## Abstract

The global macro economy is one of the most complicated systems in the world today. Hundreds of theories, formulas, and ideas have proliferated in attempts to explain it changes. Prior to computers attempts to integrate these theories into comprehensive models would have been impossible by the sheer complexity of the task. Even with the aid of computers analyzing the evolution of the global economy as a whole is unfeasible. However numerous advances in the theory of global trade (notably Paul Krugman's theory on economic geography and new trade theory) have made it possible to make accurate predictions on trade and wealth flows. The aim of this study is to use these theories to create a mathematic agent-based model simulating global wealth flows.

Introduction

The global economy is an increasingly complex structure governed by myriads of daily interactions. One of the most important topics today is the value of currency. Currency values play a role in maintaining nations budgets, development, global finance among other important issues. Predicting developments of and changes due to variations in currency are critical in the greater economy.

Accomplishing this task means time evolving a world based on the integration of several theories. Agent-based modeling is a simple and elegant solution, the agents representing businesses interact on a landscape which represents the world. Their interactions cause the capital and current account surpluses and deficits that are so critical in our world. If this model correlates with empirical data it could be a powerful predictive tool in financial and economic situations.
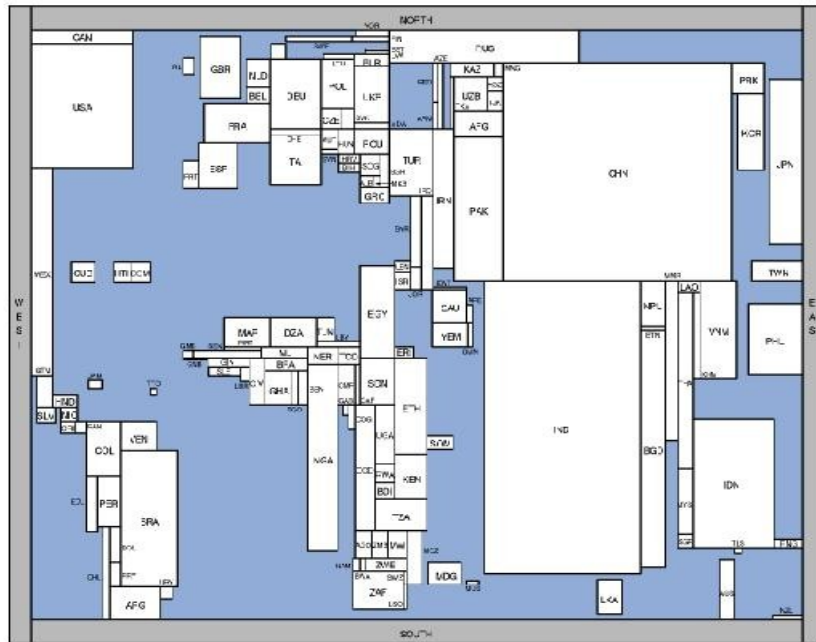
Cartogram

Results -> come back next year

Background

No nation or functioning political entity can survive in the modern world without inclusion in the global economy. When the world embraced fiat currency after the Second World War and moved into a landscape of complex credit derivatives and financial arrangements. Since then the fork between the real and the nominal has ever increased, resulting in great disparities in the financial markets and the economy. The survival, growth, and strength of an economy has been linked to value of its currency. But as the value of a currency is now nominal we must search for the causes for appreciation and depreciation of currency. The economic ideas behind this are simple - naturally derived from supply and demand but are very complex to model. The problem comes in the fact that supply and demand in this example ignores human action and internal markets. For this reason basic supply and demand must be supplemented by a variety of other actions: specifically user bias; and new trade theory. The assumptions made in this project are: i) minimum transportation requirements or costs; ii) bias towards dominating currency; iii) efficient markets (required for complexity issues; and iv) zero sum game. The last assumption is justified by considering all values to be indicators of relative rather than absolute wealth. Using heuristics based on these theories, agents (representing businesses) evaluate production chains based on arbitrage of CPI values between nations (classes that serve to hold data).

Three theories are key to this project. First, the "New Trade Theory", put forth by Paul Krugman; second, Joseph Stiglitz's theories on asymmetric information, and last, supply and demand from classical macro and micro-economics. Krugman's theory explains, simply put, why the rule of comparative advantage breaks down in certain situations in developed economies. (E.G. Germany buys cars from Finland and Finland buys cars from Germany.) Stiglitz' part of contract theory which applies when one party(ies) knows less than the other(s) . Finally, the classical law of supply and demand tells us that product prices vary directly with demand and inversely with supply. These theories summarize the information which businesses will use to determine their production chains. Integrating these ideas we are left with a heuristic that evaluates combinations based on arbitrage (difference in CPI), competing agents, and country development level. Then investment procedures are evaluated by weighting all countries and selecting by probabilities. Factors include in the weighting: crowding out is detrimental,

In addition to Stiglitz' paper "Theory of Asymmetrical Information", and Krugman's Vehicle Currencies and the Structure of International Exchange, The following books are of specific importance to the investment heuristic: i) Benjamin Graham's, Security Analysis; ii) Geoffrey Poittras', Security Analysis and Investment Strategy; iii) Jeremy J. Seigal's, Stocks for the Long Run.

Project Structure

Nations are a class in java used solely to hold information specifically the total wealth of a country. On the basis of this information a separate class representing business entities associates itself with a pair of countries to create a production chain. Over time this production chain takes money from the country of consumption and gives it to the country of production. This is the current account balance. The capital account comes from the reinvestment of the profit the companies take and follows a complicated heuristic for reinvestment. Each time-step money is

Development

Java was a simple language that was completely sufficient for the required purposes. The project would be successful if it made a model consistent with economic theory and more importantly that showed some correlation with reality. In effect the project had to be able to analyze and time evolve an economic system accurately according to economic theory and then be able to display the information in an understandable form.

The project started as a agent based modeling framework. This part is the simple part of the project. It does not deal with economic theory and is solely concerned with efficiency, complexity and speed. While these are important variable the possibility of using parallel processing or other techniques if the analysis proved lengthy meant that this part was not too important.

Of far more importance is ensuring the heuristics function accurately. Because the economic model is a simplification of the global economic system critical variables need to be reset and recalibrated. Unfortunately there is no way to resolve this issue, to my knowledge, other than trial and error.

After the heuristic is calibrated display methods need to be created. The important detail is to be able to show every country at each time-step. The most aesthetically pleasing way to accomplish this is with a rectangular cartogram weighted by GDP.

Bibliography -> under construction