ^{M}$

$\{O\}$ if $C^F F$ is an exporter, $\left\{C^M, C^F, M, F\right\} \succ^{C^M} \{O\}$ if $C^F F$ is an importer. Not $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{\cdot, C^F, M, \cdot\right\}$, or $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$: these can only be obtained by a coalition including either C^M and F, or M and F; however it is $\left\{C^M, C^F, M, F\right\} \succ^F \left\{\cdot, C^F, M, \cdot\right\}$, and either $\left\{C^M, C^F, M, F\right\} \succ^{C^M} \left\{C^M, \cdot, \cdot, F\right\}, \left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$, or $\left\{C^M, C^F, M, F\right\} \succ^F \left\{C^M, \cdot, \cdot, F\right\}, \left\{\left[C^M, F\right],\right.$ To see the latter point, note that C^M is worse off if the price goes down, while F is worse off if it goes up (and, given it is an importer at this higher price, it must have been an importer even before). Furthermore, it is $\left\{C^M, C^F, M, F\right\} \succ^M \left\{C^M, \cdot, \cdot, F\right\}$, and either $\left\{C^M, C^F, M, F\right\} \succ^M \left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$, or $\left\{C^M, C^F, M, F\right\} \succ^F \left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$. To see the latter point, note that, for one of M and F, the price must go up (and, given it is an importer at this higher price, it must have been an importer even before). ■

Proof to Lemma 3. ***Preliminaries.*** Given $S = E$, there are two independent players: M and F. Given that μ is large, it must be optimal for M to set $T^{C^M} = \Pi^{C^M}(\tau)$ if $\mathcal{T} = 1$ and C^M and M trade with each other, $T^{C^M} = 0$ otherwise. It must also be optimal for F to set $T^{C^F} = \Pi^{C^F}(\tau)$ if C^F and F trade with each other, $T^{C^F} = 0$ otherwise. Then, M's payoff can be written as $v^{C^M M}\left[p^{C^M M}(\tau)\right]$ if C^M and M trade with each other, as $v^M\left[p^M(\tau)\right]$ otherwise; and F's payoff as $v^{C^F F}\left[p^{C^F F}(\tau)\right]$ if C^F and F trade with each other, as $v^F\left[p^F(\tau)\right]$ otherwise. The proof proceeds in two steps, and various sub-steps. ***Step 1.1. If $\mathcal{T} = 1$, no outcome other than $\{C^M, C^F, M, F\}$ may be realised in a CPNE.*** Not $\left\{C^M, \cdot, M, F\right\}$, since, as shown earlier in this Appendix, it is $v^{C^F F}\left(p^{C^F F}_{\{C^M, C^F, M, F\}}\right) > v^F\left(p^F_{\{C^M, \cdot, M, F\}}\right)$. Since F can single-handedly obtain $\left\{C^M, C^F, M, F\right\}$, there is a viable deviating coalition. Not $\{\cdot, C^F, M, F\}$, since, as shown earlier in this Appendix, it is $v^{C^M M}\left(p^{C^M M}_{\{C^M, C^F, M, F\}}\right) > v^M\left(p^M_{\{\cdot, C^M, M, F\}}\right)$; and M can single-handedly obtain this outcome. Not $\left\{C^M, C^F, M, \cdot\right\}$, since $\left\{C^M, C^F, M, F\right\} \succ^F \left\{C^M, C^F, M, \cdot\right\}$, and F can single-handedly obtain this outcome. Not $\left\{C^M, C^F, \cdot, F\right\}$, since $\left\{C^M, C^F, M, F\right\} \succ^M \left\{C^M, C^F, \cdot, F\right\}$, and M can single-handedly obtain this outcome. Not $\left\{C^M, C^F, \cdot, \cdot\right\}$, since $\left\{C^M, C^F, M, \cdot\right\} \succ^M \left\{C^M, C^F, \cdot, \cdot\right\}$, and M can single-handedly obtain this outcome. Not $\{\cdot, \cdot, M, F\}$ and $\{\left[C^M, C^F\right], [M, F]\}$, since it is either $\left\{C^M, \cdot, M, F\right\} \succ^M \{O\}$ (if M is an importer) or $\left\{\cdot, C^F, M, F\right\} \succ^F \{O\}$ (if F is an importer); and M (F) can single-handedly obtain these outcomes. Not $\left\{C^M, \cdot, M, \cdot\right\}$ or $\left\{\cdot, C^F, \cdot, F\right\}$, since $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^{C^F F} \left\{C^M, \cdot, M, \cdot\right\}$ and $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{\cdot, C^F, \cdot, F\right\}$, and F (M) can single-handedly obtain this outcome. Not $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$, since $\left\{C^M, C^F, M, F\right\} \succ^{C^M M} \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ and $\left\{C^M, C^F, M, F\right\} \succ^{C^F F} \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$, and M and F can jointly obtain $\left\{C^M, C^F, M, F\right\}$.

Not $\{C^M, \cdot, \cdot, F\}$, $\{\cdot, C^F, M, \cdot\}$, since $\{C^M, \cdot, M, F\} \succ^M \{C^M, \cdot, \cdot, F\}$ and $\{\cdot, C^F, M, F\} \succ^F \{\cdot, C^F, M, \cdot\}$, and M (F) can single-handedly obtain these outcomes. Not $\{[C^M, F], [C^F, M]\}$, since either $\{C^M, C^F, M, F\} \succ^F \{[C^M, F], [C^F, M]\}$ (if F faces a higher price after the deviation) or $\{C^M, C^F, M, F\} \succ^M \{[C^M, F], [C^F, M]\}$ (if M faces a higher price), and F (M) can single-handedly obtain this outcome. ***Step 1.2. If $\mathcal{T} = 0$, and $\delta < (1+\theta)/3$, no outcome other than $\{C^M, C^F, M, F\}$ may be realised in a CPNE.*** Not $\{\cdot, C^F, M, F\}$, since $\{C^M, C^F, M, F\} \succ^M \{\cdot, C^F, M, F\}$ for $\delta \in [0, (1+\theta)/3)$, and M can single-handedly obtain this outcome. To see the former point, note that, given $\delta < 2/3$, M is an importer in $\{C^M, C^F, M, F\}$; but, for $\delta \in [0, (1+\theta)/3)$, it is also an importer in $\{\cdot, C^F, M, F\}$, since $C^F F$ is an exporter in $\{C^M, C^F, M, F\}$, and thus necessarily also in $\{\cdot, C^F, M, F\}$ (implying that M is an importer): but it is $p^M_{\{C^M, C^F, M, F\}} \leq p^M_{\{\cdot, C^F, M, F\}}$, implying the result. Not $\{[C^M, M], [C^F, F]\}$, since it is $\{C^M, C^F, M, F\} \succ \{[C^M, M], [C^F, F]\}$ and $\{C^M, C^F, M, F\} \succ^{C^F F} \{O\}$, and M and F can jointly obtain this outcome. Not any other outcome, for the same reason presented at Step 1.1. ***Step 1.3. If $\mathcal{T} = 0$, and $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, only $\{[C^M, M], [C^F, F]\}$ may be realised in a CPNE.*** Not $\{C^M, C^F, M, F\}$, since $\{[C^M, M], [C^F, F]\} \succ^M \{C^M, C^F, M, F\}$ for $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, and M can single-handedly obtain this outcome. Not $\{\cdot, C^F, M, F\}$, since $\{[C^M, M], [C^F, F]\} \succ^M \{\cdot, C^F, M, F\}$ for $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, and M can single-handedly obtain this outcome. Not any other outcome, for the same reason presented at Step 1.1. ***Step 1.4. If $\mathcal{T} = 0$, and and $\delta > 1 - 1/[(2+\theta)(2-\theta)]$, only $\{\cdot, C^F, M, F\}$ may be realised in a CPNE.*** Not $\{C^M, C^F, M, F\}$, since $\{\cdot, C^F, M, F\} \succ^M \{C^M, C^F, M, F\}$ for $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$, and M can single-handedly obtain this outcome. Not $\{[C^M, M], [C^F, F]\}$, since $\{\cdot, C^F, M, F\} \succ^M \{[C^M, M], [C^F, F]\}$ and $\{\cdot, C^F, M, F\} \succ^{C^F F} \{[C^M, M], [C^F, F]\}$, and M and F can jointly obtain this outcome. Not any other outcome, for the same reason presented at Step 1.1. ***Step 2.1. If $\mathcal{T} = 1$, $\{C^M, C^F, M, F\}$ may be realised in a CPNE.*** To see this, suppose $\tau^J_I = 1\ \forall I, J$, so that $\{C^M, C^F, M, F\}$ is realised. No other outcome can be obtained by a viable coalition. Not $\{C^M, \cdot, M, F\}$: this can only be obtained by a coalition including F; however, as shown earlier in this Appendix, it is $v^{C^F F}\left(p^{C^F F}_{\{C^M, C^F, M, F\}}\right) > v^F\left(p^F_{\{C^M, \cdot, M, F\}}\right)$. Not $\{\cdot, C^F, M, F\}$: this can only be obtained by a coalition including M; however, as shown earlier in this Appendix, it is $v^{C^M M}\left(p^{C^M M}_{\{C^M, C^F, M, F\}}\right) > v^M\left(p^M_{\{\cdot, C^F, M, F\}}\right)$. Not $\{C^M, C^F, M, \cdot\}$: this can only be achieved by a coalition including F, however it is $\{C^M, C^F, M, F\} \succ^F \{C^M, C^F, M, \cdot\}$. Not $\{C^M, C^F, \cdot, F\}$: this can only be obtained by

a coalition including M, however it is $\left\{C^M, C^F, M, F\right\} \succ^M \left\{C^M, C^F, \cdot, F\right\}$. Not $\left\{C^M, C^F, \cdot, \cdot\right\}$, $\{\cdot, \cdot, M, F\}$, $\{\left[C^M, C^F\right], [M, F]\}$: these can only be obtained by a coalition including M and F, however there exists $J \in \{M, F\}$ which is an importer in $\{O\}$, and $\left\{C^M, C^F, M, F\right\} \succ^J \{O\}$. Not $\left\{C^M, \cdot, M, \cdot\right\}$, $\left\{\cdot, C^F, \cdot, F\right\}$, or $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$: these can only be obtained by a coalition including either F or M, however it is $\left\{C^M, C^F, M, F\right\} \succ^{C^F F} \{O\}$ and $\left\{C^M, C^F, M, F\right\} \succ^{C^M M} \{O\}$. Not $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{\cdot, C^F, M, \cdot\right\}$, or $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$: these can only be obtained by a coalition including both M and F; however, in the first two outcomes, there exists $J \in \{M, F\}$ which is in autarky after the deviation. In the third outcome, there exists $J \in \{M, F\}$ which imports and faces a higher price after the deviation. Since J is an importer after the deviation, it is also an importer when facing a lower price before the deviation. In both cases, it is $\left\{C^M, C^F, M, F\right\} \succ^J \{O\}$. ***Step 2.2. If $\mathcal{T} = 0$ and $\delta < (1+\theta)/3$, $\left\{C^M, C^F, M, F\right\}$ may be realised in a CPNE.*** To see this, suppose $\tau_I^J = 1\ \forall I, J$, so that $\left\{C^M, C^F, M, F\right\}$ is realised. No other outcome can be obtained by a viable coalition. Not $\{\cdot, C^F, M, F\}$: this can only be obtained by a coalition including M; however it is $\left\{C^M, C^F, M, F\right\} \succ^M \left\{\cdot, C^F, M, F\right\}$ for $\delta \in [0, (1+\theta)/3)$. Not $\left\{C^M, \cdot, M, \cdot\right\}$, $\left\{\cdot, C^F, \cdot, F\right\}$, or $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$: these can only be obtained by a coalition including either F or M, however it is $\left\{C^M, C^F, M, F\right\} \succ^M \{O\}$ for $\delta \in [0, (1+\theta)/3)$. Not any other outcome, for the same reasons presented at Step 2.1. ***Step 2.3. If $\mathcal{T} = 0$ and $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ may be realised in a CPNE (with the exception of a subregion of $\theta \in [0.000, 0.030)$ and $\delta \in (0.746, 0.750)$).*** To see this, suppose $\tau_I^J = 1\ \forall I, J$, except $\tau_{C^F}^{C^M} = \tau_F^{C^M} = \tau_{C^F}^M = \tau_F^M = 0$. No other outcome can be obtained by a viable coalition. Not $\left\{C^M, C^F, M, F\right\}$: this can only be achieved by a coalition including M, however it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, C^F, M, F\right\}$ for $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$. Not $\left\{C^M, \cdot, M, F\right\}$: this can only be obtained by a coalition including both M and F, however $\left\{C^M, \cdot, M, F\right\} \succ^M \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ requires $\delta \geq 1 - 1/[(3-\theta)(2-\theta)] \geq 1/2$, which can never be true for $\theta \leq 1/2$ (since it is $1 - 1/[(3-\theta)(2-\theta)] \geq 1 - 1/[(2+\theta)(2-\theta)]$ in this case); furthermore, if $\theta > 1/2$ and $\delta > 1/2$ it is $v^F\left(p^F_{\{[C^M,M],[C^F,F]\}}\right) > v^{C^F F}\left(p^{C^F F}_{\{C^M,\cdot,M,F\}}\right)$.[60] Not $\{\cdot, C^F, M, F\}$: this can only be obtained by

[60] We can write $v^{C^F F}\left(p^{C^F F}_{\{[C^M,M],[C^F,F]\}}\right) - v^F\left(p^F_{\{C^M,\cdot,M,F\}}\right) = \sqrt{\delta}\sqrt{\frac{1+\theta}{3-\theta}} - \frac{1}{2(3-\theta)} - \frac{\delta}{2} \equiv A$. It is $A > 0$ for $\delta \in [1/2, 1]$ and $\theta \in [1/2, 1)$. It is easy to show that $A > 0$ for $\delta = 1/2$ and $\theta = 1/2$, and $\partial A/\partial\theta > 0$ for $\delta = 1/2$: this implies $A > 0$ for $\delta = 1/2$. Furthermore, it is $A > 0$ for $\delta = 1$ and $\theta = 1/2$, and $\partial A/\partial\delta > 0$ for $\delta = 1/2$, $\theta = 1/2$, $\partial^2 A/\partial\delta^2 < 0$: this implies $A > 0$ for $\theta = 1/2$. Finally, it is $\partial^2 A/\partial\delta\partial\theta > 0$, which together with facts stated earlier implies $A > 0$ for $\delta \in [1/2, 1]$ and $\theta \in [1/2, 1)$.

a coalition including both M and F, however it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \{\cdot, C^F, M, F\}$ for $\delta \in [(1+\theta)/3, 1-1/[(2+\theta)(2-\theta)])$. Not $\left\{C^M, C^F, M, \cdot\right\}$: this can only be achieved by a coalition including F, however it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^F \left\{C^M, C^F, M, \cdot\right\}$. Not $\left\{C^M, C^F, \cdot, F\right\}$: this can only be obtained by a coalition including M, however it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, C^F, \cdot, F\right\}$. Not $\left\{C^M, C^F, \cdot, \cdot\right\}$: this can only be obtained by a coalition including both M and F, however it is $\left\{\left[C^M, M\right]\left[C^F, F\right]\right\} \succ^M \left\{C^M, C^F, \cdot, \cdot\right\}$. Not $\{\cdot, \cdot, M, F\}$, $\{\left[C^M, C^F\right], [M, F]\}$, except for a subregion of $\theta \in [0.000, 0.030)$ and $\delta \in (0.746, 0.750)$: these can only be obtained by a coalition including both M and F; however if $\delta < 1/2$, M is an importer both before and after the change, and the deviation gives it a higher price (since $1/2 \leq \delta/(1+\theta)$ or $\delta \geq (1+\theta)/2$ is implied by $\delta \geq (1+\theta)/3$). Then, it is $\left\{\left[C^M, M\right]\left[C^F, F\right]\right\} \succ^M \{O\}$. If $\delta \geq 1/2$, M is an exporter after the change. By Result 1, it is $\left\{\left[C^M, M\right]\left[C^F, F\right]\right\} \succ^M \{O\}$ if $\delta < (3-2\theta)/(4-2\theta) < 1-1/[(2+\theta)(2-\theta)]$, $\{O\} \succ^F \left\{\left[C^M, M\right]\left[C^F, F\right]\right\}$ otherwise. It can be shown that $v^{C^F F}\left(p^{C^F F}_{\{[C^M,M],[C^F,F]\}}\right) > v^F\left(p^F_{\{O\}}\right)$ for $\theta \geq 0.030$ and $\delta \in [0.500, 0.750]$,[61] and it is $(3-2\theta)/(4-2\theta) = 0.746$ for $\theta = 0.030$. Then, there are two cases. In a subregion of $\theta \in [0.000, 0.030)$ and $\delta \in (0.746, 0.750)$, a coalition including M and F is viable, and the equilibrium collapses. Outside of this range, such a coalition is not viable. Not $\left\{C^M, \cdot, M, \cdot\right\}$ or $\left\{\cdot, C^F, \cdot, F\right\}$: these can only be obtained by a coalition including F (M) in the first (second) case, however $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^F \left\{C^M, \cdot, M, \cdot\right\}$ and $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{\cdot, C^F, \cdot, F\right\}$. Not $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{\cdot, C^F, M, \cdot\right\}$, or $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$: these can only be obtained by a coalition including both M and F, however it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, \cdot, \cdot, F\right\}$ and $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^F \left\{\cdot, C^F, M, \cdot\right\}$; furthermore, if $\theta \geq 1/2$, F faces a higher price after the change, and it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^F \left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$, if $\theta < 1/2$, M faces a higher price after the change, and it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$. ***Step 2.4. If $\mathcal{T} = 0$ and $\delta > 1-1/[(2+\theta)(2-\theta)]$, $\left\{\cdot, C^F, M, F\right\}$ may be realised in a CPNE.*** To see this, suppose $\tau^J_I = 1\ \forall I, J$, except $\tau^{C^M}_{C^F} = \tau^{C^M}_M = \tau^{C^M}_F = 0$. No other outcome can be obtained by a viable coalition. Not $\left\{C^M, C^F, M, F\right\}$: this can only be obtained by a coalition including M. however it is $\left\{\cdot, C^F, M, F\right\} \succ^M \left\{C^M, C^F, M, F\right\}$ (since M is an exporter both before and after the change). Not $\left\{C^M, \cdot, M, F\right\}$: this can only be obtained by a coalition including both M and F, however it is either $\left\{\cdot, C^F, M, F\right\} \succ^M \left\{C^M, \cdot, M, F\right\}$ or

[61] One can write $v^{C^F F}\left(p^{C^F F}_{\{[C^M,M],[C^F,F]\}}\right) - v^F\left(p^F_{\{O\}}\right) = \sqrt{\delta}\sqrt{1+\theta} - \frac{1}{\sqrt{2}}(1/2+\delta) \equiv A$. Since $\partial A/\partial\theta > 0$, it is sufficient to show that $A > 0$ for $\theta = 0.030$ and $\delta \in [0.500, 0.750]$. This is easy to verify, given $A > 0$ for both $\delta = 0.500$ and $\delta = 0.750$, and $\partial^2 A/\partial\delta^2 < 0$.

$\{\cdot, C^F, M, F\} \succ^F \{C^M, \cdot, M, F\}$ (since M remains an exporter after the change, while F remains an importer). Not $\{C^M, C^F, M, \cdot\}$: this can only be achieved by a coalition including both M and F, however it is $\{\cdot, C^F, M, F\} \succ^F \{C^M, C^F, M, \cdot\}$. Not $\{C^M, C^F, \cdot, F\}$: this can only be obtained by a coalition including M, however it is $\{\cdot, C^F, M, F\} \succ^M \{C^M, C^F, \cdot, F\}$. Not $\{C^M, C^F, \cdot, \cdot\}$, $\{\cdot, \cdot, M, F\}$, $\{[C^M, C^F], [M, F]\}$: these can only be obtained by a coalition including both M and F, however it is $\{\cdot, C^F, M, F\} \succ^F \{O\}$ (in the case of the second and third outcomes, this follows from the fact that F faces a higher price after the change, while remaining an importer). Not $\{C^M, \cdot, M, \cdot\}$, $\{\cdot, C^F, \cdot, F\}$ and $\{[C^M, M], [C^F, F]\}$: these can only be obtained by a coalition including M, however it is $\{\cdot, C^F, M, F\} \succ^M \{O\}$ (in the case of the first and third outcome, it follows from the fact that $\delta \geq 1 - 1/[(2+\theta)(2-\theta)]$). Not $\{C^M, \cdot, \cdot, F\}$, $\{\cdot, C^F, M, \cdot\}$, or $\{[C^M, F], [C^F, M]\}$: these can only be obtained by a coalition including F, however it is $\{\cdot, C^F, M, F\} \succ^F \{O\}$ (in the case of the first and third outcome, this follows from the fact that F faces a higher price after the change, while remaining an importer). ■

Proof to Proposition 1. If $\mu \geq \overline{\mu}_{\mathcal{T}}$, suppose M sets $S = E$. By definition of $\overline{\mu}_{\mathcal{T}}$, the equilibrium is as described in Lemma 3. If $\mathcal{T} = 1$, the trade outcome is the same as for $S = I$, and M gets a positive transfer. If $\mathcal{T} = 0$, the trade outcome is, for M's payoff, at least as good as for $S = I$. Thus, it is optimal for M to set $S = E$. If $\mu < \overline{\mu}_{\mathcal{T}}$, suppose again that M sets $S = E$. Now, M must worry about revolution, since, if equilibrium policy were as described in Lemma 3, C^M would stage a revolution. Note first that M's payoff is no greater for $S = R$ than for $S = I$.[62] If $\mathcal{T} = 1$, given a trade policy matrix τ, M's optimal choice of a transfer (conditional on not triggering a revolution) must be $T^{C^M} = \Pi^{C^M}(\tau) - \Pi^{C^M}(R) - (1-\theta)(B-\mu)$ at an outcome where C^M and M trade with each other, and $T^{C^M} = 0$ otherwise. Using (10), M's payoff can then be written as $v^{C^M M}\left[p^{C^M M}(\tau)\right] + \text{constant}$ if C^M and M trade with each other, $v^M\left[p^M(\tau)\right]$ otherwise. Since M's payoff is, up to a constant, the same as under unconstrained empire, and F's payoff is too, the trade policy equilibrium is as described in Lemma 3. Note

[62] If $\delta < \delta(\theta)$, the trade outcome if $S = R$ is $\{\cdot, C^F, M, F\}$ or $\{\cdot, \cdot, M, F\}$ if $\delta \in [0, 1/4)$, $\{\cdot, C^F, M, F\}$ if $\delta \in [1/4, \delta(\theta))$ (see the proof to Lemma 1). But it is $\{C^M, C^F, M, F\} \succ^M \{\cdot, \cdot, M, F\}$ if $\delta \in [0, 1/4)$, since M is an importer in both outcomes (and the price is lower in the former); and it is $\{C^M, C^F, M, F\} \succ^M \{\cdot, C^F, M, F\}$, since $\delta < \delta(\theta)$ implies $\delta < (1+\theta)/3$, which in turn implies that, again, M is an importer in both outcomes (and the price is lower in the former). If $\delta \in [\delta(\theta), 2/3)$, the trade outcome if $S = R$ is $\{C^M, C^F, \cdot, F\}$; but it is $\{C^M, C^F, M, F\} \succ^M \{C^M, C^F, \cdot, F\}$; finally, if $\delta \in [2/3, 1]$, the trade outcome if $S = R$ is $\{C^M, C^F, M, F\}$, the same as if $S = I$.

that it is $T^{C^M} > 0$ for $\mu \in \left[\underline{\mu}, \overline{\mu}_1\right)$, $T^{C^M} < 0$ for $\mu < \underline{\mu}$. If $\mathcal{T} = 0$, I proceed in four steps. ***Step 1.*** $\mu \in \left[\underline{\mu}, \overline{\mu}_0\right)$***, the outcome that realises under unconstrained empire cannot realise in a CPNE.*** To see this, note that $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ cannot be realised if $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, since $\left\{C^M, C^F, M, F\right\} \succ^M \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ (since the latter trigger a revolution) and M can single handedly obtain this outcome; and, by a similar logic, $\left\{\cdot, C^F, M, F\right\}$ cannot be realised if $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$. ***Step 2.*** $\left\{C^M, C^F, M, F\right\}$ ***if*** $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$***, and*** $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ ***and*** $\left\{C^M, C^F, M, F\right\}$ ***if*** $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$***, are the unique outcomes which, 1) give*** C^M ***a payoff higher than under unconstrained empire; 2) give*** M ***a payoff at least as high as for*** $S = I$***; 3) and do not prompt a deviation by*** F***.*** If $\delta \in [0, (1+\theta)/3]$, five outcomes may give C^M a payoff higher than under unconstrained empire: $\left\{C^M, \cdot, M, F\right\}$, $\left\{C^M, \cdot, M, \cdot\right\}$, $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$, $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$. However as shown in the proof to Lemma 3 (Step 1.2), F can profitably deviate from the first, second and fifth outcome. As for third and fourth, it is $\left\{C^M, C^F, M, F\right\} \succ^M \{O\}$. If $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$, five outcomes may give C^M a payoff higher than under unconstrained empire: $\left\{C^M, \cdot, M, F\right\}$, $\left\{C^M, C^F, M, F\right\}$, $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$, and $\{C^M, C^F, \cdot, F\}$. However as shown in the proof to Lemma 3 (Step 1.3), F can profitably deviate from the first outcome, as well as the fourth if the price is higher in the first bloc. As for the third outcome, the fourth if the price is higher in the second bloc, and the fifth, it is $\left\{C^M, C^F, M, F\right\} \succ^M \{O\}$. Finally, if $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1]$, eight outcomes may give C^M a payoff higher than under unconstrained empire: $\left\{C^M, C^F, M, F\right\}$, $\left\{C^M, \cdot, M, F\right\}$, $\left\{C^M, C^F, M, \cdot\right\}$, $\left\{C^M, C^F, \cdot, F\right\}$, $\left\{C^M, \cdot, \cdot, F\right\}$, $\left\{C^M, \cdot, M, \cdot\right\}$, $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ and $\left\{\left[C^M, F\right], \left[C^F, M\right]\right\}$. However as shown in the proof to Lemma 3 (Step 1.4), F can profitably deviate from the second, third, sixth, and eighth outcome. As for the fourth and fifth, it is $\left\{C^M, C^F, M, F\right\} \succ^M \{O\}$. Note that it is $\left\{C^M, C^F, M, F\right\} \succ^{C^M} \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$. Instead, by Result 1, it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, C^F, M, F\right\}$ for $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1 - 1/[3(2-\theta)])$, and $\left\{C^M, C^F, M, F\right\} \succ^M \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ for $\delta \in [1 - 1/[3(2-\theta)], 1]$. ***Step 3.1. If*** $\mu \in \left[\underline{\mu}, \overline{\mu}_0\right]$ ***and*** $\delta \in [(1+\theta)/3, 1 - 1/[(2+\theta)(2-\theta)])$***,*** $\left\{C^M, C^F, M, F\right\}$ ***can be realised in a CPNE.*** This can be shown using the proof to Lemma 3 (Step 2.1) except that the reasons why it is not profitable for M to deviate to $\{\cdot, C^F, M, F\}$ and $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ is that these outcomes lead to revolution. ***Step 3.2. If*** $\mu \in \left[\underline{\mu}, \overline{\mu}_0\right]$ ***and*** $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1)$***, one of*** $\left\{C^M, C^F, M, F\right\}$

and $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ ***can be realised in a CPNE, except in a subregion of*** $\theta \in [0.000, 0.190)$ ***and*** $\delta \in (0.803, 0.833)$***.*** If $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1 - 1/[3(2-\theta)])$ and $\mu \in \left[\underline{\mu}, B + \left[\Pi^{C^M}(R) - v^{C^M}\left(p^{C^M}_{\{[C^M,M],[C^F,F]\}}\right)\right]/(1-\theta)\right)$, or if $\delta \in [1 - 1/[3(2-\theta)], 1]$, $\left\{C^M, C^F, M, F\right\}$ can be realised in a CPNE. This can be shown as in Step 3.1, except that, if $\delta \in [1 - 1/[3(2-\theta)], 1]$, the reason why it is not profitable for M to deviate to $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ is that $\left\{C^M, C^F, M, F\right\} \succ^M \left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$. If $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1 - 1/[3(2-\theta)])$ and $\mu \in \left[B + \left[\Pi^{C^M}(R) - v^{C^M}\left(p^{C^M}_{\{[C^M}\right.\right.\right.$ $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$ can be realised in a CPNE. This can be shown using the proof to Lemma 3, Step 2.3, except that the reasons why it is not profitable for M to deviate to $\left\{C^M, C^F, M, F\right\}$ is that it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, C^F, M, F\right\}$ for $\delta \in [1 - 1/[(2+\theta)(2-\theta)], 1 - 1/[3(2-\theta)]]$; the reason why it is not profitable for M to deviate to $\left\{C^F, \cdot, M, F\right\}$ is that it leads to revolution (and to $\{C^M, C^F, M, F\}$, which is worse for M than $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\}$); the reason why it is not profitable for M to deviate to $\{\cdot, \cdot, M, F\}$ and $\left\{\left[C^M, C^F\right], [M, F]\right\}$ is that they lead to revolution; and that there is a viable deviation to $\left\{C^M, \cdot, M, F\right\}$ in a subregion of $\theta \in [0.000, 0.190)$ and $\delta \in (0.803, 0.833)$. This outcome can only be obtained by a coalition including both M and F; however using Result 1, one finds that it is $\left\{\left[C^M, M\right], \left[C^F, F\right]\right\} \succ^M \left\{C^M, \cdot, M, F\right\}$ iff $\delta \geq 1 - 1/[(3-\theta)(2-\theta)] < 1 - 1/[3(2-\theta)]$ (with both thresholds increasing in θ). It can be shown that $v^{C^F F}\left(p^{C^F F}_{\{[C^M,M],[C^F,F]\}}\right) > v^F\left(p^F_{\{\{\}\}}\right)$ for $\theta \geq 0.190$, and it is $1 - 1/[(3-\theta)(2-\theta)] = 0.803$ for $\theta = 0.190$, and $1 - 1/[3(2-\theta)] = 5/6 = 0.833$ for $\theta = 0$. In a subregion of $\theta \in [0.000, 0.190)$ and $\delta \in (0.803, 0.833)$, a coalition including M and F is viable, and the equilibrium collapses.

Step 4. If $\mu < \underline{\mu}$***, in any CPNE, either the outcome that realises is such that*** M ***has a lower payoff than for*** $S = I$***, or it is such that*** C^M ***stages a revolution.*** If $\left\{C^M, C^F, M, F\right\}$ realises, by definition of $\underline{\mu}$, condition 12 holds. If any other outcome realises, if it gives M a higher a payoff than $\left\{C^M, C^F, M, F\right\}$, it must lead to revolution (since $\left\{C^M, C^F, M, F\right\}$, the best such outcome from C^M's perspective, does.) In summary, if $\mu < \underline{\mu}$, and $\mathcal{T} = 0$, the equilibrium outcome is $\left\{C^M, C^F, M, F\right\}$, and the maximum transfer that M can impose (conditional on not triggering a revolution) is negative; if $\mathcal{T} = 0$, the equilibrium outcome is either one that makes M worse off than $\left\{C^M, C^F, M, F\right\}$, or one that leads to revolution. This discussion implies that M sticks to empire if $\mu \in \left[\underline{\mu}, \overline{\mu}_{\mathcal{T}}\right]$, concedes independence if $\mu < \underline{\mu}$. ■