

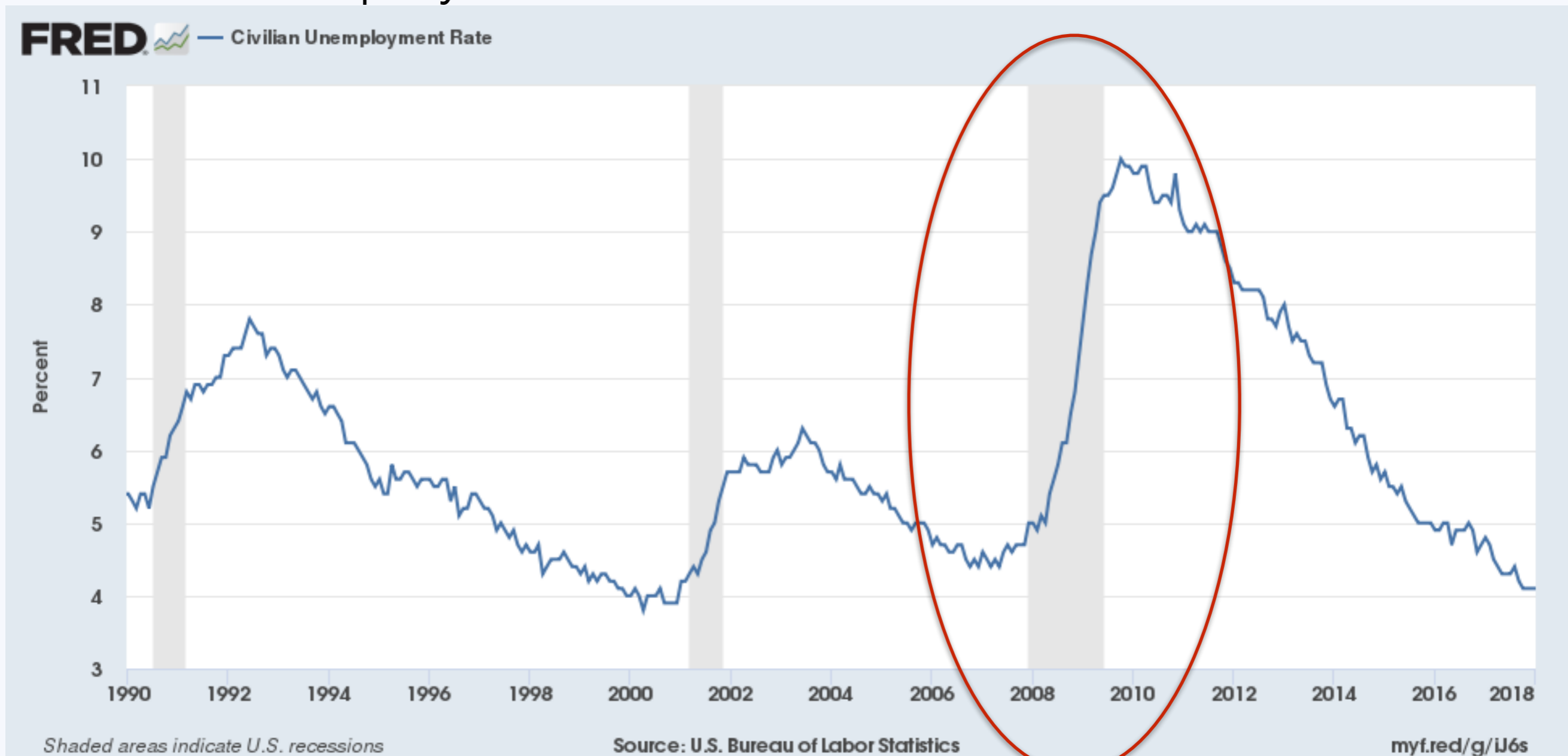
Agent-Based Modeling to Analyze the Effect of the 2009 Government Stimulus Package on the Labor Market

Kim Wellington

Advisors: Kristina Striegnitz & Stephen Schmidt

The 2008 Recession and The 2009 Stimulus

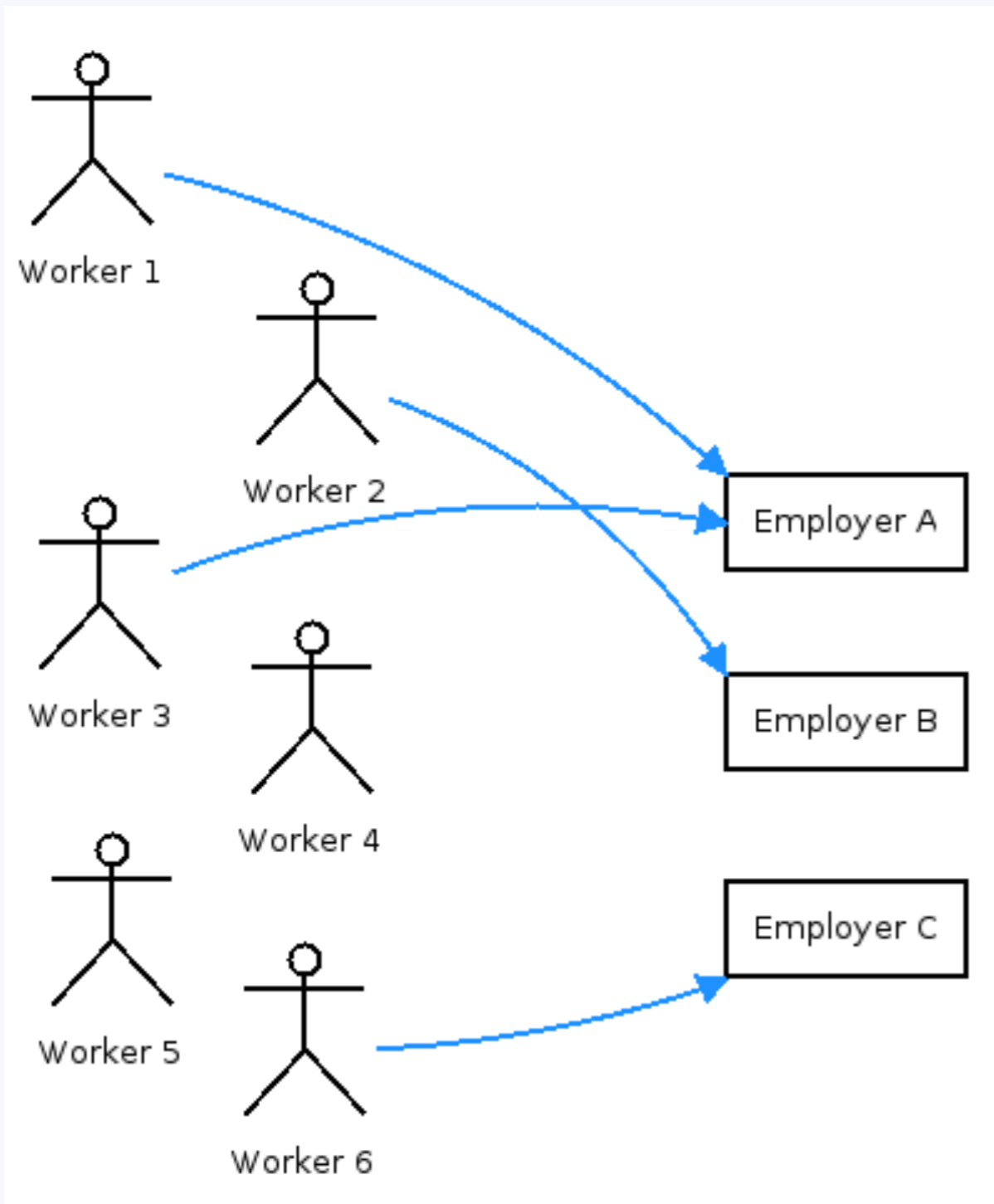
Civilian Unemployment Rate



The Research Question:

How effective were the different components of the 2009 stimulus?

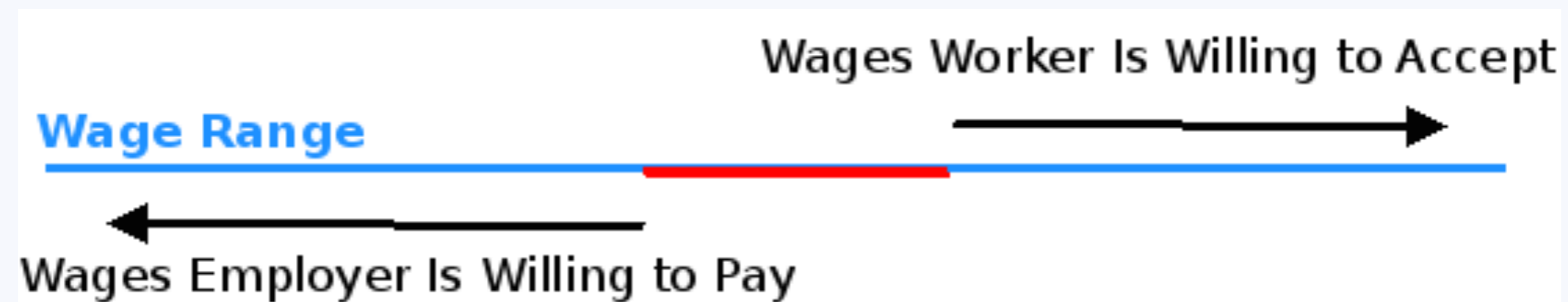
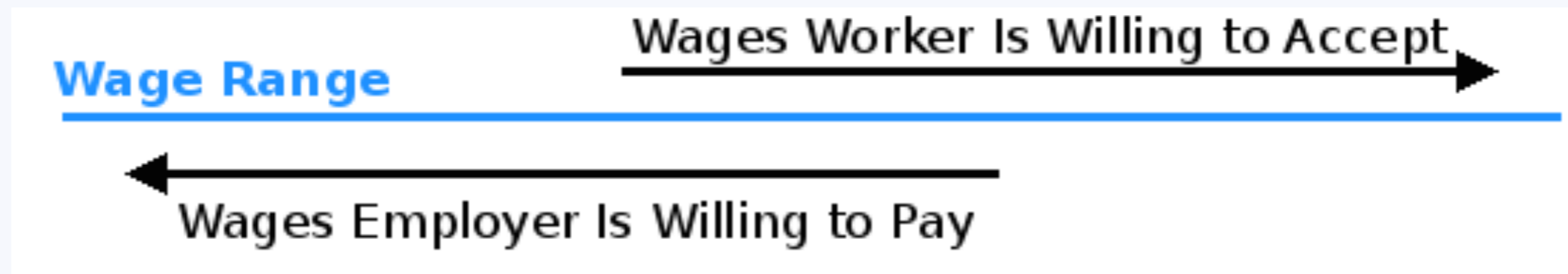
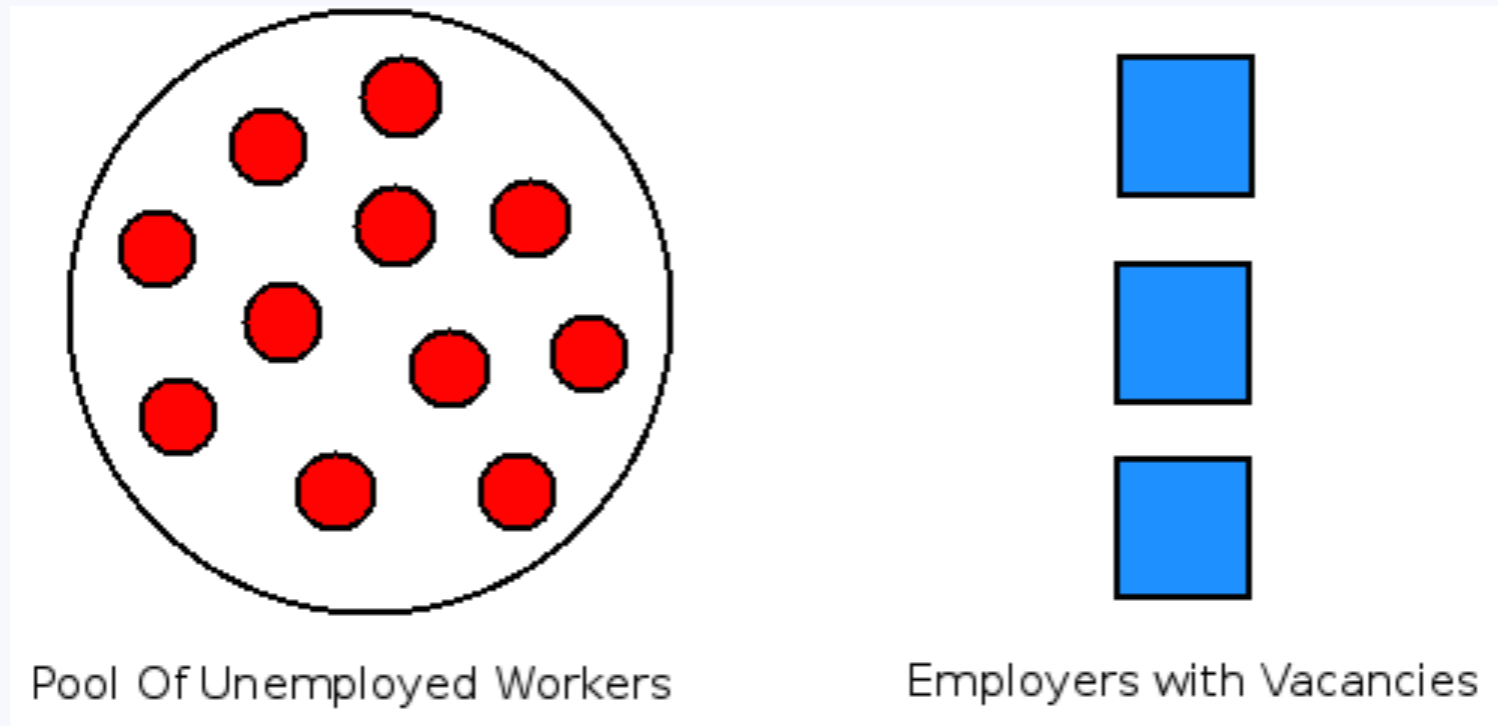
A Simple Agent-Based Model (ABM)



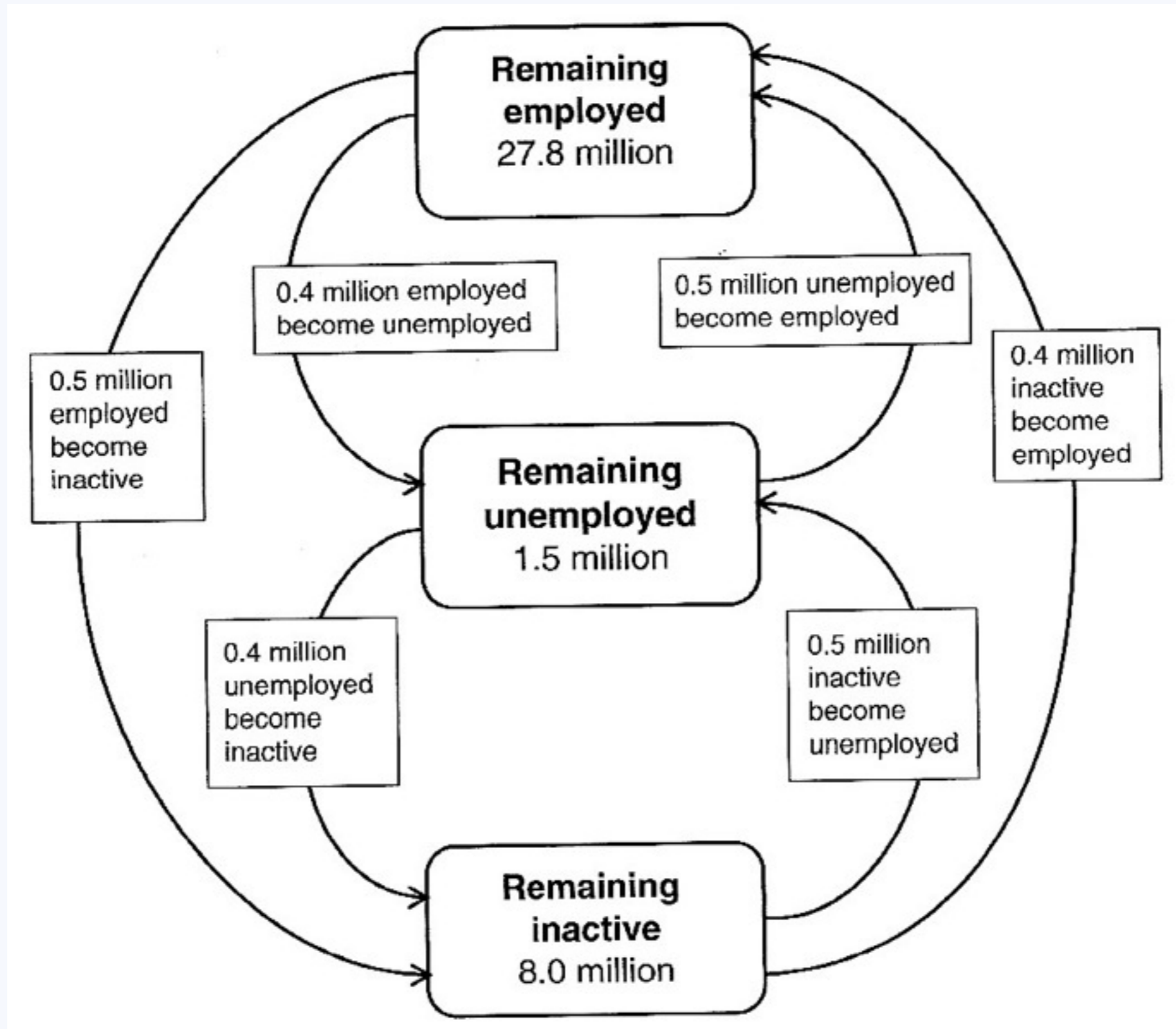
Why An ABM:

- ❖ In an ABM, agents can be heterogenous: Labor Market = workers & employers
- ❖ Some aspects of the stimulus can be disabled

The Negotiation Function



The Hamill-Gilbert Model: A Simple Labor Market



Implementation In NetLogo

number-of-runs: 2 run-counter: 2 number-of-quarters: 200 quarter-counter: 200

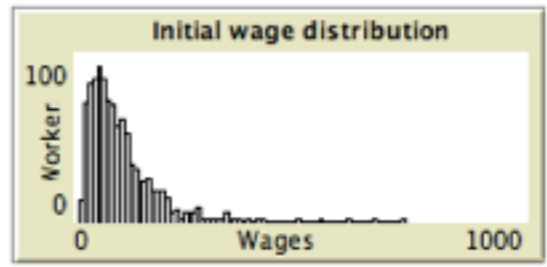
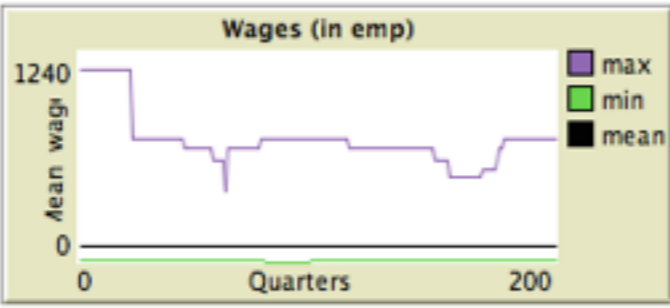
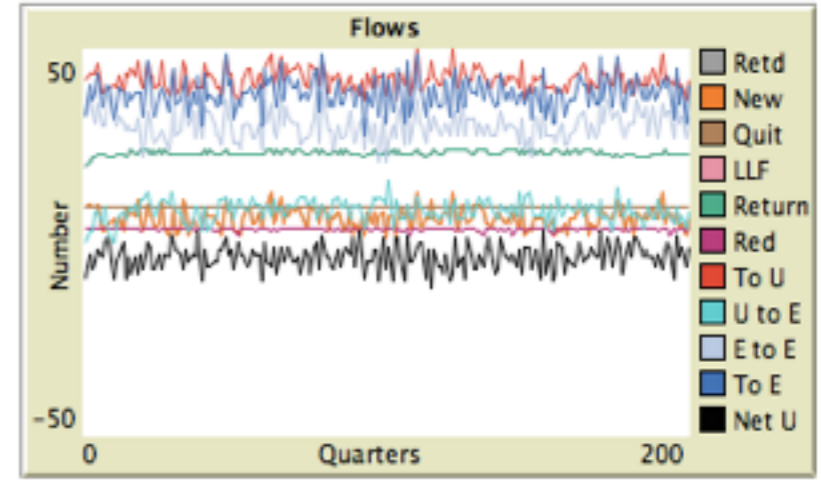
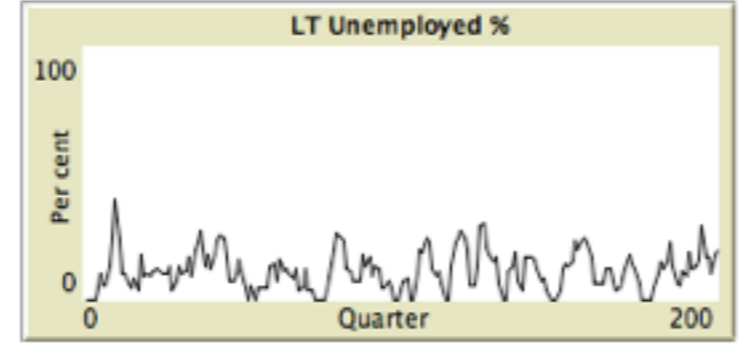
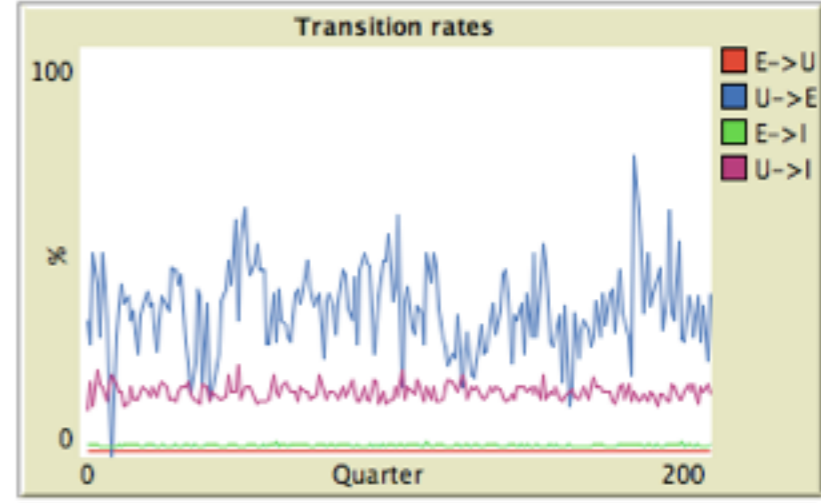
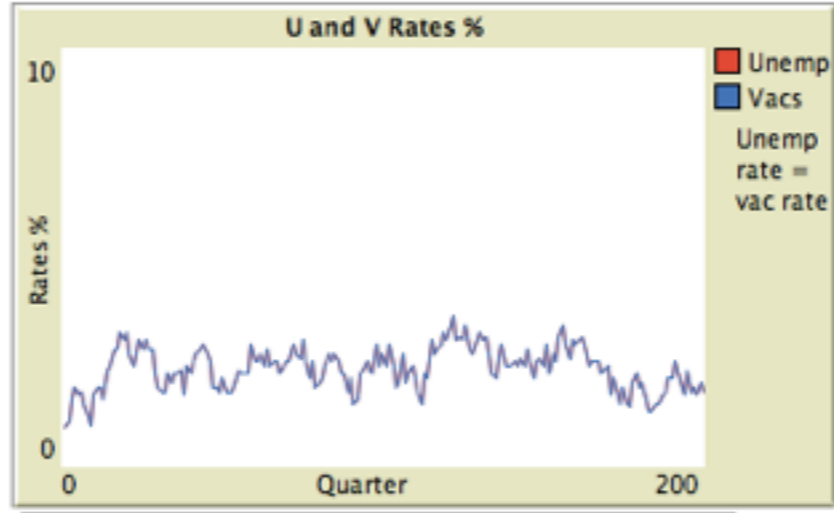
scenario: Guildford run-in-time: 100 Quarters for which results ignored.

Leaving: This is in addition to redundancies and retirement.
 Wage:

%EmpsLeavingJob: 1.0 %UnempLeavingLF: 15 %EmpLeavingLF: 2.0
 maxWageIncrease%: 10 maxWageReduction%: 10

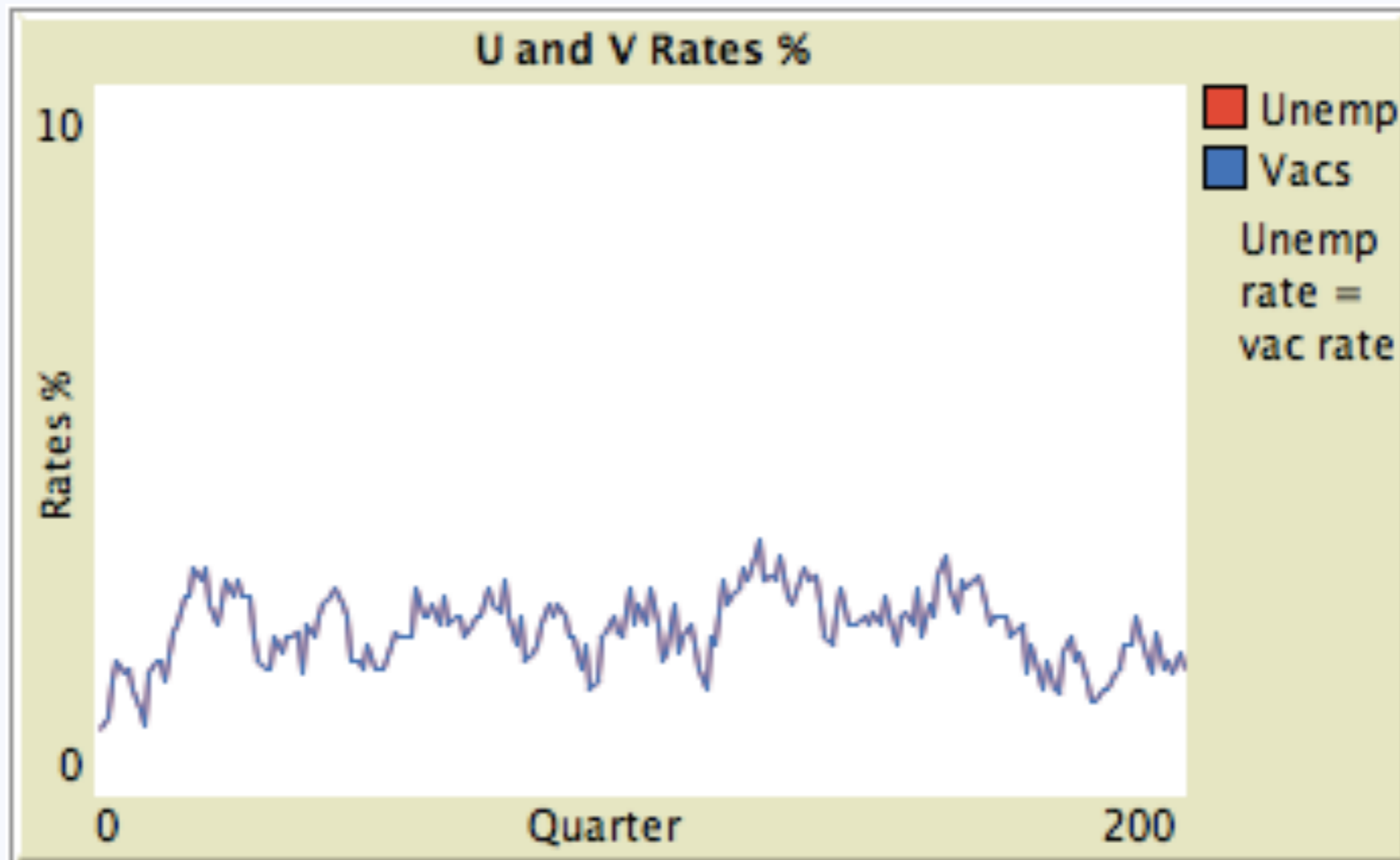
vacancy rate %: mean: 2.42 (sd 0.04)
 Unemployment rate %: mean: 2.42 (sd 0.04)
 Unemployment rate %: mean of range: 2.5 (sd 0.28)
 Long-term unemployed %: mean: 12.17 (sd 0.64)
 Hazard Rates
 E to U %: mean: 1.3 (sd 0)
 U to E %: mean: 34.58 (sd 0.18)
 E to I %: mean: 2.67 (sd 0.02)
 U to I %: mean: 15.56 (sd 0.14)

PLOTS FOR FIRST RUN



The Hamill-Gilbert Model

Assumes Jobs = Workers

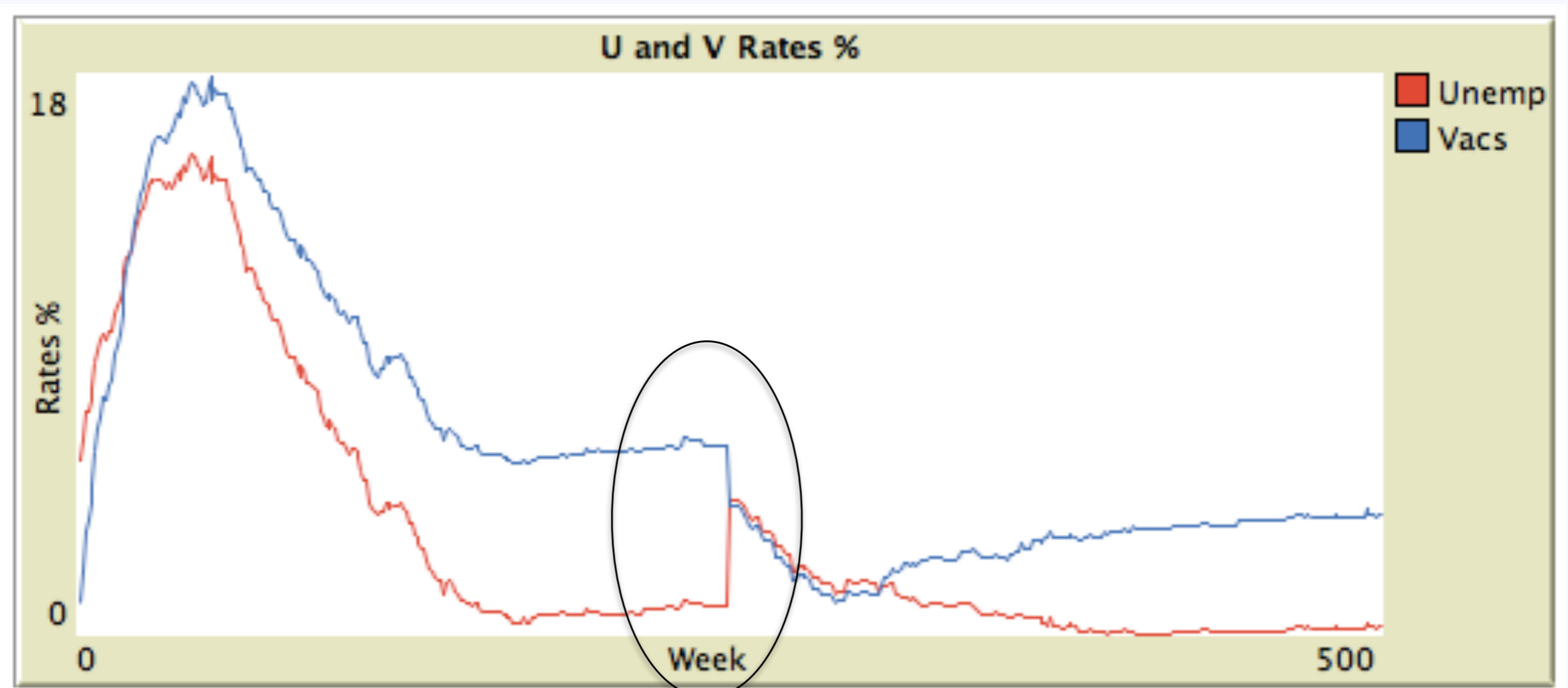


Modeling the U.S. Economy

- ❖ Number of jobs is not equal to number of workers
- ❖ Business size distribution reflects US (SBA)
- ❖ Wage standard deviation and mean reflect the US (CPS)

Modeling the Recession

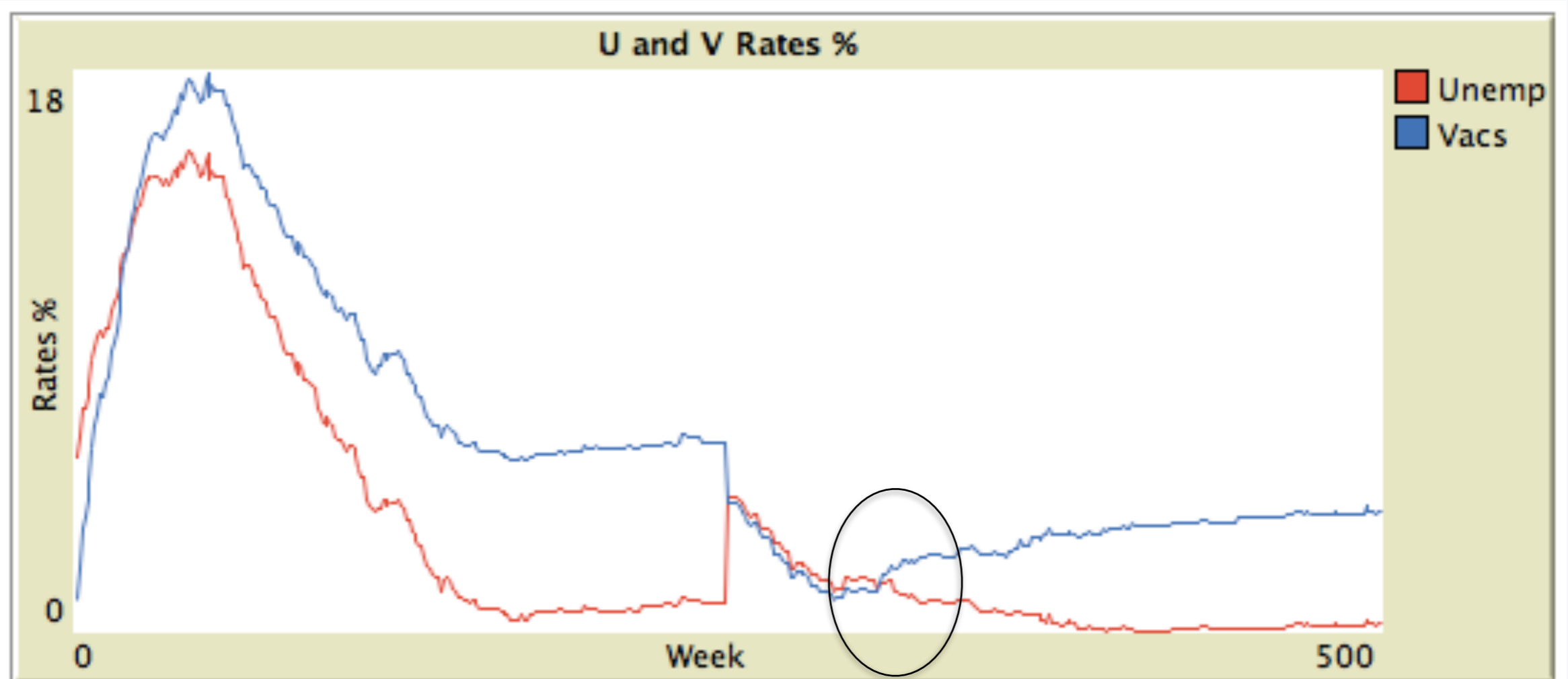
Week Recession Occurs = 250
More employers go out of business
Decrease in Vacancies
Increase in Unemployment



Modeling the Stimulus

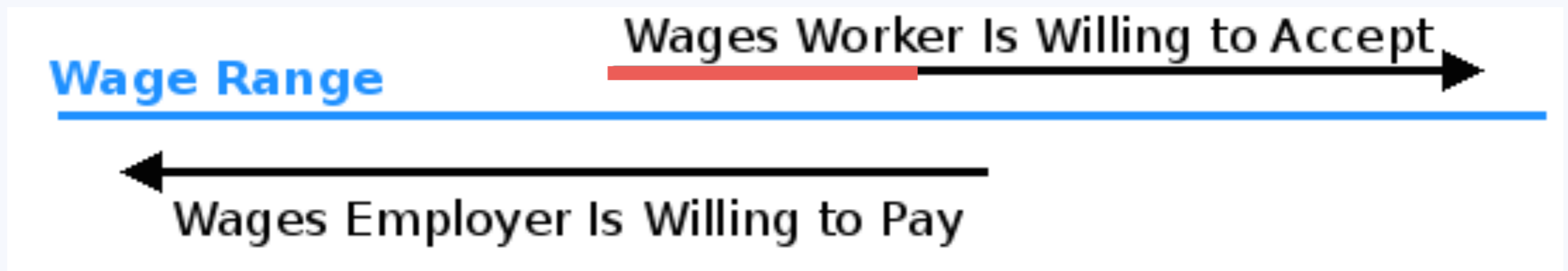
Week Stimulus Occurs = 306

1. Tax Rate Changes
2. Government Funds Projects
3. Unemployment Insurance Lengthens



Stimulus #1: Tax Rate Change

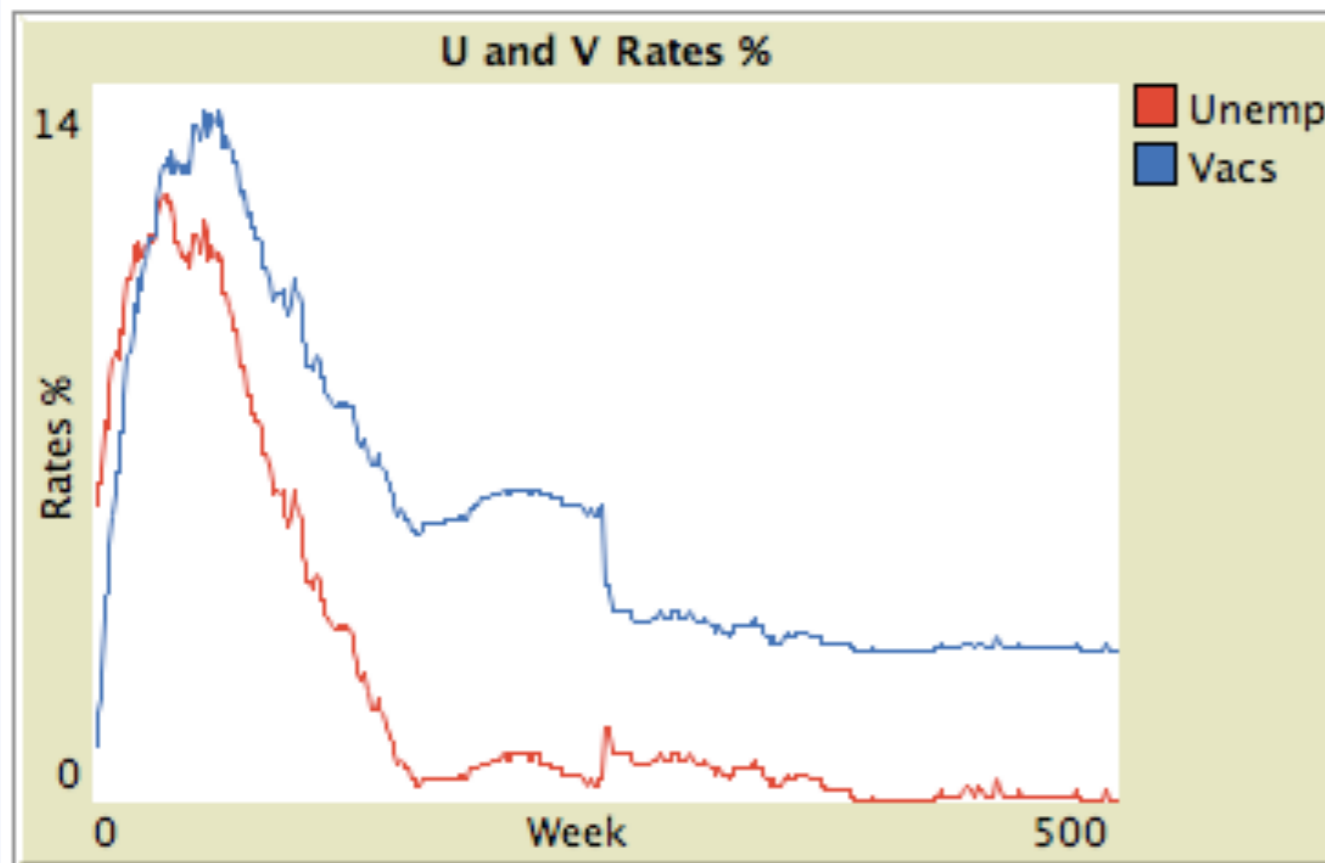
Workers Subtract Tax Rate from Offered Wage



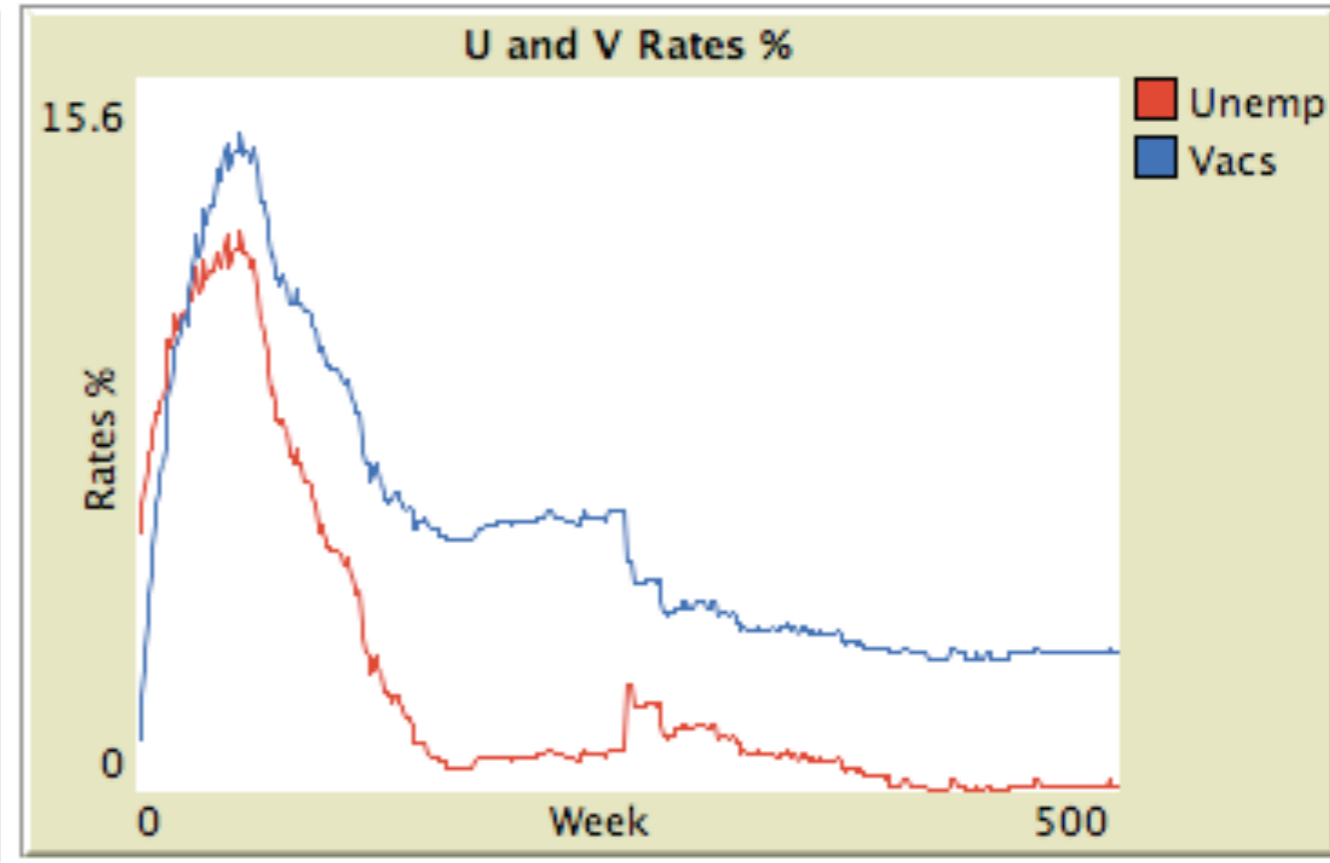
When Tax Rate decreases:
Range of wages a worker is
willing to accept increases

Results: Effect of Tax Rate Change

A cut in taxes causes
a Decrease in Unemployment



Tax Rate Decreases
By -5%



Tax Rate Decreases
By -50%

Stimulus #2: Government-Funded Projects

Demand increases

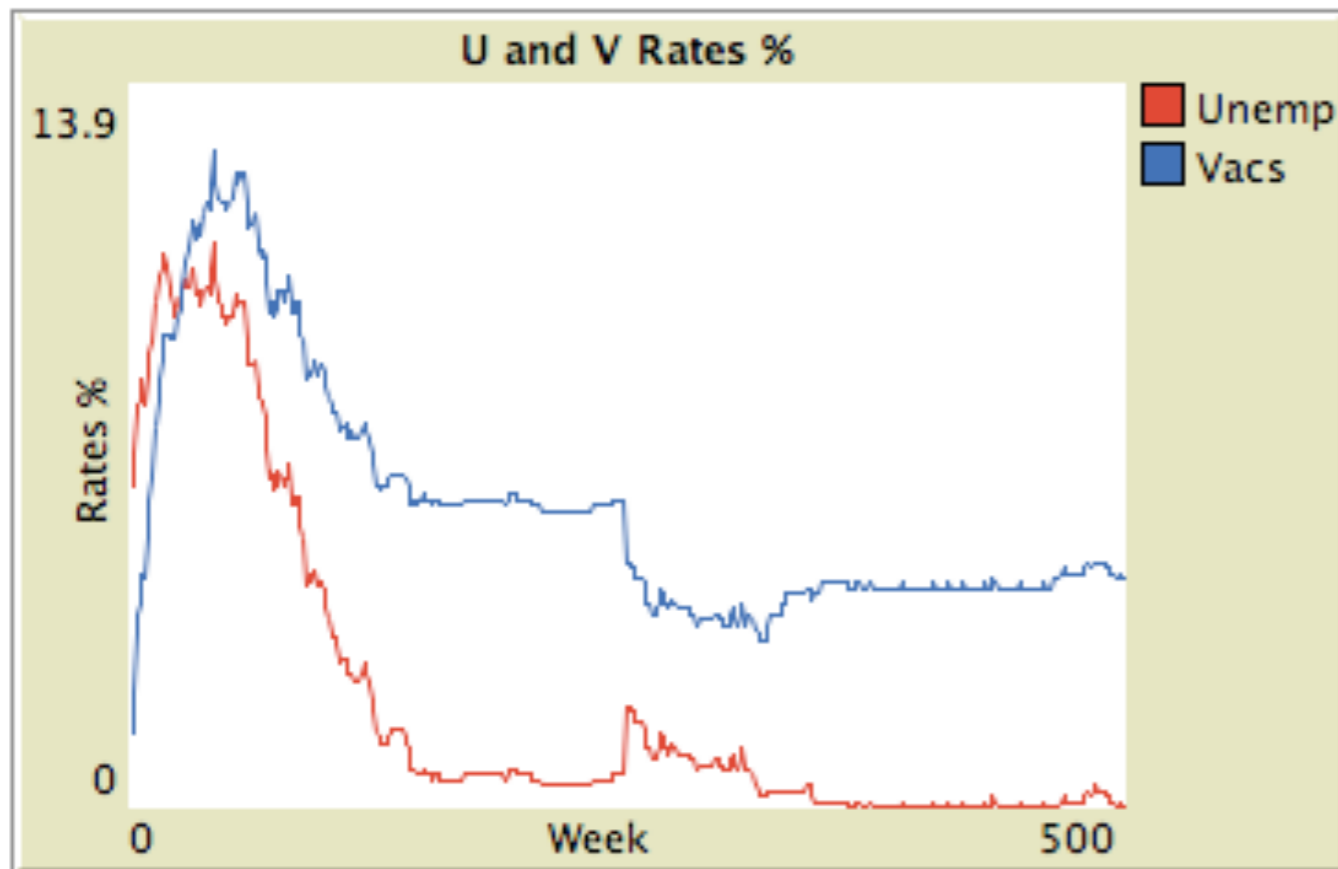
More employers are created to meet demand

Increase in Vacancies

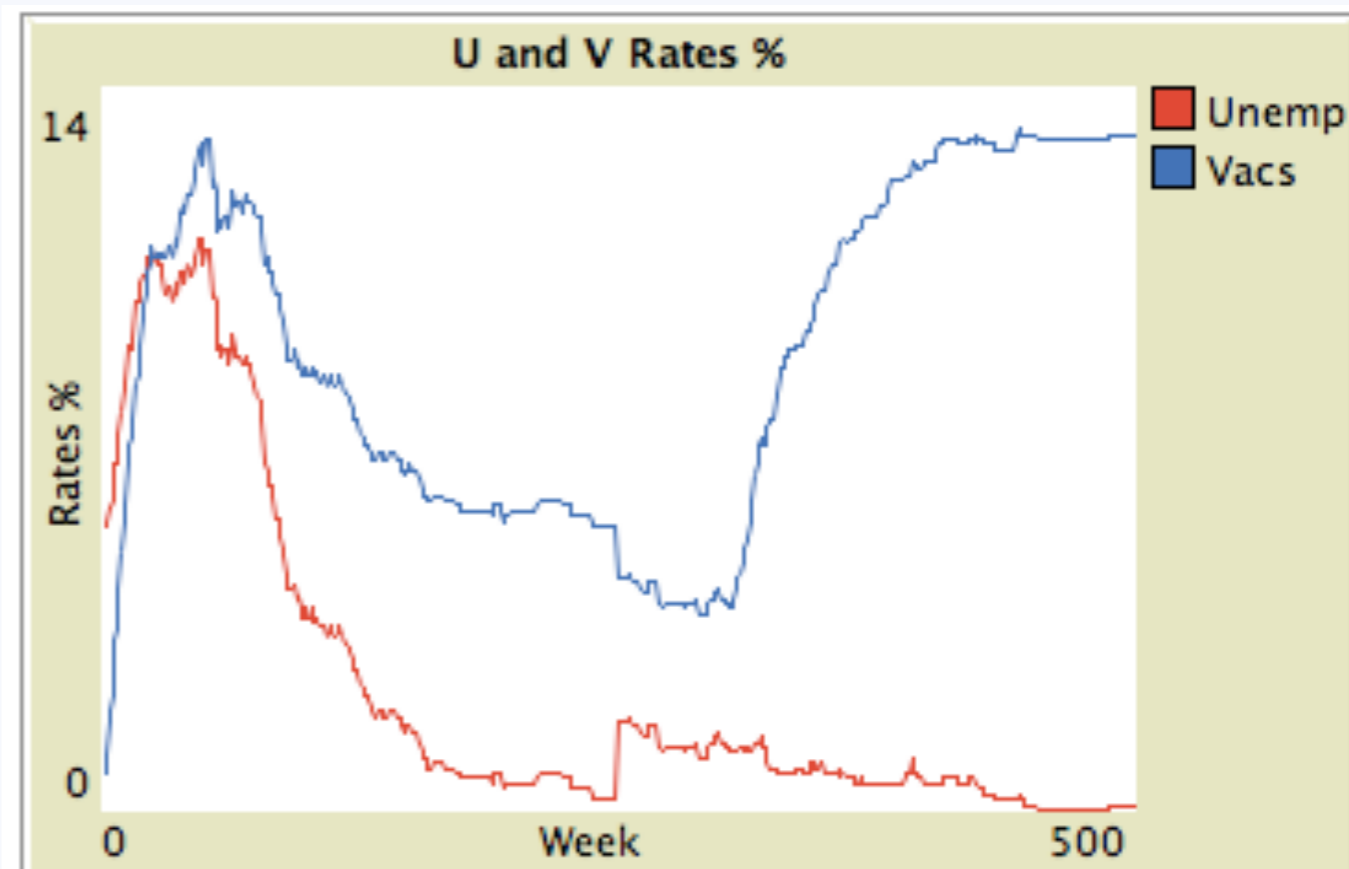
Decrease in Unemployment

Results: Effect of Government Funding

An Increase in Government Funding
Creates New Jobs



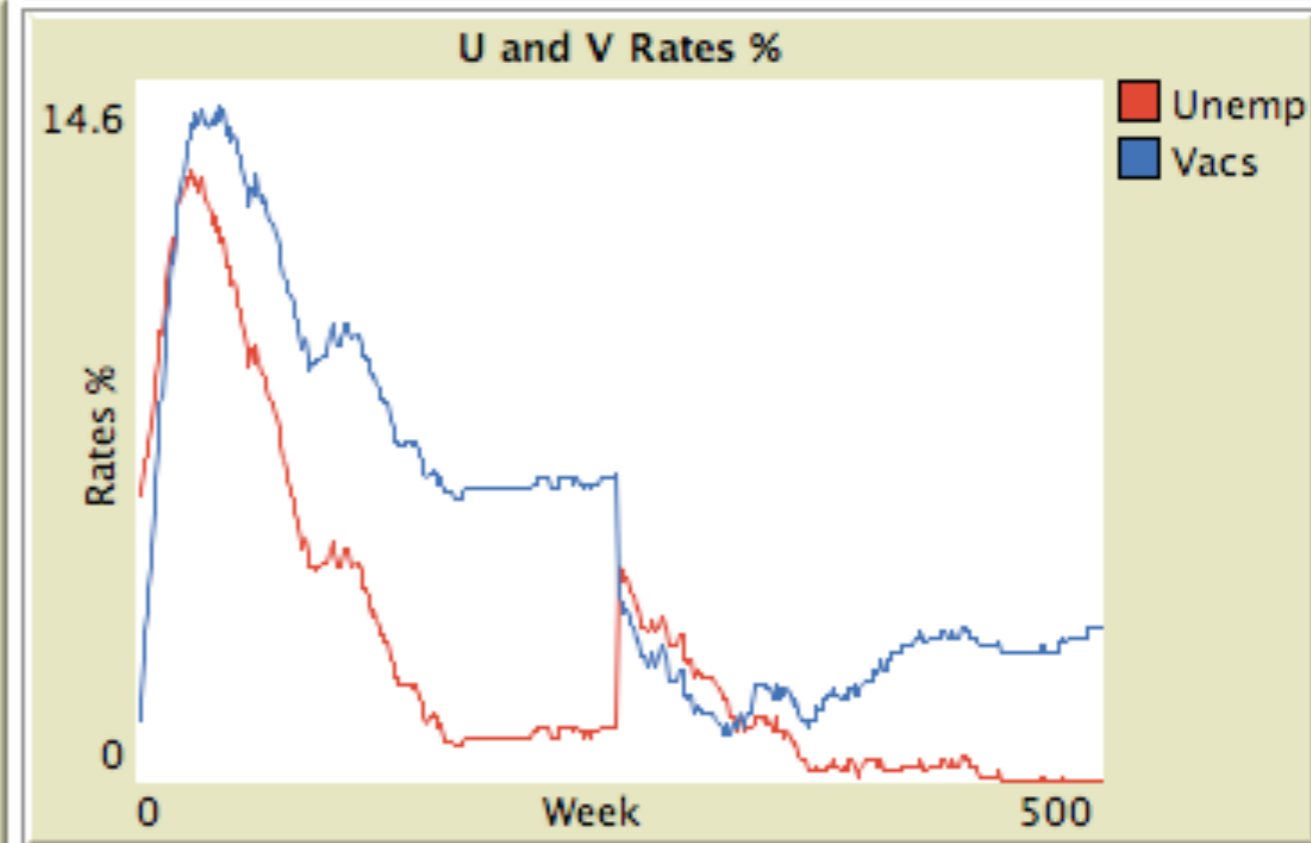
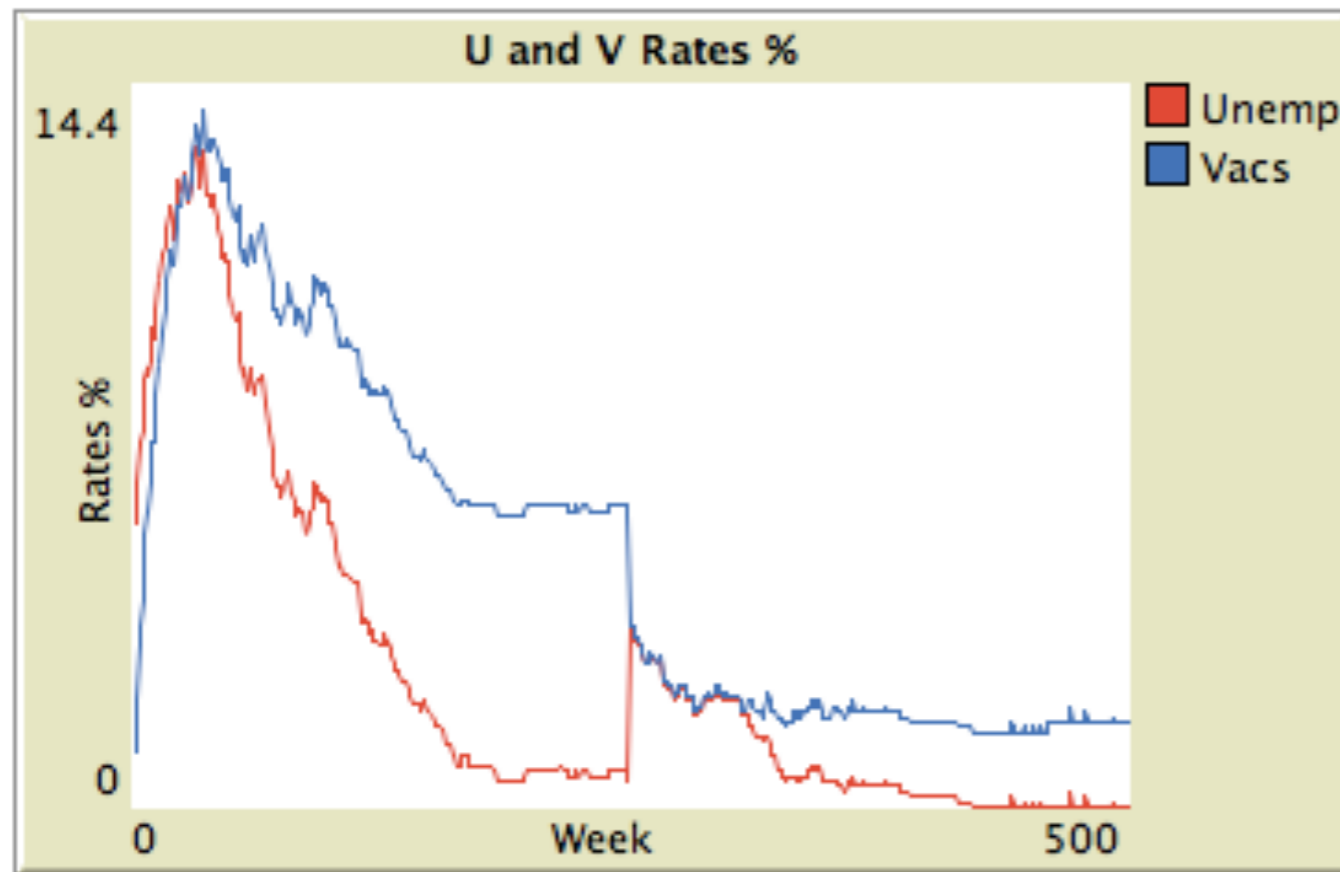
Government Funding
Index = 10



Government Funding
Index = 75

Effect of a Combination of Stimulus #1 & #2

A combination of Tax Cuts and Government Funding improves economic recovery

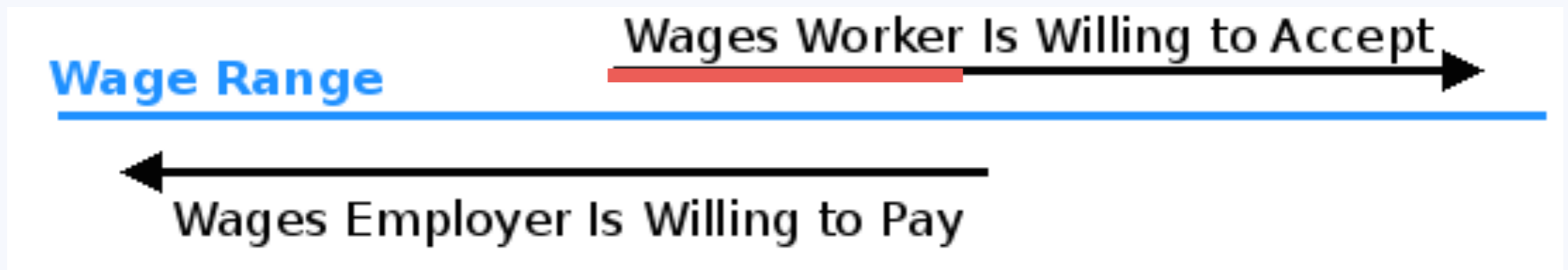


Large Tax Cut (-20%)
& A Small amount of
Government Funding (10)

Small Tax Cut (-5%)
& A Large amount of
Government Funding (25)

Stimulus #3: Unemployment Insurance

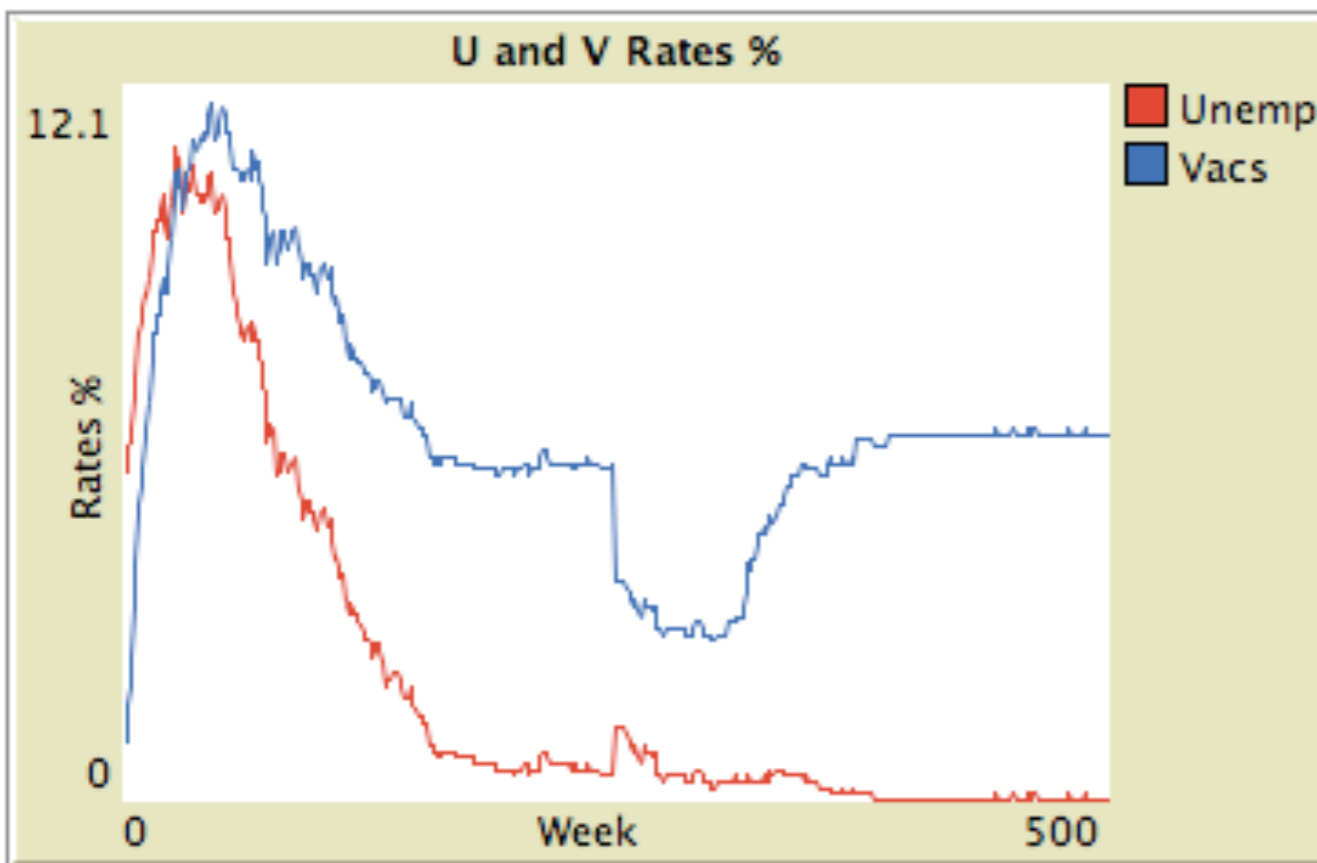
Workers are unwilling to accept a wage lower than their last wage while on unemployment insurance



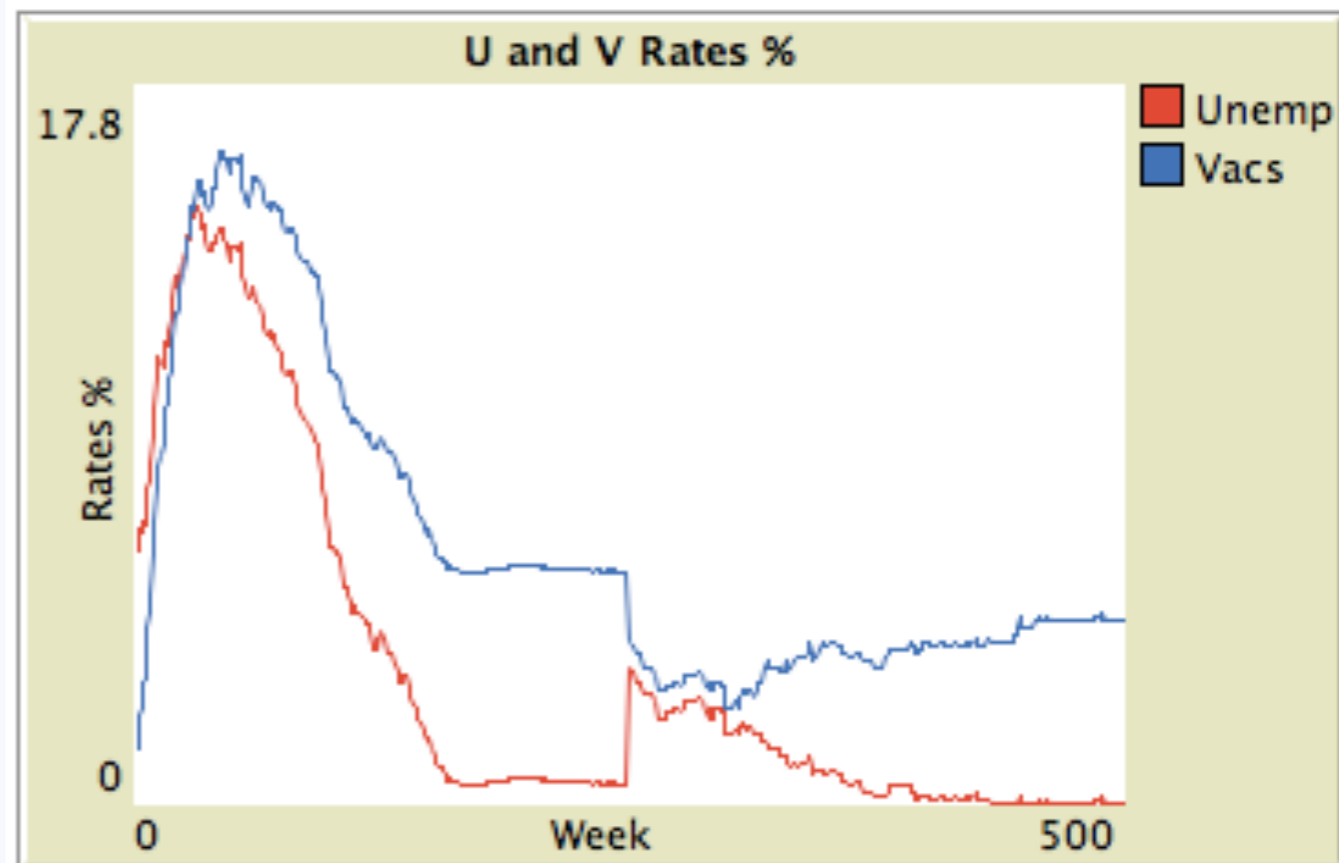
Range of wages a worker is willing to accept shrinks

Results: Effect of Unemployment Insurance

Increasing the Duration of Unemployment Insurance has a detrimental effect on economic recovery



A Stimulus Package Without Increasing Insurance



The Same Stimulus Package Increasing Insurance

Successes & Limitations

- ❖ The Developed Model Successfully:
 - ❖ Reflects the heterogeneity of the labor market
 - ❖ Demonstrates a recession
 - ❖ Shows the relative effect of the different stimulus components
- ❖ The Model is Limited By:
 - ❖ Only shows relative, not absolute effect
 - ❖ The model is simplified