**JBS Food Production Model UI Controls Manual**

**Overview**

This manual explains the interface controls for the JBS 2.0 NetLogo model, which simulates the U.S. meat processing industry and its vulnerability to cyberattacks. The model demonstrates how disruptions to major meat processors can affect food security and national security.

**Shock Parameters**

**Shock Scenario Chooser**

* **Purpose**: Selects a predefined scenario with preset values for shock magnitude, duration, and other parameters.
* **Options**:
  + **Mild Disruption**: A small-scale cyberattack with 10% production loss and quick recovery (5 ticks).
  + **Severe Crisis**: A major cyberattack with 50% production loss and extended recovery time (30 ticks).
  + **Recovery Boost**: A moderate attack (30% production loss) with industry support for recovery (20 ticks).

**Target Firm Chooser**

* **Purpose**: Selects which meat processing firm will be targeted by the cyberattack.
* **Options**:
  + **JBS (24%)**: The largest processor with 24% market share.
  + **Tyson Foods (22%)**: The second-largest processor with 22% market share.
  + **Cargill (19%)**: The third-largest processor with 19% market share.
  + **National Beef (12%)**: The fourth-largest processor with 12% market share.
  + **Random**: Randomly selects one of the major firms.

**Shock Start Time Slider (0-100)**

* **Purpose**: Determines when the cyberattack occurs during the simulation.
* **Default**: 10 ticks
* **Example Values**:
  + **5**: Early disruption before the system stabilizes.
  + **50**: Mid-simulation disruption when the system is stable.
* **Impact**: Earlier shocks may cause more severe disruptions as the system hasn't had time to build resilience.

**Apply Shock? Switch**

* **Purpose**: Toggles whether a cyberattack will occur during the simulation.
* **Options**: On/Off
* **Impact**: When off, no shock will be applied, allowing you to observe normal market conditions.

**Shock Duration Slider (0-100)**

* **Purpose**: Sets how many ticks the cyberattack actively affects the targeted firm.
* **Default**: 20 ticks
* **Example Values**:
  + **5**: A brief disruption with quick resolution.
  + **30**: An extended disruption requiring significant recovery time.
* **Impact**: Longer durations lead to greater production losses and more severe food security impacts.

**Shock Percentage Slider (0-100)**

* **Purpose**: Determines the percentage of production capacity lost at the affected firm.
* **Default**: 50%
* **Example Values**:
  + **10%**: Minor disruption to operations.
  + **75%**: Severe disruption with significant production losses.
  + **100%**: Complete shutdown of the affected facility.
* **Impact**: Higher percentages lead to greater production losses, higher prices, and more significant food security concerns.

**Recovery Parameters**

**Recovery Rate Slider (0.01-0.5)**

* **Purpose**: Determines how quickly affected firms recover their production capacity.
* **Default**: 0.1 (10% recovery per tick)
* **Example Values**:
  + **0.05**: Slow recovery (20 ticks to full recovery).
  + **0.2**: Rapid recovery (5 ticks to full recovery).
* **Impact**: Lower recovery rates extend the impact of the disruption, leading to prolonged food security concerns.

**Cascading Effects Slider (0-1)**

* **Purpose**: Determines how much the shock spreads to other firms in the industry.
* **Default**: 0.2 (20% impact spread)
* **Example Values**:
  + **0.1**: Limited spread to other firms.
  + **0.4**: Significant industry-wide impact from the initial attack.
* **Impact**: Higher values create greater system-wide disruption as unaffected firms also experience production losses.

**Market Parameters**

**Price Elasticity Slider (0.5-3)**

* **Purpose**: Determines how sensitive meat prices are to changes in supply.
* **Default**: 1.5
* **Example Values**:
  + **0.8**: Low elasticity - prices respond weakly to supply changes.
  + **2.5**: High elasticity - prices respond strongly to supply changes.
* **Impact**: Higher values lead to more dramatic price spikes during production shortfalls.

**National Security Threshold Slider (0-100)**

* **Purpose**: Sets the food security index level below which national security concerns arise.
* **Default**: 25
* **Example Values**:
  + **40**: Conservative threshold where action is taken early.
  + **15**: Higher risk tolerance before declaring a national security issue.
* **Impact**: Lower thresholds mean the model reports national security risks only in more severe situations.

**Output Monitors**

**HHI (Market Concentration)**

* **Purpose**: Displays the Herfindahl-Hirschman Index, a measure of market concentration.
* **Interpretation**: Values above 2,500 indicate a highly concentrated market, which may be more vulnerable to disruptions.

**CR4 (%)**

* **Purpose**: Shows the Combined Ratio of the top 4 firms - the percentage of the market controlled by the four largest firms.
* **Interpretation**: Higher values indicate greater industry concentration.

**Production Loss (%)**

* **Purpose**: Shows the percentage reduction in total meat production compared to pre-shock levels.
* **Interpretation**: Higher values indicate more severe disruption to the meat supply.

**Price Increase (%)**

* **Purpose**: Shows the percentage increase in meat prices compared to pre-shock levels.
* **Interpretation**: Higher values indicate greater economic impact on consumers.

**Food Security Index**

* **Purpose**: Measures overall food security on a scale of 0-100.
* **Interpretation**: Lower values indicate greater food insecurity.

**National Security Risk**

* **Purpose**: Quantifies the risk to national security on a scale of 0-100.
* **Interpretation**: Higher values indicate greater risk to national security.

**Days of Supply**

* **Purpose**: Estimates the number of days of meat supply available in the system.
* **Interpretation**: Lower values indicate potential shortages.

**Most Affected Region**

* **Purpose**: Identifies which geographic region is experiencing the greatest impact.
* **Interpretation**: Helps target response efforts to the most affected areas.

**Supply Chain Health**

* **Purpose**: Measures overall supply chain function on a scale of 0-100.
* **Interpretation**: Lower values indicate greater supply chain disruption.

**Est. Recovery Time**

* **Purpose**: Estimates the number of ticks until full recovery.
* **Interpretation**: Higher values indicate longer projected recovery periods.

**Example Scenarios**

**Mild Localized Disruption**

* **Setup**: Shock Percentage: 20%, Shock Duration: 10, Recovery Rate: 0.2, Cascading Effects: 0.1
* **Expected Outcome**: Brief disruption with minimal national security impact.

**Severe Systemic Crisis**

* **Setup**: Shock Percentage: 80%, Shock Duration: 30, Recovery Rate: 0.05, Cascading Effects: 0.4
* **Expected Outcome**: Prolonged food security crisis with significant national security implications.

**Targeted Attack on Market Leader**

* **Setup**: Target Firm: JBS (24%), Shock Percentage: 60%, Shock Duration: 20
* **Expected Outcome**: Significant but manageable disruption to the meat supply.

**Multi-Regional Impact**

* **Setup**: Target Firm: Tyson Foods (22%), Cascading Effects: 0.5
* **Expected Outcome**: Widespread regional impacts due to the geographic distribution of Tyson's facilities.