**Appendix: Comparison of SED models based on supercomputers, big data and economic simulation with other models (first draft)**

| **Comparative projects** | **SED model** | **EURACE model** | **ASPEN** | **SD** | **DSGE** | **CGE** | **GTAP** | **EM** | **Game model** | **Sand table extrapolation** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Modeling mechanisms** | Mechanism modelling  Rule modeling  Data modelling | Mechanism modelling  Rule modeling  Data modelling | Rule modeling | Mechanism modelling | Mechanism modelling  Data modelling | Mechanism modelling  Data modelling | Mechanism modelling  Data modelling | Data modelling | Rule modeling | Rule modeling |
| **Deductive attributes** | Deduction Function (platform) | Deduction Function | Deduction Function | Deduction Function | Deduction Function | Deduction Function | Regression analysis | Regression analysis | Deduction Function | Simple Deduction Function |
| **System attributes** | Macro and micro integration  Macroeconomic policies have an impact on each microeconomic-subsystem; the agent behaviour of the microeconomic-system has an impact on macroeconomic aggregates. | Macroeconomic economy | Macro and micro integration | Microeconomics | Macro and micro are independent and not integrated | Macroeconomic economy | Macroeconomic economy | Macro and micro are independent, decomposed, and not integrated | Microeconomics | Microeconomics |
| **Regional economy** | Domestic regional economy: central, provincial, municipal and county-level local economy | None | None | None | None | None | None | None | None | None |
| **Government agent function** | Central Bank, Finance, Taxation, Welfare, Investment in Infrastructure Technology, | Central Bank, Finance, Taxation, Welfare | Central Bank, Finance, Taxation, Welfare | None | None | None | None | None | None | None |
| **Enterprise agent function** | Production, sales, investment, personnel, | Industry level, production and trading | Industry level, production and trading | None | None | None | None | None | Industry level, production and trading | Industry level, production and trading |
| **Function agent residents** | Employment, consumption, investment | Employment, consumption | Employment, consumption | None | None | None | None | None | Employment, consumption, investment | Employment, consumption |
| **Agent type** | Heterogeneous agent,260 types | Heterogeneous agent,9 types | Heterogeneous agent | agent concept | agent of homogeneity | agent concept | agent concept | agent concept | agent of homogeneity | Heterogeneous agent |
| **Agent number** | more than 10 million now | Tens of thousands | Agent not exceeding 2000 | agent concept | Up to 100 million supported | agent concept | agent concept | agent concept | Multiple agent | The number of people involved in the deduction is the same |
| **Realistic simulation** | Main economic indicators and real data error within 5% | Representing only some variable response trends | Only the results of the trend | No-fidelity | No simulation, only data analysis | No simulation, only data analysis | No simulation, only data analysis | No simulation, only data analysis | No-fidelity | Semi-physical simulation, No-fidelity |
| **Simulation step** | One step a day | One step a month | One month or year |  | One month or year | None | None | None | None | None |
| **Continuity** | Dynamic and Continuous Simulation System | Dynamic, discrete systems | Dynamic, discrete systems | Dynamic systems | Dynamic, discrete systems | Static systems | Static systems | Discrete systems | None | None |
| **Control mechanisms** | Every agent in the micro-economic system has independent decision-making mechanism, according to the local information of the system, according to the profit maximization of spontaneous decision-making;  According to the overall interests of the society, the government in the macroeconomic system adjusts the macroeconomic policy according to the fastest GDP growth rate under the premise of moderate unemployment and moderate difference between rich and poor. | Global Unified Control | Discrete decision making according to exogenous rules | only global automatic control.simulation process with iterative cycles. | Non-control mechanisms | Non-control mechanisms | Non-control mechanisms | Non-control mechanisms | Non-control mechanisms | Non-control mechanisms |
| **Value scales** | Global closed value calculation, according to the behavior results of each agent normalized analysis, forming a global value scale. Accordingly, each agent can calculate whether individual behavior achieves the goal of profit maximization according to local information when making every specific microeconomic behavior. | exogenous | None | None | There is global value calculation, but not from the micro system, does not affect the economic behavior of the micro system, is limited to the macro field, and is an open loop factor, not closed. | There is global value calculation, but not from the micro system, does not affect the economic behavior of the micro system, is limited to the macro field, and is an open loop factor, not closed. | There is global value calculation, but not from the micro system, does not affect the economic behavior of the micro system, is limited to the macro field, and is an open loop factor, not closed. | None | None | None |
| **System closure** | Support both closed-loop control and open-loop control | Closed-loop control | Closed-loop control | Closed-loop control | Open loop control | Open loop control | Open loop control | Open loop control | Open loop control | Open loop control |
| **Model output** | Consistent with realistic statistical structures of countries, industries, enterprises and residents | Selected macroeconomic indicators | in line with the realistic statistical structure of the state, industry and residents, but the number of industries, enterprises and residents is small | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries | Consistent with realistic statistical structures in countries and industries |
| **Hardware Conditions** | Supercomputer, Tianhe Series or Dawn; up to 36,000 nodes | Supercomputers | Microcomputer | Microcomputer | Supercomputers | Microcomputer | Microcomputer | Microcomputer | Microcomputer | Microcomputer |
| **Universal interface** | Yes | None | None | None | None | None | None | None | None | Yes |
| **Comprehensive description** | The equilibrium and non-equilibrium steady-state control model uses the method of system dynamics to describe the movement process of a complete iterative cycle of an economic system, including the economic process of production, circulation, distribution and consumption to form a relationship of industrial division and cooperation.  Through the modeling method based on mechanism, rules and data, the simulation object is controlled to simulate the economic activities of the central government of a country at all levels of government, province, land and county, and enterprises and residents in various industries every day, that is, the specific changes in the flow of people, logistics and capital flow. The model simulates the historical process with an accuracy of more than 95%, and can give an accurate and clear explanation of the causality between micro and macroeconomic factors in the process of economic operation.It has the functions of economic history process simulation, economic theory verification simulation, economic decision benefit analysis, economic operation optimization analysis, economic development trend prediction, economic shock early warning forecast and so on. | The economic model is modeled using a combination of dynamic stochastic general equilibrium models (DSGE) and subject-based computable models (ACE), including government, central banks, commercial banks, enterprises and residents | Dynamic stochastic non-equilibrium economic models, including government departments, banks, companies and households | The system dynamics method is used to describe the movement process of a complete iterative cycle of an economic system, including the economic process of production, circulation, distribution and consumption to form a relationship of industrial division and cooperation.  The system has stability, but no quality, can not describe the upgrade of the system.  It is a powerful tool to analyze and study complex systems by combining qualitative and quantitative analysis with computer simulation. | Analyzing a cross section of the economic process,  connections of multiple independent sections, each of which only studies the equilibrium of the total social product. The model has three characteristics. "Dynamic" means that economic individuals consider intertemporal optimal selection. Therefore, the model can explore the dynamic nature of how the variables in the economic system change with time. "Random" means that the economic system is affected by various exogenous random shocks. Possible shocks, for example, are technical, monetary or preference shocks. "General equilibrium" means the sum of the best choices made by every market participant in the macroeconomic system, such as consumers, manufacturers, governments and central banks, based on their preferences and expectations for the future. | The static general equilibrium model, which studies a section of an economic process, establishes a quantitative relationship between the various components of the economy, allowing us to examine the effects of disturbances from one part of the economy on the other. For the input-output model, it emphasizes the input-output linkage or correlation effect of the industry. | The static general equilibrium model studies a cross-section of economic processes, but there are multiple countries with the same cross-section, with the production, consumption, government expenditure of individual countries as a sub-model, after inputting data and converting the parameters, to quantify the data to describe the trade relations of countries. Finally, the sub-models can be linked into multi-national and multi-sector equilibrium models. The model can be used by users to simulate the changes of gross domestic production, social welfare, employment rate, import and export of the target country or region before the implementation of trade policy. | The whole socio-economic system is decomposed into several independent and unrelated economic components, which are studied and analyzed by econometric method. Including one or more random equations, which concisely and effectively describe, summarize the quantitative characteristics of a real economic system, and more deeply reveal the law of quantitative change of the economic system. is composed of a system or equation, which consists of variables and coefficients. where the system is also composed of equations.  Econometric Model  Econometric Model  The econometric model reveals the quantitative relationship between the various factors in economic activity and is described by stochastic mathematical equations. | under certain rules of the game, based on the environmental conditions of direct interaction, each participant relies on the information they have, and selects their own strategies (actions) to achieve the process of maximizing benefits and minimizing risk costs. A game in which people compete for profit | Through leading the students into a simulated competitive industry, a number of simulation companies are set up by the students in groups, around the visual sand table teaching aids, the actual combat exercises simulate the business management and market competition of the enterprise, improve the strategic management ability in the process of the success or failure of the simulated enterprise 3-4 years, and understand the true meaning of the management decision. |