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A Study on Economic Impact of a Korea-U.S. FTA: A Dynamic CGE Approach

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I. Introduction

- **Bilateral economic relations between Korea and the U.S. have advanced to the point that the two countries in Feb. 2006 announced their intension to negotiate an FTA, which they hope to complete by 2007.**
- **Korea and the U.S. had their first round of talks over a free trade accord on 5-9 June 2006, with their second round of talks slated for 10-14 July 2006.**

I. Introduction

- **The first official round was focused on mutual understanding by explaining their respective basic positions and reducing the gap in their respective positions in many fields.**
- **The second round is expected to determine the shape and future course of the controversial deal, by proposing concessions and ‘exceptional cases’ to protect their sensitive sectors and products.**

I. Introduction

- **The U.S. is Korea's 3rd largest trading partner, 2nd largest export market, and its largest supplier of foreign direct investment (FDI)**
- **Korea is the 7th largest trading partner of the U.S. and its 7th largest export market.**
- **Therefore, a Korea-U.S. FTA is expected to affect Korean economy as a whole to a large extent, which will be an important exogenous factor for Korea's growth in years to come.**

I. Introduction

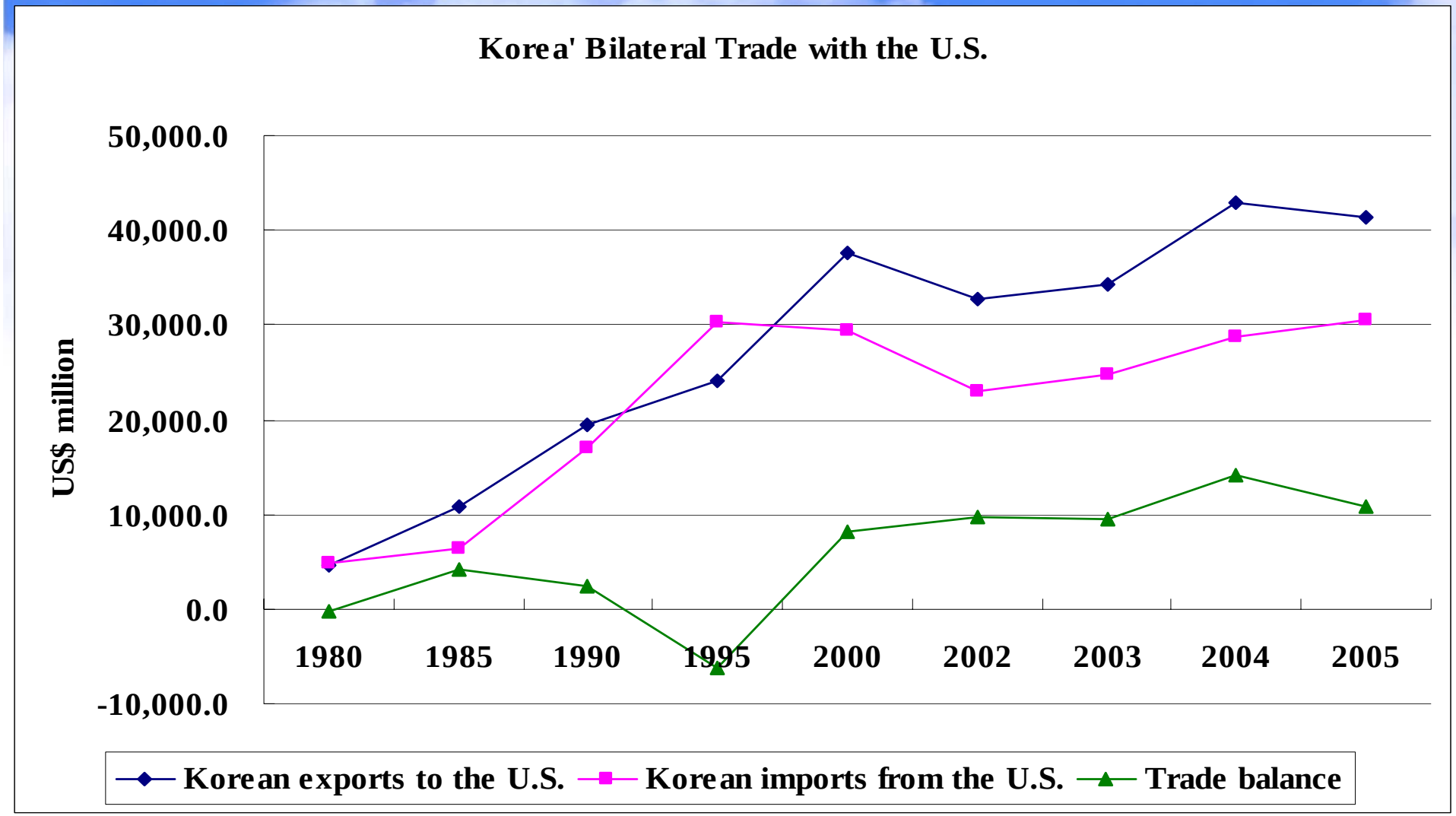
- **It is very important to estimate its potential economic effects in order to develop strategies for a Korea-U.S. FTA on the government level as well as on industry level.**
- **Some studies have been carried out by the Korea Institute for International Economic Policy (KIEP), in which a static Computable General Equilibrium (CGE) model was used.**

I. Introduction

- **Against this backdrop, the objective of this study is:**
  - **To conduct a quantitative assessment of potential economic effects of a Korea-U.S. FTA**
  - **Using a multi-region, multi-sector, recursively dynamic CGE model.**

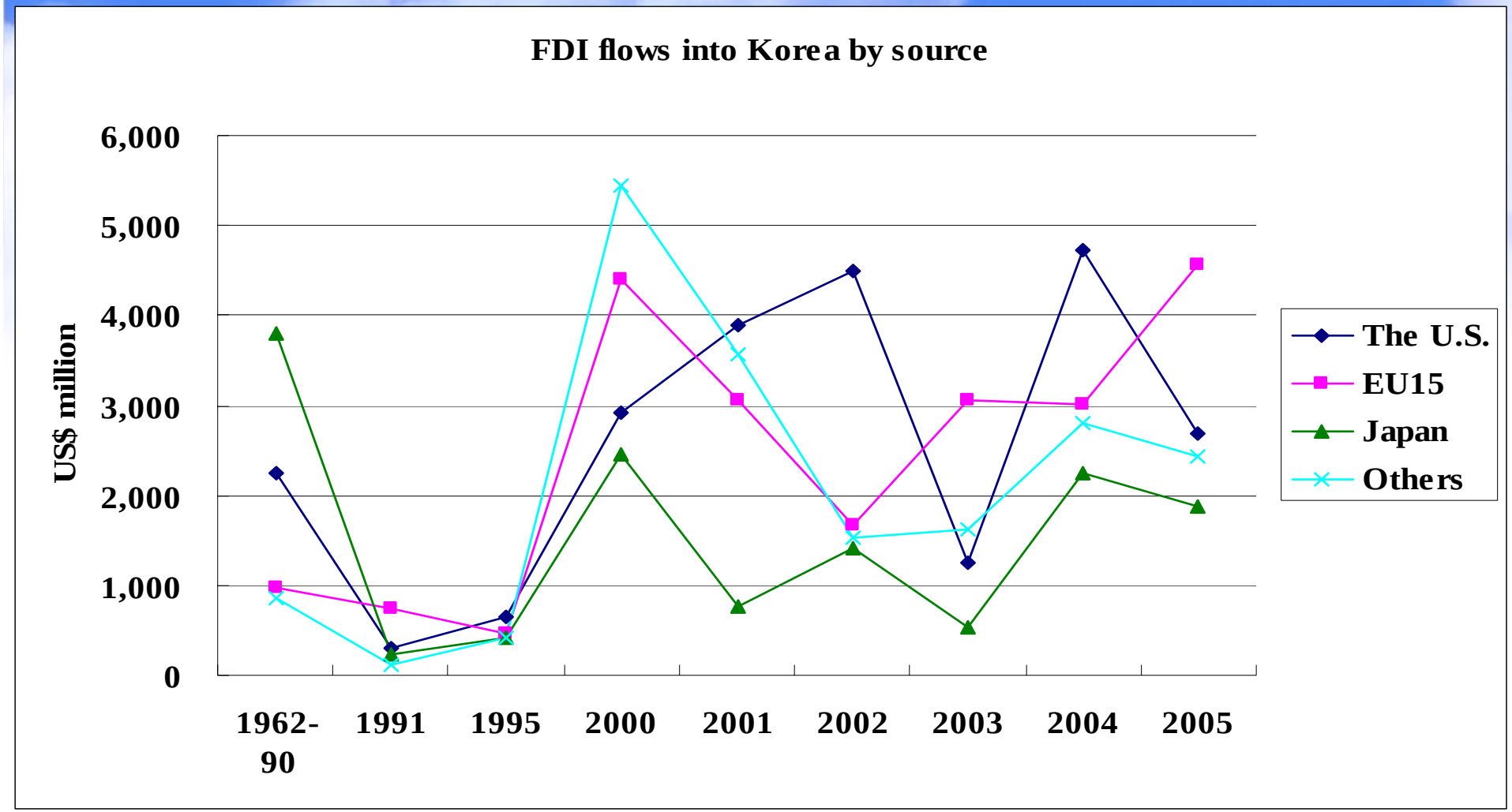
II. Economic Relations between China and Korea

Figure 1: Korea's Bilateral Trade with the U.S.



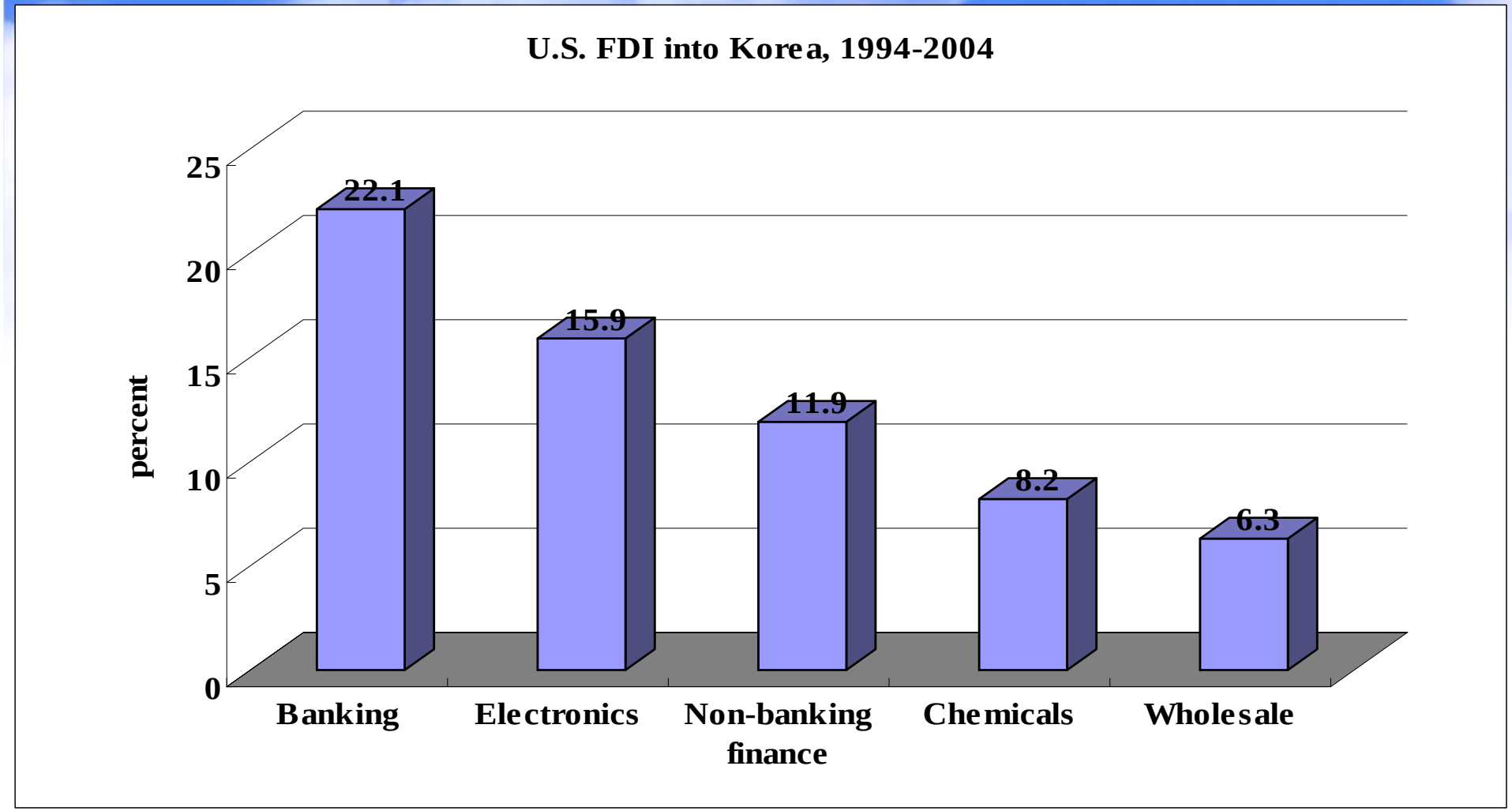
Source: Korea International Trade Association

Figure 2: FDI into Korea by Country (US$ million)



Source: Korean Ministry of Commerce, Industry and Energy

Figure 3: U.S. FDI into Korea by Industry (percent)



Source: BEA, November 2005

Data used in this study

- **The CGE model is applied to a 3-region by 21-sector aggregation of the version 6.2 of GTAP DB pre-release version 6.2, which was released in May 2006.**
- **3 regions include Korea, the U.S.A. and ROW.**
- **The GTAP data base is supplemented with foreign income data from the IMF Balances of Payments statistics to track international capital mobility and foreign wealth.**

List of 21 Sectors

Name	Description
1. Rice	Rice
2. OthCrops	Other crops except for rice
3. VgtFrt	Vegetable and fruits
4. LvstkMtDry	Livestock, meat and dairy products
5. Fishery	Fishery
6. Extract	Extract
7. PrcFood	Processed food
8. TextApp	Textile and apparel
9. WoodPaper	Wood, paper and publishing
10. PCheMineral	Petroleum, chemicals and other minerals

List of 21 Sectors

Name	Description
11. Metals	Metal and metal products
12. Autos	Automobiles and parts
13. OthTransp	Other transport equipment
14. Electronics	Electronics
15. Machinery	Machinery
16. OthMnf	Other manufactured goods
17. Construction	Construction
18. TradeTrans	Trade and transport services
19. Telecom	Telecommunications
20. FinanceBus	Finance and business services
21. OthServices	Other services

Table 1: Bilateral Trade by Sector in 2001 (US$ million)

	Korea's exports to the U.S.	*U.S.'s exports to Korea*
1 Rice	4	4
2 OthCrops	21	1,035
3 VgtFrt	23	88
4 LvstkMtDry	13	1,217
5 Fishery	2	5
6 Extract	2	200
7 PrcFood	212	622
8 TextApp	3,438	295
9 WoodPaper	476	560
10 PCheMineral	2,435	3,280
11 Metals	1,991	1,013

Source: GTAP DB pre-release version 6.2 (May 2006)

Table 1 (cont'd): Bilateral Trade by Sector in 2001 (US$ million)

	Korea's exports to U.S.	*U.S.'s exports to Korea*
12 Autos	6,969	324
13 OthTransp	282	2,706
14 Electronics	13,188	6,795
15 Machinery	4,172	5,336
16 OthMnf	926	245
17 Construction	3	4
18 TradeTrans	1,333	2,057
19 Telecom	112	187
20 FinanceBus	1,000	2,258
21 OthServices	935	1,137
Total	37,537	29,368

Source: GTAP DB pre-release version 6.2 (May 2006)

Table 2 : Bilateral Tariff Rates by Sector in 2001 (percent)

	Korea's tariffs on import from US	*US tariffs on imports from Korea*
1 Rice	1000.0	7.5
2 OthCrops	239.2	1.0
3 VgtFrt	52.5	0.7
4 LvstkMtDry	17.6	9.4
5 Fishery	19.6	0.0
6 Extract	1.7	0.1
7 PrcFood	21.8	4.3
8 TextApp	7.6	13.0
9 WoodPaper	2.8	0.4
10 PCheMineral	6.8	2.8
11 Metals	4.0	1.9
12 Autos	7.9	2.4
13 OthTransp	0.9	0.1
14 Electronics	0.6	0.2
15 Machinery	5.5	1.5
16 OthMnf	15.7	4.1
17 Construction	0.0	0.0
18 TradeTrans	0.0	0.0
19 Telecom	0.0	0.0
20 FinanceBus	0.0	0.0
21 OthServices	0.0	0.0

III. Overview of the Model

- **A Computable General Equilibrium (CGE) Model can be defined as a system of non-linear simultaneous equations describing the constrained optimization of behaviors of economic agents, such as producers, consumers, exporters, importers, savers, investors, and the government.**

III. Overview of the Model

- This study uses a multi-region, multi-sector recursively dynamic CGE model, which provides a comprehensive assessment of a Korea-U.S. FTA in a global context.
- The dynamic CGE model is a recursive-dynamic extension of the static CGE model, which was used for the analysis of several FTAs of Korea (Ko, 1995, 1998, 2000, 2002).
- The model preserves all the features of the static CGE model, while enhancing the investment theory to incorporate international capital mobility and ownership, based on Ianchovichina and McDougall (2000).

III. Overview of the Model

- A CGE Model is different from
  - a partial equilibrium model
  - a macro econometric model
  - an input-output model

III. Overview of the Model

- **The static aspects of the CGE model is neoclassical in spirit and is part of a long tradition of models that have been widely used to analyze the impact of global trade liberalization and structural adjustment programs.**
- **The earliest world CGE models were developed by Whalley (1985) and Deardorff and Stern (1990) to analyze the impact of the Tokyo Round of GATT negotiations.**
- **The model used in this study applies Whalley (1985) to endogenize all regions including the rest of the world and incorporates the macroeconomic specifications from Devarajan, Lewis and Robinson (1990) and Ko (1992).**

III. Overview of the Model

- **The CGE model has solid micro-foundations that are theoretically transparent.**
  - **Firms supply commodities to domestic and export markets via a CET (Constant Elasticity of Transformation) function, while minimizing production costs.**
  - **Production structures are represented by a nested production functions consisting of Cobb-Douglas and CES functions.**

III. Overview of the Model

- **The model includes 5 primary factors of production: unskilled labor, skilled labor, capital, land and natural resources; and intermediate inputs.**
- **Labor and capital are employed by all sectors, but land is used only in agricultural sectors, and natural resources are utilized in specific sectors.**
- **It is assumed that intermediate inputs and capital are traded between regions, whereas labor, land and natural resources are not traded.**

III. Overview of the Model

- Private consumption is represented via a Cobb-Douglas functional form.
- Product differentiation between domestic goods and imports, and imports by region of origin allows for two-way trade in each product category, depending on the ease of substitution between products from different regions (Armington approach).

III. Overview of the Model

- **Within each region, the model solves for commodity and factor prices that equate demand and supply in all commodity and factor markets.**
- **The model also solves for world prices, equating demand and supply for sectoral exports and imports across the world economy.**
- **In addition, for each region, the model specifies an equilibrium relationship between the balance of trade and the real exchange rate that measures the average price of traded goods relative to the average price of domestically produced goods sold on the domestic market.**

III. Overview of the Model

- **Some of the main features of the dynamic CGE model are as follows:**
  - **In each region, a single regional household collects income from primary factors of production such as labor, capital, land, and natural resources as well as all kinds of taxes and financial assets, and allocates them across private consumption, government expenditure, and savings according to a Cobb-Douglas utility function.**
  - **Financial assets represent claims on earnings from regional physical capital, which is owned by both domestic and foreign households via a global trust.**

III. Overview of the Model

- The global trust collects all the regional savings, and allocates them across regions to foreign investment.
- In the absence of policy reforms, the share of each regional household's wealth in domestic and foreign firms and the share of each region's capital stocks owned by domestic and foreign firms are held as close as possible to their initial values, subject to adding-up constraints, which means that their shares are likely to change, but the change is minimized.

III. Overview of the Model

- **Explicit modeling of the ownership of regional investment makes it possible to track the accumulation of wealth by foreigners, thereby ascertaining how a Korea-U.S. FTA might affect foreign investment and ownership in each region.**
- **The income accruing from the domestic and foreign ownership of assets can be appropriately incorporated into regional income, and hence the calculation of welfare, both for Korea, the U.S. and for all other regions.**

III. Overview of the Model

- The investment theory in the model makes it possible to link economic activity over time, while keeping track of endogenous regional capital stocks and financial wealth, international investment and income flows.
- Investment funds are used for the purchase of physical investment goods (in the form of FDI), which are then added to the existing stock of physical capital.

III. Overview of the Model

- **A disequilibrium approach for allocating investment across regions:**
  - **Investors respond to expected rates of return and act so as to eliminate errors in their expectations gradually over time.**
  - **In the process of adjustment, investors gradually eliminate any differences in the rates of return across regions that might exit in the short run by allocating capital from regions with lower rates of return to regions with higher rates of return, leading to equalization of rates of return across regions in the long run.**

How is investment determined?

- **Investment in a particular year is determined by three mechanisms.**
  - **The first one is the desire to eliminate errors in expectations (the second part of *Eq 1*). The expected rate of return falls by a portion (μ^r) of the error in expectations ($log(R^r_A/R^r_E)$) during the period (dY). Over time as the expected and actual rates of return converge, this error will be eliminated.**

Investment theory of the Dynamic CGE Model

$$Eq1: \hat{R}_E^r = -\phi^r (\hat{K}^r - \Omega^r dY) + \mu^r \log\left(\frac{R_A^r}{R_E^r}\right) dY$$

where

R_E^r **: Expected rate of return in region r**

$\hat{R}_E^r$ **: Proportionate change in the expected rate of return in region r**

R_A^r **: Actual rate of return in region r**

K^r **: Quantity of capital stock in region r**

ϕ^r **: Elasticity of the rate of return with respect to capital stock in region r**

Ω^r **: Normal growth rate of capital in region r**

μ^r **: Rate at which errors in expectations are eliminated in region r**

dY^r **: Change in years in region r**

How is investment determined?

- **The second one is the gradual equalization across regions of rates of return, which is reflected in *Eq 2*. This requires the movement of the expected rate of return in all regions towards the temporary equilibrium global rate of return (R_T), common to all regions. Differences between the target (R_T) and expected rates of return (R^r_E) determine the expected rate of growth in the gross rate of return (Γ^r_E). These differences are gradually eliminated at a rate determined by Λ^r.**

Investment theory of the Dynamic CGE Model

$$Eq\,2: \Gamma_E^r = \Lambda^r \left[\hat{R}_T - \hat{R}_E^r \right]$$

where

Γ_E^r **: Expected rate of growth in the expected rate of return in region r**

Λ^r **: Rate at which differences in the target and actual rate of return are eliminated in region r**

$\hat{R}_T$ **: Proportionate change in the target rate of return**

How is investment determined?

- **3) The third one is the equalization of all three rates of return. In the long run, the target and expected rates of return will have converged, leading to an expected rate of growth in the rate of return of zero (*Eq 2*). Errors will also have been eliminated ($R^r_A/R^r_E = 1$*)* and there will be no tendency for the expected rate of return to change ($\check{R}_E = 0$). For this to happen, the growth rate of capital must equal the normal growth rate of capital (first part of *Eq 1*) and investment and capital must be changing at the same rate (*Eq 3*). Additionally, there should be no tendency for the normal growth rate of capital to change ($\omega^r=0$ in *Eq 4*).**

Investment theory of the Dynamic CGE Model

$$Eq3: \Gamma_E^r = \phi^r \frac{I^r}{K^r}\left[\hat{I}^r - \hat{K}^r\right] + \phi^r d\Omega^r$$

where

I^r **: Investment in region r**

$\hat{I}^r$ **: Proportionate change in the investment in region r**

K^r **: Quantity of capital stock in region r**

ϕ^r **: Elasticity of the rate of return with respect to capital stock in region r**

$d\Omega^r$ **: Proportionate change in the normal growth rate of capital in region r**

Investment theory of the Dynamic CGE Model

$$Eq4: \omega^r = \Pi^r \left[\hat{K}^r + \frac{\hat{R}_A^r}{\phi^r} - \Omega^r dY \right]$$

$$Eq5: \hat{K}^r = I^r dY$$

where

ω^r **: Change in the normal rate of capital in region r**

Π^r **: Coefficient of adjustment for the normal growth rate of capital (** Ω^r **) in region r**

IV. Baseline and Policy Scenarios for a Korea-U.S. FTA

- **Two simulations are undertaken, one baseline scenario (without a Korea-U.S. FTA) and a policy scenario (with a Korea-U.S. FTA).**
- **The baseline scenario provides a picture of what the global economy is expected to look like without a Korea-U.S. FTA, while the policy scenario is used to examine the impact of a Korea-U.S. FTA.**
- **The difference between the baseline scenario and the policy scenario shows the effect of a Korea-U.S. FTA.**
- **The effects of a Korea-U.S. FTA are examined over the period of 2008 to 2021 in order to take into account of its long-run effects.**

IV. Baseline and Policy Scenarios for a Korea-U.S. FTA

- **1) The Baseline Scenario**
  - **To obtain the baseline scenario, forecasts of key macroeconomic variables and any anticipated policy changes are required, e.g. forecasts of the growth rates of GDP, gross domestic investment, skilled labor, unskilled labor and population for each region.**
  - **The baseline scenario also includes some policy shocks which have occurred, or which are expected to occur during the period of 2001 (base year) to 2021.**
  - **These policy shocks include implementation of the Uruguay Round, China's accession to the WTO in 2002, and a China-Hong Kong FTA**
  - **ASEAN-China FTA, ASEAN-Japan FTA, and ASEAN-Korea FTA could be considered for preciser estimation.**

IV. Baseline and Policy Scenarios for a Korea-U.S. FTA

- **2) The Policy Scenario**
  - **The dynamic nature of the model makes it possible to analyze the effects of alternative timing scenarios of a Korea-U.S. FTA.**
  - **For the policy scenarios, it is assumed that Korea-U.S. FTA negotiations will be concluded in 2007 and and that the FTA will come into effect in 2008.**
  - **The reduction of tariffs and non-tariff barriers is assumed to occur in equal installments over the period of 10 years from 2008 to 2017, which is different from an once-and-for-all tariff elimination in the case of a static CGE model.**

Policy Scenarios for a Korea-U.S. FTA

- **Eight different policy scenarios are assumed:**
  - **SC1: Reduction of tariffs on imports in 'manufacturing sectors' only by both parties by 10 percent per year for 10 years (2008-2021)**
  - **SC1 + TFP: SC1 + An increase in total factor productivity (TFP) in Chemicals, Electronics, Trade and transport services, Telecommunications, and Finance and business services by 0.1 percent per year for 10 years (2008-2021)**

Policy Scenarios for a Korea-U.S. FTA

– **SC2: SC1 + Agricultural liberalization**

- **Agricultural liberalization:**

  1) Korea excludes 'Rice' from liberalization and reduces import tariffs on all other agricultural products by 10 percent for 10 years (2008-2021).

  2) The U.S. reduces import tariffs on all agricultural products including Rice by 10 percent for 10 years.

- SC2+TFP: SC2 + the same TFP increase as in the case of SC1+TFP

Policy Scenarios for a Korea-U.S. FTA

– **SC3: SC1 + Agricultural liberalization + Service liberalization**

- **Service liberalization:**

  1) Korea reduces tariff equivalents for services by 2.5 percent per year for 10 years (2008-2021).

  2) The U.S. services are assumed to be free of barriers.

- SC3+TFP: SC3 + the same TFP increase as in the case of SC1

Policy Scenarios for a Korea-U.S. FTA

– **SC4: SC1 + Agricultural liberalization + Service liberalization**

- **Service liberalization:**

  1) Korea reduces tariff equivalents for services by 5 percent per year for 10 years (2008-2021).

  2) The U.S. services are assumed to be free of barriers.

- SC4+TFP: SC4 + the same TFP increase as in the case of SC1

V. Simulation Results

Figure 4.1: Effects on real GDP in Korea (cumulative % change from the baseline)

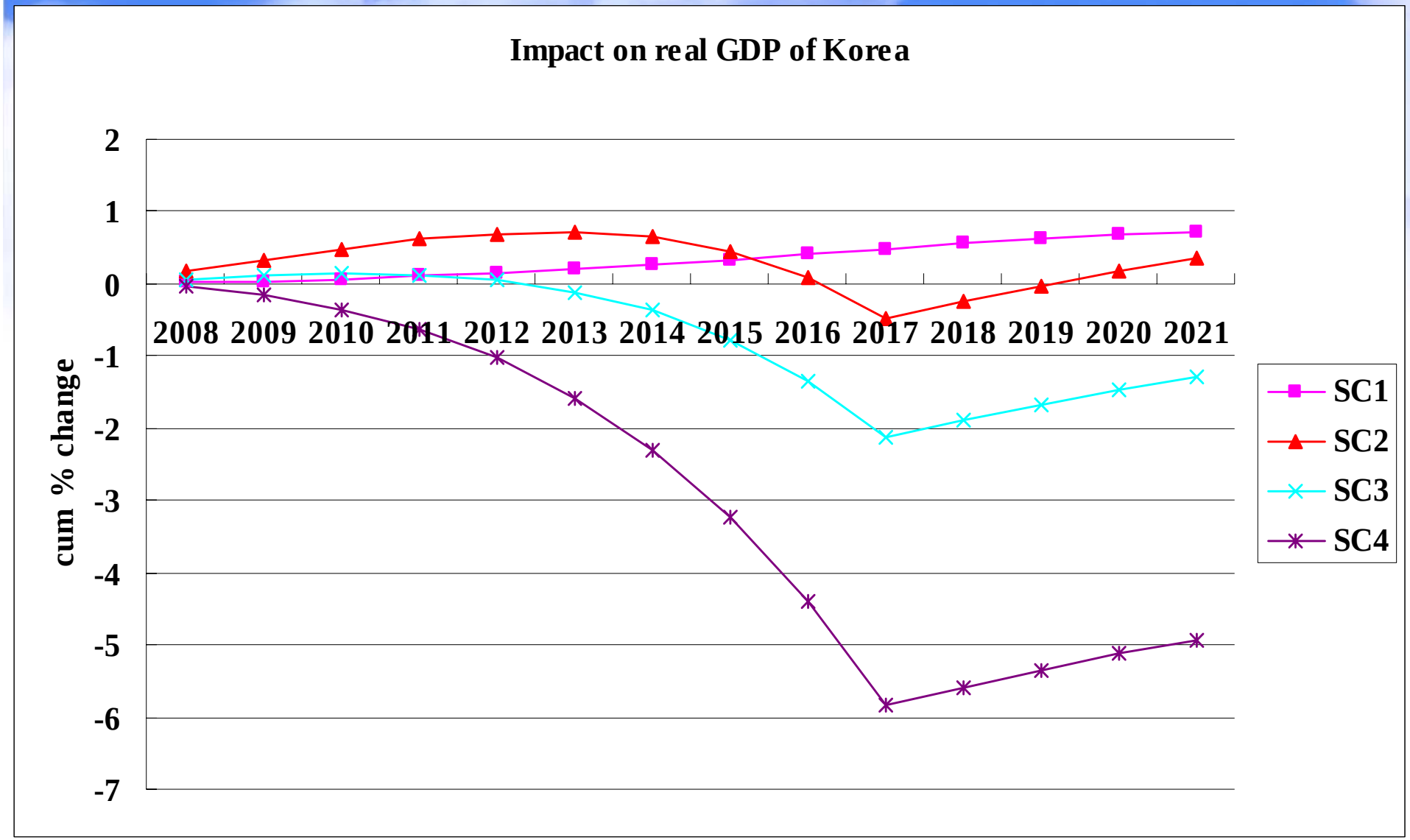


Figure 4.2: Effects on real GDP in Korea (cumulative % change from the baseline)

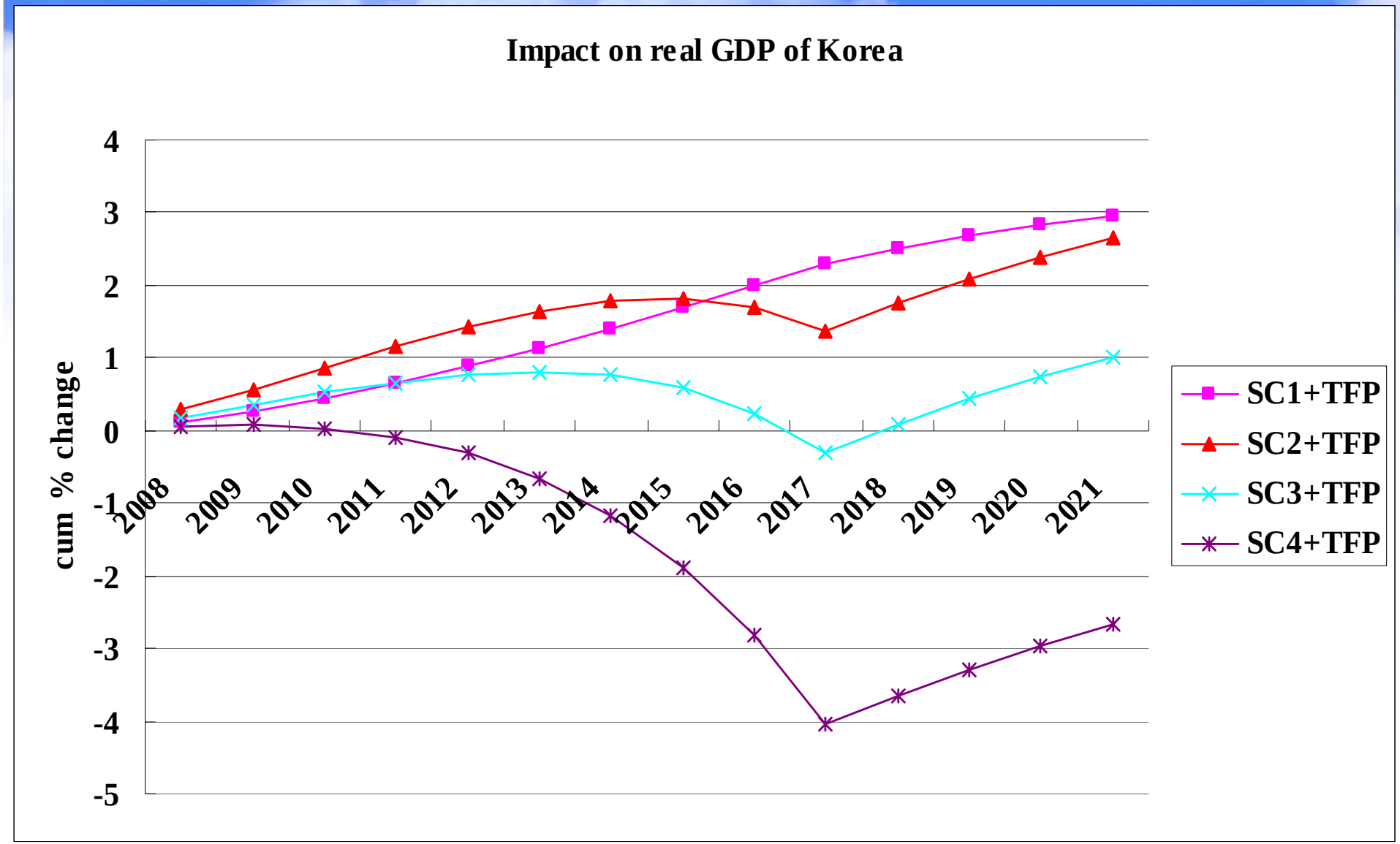


Figure 5.1: Effects on Welfare in Korea (cum. % change from the base. in US$ mil.)

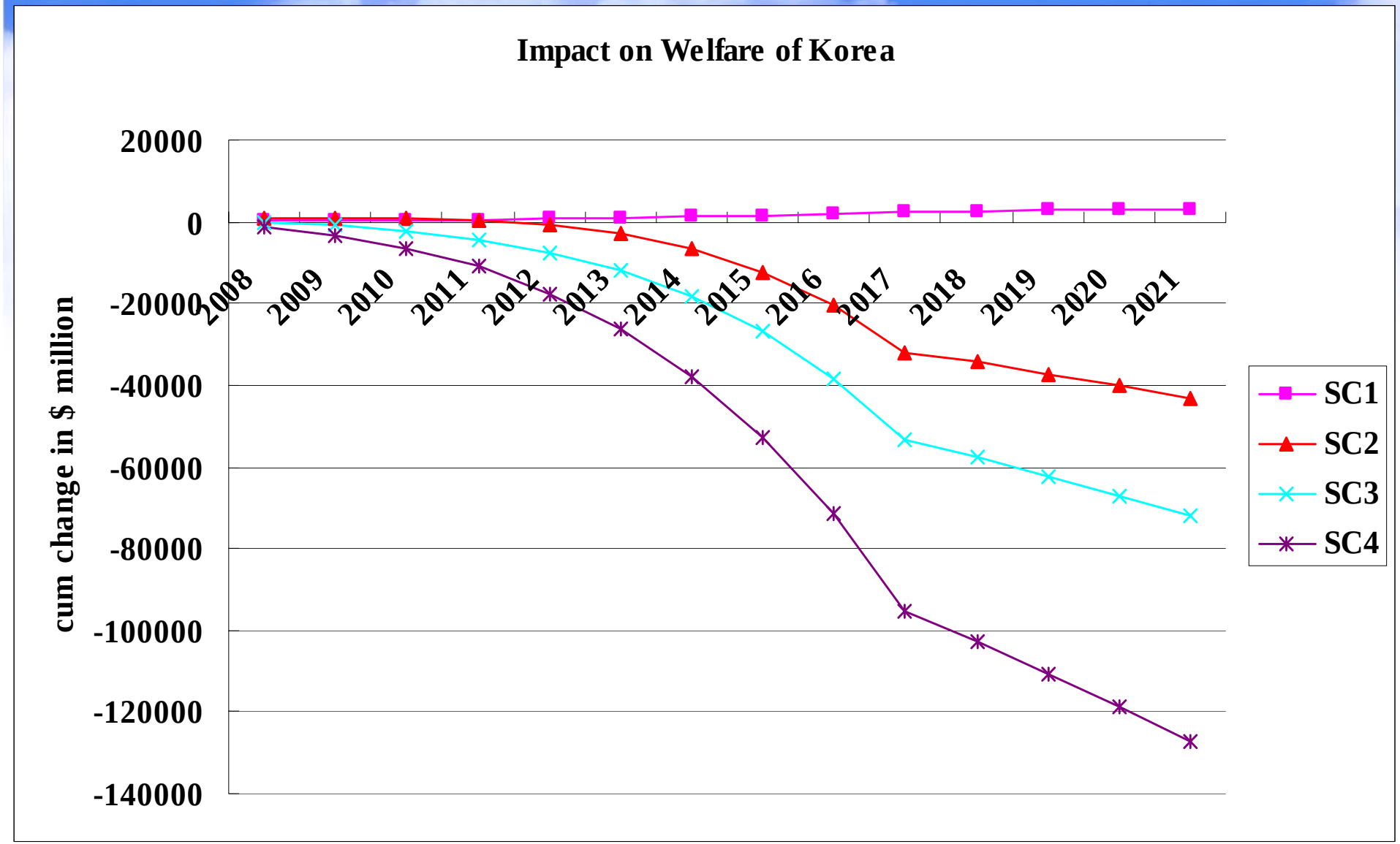


Figure 5.2: Effects on Welfare in Korea (cum. % change from the base. in US$ mil.)

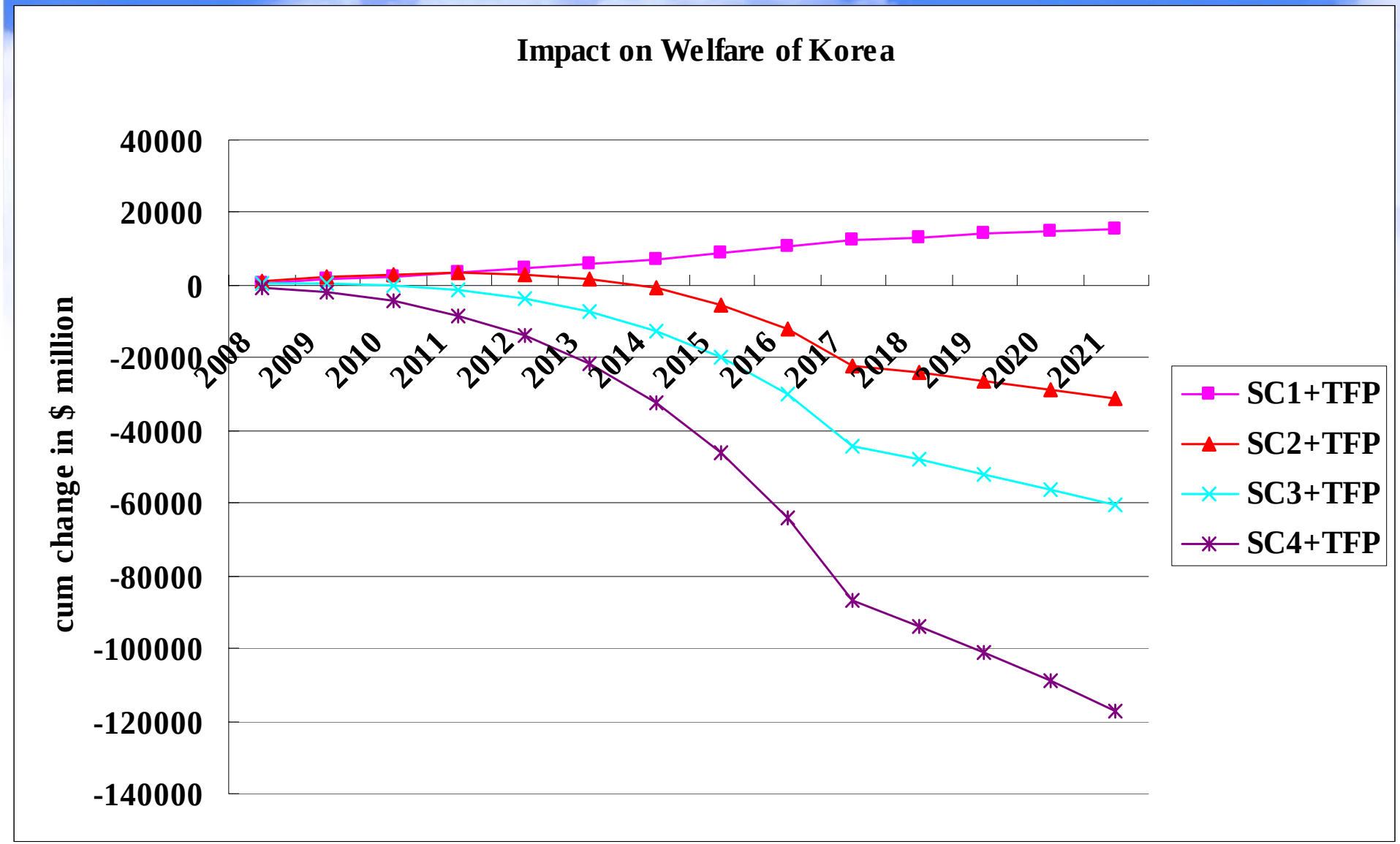


Figure 6.1: Effects on Total Exports in Korea (cum. % change from the baseline)

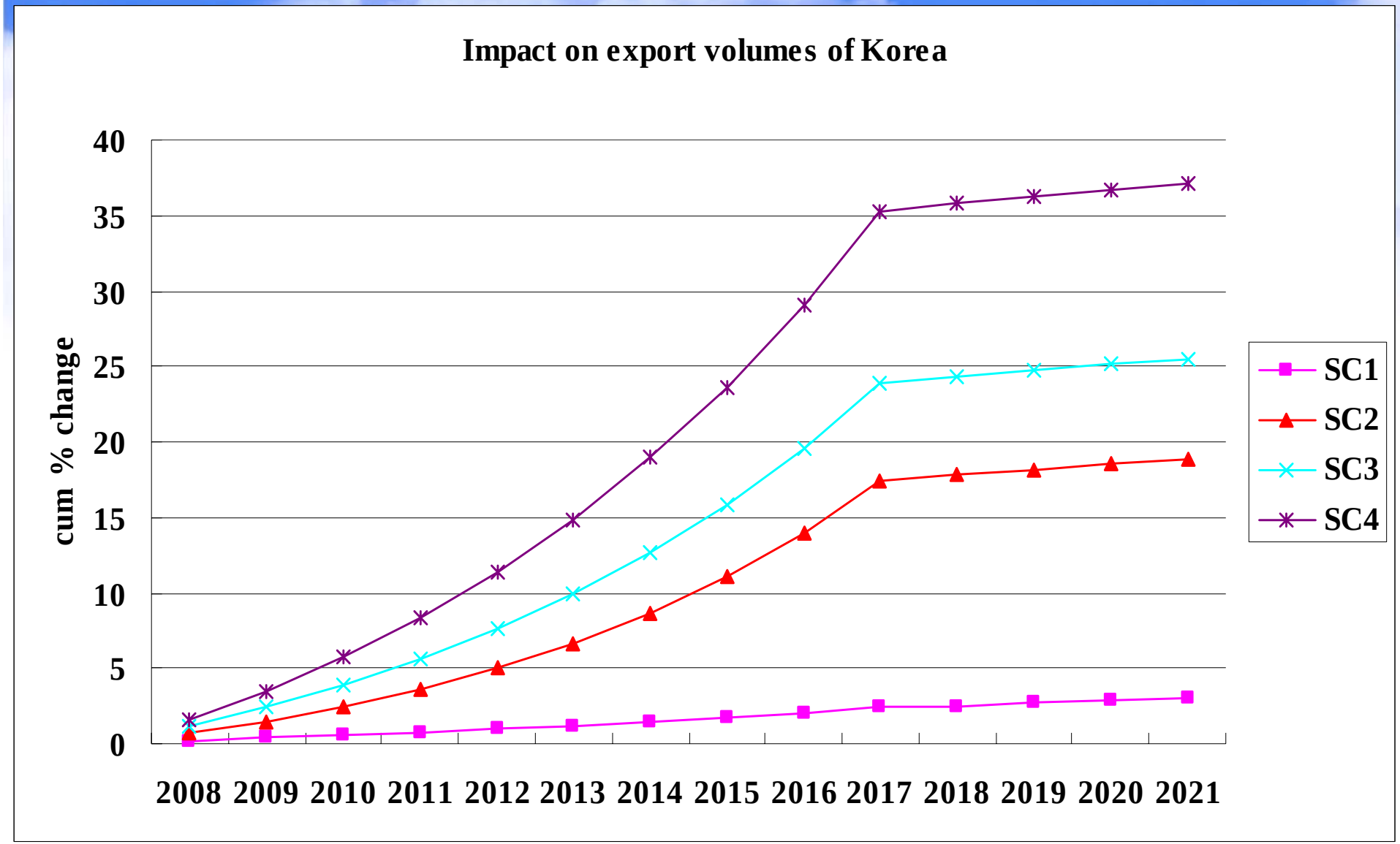


Figure 6.2: Effects on Total Exports in Korea (cum. % change from the baseline)

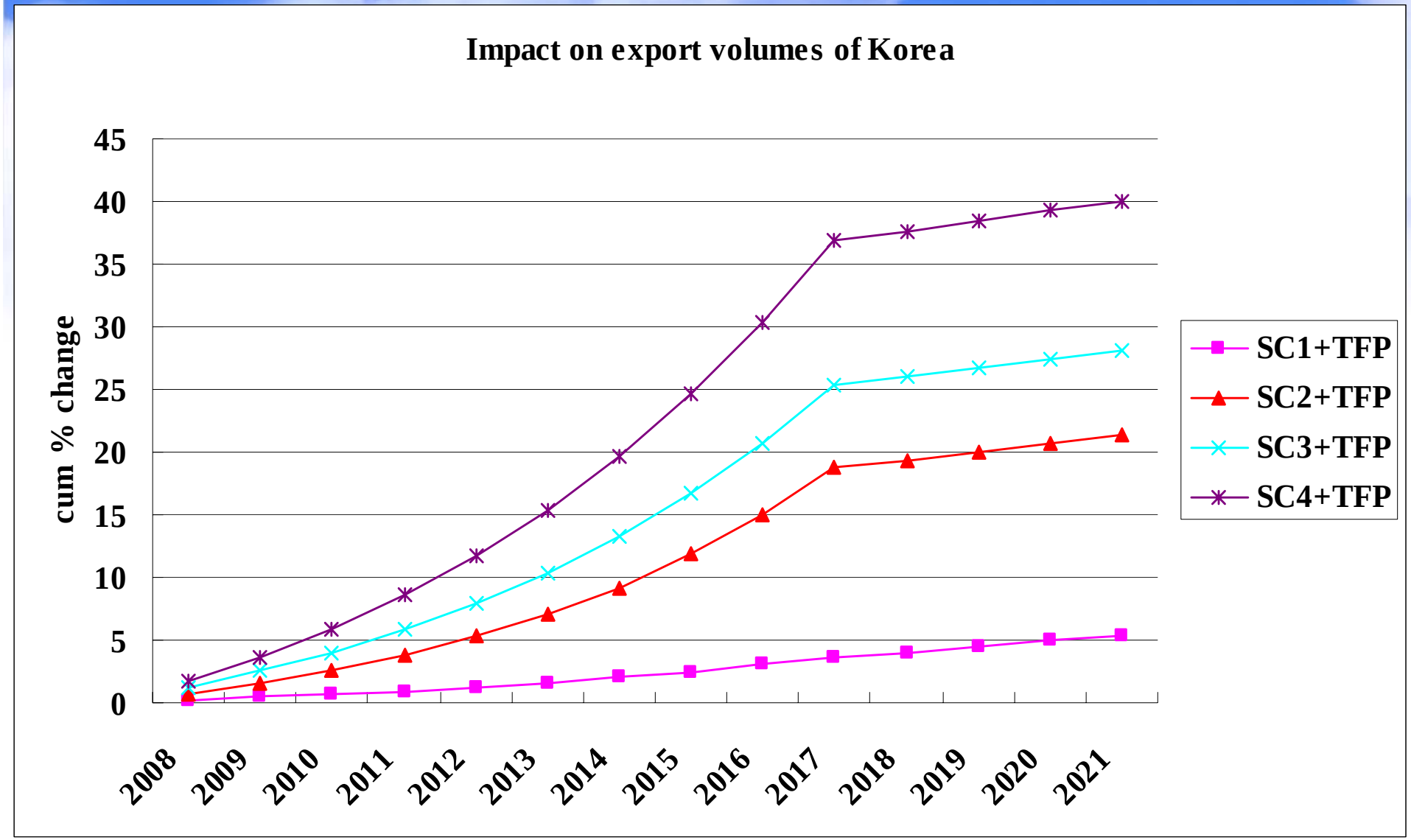


Figure 7.1: Effects on Total Imports in Korea (cum. % change from the baseline)

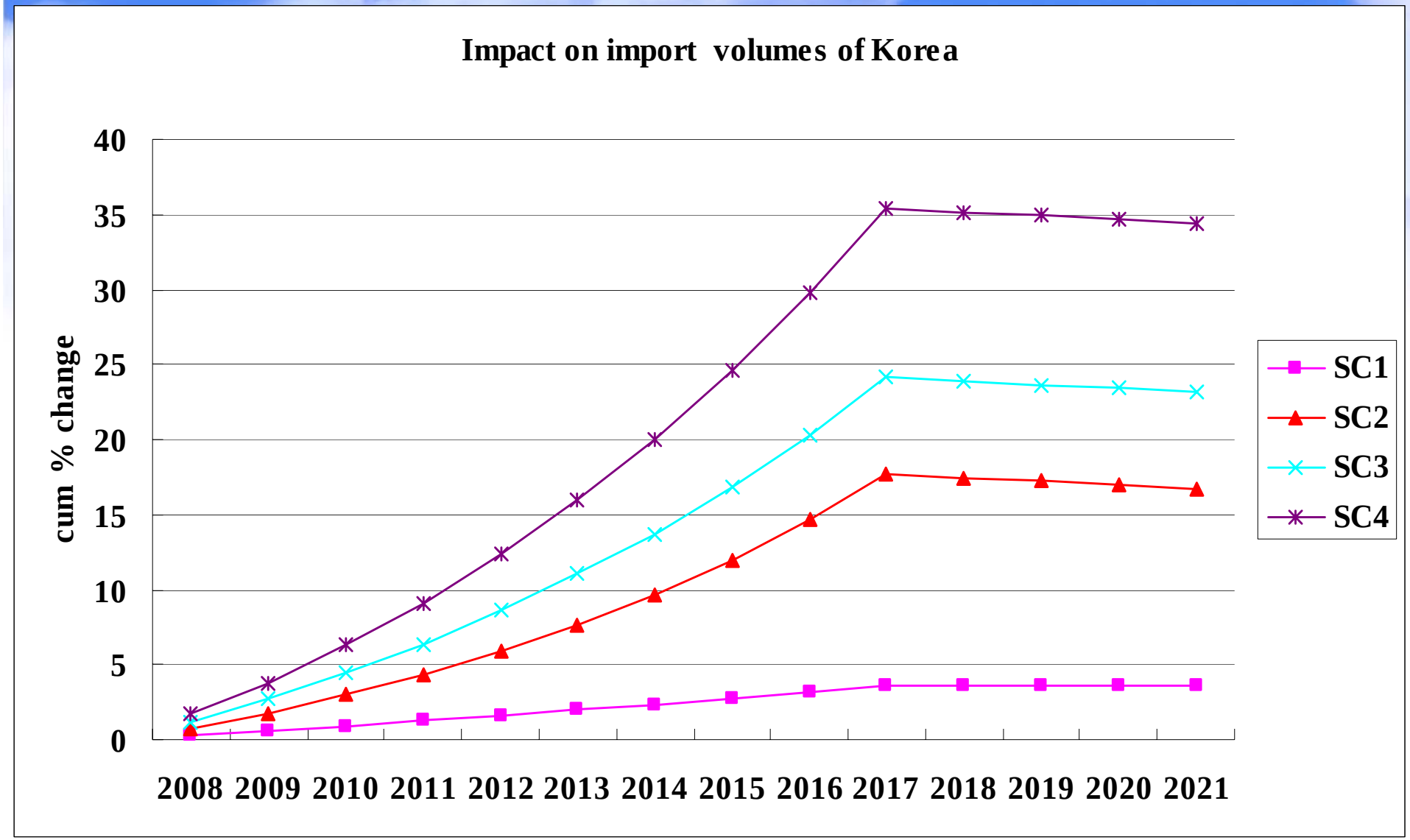


Figure 7.2: Effects on Total Imports in Korea (cum. % change from the baseline)

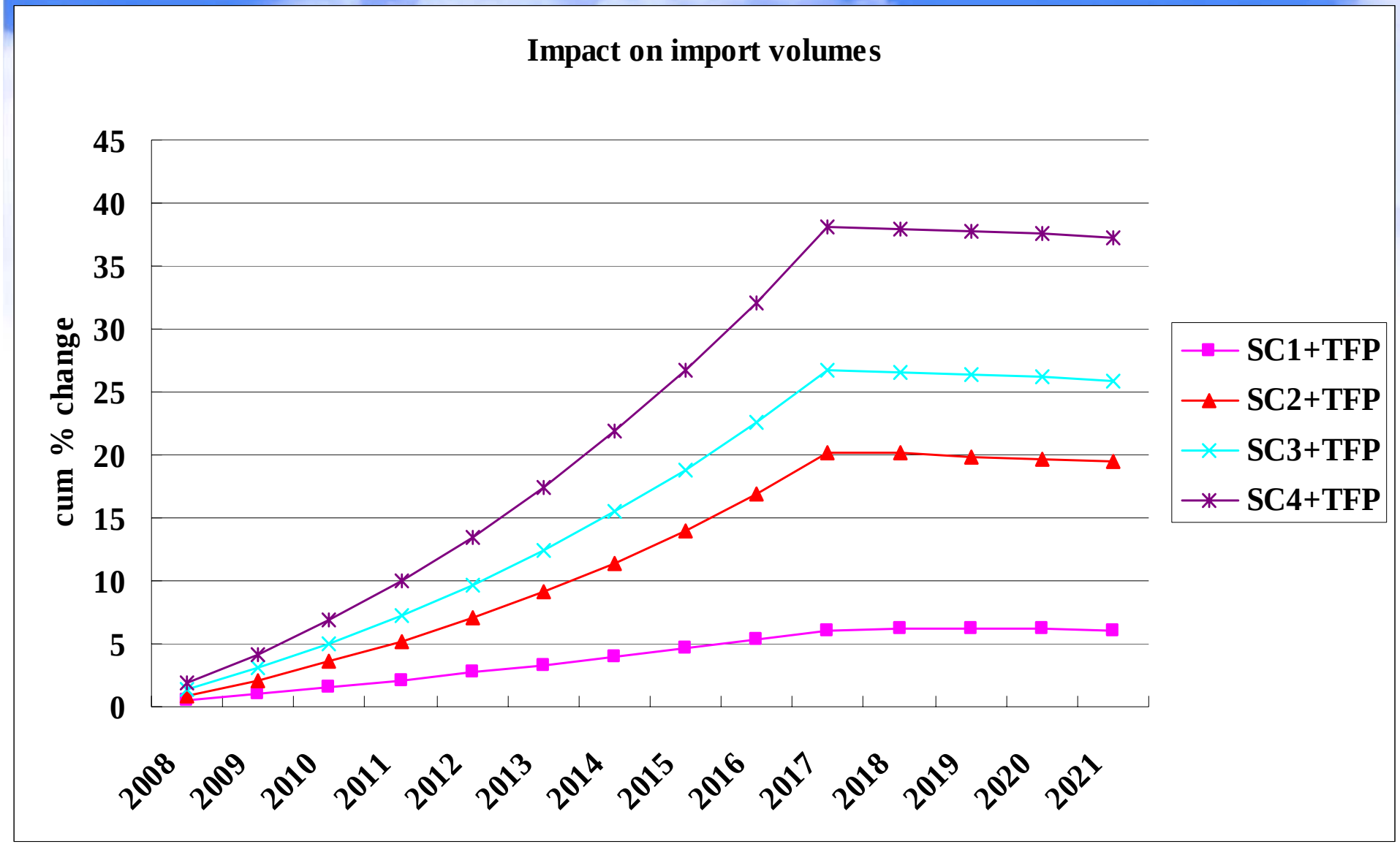


Figure 8.1: Effects on Trade Balance in Korea (cum. % change from the baseline)

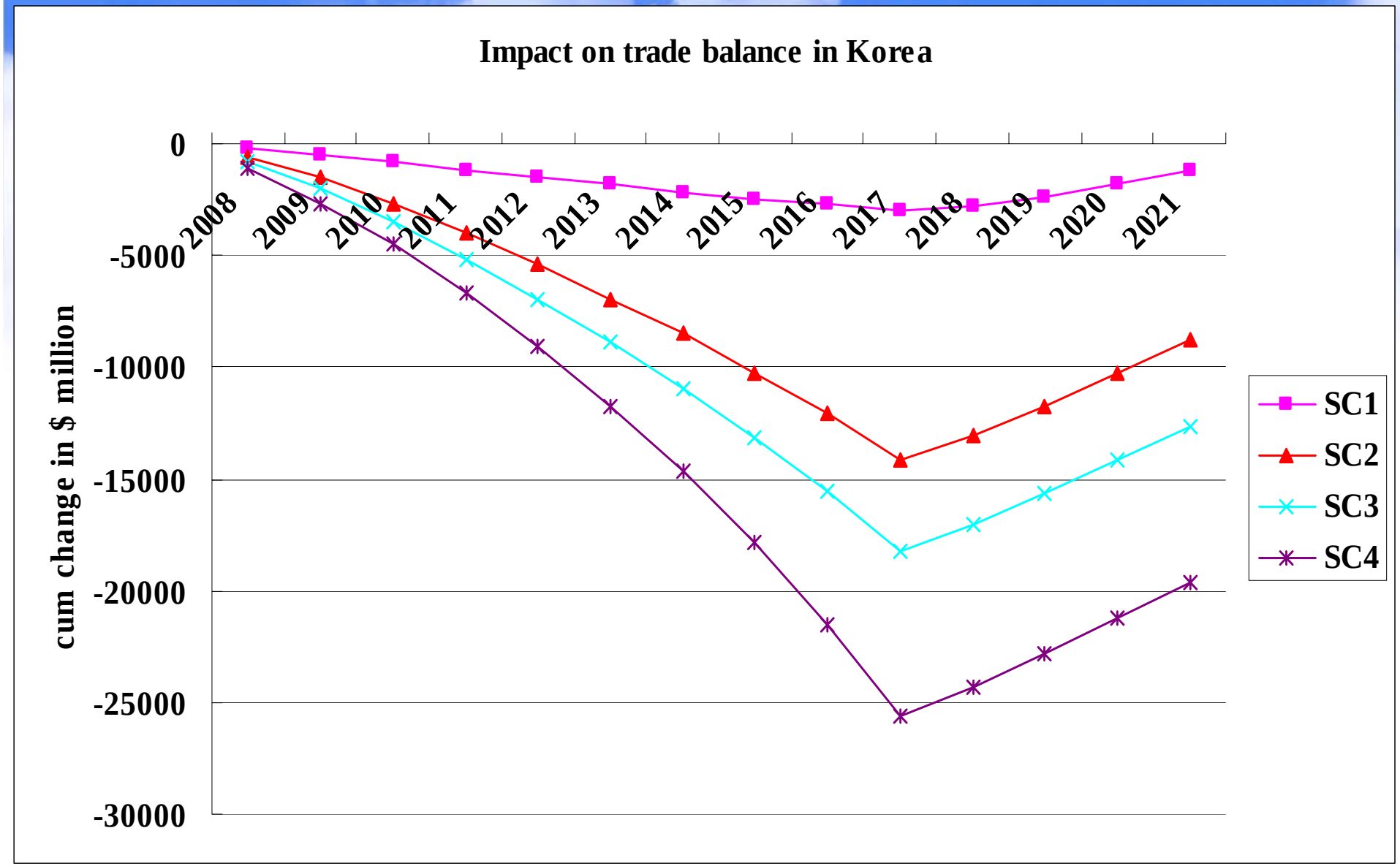


Figure 8.2: Effects on Trade Balance in Korea (cum. % change from the baseline)

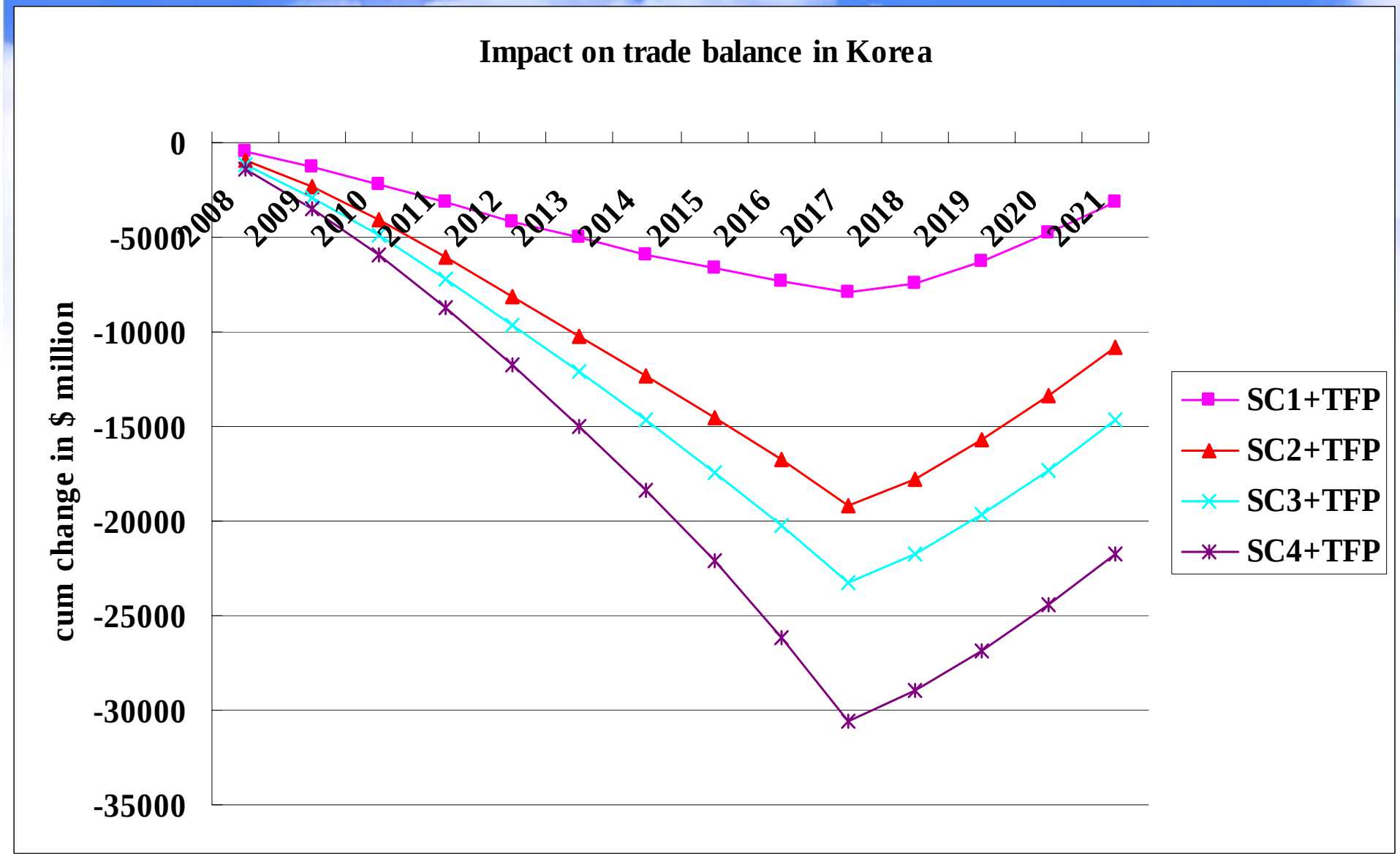


Figure 9.1: Effects on the Terms of Trade in Korea (cum. % change from the baseline)

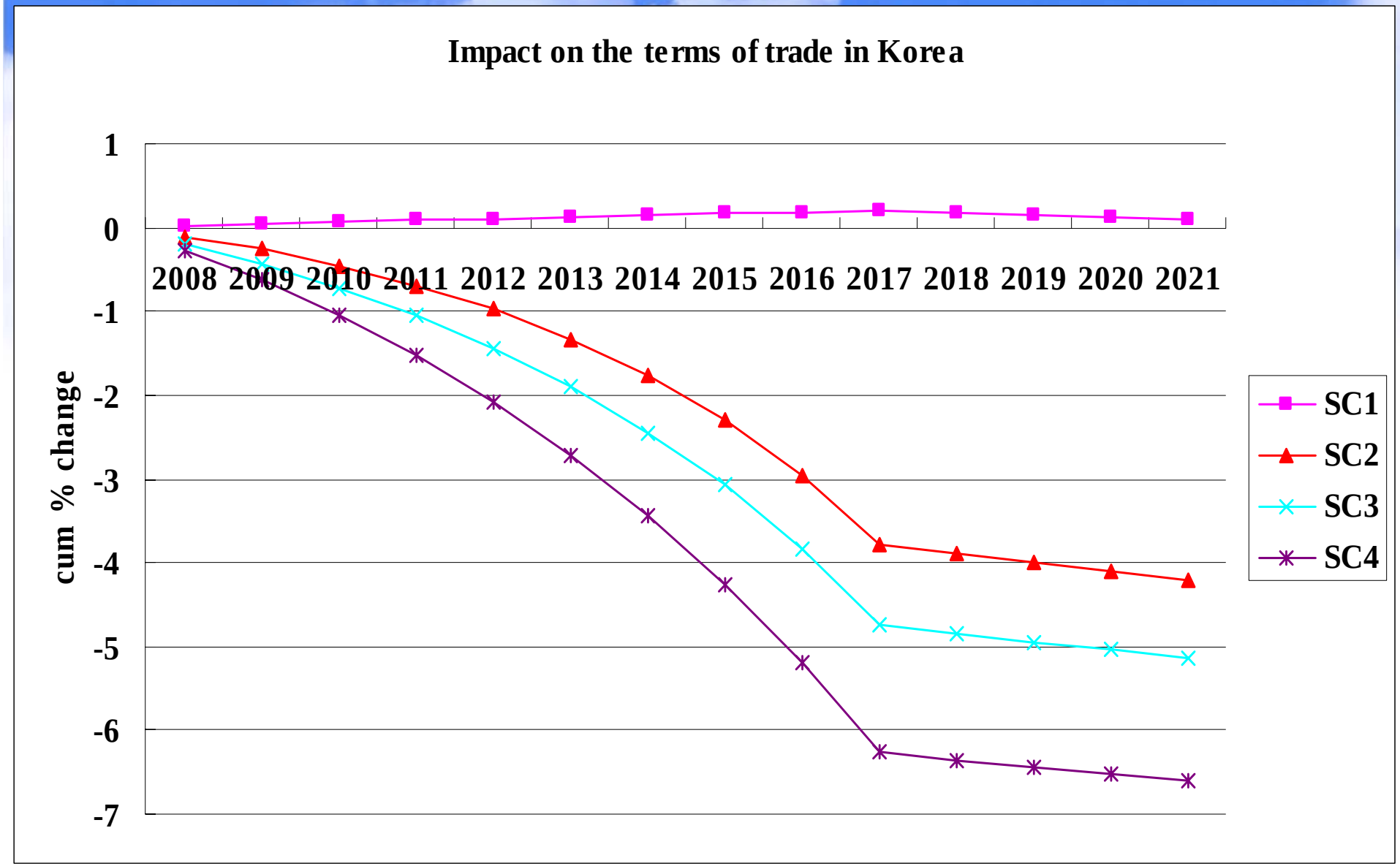


Figure 9.2: Effects on the Terms of Trade in Korea (cum. % change from the baseline)

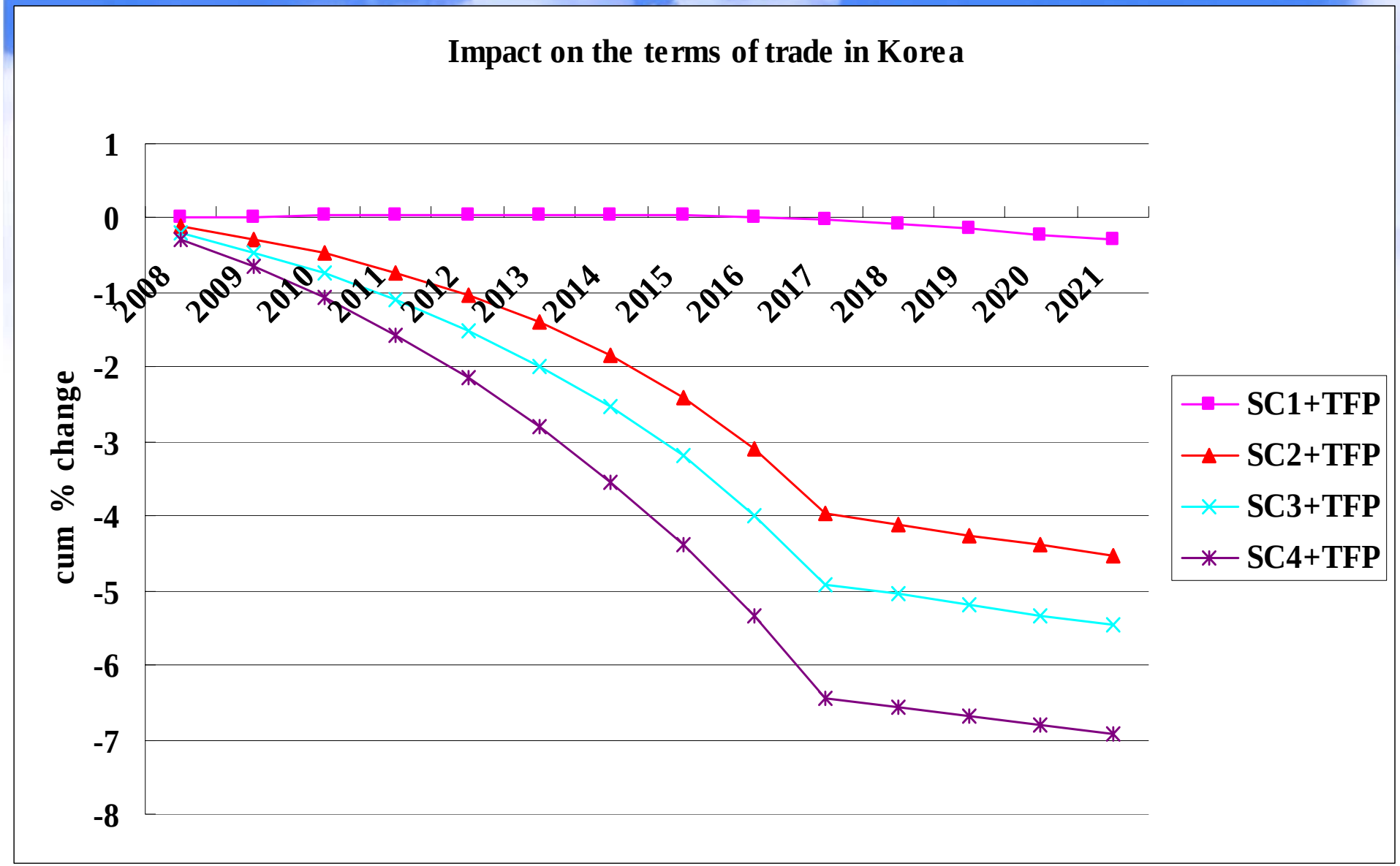


Fig. 10.1: Impact of Industry Output in Korea in 2021 (cum. % change from the baseline)

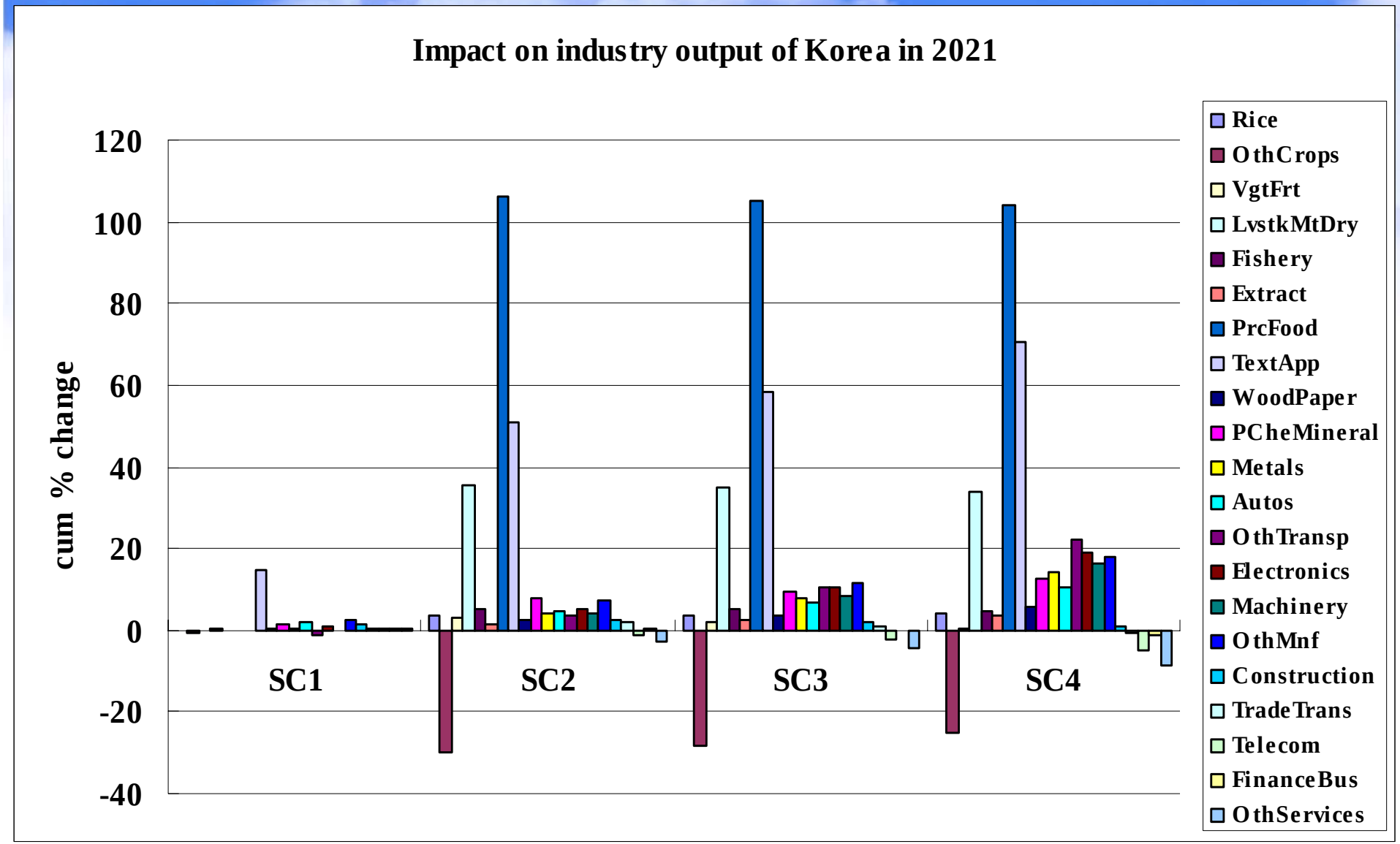


Fig. 10.2: Impact of Industry Output in Korea in 2021 (cum. % change from the baseline)

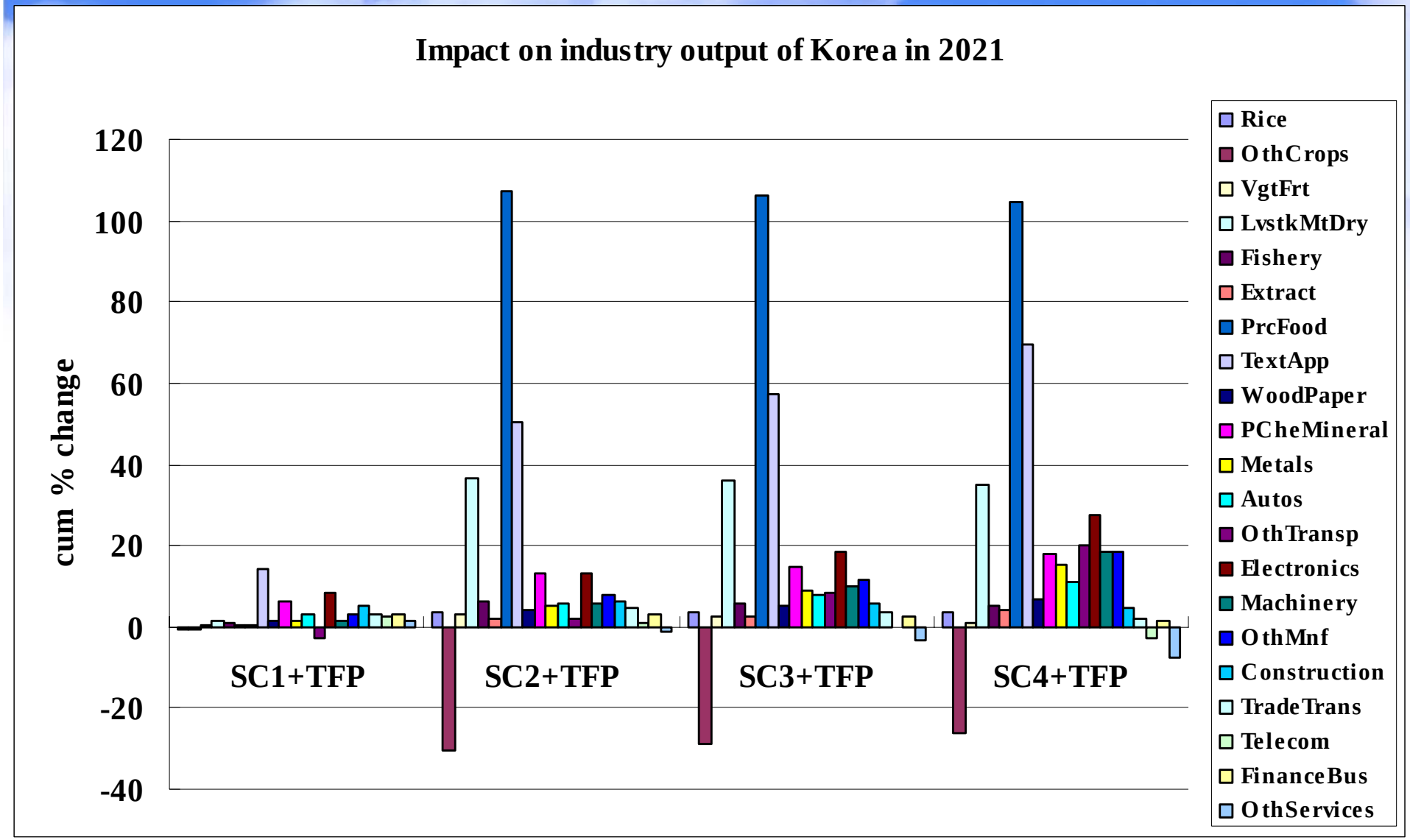


Fig. 11.1: Impact on Industry Output in Korea of SC1 (cum. % change from the base.)

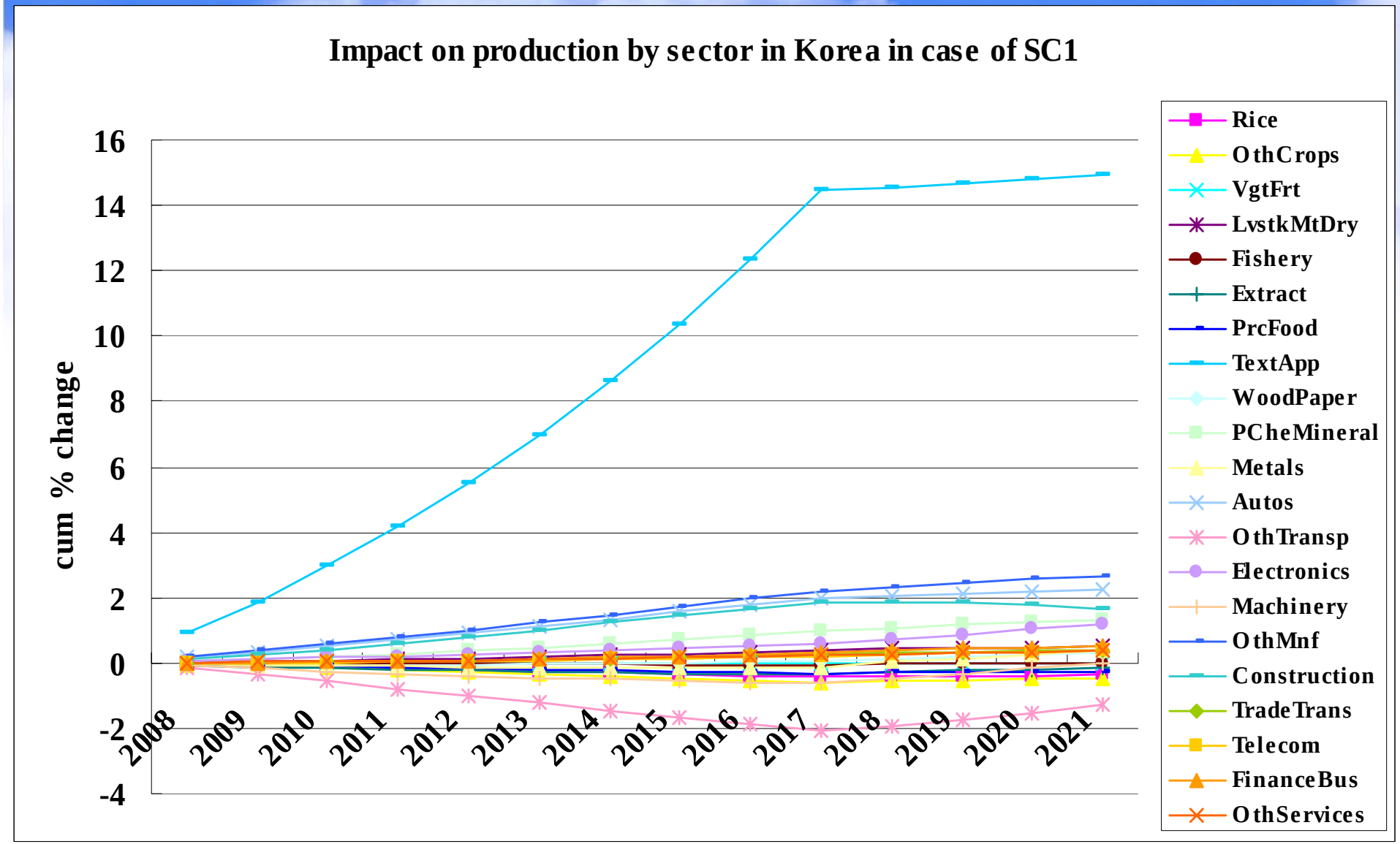


Fig. 11.2: Impact on Industry Output in Korea of SC2 (cum. % change from the baseline)

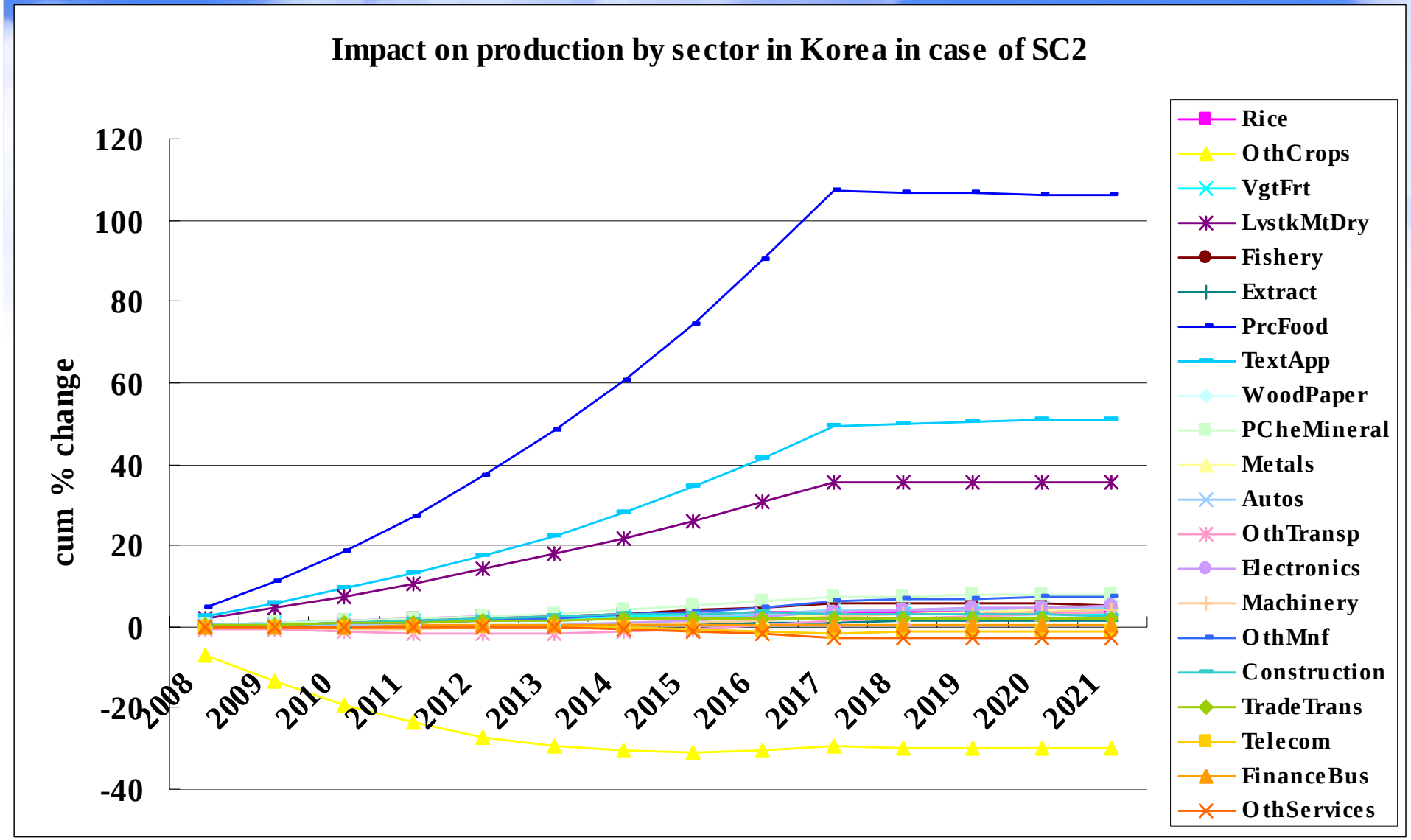


Fig. 11.3: Impact on Industry Output in Korea of SC3 (cum. % change from the baseline)

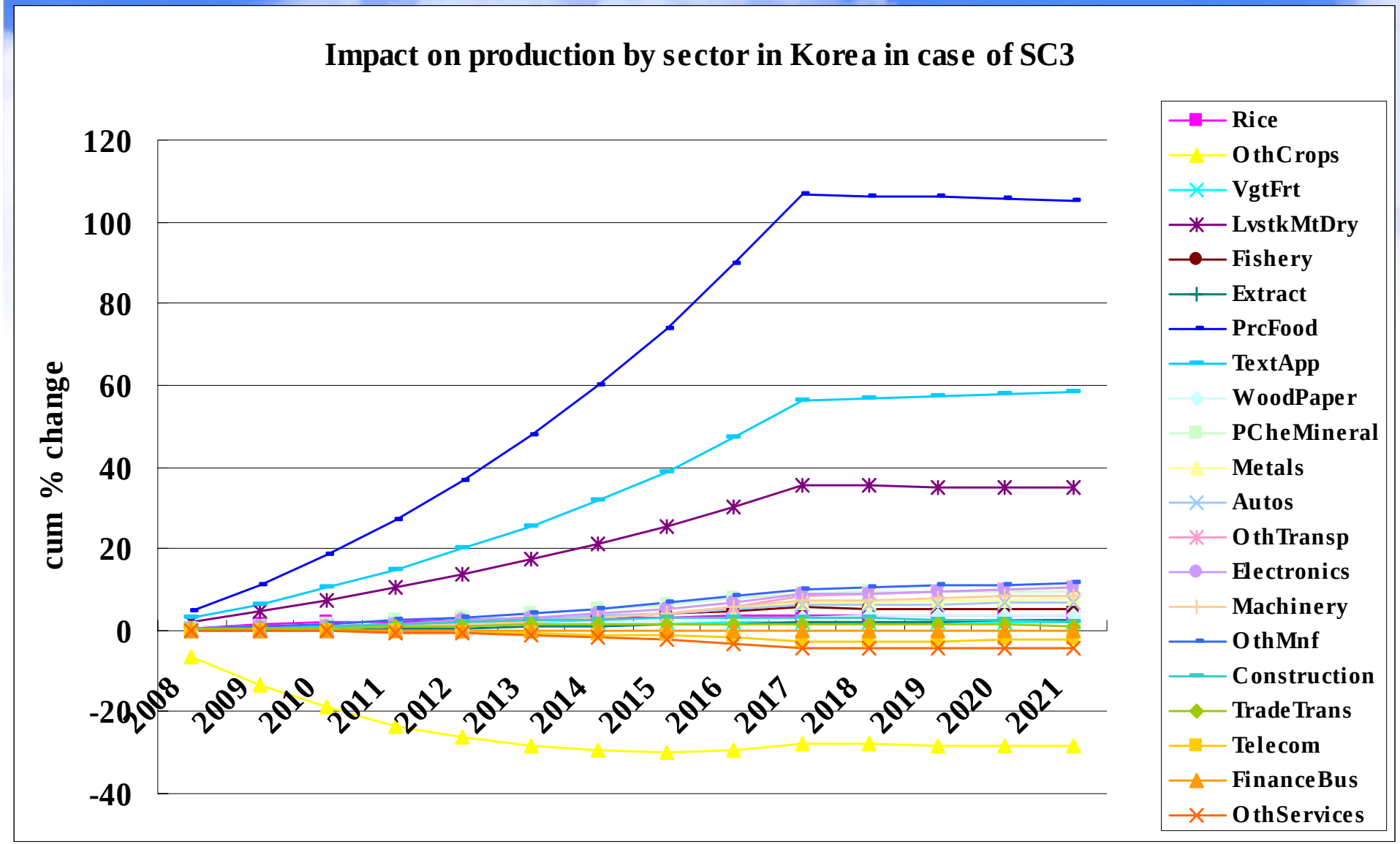


Fig. 11.4: Impact on Industry Output in Korea of SC4 (cum. % change from the baseline)

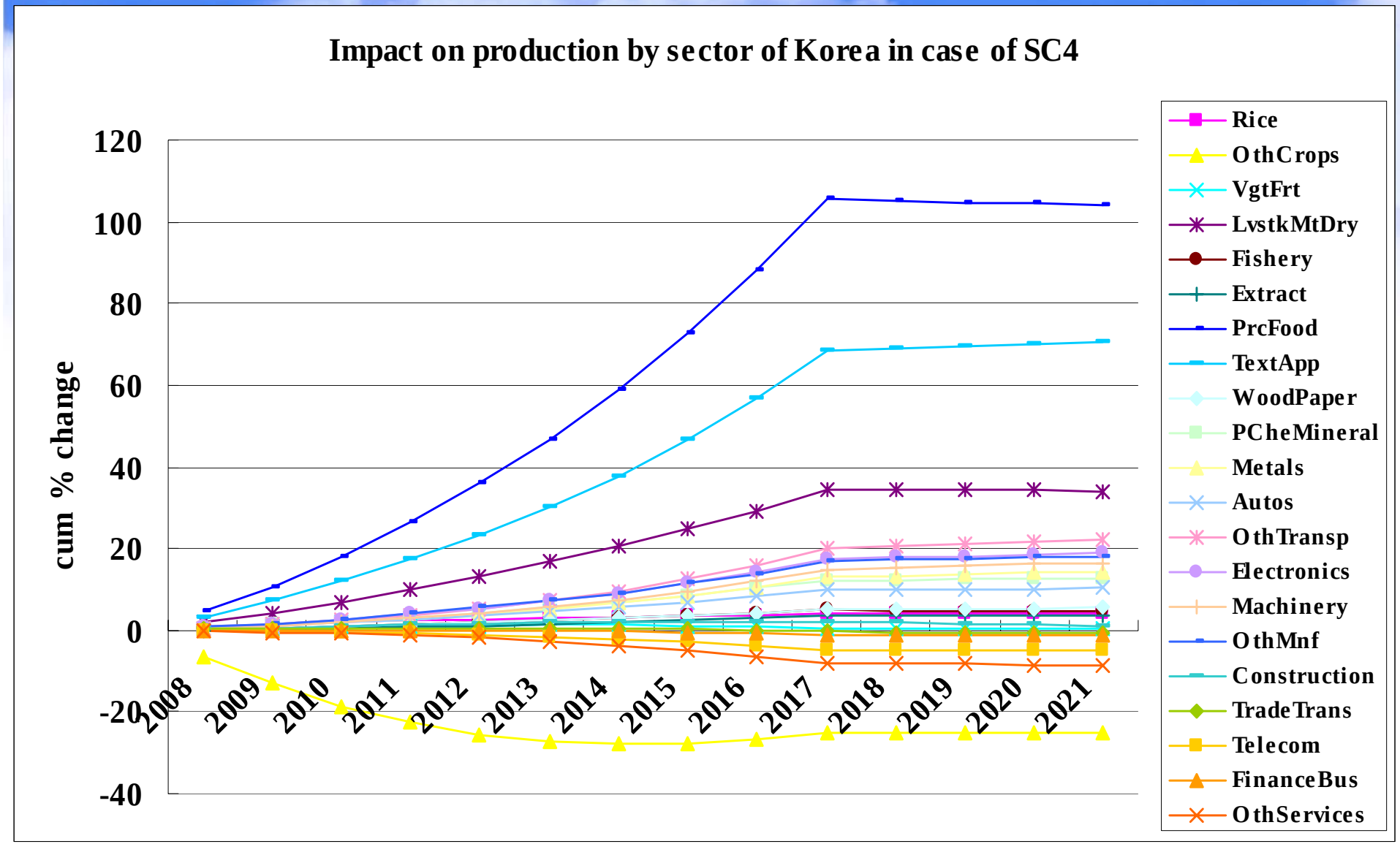


Fig. 11.5: Impact on Industry Output in Korea of SC1+TFP (cum. % change from the base.)

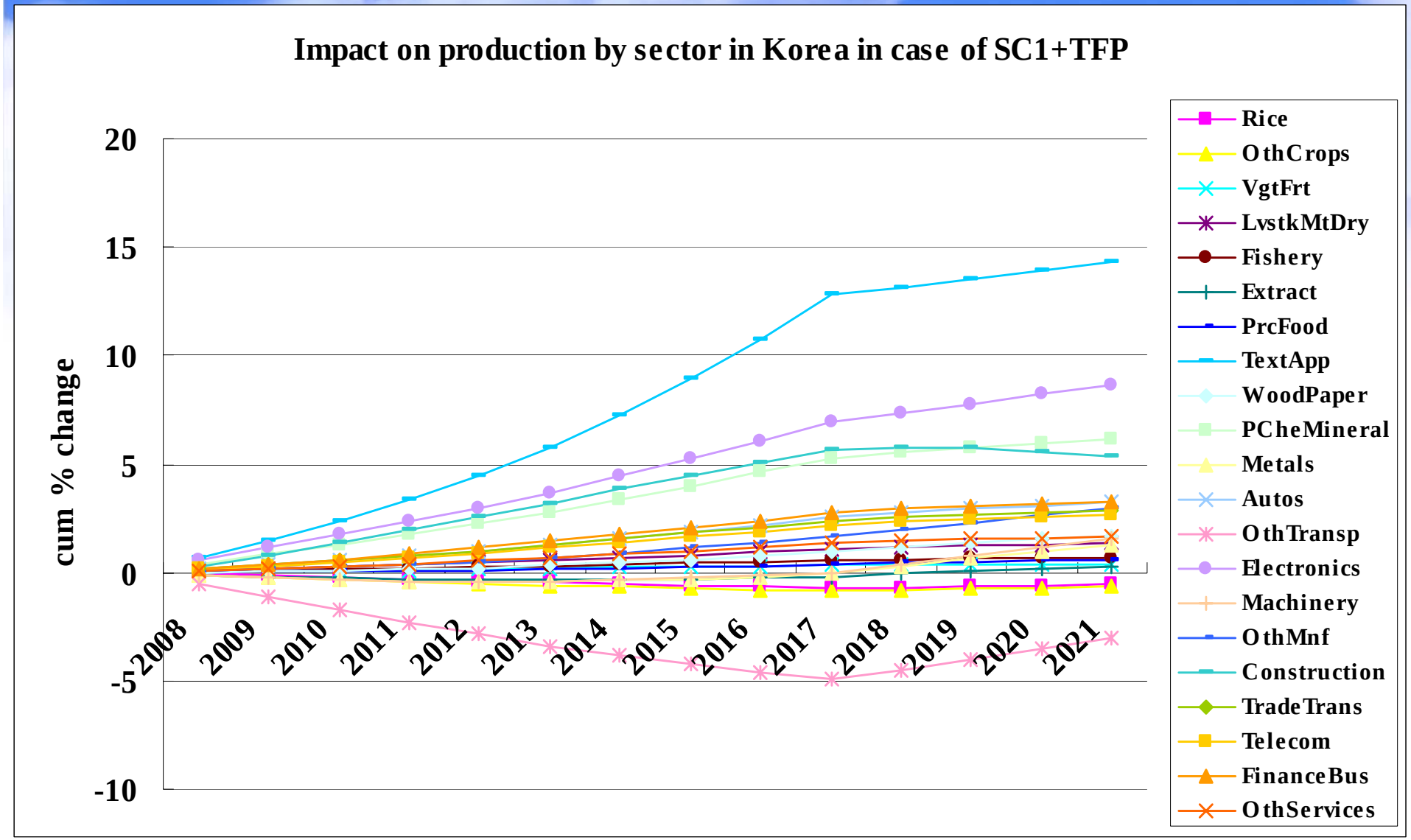


Fig. 11.6: Impact on Industry Output in Korea of SC2+TFP (cum. % change from the base.)

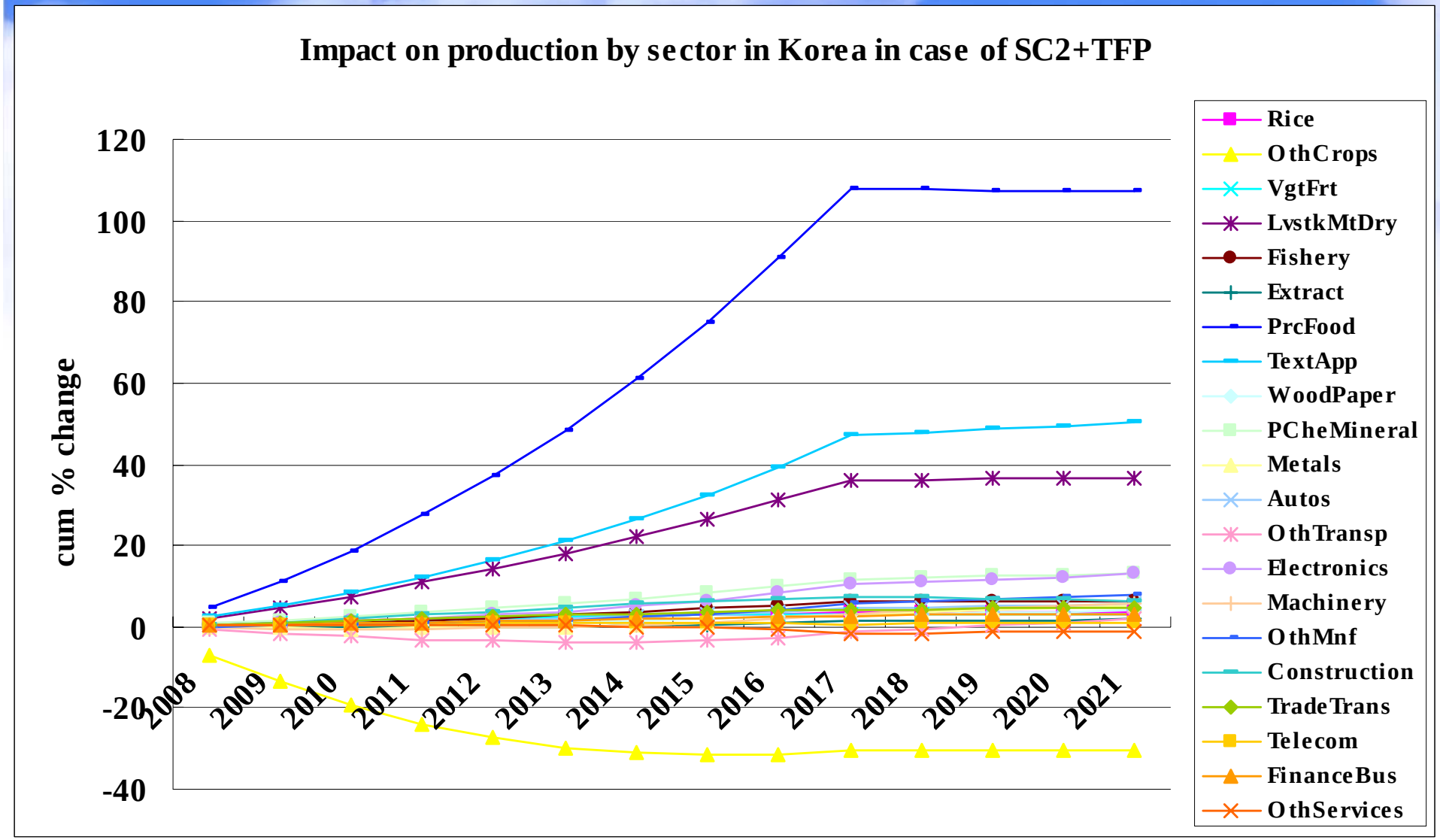


Fig. 11.7: Impact on Industry Output in Korea of SC3+TFP (cum. % change from the base.)

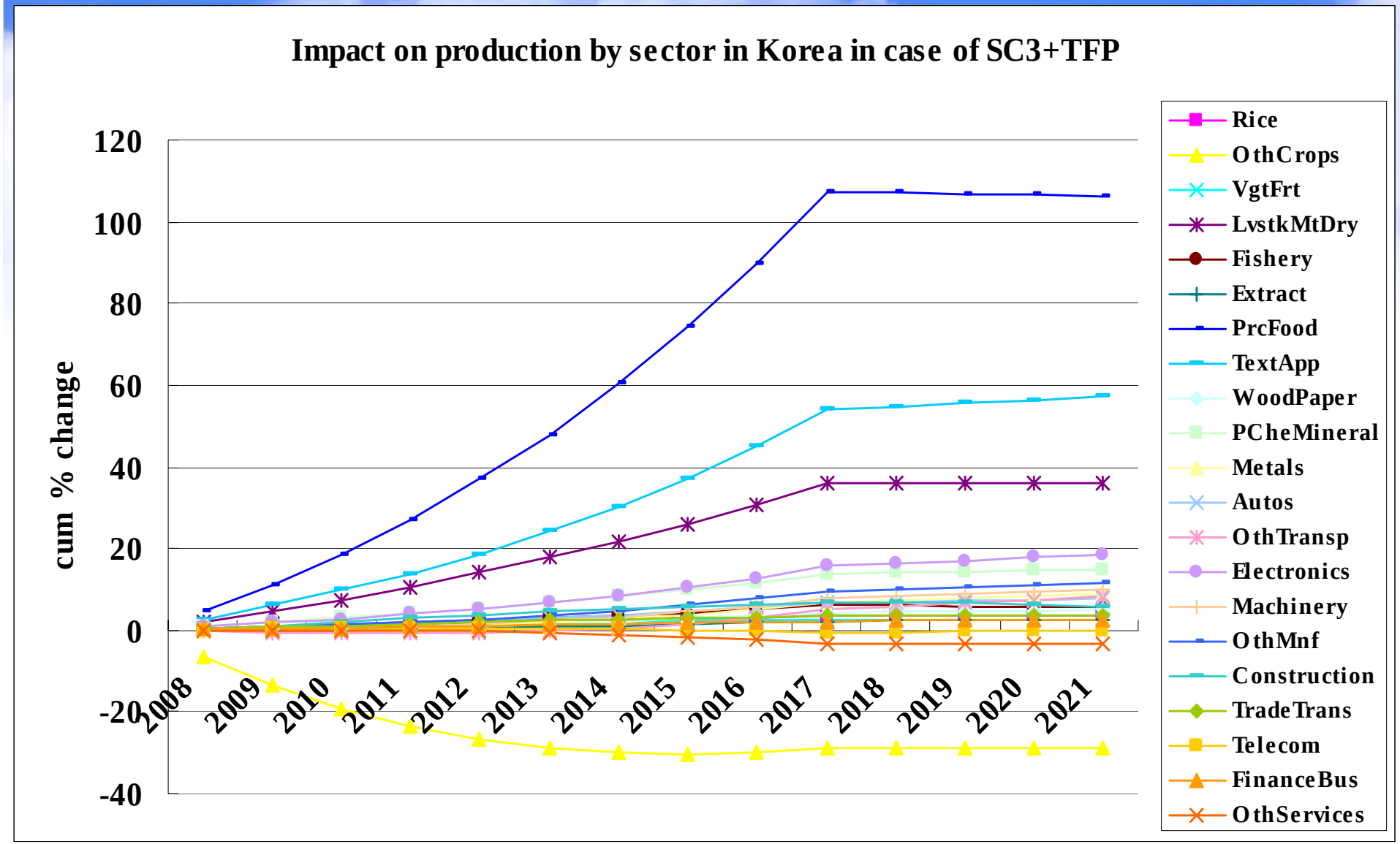


Fig. 11.8: Impact on Industry Output in Korea of SC4+TFP (cum. % change from the base.)

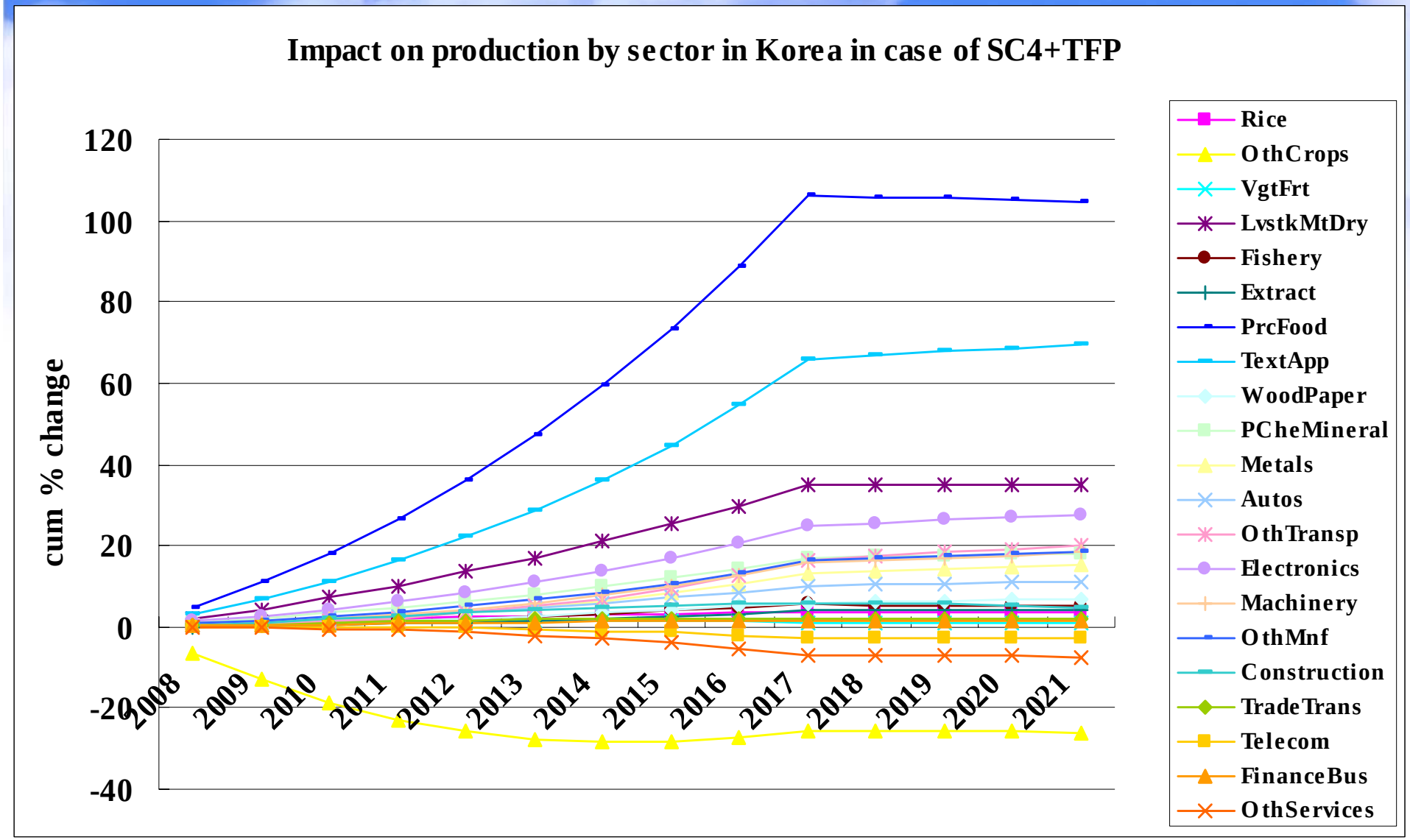


Fig. 12.1: Impact on Foreign Investment in Korea (cum. % change from the baseline)

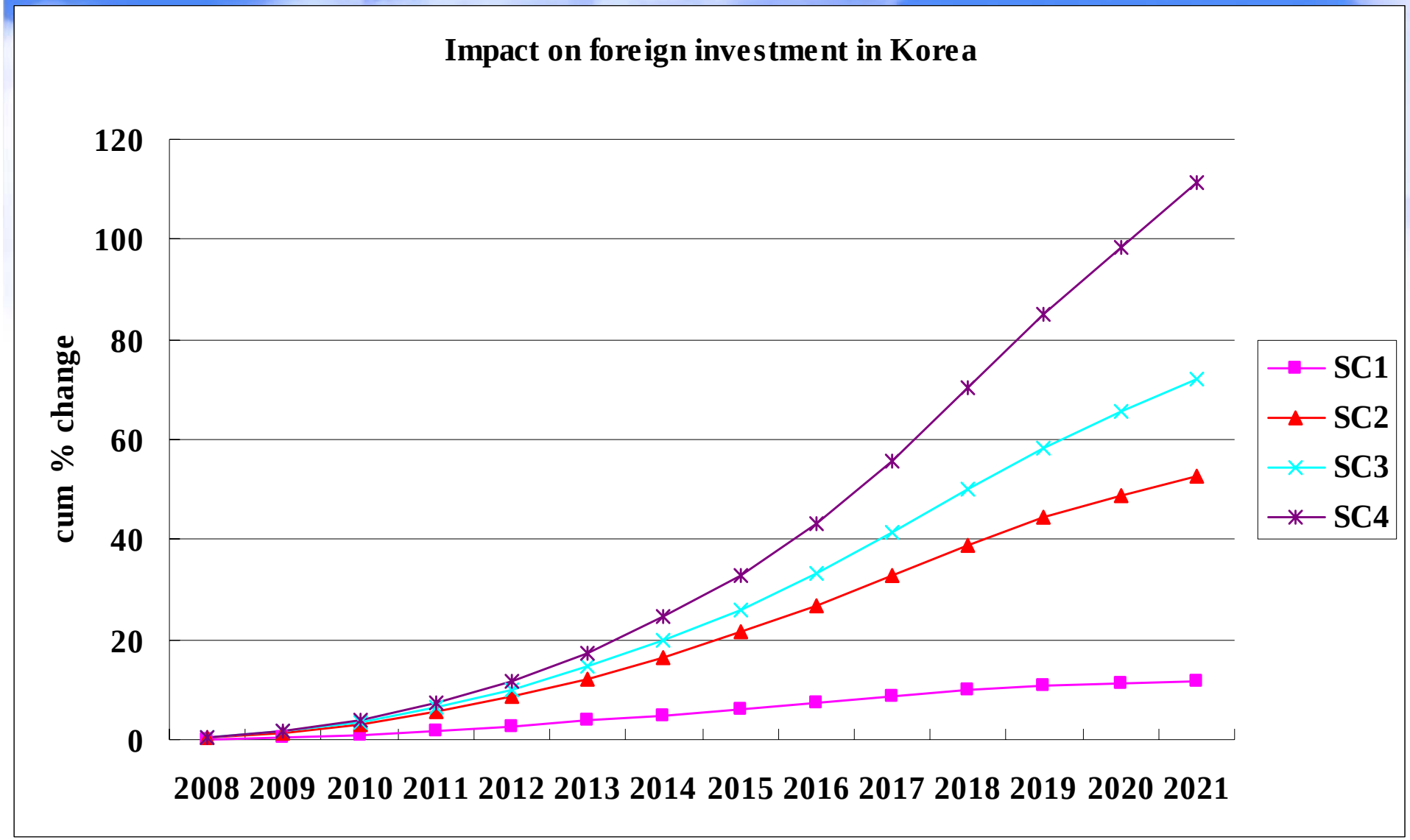


Fig. 12.2: Impact on Foreign Investment in Korea (cum. % change from the baseline)

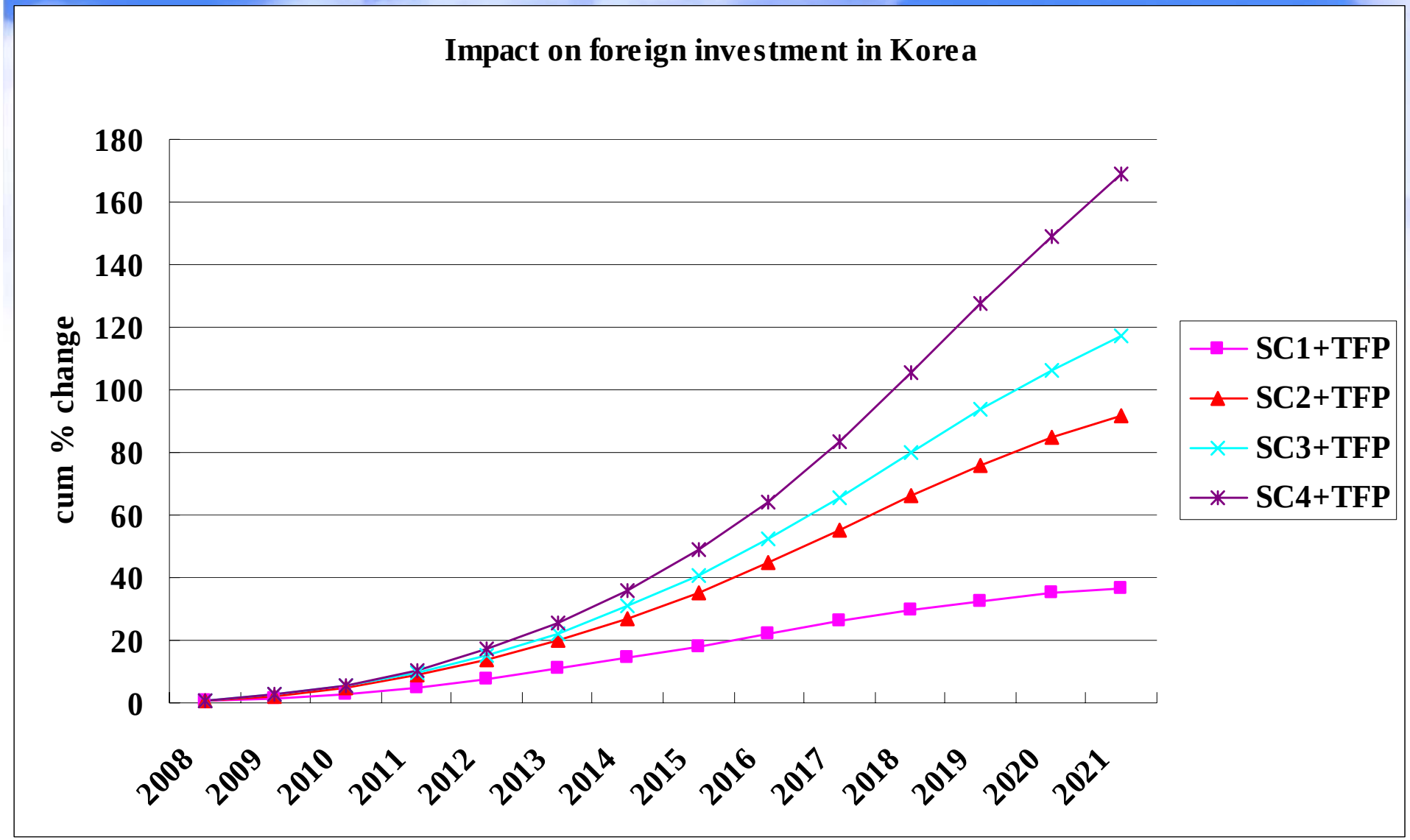


Fig. 13.1: Impact on Capital Accumulation in Korea (cum. % change)

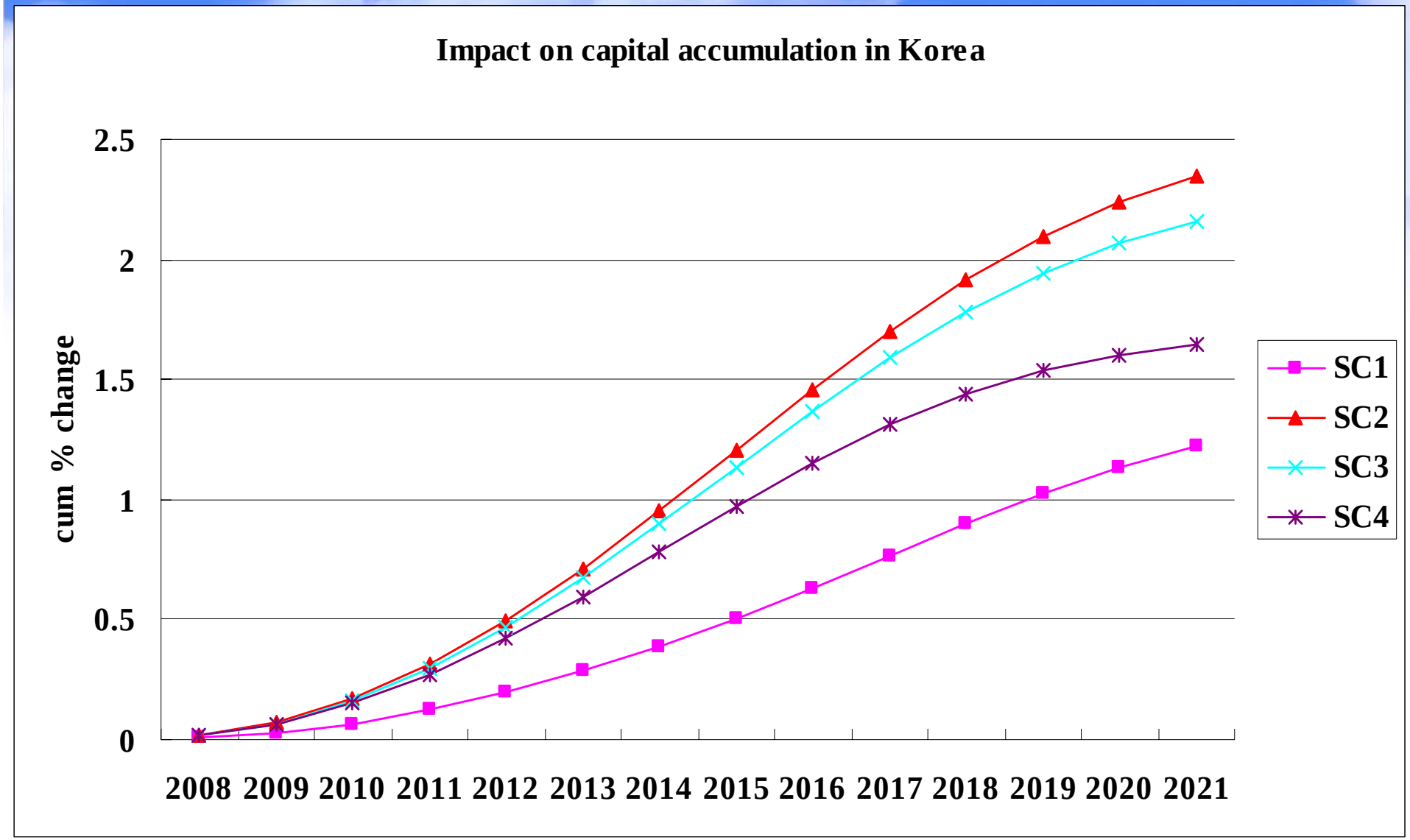
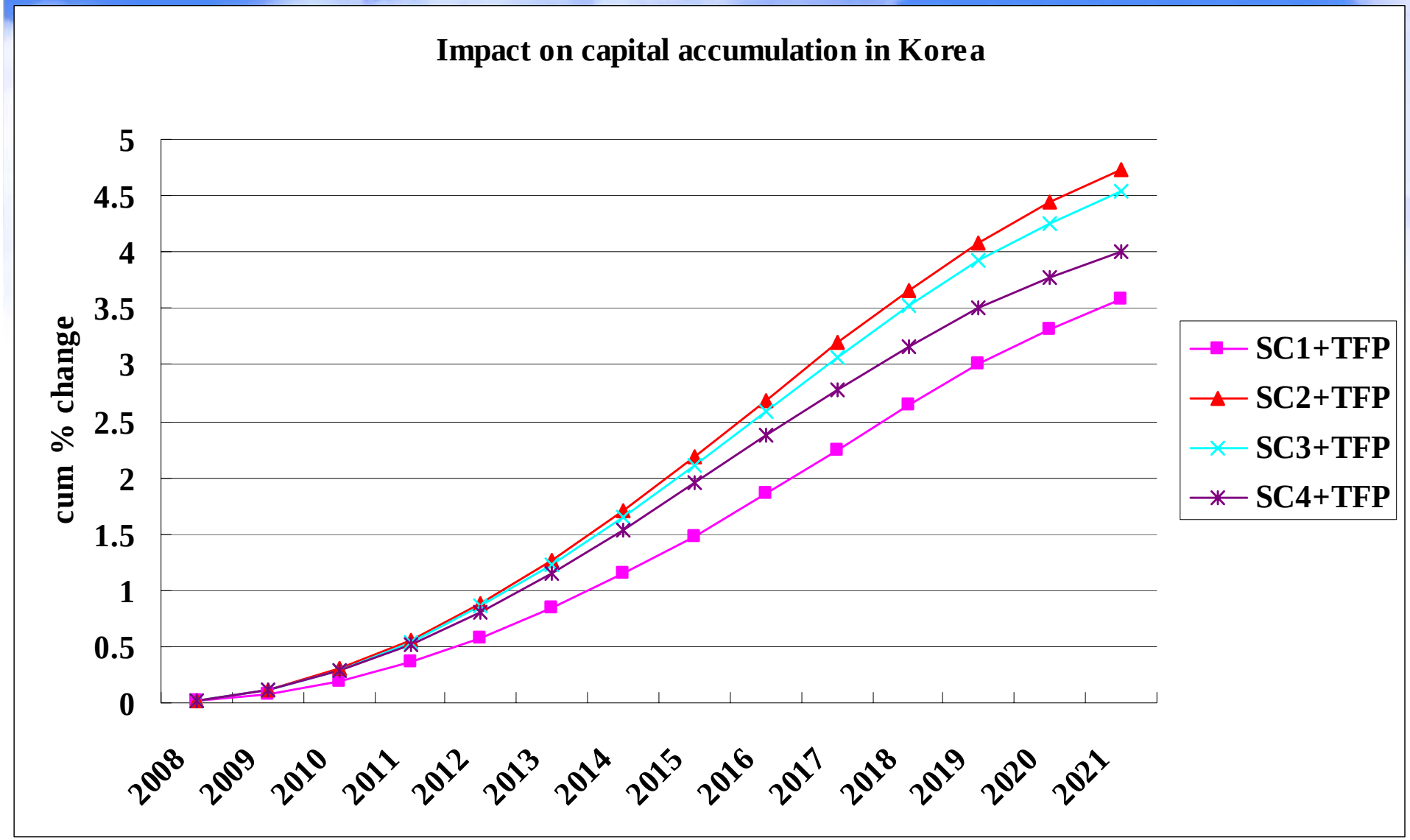


Fig. 13.2: Impact on Capital Accumulation in Korea (cum. % change)



VI. Conclusion

- **Tariff cuts on manufactured goods only (SC1) leads to continuously higher real GDP in Korea, of up to 0.72 % in 2021, whereas additional trade liberalization in agriculture (SC2) results in its rise with a decreasing growth rate by 2016, in its fall of 0.47% in 2017 when a Korea-U.S. FTA is completed, and in its steady recovery afterwards up to 0.34% in 2021.**

VI. Conclusion

- **Additional trade liberalization in services (SC3), tariffs cuts on services by 2.5% annually for 10 years, in total 25% reduction, causes a loss of real GDP to Korea from 2013 and finally Korea faces its fall of 1.28% in 2021.**
- **Further trade liberalization in services, in terms of 5% cut of tariffs on services annually for 10 years, causes a loss of its real GDP of 4.93% in 2021.**

VI. Conclusion

- **If total factor productivity (TFP) increases as a result of a Korea-U.S. FTA, its negative effects on Korea's real GDP are lessened or reversed.**
  - **SC1+TFP and SC2+TFP cause its rise of 2.96% and 2.65%, respectively, in 2021.**
  - **SC3+TFP contributes to its rise except in 2017, but further service liberalization (SC4+TFP) causes relatively big falls in real GDP of Korea, with its decline of 2.67% in 2021.**

VI. Conclusion

- **It is difficult to say that a Korea-U.S. FTA is beneficial to Korean economy as a whole in terms of welfare measured by equivalent variation (EV).**
  - **At best, Korea gains a slight increase in welfare, e.g. $3.1 billion in 2021 in the case of SC1 and $15.5 billion in the case of SC1+TFP.**
  - **In all other cases, Korea incurs a loss of welfare, which is mainly due to deteriorated terms of trade.**

VI. Conclusion

- **In all cases, trade deficits that Korea are expected to run as a result of a Korea-U.S. FTA continue to increase until 2017 and to decline afterwards, because Korea's imports rise faster than exports until 2017, exports continue to rise, though with a lower growth rate, but imports decrease or remain almost constant afterwards.**

VI. Conclusion

- **The effects of a Korea-U.S. FTA, in terms of industry output vary, depending on its comparative advantage.**
- **Investment and capital stocks increase.**
- **Moreover, a Korea-U.S. FTA raises the extent of foreign ownership of domestic assets in Korea, which is driven by the opening-up of domestic markets to foreign investment as a result of a Korea-U.S. FTA.**

VI. Conclusion

- **The effects of a Korea-U.S. FTA would be much larger, if the following factors were considered as policy shocks:**
  - **the reduction of risk premium expected by foreign investors;**
  - **rules governing foreign investment;**
  - **e-commerce regulations;**
  - **harmonization of technical standards;**
  - **sanitary and phyto-sanitary regulations; and**
  - **the streamlining of customs procedures.**
- **Further research could include them to fully take account of the impacts of a Korea-U.S. FTA.**