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Impacts of New International Tax System on Multinational Firms' FDI

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I. Introduction

Reform of the international tax system in the digital era has been suggested by the OECD, via an inclusive framework to which more than 140 countries are members, to address tax avoidance issues of multinational enterprises (MNEs). The digitalization of world economies has enabled MNEs to utilize digital technologies to conveniently circumvent paying corporate income taxes by shifting their profits from high tax rate countries to low tax rate countries (base erosion and profits shifting). To address the base erosion and profits shifting of MNEs, the OECD inclusive framework agrees to implement the following "two pillar" approaches: 1) allocation of taxing rights to market jurisdiction on exceeding normal profits of MNEs with a more broadened nexus rule not requiring permanent establishments in the jurisdiction (Pillar 1), and 2) setting the minimum level of corporate tax rates (15%) at the global level by allowing eligible jurisdictions to collect top-up taxes for MNEs when their subsidiaries pay effective tax rates below the minimum rates (Pillar 2). If the implementation process is carried out as planned, each country's tax laws and bilateral tax treaties will be adapted to incorporate the two pillars by 2023, and they will be put into action from 2024.

It is clear that introduction of the two pillars will change the tax burden weighed on MNEs' subsidiaries in different jurisdictions, curbing the tax avoidance of MNEs. If an MNE's permanent establishments producing digital products or services are located in a country with low corporate tax rates just for tax-planning purposes, i.e., to serve a near country with a large market size but with high corporate tax rates, Pillar 1 may reduce the benefits of choosing production locations in the low tax rate country. Pillar 2 has a more direct impact than Pillar 1. As it forces the MNEs to pay at least 15% of corporate income taxes at the global level, this would render ineffective tax-planning strategies including transfer pricing

and royalty payments, which take advantage of the tax rate differences and the tax treaties among different countries. In this regard, if global investments of MNEs were implemented as a part of tax-planning strategies, MNEs may respond to a new international tax system by changing their investment patterns to minimize their tax burdens while efficiently relocating their production facilities to maximize their profits after tax (PAT).

In this study, I present a theoretical model to quantitatively assess the economic impact of Pillar 1 and Pillar 2, especially focusing on the MNEs' investment decisions responding to the new international tax system. In order to capture the response of MNEs regarding investment decisions, I employ an export-FDI model incorporating firms' profits-shifting behavior à la Wang (2021)[1], where multinational firms choose their production sites and markets to serve by considering effective production costs as well as corporate income taxes to maximize the firms' PAT. My model extends Wang (2021) in that two-pillar approaches are explicitly considered in the model, so that the additional tax burdens induced by the new tax system as well as domestic corporate income taxes could affect the firms' global sourcing strategies. To clarify the changes in the taxation affecting firms' PAT, I also assumed that profits-shifting for tax-planning purposes may occur between the country with production facilities and the country with a market, excluding the role of small tax havens in the analysis.

In the following, I briefly discuss the model in Section II. Section III displays the model-based simulation outcomes focusing on inbound FDI changes responding to Pillar 1 and Pillar 2. Finally, in Section IV, I discuss the impact of the two pillars on Korea's inbound FDI.

II. Model

Let us consider a world economy which consists of N countries. There is a continuum of goods (or services) denoted by ω, which is an element of a set Ω. In each country, there is a representative household who has a CES preference over the goods with the elasticity of substitution, $\sigma > 1$. Each product is produced by one multinational firm and firms have a linear production function where the input is labor.

Three locations represented by a vector (i, l, n) are involved in the production process of the multinational firms and these locations correspond to each production stage: R&D, production, marketing and sales. First, MNEs' headquarters are located in the country i, where R&D of the product is performed. Second, MNEs' factories or servers are located in the country l, where production is carried out. Third, MNEs' distribution centers are located

[1] Wang, Zi. 2020. "Multinational production and corporate taxes: A quantitative assessment." *Journal of International Economics*, 126.

in the country n, where the product is sold (market).

In country i, developing a new good requires f_i^e units of labor where the total endowment of labor force for R&D in i is L_i^e. In country l, the MNE with a product ω uses $1/z_l(\omega)$ units of labor, where $z_l(\omega)$ denotes the MNE's productivity in l. Denoting the wage of the worker in country l by w_l^p, the marginal cost of producing ω in l is $w_l^p/z_l(\omega)$. In addition, if ω is developed in country i and is produced in l, then the production costs increase by $\gamma_{il}(\geq 1)$-fold. To sell the good produced in l to the market in country n, the MNE pays fixed costs F_n in the units of labor in n. Also, the export from l to n incurs iceberg transportation cost $\tau_{ln}(\geq 1)$. To sum up, if a product ω is developed in i, produced in l, and sold in n, then the total marginal cost for making profits is $\frac{\gamma_{il} w_l^p \tau_{ln}}{z_l(\omega)}$. Here I assume that $z(\omega) = (z_1(\omega), z_2(\omega), \cdots, z_N(\omega))$ and follows a multivariate Pareto distribution.

For each country j, there are $\bar{L}_j$ measure of workers. In each country, workers can supply their labor either in production/marketing/sales sectors (p) or in R&D sectors (e). Individual workers' productivities in these two sectors are represented by a vector $v = (v^e, v^p)$, where v^e denotes the worker's endowment for R&D sectors in the units of labor and v^p denotes the worker's endowment for production/marketing/sales sectors in the units of labor. For the given wages for R&D sectors, w_j^e, and production/marketing/sales sectors, w_j^p, a worker works in the R&D sectors if and only if $w_j^e v^e \geq w_j^p v^p$ holds. The vector v is assumed to be a random variable where $v^e = u^e/\Gamma\left(1-\frac{1}{\kappa}\right)$, $v^p = u^p/\Gamma\left(1-\frac{1}{\kappa}\right)$, with $u^e, u^p \sim_{c.d.f} e^{-u^{-\kappa}}$ $(\kappa > 1)$ and $\Gamma(\cdot)$ is a gamma function. From the above assumptions, the labor supply for production/marketing/sales sectors, L_j^p, and the labor supply for R&D sectors, L_j^e, can be derived as follows:

$$L_j^e = \bar{L}_j \left[1 + \left(\frac{w_j^e}{w_j^p}\right)^{-\kappa}\right]^{\frac{1}{\kappa}-1},$$

$$L_j^p = \bar{L}_j \left[1 + \left(\frac{w_j^e}{w_j^p}\right)^{\kappa}\right]^{\frac{1}{\kappa}-1}.$$

In the decision-making process of MNEs, they set locations for their headquarters, production facilities, and distributions centers first and then choose an optimal level of profits-shifting for maximizing PAT at the global level. I assume that MNEs consider corporate income taxes and their own tax-planning strategies in the location choices problem.

When three locations (i, l, n) are involved in making profits for an MNE producing ω, I denote the MNE's profits by $\pi_{iln}(\omega)$. As booking profits and revenues in different jurisdictions matter in taxation problems, how much profits and revenues occur in each location should be noted when applying the two-pillar approach to the model. For simplicity, I assume that neither profits nor revenues occur

in country i, where the MNE's headquarter is located. When the MNE produces a product in l, it exports the product to its subsidiary in n and gets profits of 0 as this is an internal transaction within the MNE. This can be justified by the assumption that a subsidiary in l sells its product to a subsidiary in n by charging a price which is equal to the marginal cost of production in order to avoid a double-marginalization problem. In this case, the MNE's revenue in l from selling to a third party is equal to 0. Lastly, the MNE's imported product from l to n is sold at the monopoly price to a third party. Then the profits and revenue of the subsidiary located in n are equal to $\pi_{iln}(\omega)$ and $\sigma\pi_{iln}(\omega)$, respectively. The latter expression is obtained from the property of a CES demand function in a monopolistic competition. Specifically, denoting the total output in n by X_n and price index by P_n,

$$\pi_{iln}(\omega) = \sigma^{-1}\left(\frac{\gamma_{il} w_l^p \tau_{ln}}{z_l(\omega)}\right)^{1-\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} X_n P_n^{\sigma-1}.$$

I assume that the MNE can shift $s_{iln}(\in [0,1])$ share of its profits $\pi_{iln}(\omega)$ from n to l, considering the difference in the corporate income tax rates for the two countries. However, profits-shifting is also assumed to incur economic losses to the MNE as much as $0.5\eta_{iln}s_{iln}^2\pi_{iln}(\omega)$ where η_{iln} is a parameter that captures the magnitude of friction. To sum up, after shifting profits, an MNE's profits and revenues recorded in the subsidiary of each country is as appears in Table 1. In the table, t_j denotes the corporate income tax rates in country j.

Table 1. MNE's Profits and Revenues in Subsidiaries

	Headquarter (i)	Production (l)	Market (n)
Profits before tax	0	$s_{iln}\pi_{iln}$	$(1-s_{iln})\pi_{iln}$
Profits after tax	0	$(1-t_l)s_{iln}\pi_{iln}$	$(1-t_l)(1-s_{iln})\pi_{iln}$
Third-party revenue	0	0	$\sigma\pi_{iln}$

The profits-shifting problem of an MNE is as the following:

$$\max_{s_{iln}\in[0,1]}\{(1-t_l)s_{iln}+(1-t_n)(1-s_{iln}) - 0.5\eta_{iln}s_{iln}^2\}\pi_{iln}.$$

By solving the above maximization problem, I can obtain the optimal level of profits-shifting, s_{iln}^*. Given this value, the MNE exports from l to n when the expected PAT exceed the fixed costs $w_n^p F_n$ become:

$$\{(1-t_l)s_{iln}^*+(1-t_n)(1-s_{iln}^*) - 0.5\eta_{iln}(s_{iln}^*)^2\}\pi_{iln} \geq w_n^p F_n.$$

When choosing a location for production, the MNE considers the country with the lowest marginal costs term $\frac{\gamma_{il} w_l^p \tau_{ln}}{z_l(\omega)}$ among the countries where the above inequality is satisfied. The distribution of $z(\omega)$ with distance parameters gives a cutoff productivity level at which the measure of active MNEs and trilateral trade flow are determined. Finally, aggregate levels of output, price indices, trade flows, active MNEs are expressed in terms of the parameter values including corporate income tax rates and wage vectors. Clearing conditions for goods markets and labor markets, normal profits conditions for firm entrance, and the balance of payments with trade deficits fix the equilibrium level of aggregate variables.

Incorporating the two-pillar approach to the baseline model is straightforward. I calculate the additional tax burden for an MNE with a location vector (i, l, n), attributed by the two pillars. When introducing Pillar 1, the additional tax burden added to the MNE's pre-tax profits is

$$0.25 * s_{iln} * \pi_{iln} * (t_n - t_l).$$

This implies that Pillar 1 reallocates a part of the taxable profits from the jurisdiction with low tax rates (say, l) to the jurisdiction with high tax rates (say, n) when the profit-shifting for tax-planning purposes has occurred. The MNE's changes in tax burden and PAT after introducing Pillar 1 are as appears in Table 2.

Table 2. Pillar 1's Impact on Tax Burden and PAT in Subsidiaries

	Headquarter (i)	Production (l)	Market (n)
Net changes in tax burden	0	$-0.25 s_{iln} \pi_{iln} t_l$	$0.25 s_{iln} \pi_{iln} t_n$
Profits after tax	0	$(1 - t_l) s_{iln} \pi_{iln} + 0.25 s_{iln} \pi_{iln} t_l$	$(1 - t_l)(1 - s_{iln}) \pi_{iln} - 0.25 s_{iln} \pi_{iln} t_n$

When Pillar 2 is introduced, I assume that every country has an Income Inclusion Rule and the MNE's headquarter located in a country i bears the top-up tax, which amounts to the difference between the minimum rates of corporate income tax, 15%, and the effective tax rates calculated based on the jurisdictional blending approach. Following the model's assumption that an MNE has one subsidiary in one jurisdiction, the additional top-up tax is easily calculated for the MNE with a location vector (i, l, n), as follows:

$$s_{iln} * \pi_{iln} * (\max\{0.15, t_l\} - t_l)$$
$$+(1 - s_{iln}) * \pi_{iln} * (\max\{0.15, t_n\} - t_n).$$

The MNE's changes in tax burden and PAT after introducing Pillar 2 are shown in Table 3.

Table 3. Pillar 2's Impact on Tax Burden and PAT in Subsidiaries

	Headquarter (i)	Production (l)	Market (n)
Net changes in tax burden	$s_{iln} * \pi_{iln} * (\max\{0.15, t_l\} - t_l) + (1 - s_{iln}) * \pi_{iln} * (\max\{0.15, t_n\} - t_n)$	0	0
Profits after tax	$-s_{iln} * \pi_{iln} * (\max\{0.15, t_l\} - t_l) - (1 - s_{iln}) * \pi_{iln} * (\max\{0.15, t_n\} - t_n)$	$(1 - t_l)s_{iln}\pi_{iln}$	$(1 - t_l)(1 - s_{iln})\pi_{iln}$

Introduction of the two pillars changes the profits-shifting problem of MNEs and thus, the optimal level of shifting amount s_{iln} changes accordingly. Moreover, it affects the MNE's location choice problem as the MNEs respond to the change in PAT in each jurisdiction.

I use Dekle et al. (2007)'s exact hat-algebra to simplify the calibration procedures and characterize the equilibrium changes in variables of interests. Due to the data availability, I consider 24 countries[2] in the analysis. Data for GDP (World Bank), trade shares (ADB MRIO), inbound FDI shares (UNCTAD), and effective average corporate income tax rates (OECD) are obtained or constructed from varied sources. I briefly discuss the main results of the model in the following section.

III. Simulation Results

Each country's FDI changes after introducing Pillar 1 to the baseline model are summarized in Table 4. The simulation results show that there is a moderate positive relationship (correlation coefficient of 0.67) between the level of effective average corporate income tax rates and the percentage changes in inbound FDI when Pillar 1 is introduced. In other words, inbound FDI is likely to increase in a country with high corporate income tax rates after Pillar 1 is introduced.

In my model, if an MNE originated from country i invests in country l to produce goods or services to export to country n, then the MNE's investment from i to l is affected by three factors. First, an increase in country n's total income positively affects the MNE's investment. Second, an increase in the proportion of n's expenditure spent on the

[2] Korea, Netherlands, Norway, Denmark, Germany, Russia, Luxembourg, Malaysia, Mexico, US, Belgium, Switzerland, Spain, Singapore, Ireland, UK, Italy, India, Japan, China, Canada, France, Australia, and Hong Kong SAR.

goods or services originated from i positively affects the MNE's investment. Third, an increase in the probability of an MNE's choosing country l as a production site positively affects the MNE's investment. Introducing Pillar 1 will have the most impact on the MNE's location choice via third channel when the MNE had chosen country l to locate a conduit company to shift its profits from country n. MNEs would find it less effective to move profits earned in country n to country l for tax avoidance schemes as Pillar 1 diverts taxing rights from country l to country n on a part of excessive profits shifted from country n to l. Though the size of Pillar 1's impact on specific countries' FDI changes may depend on the general equilibrium effect, the computation results suggest that Pillar 1's impact on FDI is mainly driven by the changes in an MNE's tax-planning incentives.

Table 4. Pillar 1's Impact on Inbound FDI

Country	Effective Average Tax Rate	% Changes in Inbound FDI	Country	Effective Average Tax Rate	% Changes in Inbound FDI
Korea	0.291	0.047	Spain	0.233	0.021
Netherlands	0.237	0.047	Singapore	0.161	0.027
Norway	0.205	0.012	Ireland	0.124	0.022
Denmark	0.203	0.007	UK	0.168	-0.009
Germany	0.280	0.086	Italy	0.213	0.000
Russia	0.198	-0.070	India	0.238	0.022
Luxembourg	0.232	0.060	Japan	0.294	0.109
Malaysia	0.24	0.026	China	0.230	-0.045
Mexico	0.301	0.317	Canada	0.238	0.052
US	0.223	-0.053	France.	0.294	0.094
Belgium	0.203	0.024	Australia	0.281	0.093
Switzerland	0.200	0.030	Hong Kong SAR	0.144	-0.115

Table 5 shows how Pillar 2 alters the global economy's FDI trends. Inbound FDI decreases the most in Ireland and Hong Kong SAR. It is not surprising that Ireland and Hong Kong SAR are the only two countries in the sample whose corporate income tax rates are below 15%. Indeed, Pillar 2 burdens MNEs with a top-up tax when their subsidiaries are located in a country whose corporate income tax rates fall short of 15%. In this case, the MNEs' PAT would decrease, the MNEs' incentives to in-

vest in R&D also decrease, and thus, less products are originated from the countries where the MNEs are headquartered. It is implied from the model's mechanism that in the final destination of the products, the proportion of its expenditure spent on the products originated from the headquartered country decreases, leading the MNEs to invest less in the production sites. Since Ireland and Hong Kong SAR serve as export platforms for many MNEs, these two countries would be hit the most by introducing Pillar 2.

Table 5. Pillar 2's Impact on Inbound FDI

Country	Effective Average Tax Rate	% Changes in Inbound FDI	Country	Effective Average Tax Rate	% Changes in Inbound FDI
Korea	0.291	-0.001	Spain	0.233	0.003
Netherlands	0.237	0.009	Singapore	0.161	-0.008
Norway	0.205	-0.003	Ireland	0.124	-0.079
Denmark	0.203	0.007	UK	0.168	0.002
Germany	0.280	0.007	Italy	0.213	0.000
Russia	0.198	0.000	India	0.238	-0.005
Luxembourg	0.232	0.014	Japan	0.294	0.001
Malaysia	0.24	-0.002	China	0.230	0.005
Mexico	0.301	-0.011	Canada	0.238	-0.006
US	0.223	0.006	France	0.294	0.003
Belgium	0.203	0.009	Australia	0.281	-0.005
Switzerland	0.200	0.024	Hong Kong SAR	0.144	-0.047

IV. Conclusions

Korea's inbound FDI increases by 0.047% when Pillar 1 is introduced. However, it decreases by 0.001% when Pillar 2 is introduced. When Pillar 1 is introduced, the simulation shows that inbound FDI from the US, UK, China, Netherlands, and Switzerland increase the most. Among the increase amounts of inbound FDI, the US contributes 50.7% of the total positive change, and the UK (11.5%), China (11.2%), Netherlands (4.5%), and Switzerland (3.3%) follow. These countries have lower corporate income tax rates than Korea among sample countries. If Pillar 2 is introduced, on the other hand, the inbound FDI of Korea decreases. This is mainly attributed to the general equilibrium effects, which suggest that a decrease in the variety of products developed by China or the US due to tax burden leads to less investment in a country like Korea. Among the countries whose investment

into Korea decreases after introducing Pillar 2, China and the US contribute the most to this decrease, 21.2% and 18.1%, respectively, and Switzerland (9.4%), Italy (9.3%), Denmark (8.2%), Spain (7.6%), and Russia (6.1%) follow.

The above analysis has several limitations. First, due to the limited data availability on bilateral inflow FDI stock and effective corporate income tax rates, I only include 24 countries in the sample, which may exclude several countries playing important roles in the global investment. Second, my model assumes that both Pillar 1 and Pillar 2 are applied to all MNEs. Indeed, Pillar 1 is applied to a set of MNEs whose annual consolidated revenue exceeds 20 billion euros and profit ratio is beyond 10% threshold. Pillar 2 is employed when MNEs' consolidated revenue exceeds 750 million euros. Thus, Pillar 2 is applied to a more broad set of MNEs than Pillar 1. The simulation results could be biased in a way that Pillar 1's effect is overestimated compared to that of Pillar 2. Lastly, the calculation of effective corporate income tax rates of each jurisdiction should be based on more specific information about MNEs' investment types as well as other information. These limitations may lead the simulation results to under-emphasizing the effects of Pillar 2 compared to real-world situations. Nevertheless, this study sheds light on the quantitative methods to assess the impacts of the two pillars by employing a trade-theoretical model. Further study can explore how each country will best respond to introduction of the two pillars by changing their own corporate income tax rates. KIEP