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Impacts of Sino-US trade friction and the COVID-19 pandemic on Shanghai Economic Growth: A Modeling Scenario Analysis

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Abstract

This paper uses a computable general equilibrium (CGE) model to simulate Sino-US trade friction and the COVID-19 pandemic's effects on Shanghai's growth. We focus on reducing exports and transfers to ROC (rest of China) and the possible shrinking of production capacity caused by trade friction and the COVID-19 pandemic. Our results show that due to the unique trade relationship between Shanghai, the world market, and ROC, even if a reduction in exports and transfers to ROC, will only have a limited impact on Shanghai's economic growth. The decline in Shanghai's major manufacturing industries' production capacity will profoundly affect the Shanghai economy. Under the resonance of the impact of the Sino-US trade friction and the effect of the COVID-19 epidemic, preventing the shrinking of manufacturing capacity will be a significant challenge for the Shanghai economy. To ensure the sustainable growth of Shanghai's economy, promoting the improvement of TFP on the supply side is the most critical policy option for policymakers.

Keywords: Shanghai Economy, Sino-US Trade Friction, COVID-19, CGE Model

1. Introduction

Since March 2018, Sino-US trade friction has continued to escalate in the process of continuously levying tariffs. At the beginning of 2020, the outbreak of the COVID-19 made the trade friction between the two sides gradually beyond the scope of conventional tariff increases. It began to form a trend of decoupling in more comprehensive economic relations such as trade and investment. As the most crucial part of China's economy, Shanghai's economy has outstanding export-oriented characteristics and has highly integrated with the international economy. This research's primary concern is how the Sino-US trade friction will affect Shanghai's future economic growth. Most of the quantitative studies related to Sino-US trade frictions are mainly country-specific studies based on the world model. There are relatively few studies on the regional economy within a country. Regarding the Shanghai economy, the research on Sino-US trade frictions' impact mainly focuses on statistical analysis, empirical analysis, or partial equilibrium studies of specific industries. There is a lack of research based on the following analytical framework: How does the Sino-US trade friction change Shanghai's import and export and transfer to or from ROC, and ultimately affect Shanghai's economic growth.

This study uses the computable general equilibrium (CGE) model of Shanghai's regional economy to analyze Sino-US trade friction's impact on Shanghai's economic growth. This model is based on the input-output data for 2017 and distinguishes fourteen industry sectors, capturing both demand and supply side linkages, and simulations will conduct from 2020 to 2025. We organize this paper as follows. Section 2 introduces the background of the Sino-US trade friction impact on Shanghai's economic growth through relevant literature; Section 3 describes the model of Shanghai's economy, including the structure, database, and baseline scenario.

The baseline scenario considers the impact of COVID-9; Section 4 presents the simulation scenario design and the simulation result analysis; Section 5 concludes.

2. Background of the Problem

2.1 Literature Analysis on the Impact of Sino-US Trade Friction on the National level

Regarding the impact of Sino-US trade friction, early studies focused on the effects of tariffs on enterprises and industries. For example, in August 2018, PricewaterhouseCoopers (2018) released a research report that believed that Sino-US trade frictions would mainly affect Chinese and foreign-funded enterprises in related industries, especially those with more Sino-US import and export business. These industries mainly include food and beverage, chemical products, electronic products, textiles, metals, machinery, furniture, automobiles, agriculture, and other industries. Trade friction may also significantly impact China's auto, agriculture, and aviation industries and companies that rely on imports of intermediate products.

At the macro level, the Chinese Academy of Sciences has also conducted empirical research and calculation analysis on the impact of Sino-US trade friction (Fan, 2019). The study believes that the Sino-US economic and trade conflict has not significantly impacted the Chinese economy, and the effect is minimal and generally controllable. The primary basis is that the direct support for China's economic growth in recent years is domestic demand rather than foreign trade. China's trade dependence on the United States continues to decline. Instead, the European Union has become the first, and ASEAN has become the second. The Sino-US trade friction will bring losses to both sides. The conclusions of other similar research are identical.

Among the international academic empirical research, Robinson & Karen (2019), based on the world CGE model, analyze Sino-US trade frictions' possible impact on China and the United States and other major economies. The research results show that for the United States, import tariffs are essentially huge sales taxes levied on imported products and ultimately borne by American consumers. At the same time, tariffs increase intermediate goods' prices, increase American companies' costs, and weaken American companies' competitiveness. For China, tariffs increase the price of final consumer goods, but because China exempts some intermediate products from tariffs, the direct impact on Chinese manufacturers is relatively small.

Bown (2019) conducted a continuous, systematic statistical analysis of the Sino-US trade war. He believes that one of the essential meanings of the "phase one" agreement reached on December 13, 2019, is that the United States imposes tariffs on goods imported from China as the new normal. Even after the deal goes into effect, the U.S. tariffs on China will still cover about two-thirds of all U.S. imports from China. The average U.S. tariff on imports from China will increase to 19.3%, compared to 3.0% before the trade war. Even if tariffs were reduced when the first phase deal was implemented in early 2020, the share of tariffs on imported goods affected by tariffs would not decrease. Therefore, 64.5% of U.S. imports from China will still cover by tariffs. Moreover, the tariffs imposed on goods imported from China under Section 301 often targeted intermediate products, and more than 90% of parts imported from China will continue to hit. For foreign companies headed by U.S. companies, tariffs on intermediate products make it more costly to integrate with China's supply chain. The result is that these intermediate products face continuous pressure from the U.S. and China's economic decoupling.

2.2 Literature Analysis on the Impact of Sino-US Trade Friction on Shanghai's Economy

There is little literature on the relationship between Shanghai's economy and import and export trade. In the early quantitative analysis, the research of Li and Zhao (2005) is representative. The study uses the VAR model to analyze the correlation between imports, exports, and Shanghai's economic growth. The research results show that Shanghai's international trade, directly and indirectly, promotes Shanghai's economic growth. The research is based on a partial equilibrium framework and does not include the relationship between Shanghai's economy and ROC. The literature on this round of Sino-US trade friction and Shanghai's economic growth is minimal. Ku (2018) adopted statistical analysis and qualitative analysis to analyze the impact of this round of Sino-US trade friction on Shanghai's economy from three perspectives: the quality of economic development, the path of industrial upgrading, and the control of financial risks. Research shows that the Sino-US trade friction affects the interests of US-funded enterprises in Shanghai. The economic recovery of emerging market countries will boost exports from China and Shanghai and partially offset the Sino-US trade friction impact on Shanghai's exports.

Industries that rely heavily on exports to the United States are more affected, mainly electromechanical equipment and textile products, furniture, toys, and textiles, which account for 46.2%, 12.1%, and 9.9% of exports to the United States, respectively. This study believes that the Sino-US trade friction has a limited impact on Shanghai's high-tech industry. The research is mainly empirical and statistical analysis and does not involve Shanghai's economic growth.

The results of literature analysis show that at the national level, if only tariff increases, the impact of Sino-US trade friction will limit, and the adverse effects on the United States will be more significant. However, if the United States' significant tariffs on China are mainly intermediate products, its crackdown target will become foreign-funded enterprises in China. This action will force foreign-funded enterprises to move their industrial chains away from China, causing the decoupling of Sino-US economic relations. Regarding the Shanghai economy, a few existing studies' conclusions are consistent with national studies' findings. In 2020, the Sino-US trade friction continues to escalate, the first phase of the agreement begins to implement, the COVID-19 has spread across the world. The severance of trade and the stagnation of consumption and production have dealt a severe blow to the world economy. In particular, it caused a break in global business and industrial chains among many countries. The superimposed effect of tariff barriers formed by Sino-US trade friction and the destruction of the industrial chain by the COVID-19 pandemic may lead to the reconstruction of the global industrial chain. Once this reconstruction trend takes shape, it will inevitably have a profound impact on the Chinese economy, which is already facing the high normalized tariffs of the United States. It will also have a long-term effect on Shanghai's economic growth regarding Shanghai's international and domestic trade and the retention of foreign-funded enterprises in Shanghai. The above background analysis will incorporate a scenario analysis of Sino-US trade friction's impact on Shanghai's economic growth.

3. The Dataset and Baseline of Model for the Shanghai economy

CGE models designed to study development issues received considerable impetus from Dervis, de Melo, and Robinson (1982). Madden (1990) developed a dynamic regional CGE model of Australia as two regions of an economy. Sun and Islam (2017) also developed a single region model of Shanghai to study the linkage with ROW and ROC. The model used in this paper is focusing on the effects of goods trade activity on the Shanghai economy with a new dataset based on the 2017 input-output table and different industry distinctions. The basic structure and features of the model are presented in Sun and Islam (2017).

The baseline information summarized in the Social Accounting Matrix (SAM) form present in appendix table 1. The parameters of the model calibrate on the information contained in this SAM. It shows the balance between demand and supply in the output market, the balance between aggregate savings and investment, the budgetary balance of various actors, and the balance in the transactions with ROC and ROW. The SAM base on Shanghai's input-output table of 2017 and other macroeconomic and sectoral information obtained from *Shanghai Statistical Yearbook 2018*. The model uses five kinds of elasticity on CES and CET functions. GTAP data used to get the elasticity of substitution between labor and capital and between imports and domestic goods. The evidence is available in other studies to obtain the elasticity of transformation between domestically disposed of output and export and between export to ROC and ROW.

The first task using the CGE model is to establish the baseline scenario (for 2017-2025). The baseline needs to be reasonable, reflecting what would have happened if the recent trends by and large continued and parameter values did not change too much. For such a baseline, we need to assume that during 2017-2025 labor, real investment, and TFP of each industry, respectively. These values accord well with the recent experience. The scale parameter of exports in each sector is extrapolated based on exports' growth performance in the past. The exchange rate fixed at the 2017 level, the coefficients of intermediate inputs are assumed to remain the same as in the 2017 input-output table.

Appendix table 2 presents the baseline scenario in terms of average growth rates of key macroeconomic variables and the industry's gross value during 2017-2025. Therefore, the baseline scenario reflects the current trend of Shanghai's increasing dependence on ROW as a source of consumption and ROC as a source of demand for her output.

4. The Simulations and their results

4.1 Simulations Scenarios

The escalation of Sino-US trade friction will lead to changes in the international and domestic economic environment and the Shanghai economy's internal conditions. Whether on the supply side or the demand side, Shanghai's economic growth will have many uncertainties. The problem is how to convert the uncertainties (changes) caused by Sino-US trade frictions into quantitative exogenous variables related to designing scenarios for simulation analysis. This study is not to study how the Sino-US trade friction will reduce exports, but in this context, if exports are reduced (without distinguishing between the United States and other regions), to what extent will it affect Shanghai's economic growth. The purpose of the research is to analyze how the decline in exports and transfers to ROC affects Shanghai's economic growth and other macro performance (direct effects). Therefore, consider the following aspects in the scenario design.

First of all, the United States is the most important source of China's trade surplus, and reduced exports to the United States mean that the surplus will decrease. From 2000 to 2019, the trade surplus with the United States accounted for more than 100% of China's total surplus in 8 years, more than 90% in 3 years, and more than 80% in 2 years. From 2000 to 2019, the cumulative trade surplus with the United States was 3,437.9 billion, accounting for more than 70% of its cumulative trade surplus during the same period.

Shanghai's exports to the United States in 2019 decreased by 10.9% compared with the previous year (still maintained a surplus of 105.8 billion), to the E.U. decreased by 2.6% (deficit of 253.5 billion), and to Japan decreased by 4.2% (deficit of 99.4 billion), but for the "Belt and Road" countries grew by 5.9% (a deficit of 98.2 billion). Its exports to ASEAN, South Korea, and Taiwan are all in deficit. In contrast, exports to Hong Kong, China (the final destination of re-export trade is mostly the United States) increased by 6.6% (surplus of 130.4 billion). The total export volume still Maintained at about 0.4%.

It expects that the export situation will be more difficult after 2020, and Shanghai's total export volume may decline. The importance of trade activities, especially exports, to the Chinese economy and Shanghai's economy is self-evident. Over the years, export trade's continuous growth has been of great significance to China's economic growth. External demand has always been a vital pulling force for economic growth. The normalization of high tariffs in Sino-US trade friction will affect the export scale and trade surplus of China and Shanghai.

Secondly, Shanghai's economy has close trade relations (integration) with other provinces in the country. Other regions and cities are affected by the Sino-US trade friction and will affect Shanghai's economic growth by transferring products from or to Shanghai.

Third, the high tariff barriers formed by Sino-US trade friction and COVID-19 may lead to the reorganization of the global industrial chain, leading to the withdrawal of foreign-funded enterprises in China and Shanghai, which may lead to the shrinking of Shanghai's main manufacturing capacity. Before 2016, the export scale of foreign-funded companies in China was more extensive than that of domestic private and state-owned companies. After 2017, foreign-owned companies' export scale gradually surpassed private companies, but it is still far more extensive than state-owned enterprises' export capacity. Shanghai's exports of goods by foreign-funded companies in 2019 were 853 billion yuan, private companies were 347.1 billion yuan, state-owned companies were 156.5 billion yuan, and foreign-funded companies accounted for 40%. If foreign-funded companies gradually withdraw, it will affect the export capacity of China and Shanghai. Given the above aspects' impact, this study designed the following four simulation scenarios (see Table 1).

Table 1: Simulation Scenarios

Simulation scenario		Simulated content
A: 2020 revision based on Covid-19 (new baseline)		The economy shrinks in the first quarter of 2020
Decrease in exports	B1: Decline in demand for exports of manufacturing products (the impact of trade friction and the COVID-19 pandemic on the market for Shanghai's manufacturing products)	Major manufacturing exports decreased by 5%
	B2: Decline in demand for exports of all industries (the impact of trade friction and the COVID-19 pandemic on the market for Shanghai's all industries)	All industrial exports decreased by 5%
The decrease in transfer to ROC	C1: Decline in demand for the transfers to ROC of manufacturing products (the impact of trade friction and the COVID-19 pandemic on demand for Shanghai's manufacturing products)	Major manufacturing transfers to ROC decreased by 5%
	C2: Decline in demand for transfers to ROC of all industries (the impact of trade friction and the COVID-19 pandemic on the market for Shanghai's all industries)	All industrial transfers to ROC decreased by 5%
D: The withdrawal of foreign capital in major manufacturing industries		Major manufacturing capacity shrinks by 5%

Due to the impact of COVID-19, a large-scale stagnation of economic activities happened from the end of January to April 2020. The effect is comprehensive, involving all aspects of the supply side and the demand side. The sudden shrinking of output and the premature shrinking of exports are apparent. Therefore, scenario A is that Shanghai's major industries' production will shrink in 2020 (see below for details), and the state of the COVID-19 shock will use as the new baseline scenario.

Secondly, assuming that trade friction has led to a reduction in the international market's demand for Shanghai's manufacturing products (excluding trade in services), and B1 scenario, the exports of Shanghai's primary manufacturing industries will decline by 5% year by year. Trade friction has reduced the international market's demand for all sectors (including trade in services). In the B2 scenario, all industrial exports in Shanghai will fall by 5% year by year.

Third, in the C1 scenario, it is assumed that trade friction leads to a decrease in domestic market demand (decreased demand for Shanghai's manufacturing products in other provinces). Shanghai's manufacturing industry's transfers to ROC will reduce by 5% each year. In the C2 scenario, it is assumed that trade friction reduces domestic market demand (decrease in demand for the transfer of all industries in Shanghai from other provinces). The transfers to ROC of all sectors in Shanghai will decrease by 5% each year.

Fourth, Scenario D assumes that the major manufacturing industries will experience foreign capital withdrawal, causing Shanghai's major manufacturing industries to experience a 5% decline in production capacity each year.

4.2 Simulation Results

Scenario A: 2020 revision based on the epidemic Covid-19 (new baseline). The COVId-19 that occurred in early 2020 caused the suspension of large-scale economic activities nationwide in the first quarter, and the Shanghai economy is no exception. According to published data, the economic growth in the first quarter of 2020 was -6.7%. The real estate industry was -18.2%, the secondary industry was -18.1%, of which the manufacturing industry was -18.5%, and the tertiary industry was -2.7%. Assuming that after the economic restart, economic activities maintain the same growth rate of 6% in the baseline scenario, a rough estimate of the annual economic growth rate in 2020 will drop from 6% in the original baseline scenario to about 2.8%. Therefore, simulation scenario A becomes the new reference scenario for subsequent simulation scenarios. The main indicators of the new baseline scenario are presented in appendix table 3.

Scenario B: a simulation analysis of export demand reduction. The simulation results of scenario B1 (main manufacturing exports reduced by 5%) show that compared with the baseline scenario after the outbreak of COVID-19, at the macro level, the impact of Sino-US trade friction on Shanghai's actual GDP is minimal, basically around 0% float. This result is determined by the position of Shanghai's economy in the international economy and the domestic economy. The exports of Shanghai's major manufacturing industries to the global market are accompanied by a corresponding amount of intermediate product imports and transfers from ROC. The decline in manufacturing exports has led to a reduction in international market imports demand and domestic market transfer demand. Simultaneously, investment demand has increased, and household consumption and government consumption have decreased, while ROC transfers are weak. Therefore, in the final summary of GDP, growth factors and reduced factors hedge each other, and GDP changes little. Also, due to the decrease in exports, inflation has slowed down. Compared with the baseline scenario, the GDP deflation index has fallen, resulting in a nominal GDP reduction.

At the industrial level, the added value of major manufacturing industries has all decreased. The electronic equipment and communication equipment manufacturing industries, which accounted for the largest proportion of exports, experienced the largest decrease. In contrast, the added value of most service industries in the tertiary industry increased. Since Shanghai's service industry accounts for a relatively large proportion, the reduction in manufacturing value-added caused by the decline in manufacturing exports is offset by the increase in service industry value-added, and the actual total GDP changes slightly. See appendix table 4 for changes in the composition of specific GDP expenditure items and changes in specific industrial added value.

The simulation results of scenario B2 (all industrial exports reduced by 5%) show that compared with the baseline scenario, the impact on Shanghai's actual GDP is minimal at the macro level. This result is very close to scenario B1, where the exports of major manufacturing industries are reduced by 5%, and the impact on real GDP is weak. Because Shanghai's service industry exports account for a small proportion, and there is no corresponding import or transfer from ROC of intermediate products, even if it decreases, it will not have much impact. Also, the price (inflation) impact is smaller than in scenario B1, and the reduction in nominal GDP is slightly smaller. See appendix table 5 for changes in the composition of specific GDP expenditure items and changes in specific industrial added value.

Scenario C: A simulation analysis of transfer to ROC reduction. The simulation results of Scenario C1 (5% reduction in the transfer to ROC of major manufacturing industries) are very similar to the B1 scenario where manufacturing exports fell by 5%. Compared with the baseline scenario, the reduction in the transfer of major manufacturing products to the domestic market has a minimal impact on Shanghai's actual GDP. Like exports, Shanghai's primary manufacturing industry's relocation to the domestic market is accompanied by a corresponding amount of intermediate product imports and transfers from ROC. Conversely, the decline in manufacturing relocation has caused a decrease in international market import demand and domestic market transfer demand. GDP Increasing factors and decreasing factors are hedged, and GDP changes little. The price effect of the reduction is more significant. Compared with the baseline scenario, the GDP deflation index decreases, resulting in a nominal GDP decrease. From an industrial perspective, the added value of major manufacturing industries has reduced. The more the manufacturing industry that accounts for a larger proportion, the greater the impact on the added-value. For example, metal manufacturing, equipment manufacturing, petroleum and chemical manufacturing, etc. As in Scenario B1, since Shanghai's service industry accounts for a relatively large proportion, the reduction in manufacturing value-added caused by the decrease in manufacturing transfers is offset by the increase in service industry value-added, and the actual total GDP changes slightly. See appendix table 6 for changes in the composition of specific GDP expenditure items and changes in specific industrial added value.

The simulation results of Scenario C2 (5% reduction in the transfer to ROC of all industries) show that compared with the baseline scenario, the GDP change is similar to that of Scenario C1. Still, the magnitude is more extensive, and the impacts involved at the industrial level are different. Real GDP has increased, while nominal GDP has drastically reduced, and household consumption has drastically reduced. Therefore, it can determine that the reduction in service industry transfers has a more significant impact on market prices. The decline in demand for transfer to ROC has a substantial effect on imports and transfers from ROC, but it has little impact on exports. The industrial level is significantly different from scenario C1, where manufacturing transfers decrease. That is to say, the decrease in the value-added of the manufacturing industry has been significantly smaller.

Even the value-added of the electronics and communication equipment manufacturing industry has increased, and the service industry's value has also shown different changes. The difference from scenario C1 is mainly because Shanghai's intermediate input in the service industry is relatively small compared to the manufacturing industry. See appendix table 7 for changes in the composition of specific GDP expenditure items and changes in specific industrial added value.

Scenario D: The main manufacturing capacity shrinks by 5%. This scenario assumes that due to the normalization of high tariffs between China and the United States and the impact of COVID-19, there is a trend of restructuring the global industrial chain and the withdrawal of foreign-funded enterprises, causing Shanghai's main manufacturing capacity to shrink by 5% every year. From a macro perspective, compared with the baseline scenario, this scenario has a more significant impact on Shanghai's actual GDP, and the impact is increasing year by year. At the same time, international import and export trade and domestic transfers have shrunk, and the magnitude is relatively large. Household consumption, government consumption, and investment consumption have all decreased. This result shows that the economic impact of shrinking capacity is extensive and profound. At the same time, domestic prices rise (inflation), and nominal GDP rises. From an industrial perspective, the value-added of all industries have shrunk, and the value-added of the major manufacturing industries has fallen sharply. The impact has increased year by year. See appendix table 8 for changes in the composition of specific GDP expenditure items and changes in specific industrial added value.

5. Conclusions

In 2020, the high tariffs of Sino-US trade friction and the sudden impact of COVID-19 had formed a resonance effect. The prospects for Sino-US trade are unclear. At the same time, Sino-US economic decoupling has become a possible trend. This study constructed a computable general equilibrium (CGE) model of Shanghai's economy based on the 2017 data set and the economic data of the first quarter of 2020 (the quarter most affected by the COVID-19), the baseline scenario of the model Corrected. The revised simulation scenario A serves as a new baseline scenario for the study of Sino-US trade friction. On this basis, this study simulated the possible impact of Sino-US trade friction on Shanghai's economic growth. The simulation scenarios include reduced exports in the international market, reduced transfers to the domestic market, and production capacity shrinkage caused by the withdrawal of foreign investment in manufacturing.

The main research conclusions are as follows. First of all, suppose the Sino-US trade friction and the COVID-19 pandemic cause Shanghai's exports to the international market to decrease. It will only have a limited impact on Shanghai's actual GDP, which is determined by the position of Shanghai's economy in the global economy and the domestic economy. That because the export of Shanghai's primary manufacturing industry to the international market is accompanied by a corresponding amount of intermediate product imports (global) and transfer (domestic). The decline in manufacturing exports has led to a reduction in import demand in the international market and transfer demand in the domestic market. The increasing factors and decreasing factors of GDP offset each other, resulting in GDP growth being less affected by changes in exports.

Second, suppose the Sino-US trade friction and the COVID-19 pandemic cause a reduction in the domestic market's demand for Shanghai's manufacturing products. In that case, the result will have a minimal impact on Shanghai's actual GDP. Like export to the international market, the export of Shanghai's primary manufacturing industries to the domestic market is accompanied by a corresponding amount of intermediate product imports and transfers from ROC. Conversely, the decline in manufacturing transfers has caused a decrease in international market import demand and domestic market transfer demand. As a result, increasing factors and decreasing factors offset each other and have little impact on GDP. However, unlike the manufacturing industry, the service industry has no corresponding intermediate products and no hedging effect. Therefore, if the transfer of all industries in Shanghai (including manufacturing and service industries) declines, the impact on Shanghai's real GDP will increase.

Third, suppose that the normalization of high tariffs between China and the United States and the impact of the COVID-9 pandemic will promote the global industrial chain's restructuring and cause foreign-funded enterprises' withdrawal. The resulting decline in Shanghai's major manufacturing industries' production capacity will significantly impact Shanghai's actual GDP. At the same time, international import and export trade and domestic transfers will dramatically shrink. Such a result means that the shrinking capacity's economic impact is extensive and profound, far greater than the general export reduction.

All in all, as a regional economy, the impact of the decline in exports on Shanghai's economic growth is not significant. That is determined by Shanghai's trade relations with the international market, the domestic market, and Shanghai's industrial structure. Although export trade has little impact on Shanghai's economic growth, it is of great significance to the domestic market (China's economy) because Shanghai's exports will increase transfers from ROC and boost ROC's economic growth. Simultaneously, the products that Shanghai has transferred to the domestic market are products that integrate the international market's technological supply and are of great significance to improving domestic market productivity (ROC and Shanghai). Suppose there is a withdrawal of foreign capital due to the Sino-US trade friction and the COVID-19 pandemic, resulting in a decline in Shanghai's manufacturing capacity. In that case, it will severely damage the Shanghai economy and the Chinese economy.

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Appendix Table 1: Shanghai Social Accounting Matrix (SAM) (2017, 100 Million Yuan)

	Activities	Commodities	Capital	Labor	Enterprises	Households.	Government	Investment	Export to ROC	Export to World	Total
Activities		31351							49270	13493	94114
Commodities	63420					12970	4642	12193			93225
Capital	11770										11770
Labor	13607										13607
Enterprises			11770								11770
Households				11876	8162		6014				26052
Government	5316			1731	3608		5862				16517
Savings						13082			-13459	12570	12193
Import from		35812									35812
Import from World		26063									26063
Total	94114	93225	11770	13607	11770	26052	16518	12193	35812	26063	

Appendix table 2: Baseline of Shanghai Economy, 2017-2025 (100 Million Yuan) [1]

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Real GDP growth rate	6.90%	6.65%	6.11%	6.00%	5.93%	5.81%	5.69%	5.58%	5.46%
Real GDP	30633	32671	34668	36746	38924	41185	43529	45957	48467
Nominal GDP	30633	33473	36409	39793	43542	47699	52304	57403	63045
GDP deflator	1.00	1.02	1.05	1.08	1.12	1.16	1.20	1.25	1.30
Households consumption	12970	14129	15319	16685	18185	19833	21640	23620	25790
Gonvernment	4581	4881	5176	5498	5839	6200	6582	6987	7416
Investment	12194	13052	13622	14214	14825	15453	16099	16763	17444
Transfer to ROC	49270	52407	55410	58571	61901	65380	69012	72804	76761
Export	13493	14103	14371	14678	14986	15291	15591	15887	16179
Transfer from ROC	35812	38164	40334	42593	45008	47580	50322	53246	56368
Import	26063	27737	28896	30306	31804	33391	35073	36858	38755
I1	728	759	761	765	770	773	776	779	780
I2	2709	2814	2896	2983	3071	3157	3243	3327	3410
I3	1474	1529	1561	1595	1628	1661	1693	1725	1756
I4	1780	1852	1912	1973	2035	2098	2160	2223	2286
I5	589	612	623	635	647	658	670	681	692
I6	6941	7377	7891	8423	8981	9559	10156	10772	11407
I7	698	726	747	769	791	813	835	858	880
I8	3803	4094	4379	4675	4986	5310	5647	5997	6360
I9	3207	3582	3954	4355	4791	5261	5768	6314	6901
I10	971	1029	1068	1109	1150	1192	1234	1277	1320
I11	115	115	116	115	115	115	114	114	113
I12	5331	5806	6283	6780	7309	7869	8461	9087	9748
I13	416	439	463	486	511	537	563	589	616
I14	1873	1992	2108	2225	2346	2470	2599	2731	2867

[1] I1: Electronic & Communication Equipment Manufacturing; I2: General Equipment Manufacturing; I3: Light Industry & Textile Manufacturing; I4: Petroleum & Chemical Manufacturing; I5: Electrical & Instrument Manufacturing; I6: Retail Wholesale & Business Services; I7: Metal Smelting & Product Manufacturing; I8: Other Social Service Industries; I9: Transportation & communication industry; I10: Construction industry; I11: Agriculture; I12: Finance & insurance service industry; I13: Water, electricity & gas industry; I14: Real estate industry.

Appendix Table 3: New Baseline of Shanghai Economy, 2017-2025 (10 Million Yuan)

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Real GDP growth rate	6.9%	6.65%	6.11%	2.80%	5.84%	5.73%	5.61%	5.50%	5.39%
Real GDP	30633	32671	34668	35639	37722	39883	42122	44439	46832
Nominal GDP	30633	33473	36409	39572	43267	47358	51887	56897	62435
GDP deflator	1.00	1.02	1.05	1.11	1.15	1.19	1.23	1.28	1.33
Households consumption	12970	14129	15319	16637	18117	19741	21520	23469	25601
Gonvernment	4581	4881	5176	5396	5728	6081	6453	6848	7266
Investment	12194	13052	13622	13806	14377	14962	15561	16173	16799
Transfer to ROC	49270	52407	55410	56172	59331	62632	66078	69676	73429
Export	13493	14103	14371	14058	14340	14617	14889	15157	15421
Transfer from ROC	35812	38164	40334	41168	43482	45947	48574	51377	54369
Import	26063	27737	28896	29262	30690	32202	33806	35507	37315
I1	728	759	761	730	733	736	737	738	739
I2	2709	2814	2896	2825	2905	2984	3062	3139	3215
I3	1474	1529	1561	1515	1545	1574	1603	1631	1659
I4	1780	1852	1912	1870	1927	1984	2041	2098	2155
I5	589	612	623	604	615	625	635	645	655
I6	6941	7377	7891	8136	8669	9220	9791	10379	10985
I7	698	726	747	727	748	768	788	808	828
I8	3803	4094	4379	4491	4787	5094	5414	5747	6091
I9	3207	3582	3954	4229	4650	5104	5594	6122	6689
I10	971	1029	1068	1041	1076	1111	1146	1181	1215
I11	115	115	116	110	110	109	108	108	107
I12	5331	5806	6283	6764	7283	7832	8413	9027	9675
I13	416	439	463	486	511	537	563	589	616
I14	1873	1992	2108	2139	2251	2367	2485	2607	2732

Appendix Table 4: The Impact of 5% Decrease in Shanghai Manufacture's Export to ROW (%)

	2020	2021	2022	2023	2024	2025
Real GDP	0.02	0.02	0.01	0.00	-0.03	-0.06
Nominal GDP	-0.63	-1.16	-1.59	-1.94	-2.22	-2.44
GDP deflator	-0.65	-1.18	-1.60	-1.93	-2.19	-2.38
Households consumption	-0.43	-0.79	-1.09	-1.33	-1.51	-1.66
Gonvernment consumption	-0.03	-0.06	-0.09	-0.13	-0.17	-0.21
Investment	0.14	0.25	0.36	0.45	0.52	0.58
Transfer to ROC	-0.02	-0.03	-0.04	-0.05	-0.05	-0.06
Export	-1.81	-3.52	-5.15	-6.69	-8.15	-9.53
Transfer from ROC	-0.37	-0.70	-0.98	-1.23	-1.43	-1.60
Import	-0.58	-1.10	-1.55	-1.94	-2.27	-2.55
I1	-3.09	-6.04	-8.84	-11.49	-14.01	-16.38
I2	-0.28	-0.55	-0.81	-1.06	-1.29	-1.51
I3	-1.01	-1.97	-2.88	-3.72	-4.50	-5.22
I4	-0.31	-0.60	-0.89	-1.15	-1.40	-1.63
I5	-1.31	-2.54	-3.69	-4.77	-5.76	-6.68
I6	0.12	0.22	0.30	0.37	0.43	0.48
I7	-0.54	-1.04	-1.50	-1.94	-2.34	-2.70
I8	0.24	0.44	0.60	0.72	0.80	0.86
I9	0.35	0.66	0.92	1.14	1.32	1.47
I10	0.19	0.35	0.50	0.62	0.73	0.83
I11	-0.16	-0.33	-0.50	-0.67	-0.83	-0.99
I12	0.25	0.47	0.65	0.81	0.95	1.06
I13	-0.06	-0.11	-0.13	-0.14	-0.13	-0.12
I14	0.25	0.45	0.63	0.77	0.89	0.98

Appendix Table 5: The Impact of 5% Decrease in All Shanghai Industry's Export to ROW (%)

	2020	2021	2022	2023	2024	2025
Real GDP	0.02	0.02	0.01	0.00	-0.02	-0.05
Nominal GDP	-0.46	-0.84	-1.14	-1.37	-1.55	-1.69
GDP deflator	-0.45	-0.81	-1.10	-1.33	-1.51	-1.64
Households consumption	-0.30	-0.53	-0.72	-0.87	-0.97	-1.05
Gonvernment	0.02	0.02	0.02	0.02	0.01	-0.01
Investment	0.11	0.20	0.28	0.34	0.39	0.43
Transfer to ROC	-0.05	-0.10	-0.14	-0.18	-0.22	-0.25
Export	-1.72	-3.33	-4.84	-6.25	-7.56	-8.78
Transfer from ROC	-0.34	-0.64	-0.90	-1.11	-1.29	-1.44
Import	-0.58	-1.09	-1.53	-1.90	-2.22	-2.49
I1	-3.14	-6.14	-8.97	-11.66	-14.20	-16.60
I2	-0.35	-0.69	-1.01	-1.31	-1.59	-1.85
I3	-1.09	-2.11	-3.07	-3.96	-4.79	-5.54
I4	-0.38	-0.73	-1.07	-1.38	-1.67	-1.94
I5	-1.38	-2.68	-3.89	-5.02	-6.06	-7.01
I6	0.21	0.40	0.56	0.69	0.79	0.88
I7	-0.60	-1.16	-1.68	-2.16	-2.60	-3.00
I8	0.33	0.61	0.84	1.02	1.16	1.27
I9	0.32	0.60	0.82	1.01	1.15	1.27
I10	0.16	0.29	0.41	0.50	0.59	0.65
I11	0.22	0.39	0.52	0.62	0.69	0.74
I12	0.19	0.34	0.47	0.58	0.66	0.72
I13	-0.07	-0.12	-0.16	-0.18	-0.19	-0.19
I14	0.19	0.34	0.46	0.56	0.64	0.70

Appendix Table 6: The Impact of 5% Decrease in Shanghai Manufacture's Export to ROC (%)

	2020	2021	2022	2023	2024	2025
Real GDP	0.03	0.05	0.06	0.06	0.06	0.05
Nominal GDP	-1.14	-2.07	-2.86	-3.52	-4.07	-4.53
GDP deflator	-1.10	-1.99	-2.75	-3.40	-3.93	-4.37
Households consumption	-0.75	-1.36	-1.87	-2.29	-2.64	-2.92
Gonvernment consumption	0.03	0.03	0.02	-0.01	-0.05	-0.11
Investment	0.25	0.47	0.67	0.84	0.99	1.13
Transfer to ROC	-0.65	-1.23	-1.78	-2.28	-2.74	-3.17
Export	-0.73	-1.44	-2.16	-2.89	-3.62	-4.35
Transfer from ROC	-0.74	-1.40	-2.01	-2.56	-3.07	-3.54
Import	-0.91	-1.72	-2.48	-3.20	-3.86	-4.47
I1	-0.56	-1.10	-1.69	-2.31	-2.97	-3.67
I2	-2.47	-4.79	-7.07	-9.30	-11.48	-13.59
I3	-1.64	-3.24	-4.86	-6.48	-8.11	-9.72
I4	-1.78	-3.48	-5.15	-6.81	-8.43	-10.02
I5	-1.53	-3.01	-4.52	-6.04	-7.56	-9.07
I6	0.48	0.89	1.26	1.59	1.87	2.11
I7	-2.58	-4.99	-7.36	-9.68	-11.93	-14.12
I8	0.75	1.38	1.92	2.39	2.78	3.10
I9	0.73	1.35	1.89	2.37	2.78	3.12
I10	0.37	0.68	0.97	1.23	1.46	1.67
I11	0.50	0.90	1.22	1.48	1.67	1.82
I12	0.43	0.79	1.11	1.38	1.62	1.81
I13	-0.17	-0.31	-0.42	-0.51	-0.57	-0.62
I14	0.43	0.78	1.09	1.35	1.56	1.74

Appendix Table 7: The Impact of 5% Decrease in All Shanghai Industry's Export to ROW (%)

	2020	2021	2022	2023	2024	2025
Real GDP	0.11	0.23	0.37	0.53	0.71	0.92
Nominal GDP	-3.39	-6.49	-9.44	-12.25	-14.93	-17.47
GDP deflator	-3.29	-6.31	-9.19	-11.95	-14.57	-17.08
Households consumption	-2.61	-5.01	-7.31	-9.51	-11.61	-13.62
Gonvernment consumption	-0.23	-0.47	-0.74	-1.03	-1.36	-1.71
Investment	0.38	0.77	1.18	1.63	2.11	2.61
Transfer to ROC	-0.65	-1.22	-1.77	-2.27	-2.75	-3.19
Export	-0.03	-0.04	-0.04	-0.03	-0.01	0.02
Transfer from ROC	-1.17	-2.29	-3.39	-4.48	-5.57	-6.66
Import	-1.09	-2.12	-3.15	-4.17	-5.20	-6.22
I1	0.12	0.28	0.45	0.61	0.78	0.95
I2	-1.59	-3.06	-4.50	-5.92	-7.29	-8.63
I3	-0.69	-1.36	-2.05	-2.76	-3.49	-4.24
I4	-0.93	-1.81	-2.70	-3.59	-4.48	-5.37
I5	-0.59	-1.17	-1.76	-2.36	-2.97	-3.59
I6	0.20	0.40	0.61	0.82	1.05	1.29
I7	-1.80	-3.47	-5.12	-6.73	-8.29	-9.82
I8	0.77	1.48	2.15	2.78	3.38	3.94
I9	-0.53	-1.04	-1.55	-2.07	-2.58	-3.09
I10	0.17	0.37	0.66	1.02	1.46	1.99
I11	0.43	0.87	1.38	1.97	2.64	3.38
I12	0.44	0.82	1.20	1.57	1.92	2.27
I13	-0.16	-0.25	-0.30	-0.30	-0.24	-0.13
I14	1.12	2.18	3.24	4.30	5.34	6.37

Appendix Table8: The Impact of Main Manufacturing Capacity Shrinks by 5% (%)

	2020	2021	2022	2023	2024	2025
Real GDP	-0.65	-1.65	-2.57	-3.40	-4.15	-4.81
Nominal GDP	0.61	1.33	1.91	2.36	2.69	2.90
GDP deflator	0.60	1.30	1.88	2.32	2.65	2.86
Households consumption	-0.56	-1.25	-1.83	-2.31	-2.68	-2.96
Gonvernment consumption	-0.17	-0.37	-0.53	-0.67	-0.77	-0.85
Investment	-0.05	-0.10	-0.14	-0.15	-0.15	-0.14
Transfer to ROC	-1.04	-2.66	-4.18	-5.61	-6.95	-8.17
Export	-1.79	-4.19	-6.63	-9.09	-11.57	-14.06
Transfer from ROC	-0.64	-1.64	-2.59	-3.49	-4.33	-5.11
Import	-0.91	-2.12	-3.31	-4.45	-5.56	-6.60
I1	-1.95	-3.91	-6.04	-8.32	-10.76	-13.35
I2	-3.25	-6.50	-9.83	-13.23	-16.67	-20.14
I3	-3.45	-6.82	-10.21	-13.62	-17.03	-20.43
I4	3.35	-0.41	-4.18	-7.93	-11.67	-15.36
I5	-3.24	-6.45	-9.72	-13.05	-16.42	-19.81
I6	-0.63	-1.35	-1.96	-2.46	-2.86	-3.16
I7	-2.85	-5.68	-8.63	-11.69	-14.85	-18.08
I8	-0.45	-0.93	-1.32	-1.61	-1.82	-1.95
I9	-0.39	-0.80	-1.13	-1.37	-1.54	-1.64
I10	-0.09	-0.18	-0.25	-0.30	-0.32	-0.32
I11	-0.47	-0.95	-1.35	-1.68	-1.92	-2.10
I12	-0.33	-0.68	-0.96	-1.18	-1.33	-1.42
I13	-0.25	-1.02	-1.71	-2.31	-2.84	-3.29
I14	-0.24	-0.49	-0.67	-0.80	-0.89	-0.92