

# Indicative Case Solution – RE Boom and Bust in Dubai (EN)

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First, students need to make a Stock Flow Diagram (green variables in Figure 1(a)) and a detailed CLD (green variables in Figure 1(b)) of the first part of the case description. In second stage, they need to extend the simulation model to the full description (Figure 1). They need to specify at least one  $\text{MAX}(0, \dots)$  function, one MIN function, one DELAY FIXED or PPL DELAY function, possibly one lookup/graph function of Time, and one normal with lookup/graph function.

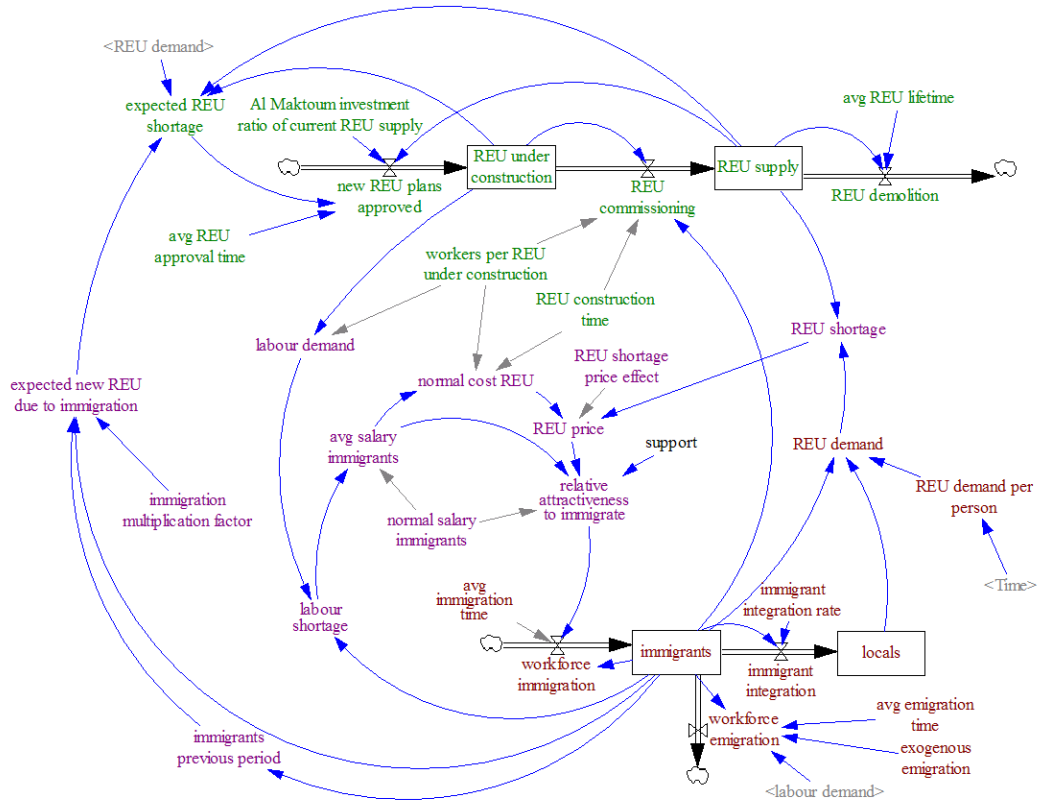
They are need to verify, validate, simulate, and plot graphs of the model, first without crisis settings (see Figures 2(a) and 2(b)). Later they need to add crisis settings to the model and simulate the unfolding of the real estate bust after month 10 and make corresponding graphs (see Figure 2(c) and 2(d)).

However, these changes are not enough to generate a true collapse. Hence, students need test the influence of the uncertainty related to the *average immigration time* (1 – 3 months) with crisis settings (Figure 3(a)) and the *REU construction time* (1 – 4 months) with crisis settings (Figure 3(b)) on the number of *immigrants*, and their combined effects without crisis settings (Figure 3(c)).

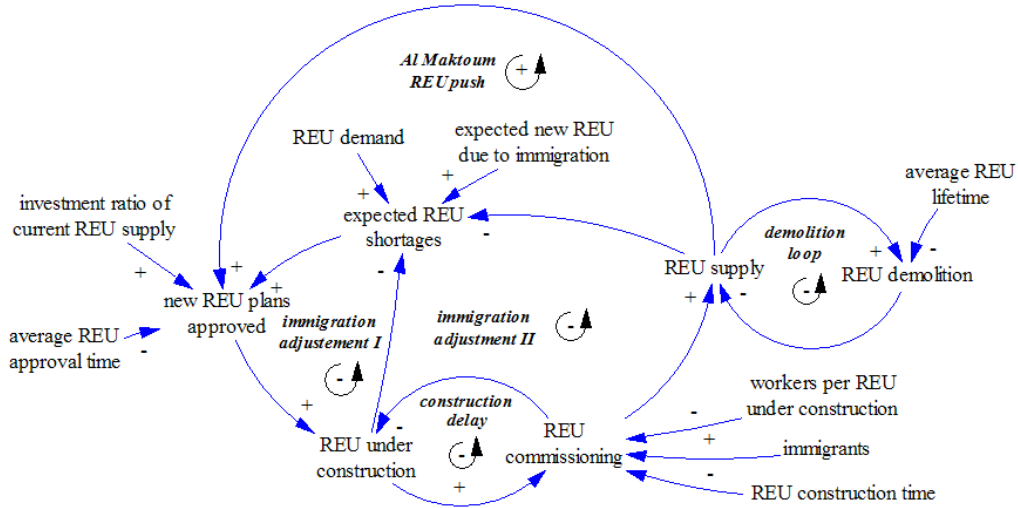
After these simulations, students should recognize that two different modes of behaviour can be simulated with combinations of different values for these two parameters (exponential growth and a partial collapse followed by exponential growth), that total collapses without redress are not experienced without crisis settings, contrary to simulation *with* crisis settings.

Students should also be able to deduct that the exponential growth is caused by: more immigrants, more REU needed, more REU under construction, more immigrants, etc. The partial collapse is caused by an initial surplus of immigrants and REU under construction for runs with small values of the immigration time and construction time in which the construction time is smaller than the immigration time. Hence, the REU under construction initially in the pipeline are completed before new immigrants can be attracted.

However, only a very small fraction of our students is able to distill these conclusions during the time constrained exam: only those few students are able to make extremely aggregated *causal loop diagrams* of the model that allow them to explain the link between system structure and behavior and give appropriate policy advice derived from the model.

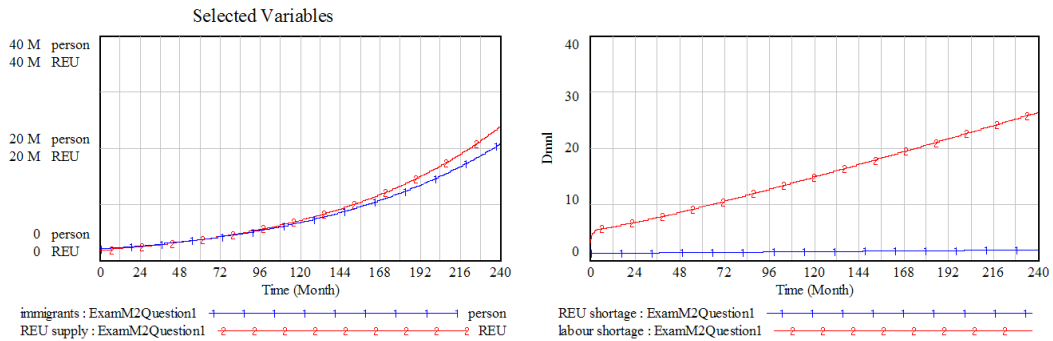


(a) SFD of preliminary model (in green) embedded in the SFD of the full model

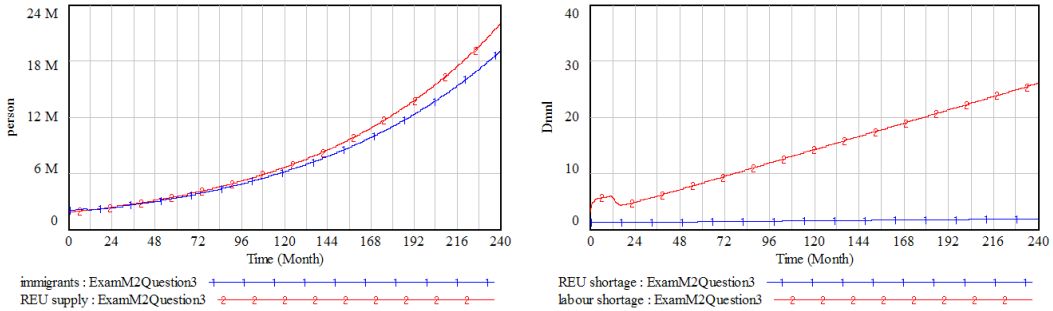


(b) Complete CLD of preliminary SFD – in other words, of the green variables

Figure 1: SFD and CLD



(a) Immigrant and REU supply without crisis settings (b) Labour and REU Shortage without crisis settings



(c) Immigrant and REU supply with crisis settings (d) Labour and REU Shortage with crisis settings

Figure 2: Plots with/out crisis settings

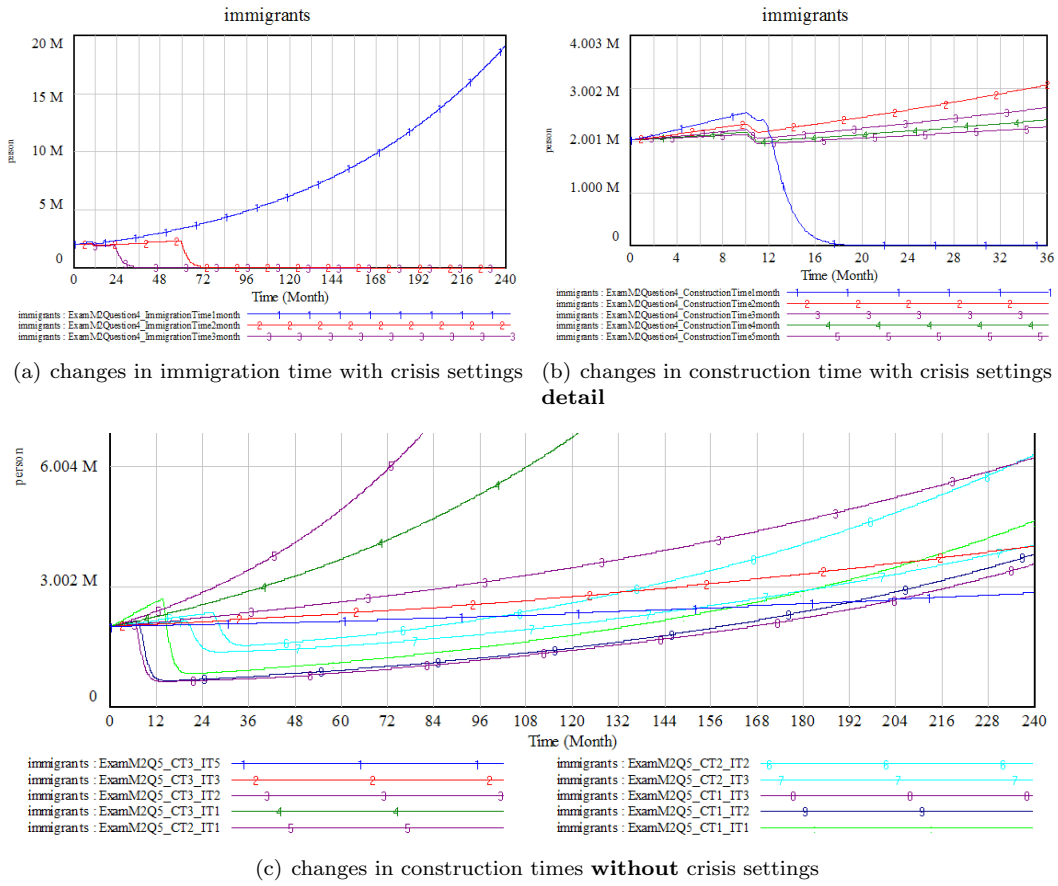


Figure 3: Plots with/without crisis settings for different immigration and construction times