Supprementary Analysis for Section 5.2

This Appendix presents a more detailed analysis for Section 5.2 of the paper.

Assumption on benefit of ethnic-specific club goods

In the model, individuals participate in an ethnic conflict even when they have a national identity or are in the modern sector. This might be justified by the fact that resources are contested between ethnic groups, not between socioeconomic classes or groups with different ideologies, in many developing countries, particularly in sub-Saharan Africa (Posner, 2005). Even when people identify with the nation or are in the ethnically integrated modern sector, they have no choice but to engage in ethnic conflict to receive a share of contested resources in many countries.

However, for those with a national identity, the benefit of some ethnic-specific club goods, such as public spending on ethnic culture and language, might be small, while the benefit of some public goods, such as spending on common culture and language, might be large. How does a consideration of this factor affect results?

Suppose that a fixed amount of resources exists. A part of the resources is allocated to the government based on rule and are used, for the sake of simplicity, entirely for the provision of public goods, while the rest of the resources V are allocated between ethnic groups as a result of ethnic conflict and are used for the provision of ethnic-specific club goods. The proportion of the resources allocated for each use is assumed to be fixed for simplicity. This might be justifiable because the allocation largely depends on the quality of political institutions presumed to be constant in the model: good institutions inhibit rent-seeking activities and violent conflict, and thus lower the resources used for ethnic-specific goods. Assume that those with an ethnic identity have a stronger preference for group-specific club goods than those with a national identity, that is, $\delta_e > \delta_n$; the benefit of public goods is normalized to be 0 for the former and is positive for the latter.

Assuming $\delta_e > \delta_n$ increases the difference in contribution to conflict f_i between those with an ethnic identity and those with a national identity and in the level of conflict F between an equilibrium with many people having an ethnic identity and the one with many people having a national identity.[1] However, qualitative results are not affected.

Alternatively, the benefit of ethnic-specific club goods, such as education, health services, and roads for particular groups or for areas they are clustered, can be small for modern sector workers because they work and live in relatively ethnically integrated environments, whereas the benefit of public goods, such as legal service and scientific knowledge, can be large for them. This factor can be considered by assuming that $\delta_T > \delta_M$ and the benefit of public goods is normalized to be 0 for traditional sector workers and is positive for modern sector workers.

This modification does not change the main result that the society ends up with the equilibrium of universal ethnic (national) identity when the status difference ΔS is small (large) or when ω_e in the perceived distance or the amount of contested resources V is large (small). However, several results are qualitatively affected. Owing to $\delta_T > \delta_M$, modern sector workers contribute less to conflict than traditional sector workers even when they share the same identity. Hence, an increase in A_M lowers F even in a homogenous identity equilibrium.[2] Under the original setting, when ΔS (ω_e or V) is relatively, but not extremely, small (large), F increases as the society shifts from a

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[1] $f_i = 0$ does not occur even for those with a national identity unless $\delta_n = 0$. This is because the cost of contributing to conflict is given by $c(f_i) = \frac{1}{\theta}(f_i)^\theta$, $\theta \geq 2$, where the assumption $\theta \geq 2$ follows Esteban and Ray (2011) and is needed to prove some results. If $\theta = 1$ is assumed, as in Sambanis and Shayo (2013), $f_i = 0$ can occur.

[2] Regarding heterogenous identity equilibria, as under the original setting, an increase in A_M lowers (raises) F in equilibria (d) and (Md) (in equilibrium (Td)).

heterogeneous identity equilibrium to equilibrium (e). Conversely, when δ_M is sufficiently small relative to δ_T, modernization always lowers the level of conflict.

Assumption of symmetric ethnic groups

In the model, ethnic groups are assumed to be symmetric in every respect, for analytical tractability and for the sake of focusing on a society without a dominant ethnic group. In the real world, dominant groups exist in many societies. Hence, it would be important to discuss the kind of new questions that can be examined using extended models with asymmetric ethnic groups, though an analysis of such models is very complicated.

One interesting question arising in a society with asymmetric ethnic groups is whether a large ethnic group is more likely than a small group to identify with the nation. This question can be examined using a simplest model with asymmetric groups in which the population of group 1 is much larger than that of each of groups 2 to n_e, and the smaller groups are symmetric. It would be realistic to suppose that, owing to the large population, the status of group 1 is higher than that of the other groups. This implies that, given S_N, ΔS is smaller for group 1, which makes the group less inclined than the other groups to identify with the nation. At the same time, the perceived distance under national identity is smaller for group 1 because of their population size, which makes the group more inclined to identify with the nation. Thus, group 1's individuals are more likely than the others to have an ethnic identity when the group's status is sufficiently higher than that of the other groups; otherwise, they are more likely to have a national identity. Hence, when S_N is relatively, but not extremely small, as modernization proceeds, the society would shift to an equilibrium with a universal ethnic identity for group 1, and a universal national identity for the smaller groups in the former case, whereas in the latter case, it would shift to an equilibrium with a universal national identity for group 1, and universal ethnic identities for the other groups.

A model with asymmetric groups can also be used to examine the relationship between measures of divisions of ethnic groups and conflict. Esteban, Mayoral, and Ray (2012) empirically show that the intensity of civil conflict is significantly related to the three measures of ethnic divisions, positively to the polarization and fractionalization indexes, and negatively to the Greenberg-Gini index. The effect of polarization (fractionalization) on conflict increases (decreases) when public or club goods, instead of private goods, become more important as rewards to conflict.[3] Their analysis is based on the theoretical study by Esteban and Ray (2011), which shows that, in a contest model of conflict without socio-psychological factors, the level of conflict is an increasing function of a linear combination of the measures of the ethnic divisions. When the competition for resources is over group-specific club goods, as in the present model, the result shows that the level of conflict depends on the polarization and Greenberg-Gini indexes.

An examination of the present model of symmetric ethnic groups, in which the values of the three measures are determined by the number of ethnic groups n_e,[4] reveals that, in homogenous identity equilibria, the result of Esteban and Ray (2011) applies, though, in order for the polarization index to influence conflict, as shown in Esteban and Ray (2011), individual utility must also depend on the utilities of other members of the group with which one identifies him- or herself.

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[3]The polarization index is $P = \sum_{i=1}^{n_e} \sum_{j=1}^{n_e} \left(\frac{L_i}{L}\right)^2 \frac{L_j}{L} \delta_{ij}$, the fractionalization index is $F = \sum_{i=1}^{n_e} \frac{L_i}{L}\left(1 - \frac{L_i}{L}\right)$, and the Greenberg-Gini index is $G = \sum_{i=1}^{n_e} \sum_{j=1}^{n_e} \frac{L_i}{L} \frac{L_j}{L} \delta_{ij}$, where δ_{ij} is the difference in the benefits of group i's individuals from their own and group j's club goods. In the present model, $\delta_{ij} = V$ for $i \neq j$ (because the benefits of club goods of other groups are 0) and $\delta_{ij} = 0$ for $i = j$.

[4]In the present model, values of the fractionalization and Greenberg-Gini indexes equal $\left(1 - \frac{1}{n_e}\right)V$ and the value of the polarization index equals $\frac{1}{n_e}\left(1 - \frac{1}{n_e}\right)V$, which is decreasing in n_e.

In heterogenous identity equilibria, conversely, F depends on n_e not only through the measures of ethnic divisions but also through variables related to population sizes of each ethnic group and each sector. In an extended model with asymmetric groups, the result of Esteban and Ray (2011) would hold if all ethnic groups are in the same homogenous identity equilibrium; otherwise, F would depend on the demographic variables as well as on the measures of ethnic divisions.

References

[1] Esteban, J., L. Mayoral, and D. Ray (2012), "Ethnicity and conflict: An empirical study," *American Economic Review* 102(4): 1310$-$42.

[2] Esteban, J. and D. Ray (2011), "Linking conflict to inequality and polarization," *American Economic Review* 101 (4): 1345–1374.

[3] Posner, D. N. (2005), *Institutions and Ethnic Politics in Africa*, Cambridge, UK: Cambridge University Press.

[4] Sambanis, N. and M. Shayo (2013), "Social identification and ethnic conflict," *American Political Science Review* 107 (2): 294–325.