0.1 Independence effects by type of colonial relationship

These notes to be incorporated in the JIE revision, probably in the appendix?? I use *od* notation because that is what our handwritten notes used. **Perhaps we should be consistent across our papers and use *od* in this paper.** We did before but abandoned it, perhaps because I thought it should be $ijk\ell$ for tetrads. But we could make it *od* and then use i and e for the reference importer and exporter, since there are no mnemonics for k ℓ.

Suppose initially that there is a single empire comprising a metropole and several colonies. Let s_{ot} denote the time since separation for origin o from its metropole. Then trade between o and d depend upon s_{ot} and s_{dt}, as well as upon the nature of the relationship between o and d. Let $M_{od} = 1$ if o has colonized d or vice-versa (i.e. either o or d is the metropole). Let $S_{od} = 1$ if o and d have both been colonies of the metropole. In the cases for which $M_{od} = S_{od} = 0$ because there has never been either type of colonial relationship, we set R_{od}=1.

There is another notational inconsistency to resolve since we already used M for the monadic effect and R for the first ratio in the tetrads derivation.

$$Z_{odt} = M_{od}[f^M(s_{ot}) + g^M(s_{dt})] + S_{od}[f^S(s_{ot}) + g^S(s_{dt})] + R_{od}[f^R(s_{ot}) + g^R(s_{dt})], \quad (1)$$

where $f^M()$, $f^S()$, and $f^R()$ are the functions showing how the exporter's number of years since separation affects its shipments to the metropole, siblings, and rest of world. Correspondingly, $g^M()$, $g^S()$, and $g^R()$ are the effects of time since independence for the importing country.

As before we use non-parametric functions of the times since separation. The effect of s_{ot} on exports *to* or imports *from* a metropole is modeled as $f^M(s_{ot}) = \sum_{n=1}^{\bar{s}} \theta^M_{on} I_{otn}$ where $I_{otn} = 1$ if $s_{ot} = n$ and zero otherwise. To control the number of parameters that need to be estimated we cap time since independence at $\bar{s}$ years. Thus $I_{ot\bar{s}} = 1$ for $s_{ot} \geq \bar{s}$. Again to reduce the number of parameters that we will need to estimate, display, and interpret, we assume symmetry, that is $f^i() = g^i()$ for $i = M, R, S$. This implies that $f^M(s_{ot}) + g^M(s_{dt}) = \sum_{n=1}^{\bar{s}} \theta^M_{on}(I_{otn} + I_{dtn})$. Considering the effects of independence pertaining to imports and exports with metropoles, siblings, and rest of world we have,

$$Z_{odt} = M_{od} \sum_{n=1}^{\bar{s}} \theta^M_n (I_{otn} + I_{dtn}) + S_{od} \sum_{n=1}^{\bar{s}} \theta^S_n (I_{otn} + I_{dtn}) + R_{od} \sum_{n=1}^{\bar{s}} \theta^S_n (I_{otn} + I_{dtn}). \quad (2)$$

The sum $I_{otn} + I_{dtn}$ remains binary for *od* where $M_{od} = 1$. For sibling pairs it takes on a value of one if country o and country d have been independent for different numbers of years. In those cases, more than one of the independence indicators will be turned on at a given time. For example, in 1964, if the origin is Senegal (independence in 1960) and the destination is Algeria (independence in 1962), we would have $I_{o4} = 1$ and $I_{d2} = 1$. For the cases where two countries achieved independence from the same hegemon in the same year ($s_{ot} = s_{dt} = n$) or both achieved independence a very long time before ($s_{ot} \geq \bar{s}$ and $s_{dt} \geq \bar{s}$), the variable $I_{otn} + I_{dtn}$ takes a value of two.

We now generalize to allow for multiple empires, each of which share the same functions linking time since separation to trade. The times since separation vary by metropole. If each country that was ever colonized had only had one metropole, the extension to multiple empires would be immediate. However, there is a number of cases where some countries where colonized by several colonizers at different points in time. For example in 1980, Seychelles had been independent four years from Britain and 170 years from France. Those cases require that we work out carefully the extension to multiple empires, since we want to track years since independence from each of the metropoles, and also account for the fact that countries like Seychelles have siblings in two different families.

The time since independence indicators now require superscript m to denote from which metropole the former colony has been independent from, for n years. The relationship dummies also must be redefined so that there is a different one for each metropole m. Thus M_{od}^m indicates that either o or d is metropole m and S_{od}^m indicates that o and d were both colonies of metropole m. As before $R_{od}^m = 1 - M_{od}^m - S_{od}^m$.

$$Z_{odt} = \sum_{n=1}^{\bar{s}} \theta_n^M \sum_m M_{od}^m (I_{otn}^m + I_{dtn}^m) + \sum_{n=1}^{\bar{s}} \theta_n^S \sum_m S_{od}^m (I_{otn}^m + I_{dtn}^m) + \sum_{n=1}^{\bar{s}} \theta_n^S \sum_m R_{od}^m (I_{otn}^m + I_{dtn}^m). \tag{3}$$

This generalization still has $3(\bar{s}-1)$ parameters to be estimated once the sums over the sums of indicators have been constructed. Despite the more complicated algebra, the first term related to colony-metropole trade, remains the same as we have employed in previous regressions. That is it is just $\bar{s}-1$ dummy variables corresponding to different numbers of years of independence.[1] The independence indicator sums can take on more possible values for sibling and rest-of-world trade in those cases where the same country was colonized repeatedly. For example, Seychelles...

[1] This is because when $M_{od}^m = 1$ either I_{otn}^m or I_{dtn}^m is always zero so their sum remains binary.