Consider a version of the model of international trade and firm dynamics that we covered in class based on my paper with Melitz, (`http://www.econ.ucla.edu/arielb/firmdynamics.pdf`). Assume that productivity dynamics are exogenous, that is $q(z) = \bar{q}$ for all z, where $\bar{q}$ is a fixed parameter that the firm does not choose (and there are no incumbent innovation costs).

Introduce (partial) irreversibility of the export decision by assuming that some of the fixed export costs are sunk. In particular, in addition to the fixed export costs f_x, a non-exporter that becomes an exporter must hire f_{xs} units of labor during the first period as an exporter. An exporter that stops exporting must incur these sunk costs again to restart exporting.

Assume that both countries are symmetric and that the economy is in a steady state.

1) Write the value function of a firm with productivity index z that starts the period as an exporter, $V_x(x)$, and the value of a firm with productivity index that starts the period as a non-exporter.

2) Provide an expression for the productivity cutoff of non-exporters that become exporters, z_x, and the productivity cutoff of exporters that become non-exporters, z_n. Show that $z_n < z_x$ when sunk costs are positive, and $z_n = z_x$ when sunk costs are zero. Provide intuition for your answer.

3) Provide expressions for the measure of firms with productivity index z that are exporters, $M_x(z)$, and the measure of firms that are non-exporters, $M_n(z)$ at the start of the period, given cutoffs and a mass of entrants M_e.

4) Describe an algorithm to solve for the equilibrium objects: thresholds, $z_x, z_{nx}, M_x(z), M_n(z)$, mass of entrants M_e, production labor, and aggregate output.

5) Impose the parameter values in the paper and solve the model numerically by applying the algorithm in 4).

6) Plot log employment as a function of z (separately for exporters and non-exporters). Plot M_x and M_z. Calculate the average size of non-exporters that become exporters relative to the average size of exporters that become non-exporters.

7) Discuss the model's ability to account (qualitatively) for Facts 1-4 in Alessandria-Arkolakis-Ruhl (2020)'s Annual Review paper
(`https://www.annualreviews.org/doi/pdf/10.1146/annurev-economics-090919-025159`)