Economic Impact of Japan's Food and Agricultural FDI on Worldwide Recipient Countries

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Abstract

The consumption of food and agricultural (F&A) products in Japan is flattening out. As a result, the sector has been shrinking reheating the talks in Japan about the need to establish policies aimed at revitalizing and enlarging the scope of the Japanese agri-business. One possible strategic response is overseas expansion which also bears the potential to improve food availability for Japanese consumers. However, concerns have been raised over whether outward FDI in F&A may in fact aggravate the country's food security problem by having a "boomerang effect" on the farming sector caused by FDI-induced F&A exports to Japan, an issue closely related to Japan's import protection policies. This paper discusses the impacts of Japan's outward FDI in the F&A sectors and Japan's F&A import protection policies. Two complementary methodologies are adopted. First, a panel data specification is used to assess the F&A productivity response to Japanese FDI in the recipient economies. Following, the GTAP model is employed to analyze the worldwide impacts of Japanese outward FDI in F&A and the effects of unilateral changes in Japan's agricultural import protection policies. The major policy implications derived from this study are: increases in Japanese FDI can contribute to enhance F&A production in some of the regions considered, although the impact is small; Japan's FDI is welfare-improving in both supplier and those recipient regions able to rip the benefits of the technological spillovers; concerns that outward FDI could have a boomerang effect in Japan seem to be justified although this conclusion is largely influenced by the year of the database used; an import tariff increase makes Japanese consumers worse-off, producers better-off and improves the country's self-sufficiency rate; and import tariff reduction has positive impact for Japanese consumers, hurts producers and Japan experiences a deterioration of its self-sufficiency rate.

I. INTRODUCTION

Food production and consumption in Japan and Japanese outward FDI in food and agriculture

Japanese demand for food and agricultural (F&A) products grew markedly from the early 1960s until the early 1980s, a period of rapid economic growth and considerable increases in population. In the past few decades, however, economic and population growth have slowed down and Japanese demand for F&A products has stagnated (Roberts, Warr and Rodriguez, 2006; MIC, 2010).

Japanese diets have also undergone substantial modifications. Until the early 1990s, the Japanese diversified their diets incorporating more meat and dairy products in their daily intakes. Since then, however, consumers' interest in fresh foods weakened: the demand for meat and dairy products have eased while the consumption of rice and other starchy staples, such as seafood and vegetables, has fallen (Roberts, Warr and Rodriguez, 2006). Moreover, there has been an increasing substitution of homemade dishes with prepared foods and eating-out, reflecting lifestyle changes and the growing number of single-member households.

These changes have severely affected aggregate demand for F&A products in Japan and, a result, the sector has been shrinking in comparison with the non-agricultural sector.

The ongoing downward pressures on Japan's domestic food production along with the recent food price hikes and export restrictions by main agricultural exporter countries, have reheated the talks in Japan about the need to establish policies aimed at revitalizing the farming sector and enlarging the scope of the Japanese agri-business, particularly the food distribution and service sectors.

One possible strategic response to achieve such objectives is for Japanese enterprises to look for new settlements to expand their business investing in F&A production abroad. Japanese corporations have been stepping up their diversification by acquiring existing or developing new overseas food supply chains, from the ownership the farms through to the processing and distribution of the food stuffs. Several examples can be found worldwide: in the Chinese rice industry, Mitsui & Co., a Japanese trading company, started producing specific Japanese rice varieties through contract farming in the late 1990s (Zhan, 2009); in Australia, Nippon Meat Packers and Itoham breed beef, monitor or own abattoirs, pack the meat, and ship the finished product to their own distribution centers in Japan (Lloyd, 2008); in Latin America, Central Asia and Eastern Europe, the government of Japan, in coordination with the state-owned Japan Bank for International Cooperation and the Japan International Cooperation Agency, is planning investments for supply of corn, soybeans and wheat (Takada, 2009); just to mention a few.

Along with the revitalization of the sector, another possible consequence of the expansion of Japan's

agri-business abroad is the potential it bears to improve food availability and the variety of the diet for Japanese consumers through the generation of new food sources and increased import availability. But, this is not always seen as a positive outcome. There has been considerable debate and concern in Japan over whether outward FDI in F&A may, in fact, aggravate the country's food security problem by having an adverse effect on Japan's own agricultural production. The discussion has been centered on whether the relocation of the Japanese productive capacity abroad may cause a "boomerang effect", i.e. FDI-induced F&A exports to Japan from overseas subsidiaries, which may further weaken the fragile Japanese farming sector. Naturally, the possibility of a boomerang effect is an issue closely related to Japan's import protection policies. Traditionally in Japan, policies aimed at achieving food self-sufficiency have been used to justify agricultural protection resulting in Japan having the highest average F&A import tariffs among all industrialized nations.

Using data on trade flows and FDI to 9 of its major trading partners, this paper discusses the issues of Japan's outward FDI in the F&A sectors and Japan's F&A import protection policies, with particular interest on the implications for Japanese consumers, producers and the country as a whole. The following questions will be addressed: First, does Japan's outward FDI exert any impact on the F&A productivity of the recipient regions? Second, what are the implications for Japan and worldwide? And third, allowing for the worldwide macroeconomic effects of Japan's FDI in F&A, how would Japan's F&A consumption and production be also affected by unilateral changes in Japan's import protection policies? The remainder of this article is organized as follows: Section II presents the literature review. Section III contains the theoretical considerations for estimating the FDI effects on regional F&A production. Estimation results are presented in section IV. Section V contains the framework of the computable general equilibrium (CGE) model applied for assessing the worldwide macroeconomic impacts of FDI-induced output expansion in recipient economies and unilateral changes in Japan's import protection policies. Simulation results are presented in section VI. Concluding remarks follow in section VII.

II. LITERATURE REVIEW

Amid the several potential determinants to expand production (an adequate macroeconomic environment, the development of institutional factors and human capital, among others), many of the existing empirical and theoretical literature also highlights the importance of FDI as a key factor conducive to higher productivity. International investments have the potential for boosting the host economy's production through the generation of knowledge spillovers, such as technology transfers and know-how diffusion, thereby enhancing the recipient country's production capacity (Blomström, 1991; Burfisher, Robinson, and Thierfelder, 1992; Aitken and Harrison, 1994; Chuang and Lin, 1999; Blalock, 2001; Itakura, Hertel and Reimer, 2003; Loko and Diouf, 2009; Zhan, 2009).

For other authors, however, the overall impact of FDI on productivity is somewhat mixed. Saggi shows that recipient countries need to have reached a certain threshold of development (e.g. education or infrastructure) before being able to capture the benefits associated with FDI (Saggi, 2000). Loko and Diouf recognize that FDI helps productivity gains but that the impact of FDI on TFP growth critically depends on the absorptive capacity of the local economy (Loko and Diouf, 2009). Hallam concludes that host countries need an appropriate framework of domestic policy measures to ensure that local agriculture is capable of capitalizing on any spillover benefits of investments (Hallam, 2009).

III. THEORETICAL CONSIDERATIONS

Production Function Specification and Parameter Estimates

F&A output in recipient economies is modeled as a function of Japan's outward FDI and other critical macroeconomic determinants suggested by the literature reviewed. The regression equation is the following:

$$FAP_{it} = \alpha_i + \beta_1 GEX_{it} + \beta_2 GDPPC_{it} + \beta_3 GFCF_{it} + \beta_4 LF_{it} + \beta_{5i} FDI_{it} + \mu_{it} \quad \text{..... (1)}$$

where α_i is a region-specific fixed effect; *FAP* denotes the food and agricultural production in the recipient economies; *GEX* is the ratio of government expenditure to the GDP of recipient regions, used as an indicator of government size; *GDPPC* is gross domestic product per capita; *GFCF* is gross fixed capital formation; *LF* is total labor force; *FDI* is the ratio of Japan's FDI in F&A to the GDP of recipient regions; and μ_{it} is a random effect assumed identically independently normally distributed error term. In equation (1) all variables are expressed in their logarithmic form.

Expansions in government size are associated with expansions in output (Zhan, 2009). However, there are authors who find a statistically significant negative relationship between government size and productivity growth. They claim that the output-enhancing features of government prevail in newly emerging economies when government is very small since it generates beneficial externalities through the creation of infrastructure, administrative and legal institutions and improved environment for investments as opposed to excessively large government spending which can contribute to economic stagnation and decline as a result of the progressive burden of taxation and distortions in the free market due to excessive government intervention (Barro, 1991; Fölster and Henrekson, 2000; Vedder and Gallaway, 2001). Therefore, the effect of *GEX* on *FAP* can be either positive or negative.

Following (Gros and Suhrcke, 2000; Martincus, 2005; Frederick and Monsen, 2006) we use *GDPPC* as a sign of overall economic performance. We then expect it to have a positive effect on *FAP*.

As a measure of gross net investment in fixed capital, *GFCF* has the potential to enhance output either by purchasing or improving tangible assets such as land, animals, equipment, machinery and infrastructure (OECD, 2009). We therefore expect to find a positive relation between *GCFC* and *FAP*.

The importance of human capital as a determinant of growth of output is presented in Barro and Sala (Barro and Sala, 1995). Most empirical studies use labor quality (ratio of skilled to unskilled labor, employment share of white-collar to blue-collar workers and schooling years, among others) as a factors explaining production growth (Chuan and Lin, 1999; Barro, 2001; Zhan, 2009). However, these data was not available for the regions encompassed in our analysis. We therefore follow the approach presented in Röller and Waverman (Röller and Waverman, 2001) and Isaksson (Isaksson, 2009) and use total labor force as a proxy for human capital. The main advantage of this indicator is it readiness. The main disadvantage is that it leads to underestimation of productivity and overestimation of the labor input because not everyone in the labor force is actually working (either due to unemployment or underutilization). Nonetheless, we expect *LF* to have a positive impact on *FAP*.

Based on the previous discussion, even if small, we expect Japan's outward FDI to have a positive effect on the F&A production of at least some of the recipient regions considered in the analysis.

We estimate equation (1) as a fixed effect model to control for region-specific characteristics. Fixed effects are assumed constant over time. The selection criteria used to determine the appropriate model was based on the *F*-test to determine the significance of the fixed effect hypothesis over the model with a constant intercept along regions (pooled estimation). Regressors β_1 to β_4 are common to all regions and periods. *FDI* is the only variable defined as cross-section specific since the purpose of this section is to assess the impact of Japan's FDI on the F&A sector of each recipient region. Given the log-log specification, the parameter β_{5i} directly provides the elasticity of *FDI* to each region's F&A output.

We use an estimated generalized least squares (EGLS) approach assuming the presence of cross-section heteroskedasticity, which allows for a different residual variance for each cross-section, and white cross-section standard errors to allow for general contemporaneous correlation between the residuals.

Data

Macroeconomic data on 9 FDI recipient regions (China, India, Korea, Australia and New Zealand, ASEAN, NAFTA, EU 25, MERCOSUR and the Rest of the World) for the time period 1989-2004 were pooled to obtain the panel which was then used to estimate equation (1). The variables definition and its sources are presented in Table 1.

Table 1: Variables definition and sources

Variables	Definition	Units	Source	Notes
FAP	Net food and agricultural production	1,000 intl. US$	(1)	(1)
GEX	Ratio of government expenditure to GDP	---	(2)	(2)
GDPPC	GDP per capita	US$	(2)	(2)
LF	Labor force, total	person	(2)	-
GFCF	Gross fixed capital formation	US$	(2)	(2)
FDI	Ratio of Japan's FDI in food and agriculture to recipient regions' GDP	---	(3)	(3),(4)&(5)

Sources: (1) FAO Statistical Databases; (2) The World Bank - World Development Indicators (WDI) 2009; (3) Ministry of Finance Japan.
Notes: (1) "International US$" are derived using a Geary-Khamis formula for the agricultural sector. This method assigns a single "price" to each commodity. For example, one metric ton of wheat has the same price regardless of the country where it was produced; (2) Constant dollars, base year 2000; (3) Includes forestry; (4) GDP deflators extracted from The World Bank - WDI (2009) were used to compute real FDI outflows as investment deflators were not available from the WDI; (5) Countries with an appropriate macroeconomic environment are expected to attract more FDI (Zhan, 2009). For that reason, we used the ratio of FDI to GDP.

With reference to FDI, there are basically two classes of time series data: the Balance of Payment (BOP) statistics, published by the IMF, and individual-country statistics. The advantage of the BOP-based data is that statistics are compiled uniformly, thus facilitating cross-country comparisons. However, BOP statistics only provide aggregated flows without information on source/destination country nor industry breakdown. On the other hand, even when compilation methods and industry categorization varies, individual-country statistics provide disaggregation both by country and by industrial sector. In Japan, detailed data on FDI is gathered by the Ministry of Finance and it is therefore the data we used in our calculations.

IV. ESTIMATION RESULTS

Estimation results are reported in Table 2.

Table 2: Estimation results

Dependent Variable: Ln(FAP)		
Method: Pooled EGLS (Cross-section weights)		
Sample: 1989 2004		
Cross-sections included: 9		
Total pool observations: 133		
Variable	Coefficient	Std. Error
C	-2.880**	1.273
Ln(GEX)	0.121	0.079
Ln(GDPPC)	0.155***	0.055
Ln(LF)	0.929***	0.069
Ln(GFCF)	0.129***	0.042
$Ln(FDI_{CHN})$	-0.009	0.011
$Ln(FDI_{IND})$	0.003	0.006
$Ln(FDI_{KOR})$	0.027**	0.012
$Ln(FDI_{AUS/NZL})$	0.038**	0.016
$Ln(FDI_{ASEAN})$	0.001	0.006

$Ln(FDI_{NAFTA})$	0.016*	0.009
$Ln(FDI_{EU25})$	0.008*	0.004
$Ln(FDI_{MER})$	-0.003	0.020
$Ln(FDI_{ROW})$	0.011	0.008
Adjusted R-squared	0.999	
F-statistic	108081.6	
Prob(F-statistic)	0.000	
Durbin-Watson stat	0.948	

Source: Authors' calculations.
Notes: (1) Asterisks indicate significance at 10% *, 5%** and 1%***: (2) White heteroskedasticity consistent errors; (3) The regression includes regional fixed effects but are not shown here due to space limitations.

The results suggest a good model fit. In general, the estimated coefficients are significant and consistent with the expected economic relationships.

We find that *GEX* is not significantly associated with *FAP*. Our results seem to confirm the ambiguity between the relationship between the public expenditure and economic growth (Zhan, 2009).

In line with our theoretical expectations, find that there is a robust, positive relationship between *GDPPC*, *LF* and *GFCF* and *FAP*.

Turning to the impact of Japan's FDI on the F&A sector of each recipient region, regression results confirm that increases in Japanese outward FDI in F&A contribute to enhance food and agricultural production in some of the regions considered, although, as expected, the impact is small. A 1% increase in FDI results in a 0.03% increase in the F&A output of Korea, a 0.04% increase in Australia and New Zealand (both impacts significant at the 5% level), a 0.016% in the NAFTA region and 0.008% in EU25 (these last two at the 10% significance level). However, Japanese FDI does not seem to exhibit any significant effect in the agricultural and food sectors of China, India, ASEAN, MERCOSUR and the Rest of the World. We can think of at least two possible explanations for this. First, during the period considered, 80% of the total outflows of Japan's F&A FDI concentrated in three regions: the EU25 (44%), NAFTA (26%) and Australia and New Zealand (10%). And second, in line with the literature which argues that the overall effect of FDI on productivity is complex, the regions where Japanese FDI does exert an impact are characterized by more favorable macroeconomic frameworks that can better accommodate the increased resources, giving them the greater ability to absorb the knowledge spillover effects of FDI.

V. FRAMEWORK OF THE CGE MODEL

The Global Trade Analysis Project (GTAP) model (Hertel, 1997) is employed to analyze the possible the impacts of Japanese outward FDI in F&A and the effects of unilateral changes in Japan's agricultural import protection policies. In this section, first, an outline of the fundamental structure of the model is presented, followed by the simulations conducted and the assumptions on the experiments.

Model structure

The standard GTAP Model is a multi-region, multi-sector, computable general equilibrium model (CGE). It is built on the Walrasian general equilibrium system, in which the central idea is that market demand equals supply for all commodities at a set of relative prices.

Each region of the model is represented by three types of economic agents: private households, producers and the government, and it is endowed with five primary factors: skilled and unskilled labor, natural resources, land and capital.

The "regional household", a single decision making economic agent, at the upper level, maximizes a Cobb-Douglas utility function constrained by a budget made up of endowment incomes paid by producers and the sum of all taxes paid by private households, firms, the government and taxes on international transactions. This regional income is exhausted over the three forms of final demand: private household and government expenditures and savings.

On the demand side, private household preferences are dictated by a constant demand elasticity (CDE) implicit expenditure function. On the supply side, firms are assumed to combine intermediate inputs (domestic and imported) in fixed proportions with primary factors which demands are represented by a constant elasticity of substitution (CSE) and are based on the profit maximizing behavior of firms. Perfect competition is assumed so firms earn zero-profits and operate under constant returns to scale. At the final stage, both intermediate inputs and primary factors are used to produce the final output assuming a Leontief production function. Each region produces homogeneous goods, thus products are only differentiated by origin (Armington assumption), and trades with other regions.

All savers in the model face a common price for a savings commodity and a global banking sector ensures that global demand for savings equals global demand for investment in the post-solution equilibrium. This means that if all other markets in the multi regional model are in equilibrium, all firms earn zero profits, and all households are on their budget constraint, then global investment must equal global savings by virtue of Walras' Law.

Data and baseline

The current study uses version 6 of the GTAP database, which is benchmarked to 2001 and comprises 87 economic regions and inter-industry linkages for 57 sectors. Before we perform the simulations, a pre-experiment is implemented to construct an updated post-simulation database which we then used as a starting point for our subsequent policy experiments[1]. The updated baseline introduces changes to the policy landscape that took place since 2001 and 2005. These include: EU enlargement (EU 25), the implementation of Uruguay Round commitments including abolition of quotas on textiles and clothing by end-2004, and the WTO accession commitments by China.

Regional and sectoral aggregations

We aggregate the GTAP data up to 10 regions and 4 sectors presented in Table 3. Our regional aggregation has been chosen to reflect major economic areas and countries of the world in order to obtain practical implications in terms of regional trade relations.

Table 3: Regional and sectoral aggregations

Regions	
JPN	Japan
CHN	China
IND	India
KOR	Korea
AUS/NZL	Australia and New Zealand
ASEAN	Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Rest of Southeast Asia
NAFTA	United States, Canada, Mexico
EU25	Austria, Belgium, Denmark, Finland, France, Germany, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, Cyprus, Czech Republic, Hungary, Malta, Poland, Slovakia, Slovenia, Estonia, Latvia, Lithuania
MERCOSUR	Argentina, Brazil, Uruguay[2]
ROW	Hong Kong, Taiwan, Rest of North America, Switzerland, Rest of EFTA, Rest of Europe, Croatia, Rest of Middle East, Rest of Oceania, Sri Lanka, Colombia, Peru, Venezuela, Rest of Andean Pact, Chile, Rest of South America, Central America, Rest of FTAA, Rest of the Caribbean, Albania, Bulgaria, Romania, Russian Federation, Rest of Former Soviet Union, Turkey, Morocco, Tunisia, Rest of North Africa, Botswana, South Africa , Rest of Southeast Asia, Bangladesh, Rest of South Asia, Rest of South African CU, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe, Rest of SADC, Madagascar, Uganda, Rest of Sub-Safrica
Sectors	
Agriculture and Food	Wheat, Cereal grains nec, Oil seeds, Paddy rice, Vegetables, fruit, nuts, Sugar cane, sugar beet, Plant-based fibers, Crops nec, Meat: cattle,sheep,goats,horse, Cattle,sheep,goats,horses, Animal products nec, Raw milk, Wool, silk-worm cocoons, Meat products nec, Vegetable oils and fats, Dairy products, Processed rice, Sugar, Food products nec, Beverages and tobacco products, Forestry

[1] A process based on the GTAP Altertax procedure is used to impose these changes while minimizing the distortions to the original GTAP dataset (Malcolm, 1998).

[2] Paraguay is not identified as a separate region in the GTAP 6 database and can therefore not be included in the simulation analysis.

Natural resources and Energy	Fishing, Minerals nec, Coal, Oil, Gas
Manufactures	Textiles, Wearing apparel, Leather products, Wood products, Paper products, publishing, Petroleum, coal products, Chemical,rubber,plastic prods, Mineral products nec, Ferrous metals, Metals nec, Metal products, Motor vehicles and parts, Transport equipment nec, Electronic equipment, Machinery and equipment nec, Manufactures nec
Services	Electricity, Gas manufacture, distribution, Water, Construction, Trade, Transport nec, Sea transport, Air transport, Communication, Financial services nec, Insurance, Business services nec, Recreation and other services, PubAdmin/Defence/Health/Educat, Dwellings

Simulations conducted

In this paper, two model simulations are carried out, one of top of the other. The first one is a F&A output expansion in the FDI recipient regions identified in the previous section. Following, we consider unilateral changes in Japan's F&A import protection policies. Table 4 shows the relationships among the simulations conducted. The precise designs of these two experiments are discussed below.

Table 4: Simulations design matrix

Pre-experiment (updated baseline)	Simulation 1	Simulation 2	
• EU enlargement (EU 25) • Implementation of Uruguay Round commitments including abolition of quotas on textiles and clothing by end-2004 • WTO accession commitments by China	F&A output expansion in Japan's FDI recipient regions'	Unilateral changes in Japan's F&A import protection policies (on top of Simulation 1)	
		Simulation 2.1	Simulation 2.2
		5% increase in import tariffs	5% reduction in import tariffs

Simulation 1: F&A output expansion Japan's FDI recipient regions'

Assuming that Japan's FDI flows result in knowledge spillovers in the recipient regions and using the elasticity estimates obtained in section IV, the F&A output of the four recipient regions for which regression results showed significant FDI coefficients is augmented. Output changes are taken as changes in the Hicks-neutral technology parameters for the F&A production sectors of the respective regions. The exogenous shocks implemented in the simulation are shown in Table 5.

Table 5: Regional shocks applied to F&A output

Regions	Shocks (%)
KOR	0.027
AUS/NZL	0.038
NAFTA	0.016
EU25	0.008

Source: Authors' calculations based on regression results from Table 2.

Simulation 2: Unilateral changes in Japan's F&A import protection policies

Following, we considered the impacts of unilateral changes in Japan's external policy measures. Specifically, a 5% increase and a 5% reduction of F&A import tariffs. These simulations are conducted using the output file produced in Simulation 1 as a baseline.

The large number of tariff rate quotas (TRQs) applied by Japan for food and agricultural products provides a major aggregation problem and the possibility of aggregation bias, since the aggregation we employ combines F&A products into a single commodity. Thus we do not consider the effect of changes in TRQs.

VI. SIMULATIONS RESULTS

This section summarizes the results and main findings of the simulations conducted. Two dimensions of the impacts are discussed: the worldwide impacts, in general, and the impact on Japan and its macroeconomic agents (consumers and producers), in particular.

Simulation 1: F&A output expansion Japan's FDI recipient regions'

The global impacts on both recipients' and Japanese economies are summarized in Table 6.

Table 6: Changes in key indicators from updated baseline

Simulation	Welfare (million US$)				Real gdp	Total tot	F&A tot	F&A x	F&A m	F&A o	F&A ss
1	a_e	t_ch	tot	Total	(%)	(%)	(%)	(%)	(%)	(%)	(%)
NAFTA	2.454	201.832	-6.326	201.976	0.002	0.000	-0.001	0.043	-0.016	0.008	0.00004
EU25	6.386	94.445	1.306	101.419	0.001	0.000	0.000	0.003	-0.003	0.002	0.00001
MERCOSUR	-0.383	0.000	-2.717	-3.172	0.000	-0.003	-0.001	-0.031	0.001	-0.008	-0.00006
JPN	5.224	0.000	6.229	10.612	0.000	0.001	0.002	-0.048	0.023	-0.005	-0.00002
KOR	-3.786	18.727	2.378	16.824	0.003	0.001	0.000	0.144	-0.043	0.025	0.00011
CHN	1.551	0.000	2.018	2.765	0.000	0.001	0.001	-0.051	0.026	-0.004	-0.00003
AUS/NZL	1.434	29.183	-5.666	24.597	0.007	-0.006	-0.010	0.128	-0.037	0.056	0.00054
IND	0.503	0.000	-0.307	0.147	0.000	0.000	0.000	-0.043	0.017	-0.002	-0.00002
ASEAN	0.119	0.000	-0.685	-0.877	0.000	0.000	0.000	-0.031	0.015	-0.010	-0.00007
ROW	5.526	0.000	3.772	8.922	0.000	0.000	0.001	-0.043	0.015	-0.007	-0.00004

Source: Authors' calculations.
Notes: 1) a_e: allocative efficiency; 2) t_ch: technological change; 3) tot: terms of trade; 4) x: exports; 5) m: imports; 6) output; 7) ss: self-sufficiency.

As it can be seen in the decomposition of welfare, the induced technological changes dominate and result in welfare[3] gains in all recipient regions for which output expands. Japan, as the supplier of FDI, also benefits from the technology spillovers and its welfare also improves. This confirms the earlier findings by

[3] As measured by an equivalent variation in income (see Hertel 1997).

Kojima (Kojima 1973 and 1985) that Japan's FDIs are welfare-improving in both supplier and recipient countries. Unable to absorb the knowledge spillover effects of Japan's FDI, the regions experiencing a decline in welfare under Simulation 1 are MERCOSUR and ASEAN, both F&A exporters and for which the negative effects of terms of trade shifts dominate.

Expressing the gains as a share of real GDP is perhaps a better indication of the magnitude of gains (as opposed to the absolute monetary value) as account is taken of the size of the economy. It is only the recipient regions for which a technology transfer due to FDI was simulated, those which experience small but positive increases in real GDP. The rate of change in the remaining regions, Japan included, is insignificant.

F&A terms of trade deteriorate for AUS/NZL, NAFTA and MERCOSUR although for different reasons. In the case of the first too, the deterioration is largely driven by a decrease in the regional export price caused by the increase in output. Something different occurs in MERCOSUR, where increased competition due to price reductions in other major F&A productive regions leads to export price contractions and output decrease. However, the reduction in export prices does not seem to be enough to penetrate new markets or even maintain the current level of international sales and exports shrink. F&A terms of trade improve in Japan. This improvement is mainly caused by a decline in output and a product price increase which cause exports to shrink and imports to expand. These results are consistent with those of Otsubo (Otsubo, 2005) who noted that terms of trade worsen in the FDI-recipients economies and improve in the FDI-supplier economy.

We now turn to examine the changes in the self-sufficiency rate implied by this scenario. As expected, self-sufficiency rates improve for all recipient regions experiencing an FDI-induced output expansion and deteriorate in those unable to rip the benefits of technological spillovers caused by Japan's FDI. The self-sufficiency rate also deteriorates for the FDI supplier. It appears from these results that Japan's attempts to diversify its sources of food supply through investment in overseas agriculture have not delivered what is needed to benefit to Japanese consumers in terms of enhancing food availability and the diversity of their diets.

Simulation 2: Unilateral changes in Japan's import protection policies

Table 7 presents the effects of unilateral changes in Japan's import protection policies.

Table 7: Changes in key indicators using the output file produced in Simulation 1 as a baseline

Simulation	Welfare (million US$)				Real gdp	Total tot	F&A tot	F&A x	F&A m	F&A o	F&A ss
2.1	a_e	t_ch	tot	Total	(%)	(%)	(%)	(%)	(%)	(%)	(%)
NAFTA	21.329	201.677	-184.433	26.402	0.002	-0.013	-0.001	-1.336	-0.050	-0.131	-0.00097
EU25	46.781	94.412	-35.459	124.744	0.002	-0.001	0.001	-0.257	-0.008	-0.063	-0.00042

MERCOSUR	-2.068	0.000	-19.815	-20.650	0.000	-0.019	-0.009	-0.293	-0.044	-0.076	-0.00055
JPN	-996.632	0.000	544.110	-508.438	-0.024	0.115	0.011	-2.834	-8.100	1.312	0.00578
KOR	-23.018	18.705	-24.732	-26.285	-0.001	-0.015	0.001	-3.744	-0.200	-0.135	-0.00089
CHN	17.363	0.000	-59.170	-25.756	0.002	-0.018	0.001	-2.544	-0.042	-0.116	-0.00088
AUS/NZL	0.458	29.117	-73.422	-40.275	0.007	-0.079	-0.042	-0.791	-0.294	-0.337	-0.00309
IND	7.366	0.000	-8.724	0.389	0.002	-0.014	0.001	-0.817	0.065	-0.034	-0.00031
ASEAN	-9.911	0.000	-112.168	-111.605	-0.002	-0.025	-0.006	-1.000	-0.183	-0.230	-0.00179
ROW	27.086	0.000	-26.623	13.744	0.001	-0.002	0.001	-0.647	-0.006	-0.074	-0.00049

Simulation	Welfare (million US$)				Real gdp	Total tot	F&A tot	F&A x	F&A m	F&A o	F&A ss
2.2	a_e	t_ch	tot	Total	(%)	(%)	(%)	(%)	(%)	(%)	(%)
NAFTA	-18.820	202.000	195.415	400.920	0.002	0.014	-0.001	1.601	0.023	0.165	0.00117
EU25	-39.225	94.481	42.372	74.791	0.001	0.002	-0.001	0.298	0.003	0.075	0.00050
MERCOSUR	1.533	0.000	16.636	16.636	0.000	0.016	0.008	0.266	0.051	0.068	0.00049
JPN	880.351	0.000	-604.431	336.666	0.021	-0.126	-0.009	3.091	9.178	-1.418	-0.00629
KOR	17.825	18.751	32.833	65.296	0.009	0.019	-0.001	4.513	0.133	0.206	0.00123
CHN	-16.281	0.000	71.236	35.270	-0.001	0.022	0.000	2.758	0.103	0.123	0.00093
AUS/NZL	2.608	29.254	70.850	97.969	0.008	0.076	0.027	1.157	0.251	0.497	0.00460
IND	-7.215	0.000	9.153	-0.128	-0.002	0.014	0.000	0.831	-0.036	0.034	0.00031
ASEAN	11.401	0.000	125.149	124.201	0.002	0.028	0.007	1.055	0.237	0.236	0.00186
ROW	-18.741	0.000	40.244	5.809	-0.001	0.003	0.000	0.640	0.040	0.068	0.00046

Source: Authors' calculations.
Notes: 1) a_e: allocative efficiency; 2) t_ch: technological change; 3) tot: terms of trade; 4) x: exports; 5) m: imports; 6) output; 7) ss: self-sufficiency.

Simulation 2.1: Five-percent increase in F&A import tariffs

Under this scenario, the loss to Japanese consumers caused by the F&A import price increase outweighs the gain to domestic producers and Japan experiences a welfare reduction. Despite the improvement in its terms of trade, there is a welfare loss in Japan due to the offsetting effect of the less efficient resource allocation.

In Japan, in addition to welfare declines, real GDP also deteriorates. Japan experiences the greatest reduction of all regions which is consistent with the fact that in the absence of changes in factor supplies and productivity growth with the policy shock, changes in the real GDP reflect the welfare changes due to the allocative effects.

Not only Japan is the only region showing an improvement in total terms of trade but it also shows the largest F&A terms of trade gains of all regions. Both effects consistent are with the theory that when a large country[4] imposes a tariff, it experiences a terms of trade improvement. The tariff increase decreases the world price, decreases output in all recipient regions and increases the domestic price for the imported F&A products in Japan, producing a substitution effect of domestically produced goods for imports. The increase in the consumption of domestically produced (exported) goods in Japan increases its price relative to world prices resulting in an improvement of country's terms of trade.

[4] Due to the Armington assumption in the GTAP model.

The only region where output expands is in the FDI supplier confirming that, indeed, the F&A output-enlarging effect of Japan's FDI in the recipient regions is small and can be easily reversed by a unilateral import tariff increase in the donor country. As a result, the volume of world trade shrinks and world prices increase. Thus, as a result of Japan's tariff increase, both consumers and producers the world bear a reduced flow of traded goods at higher costs in general.

Production in Japan is encouraged by the increased consumption of domestically produced goods and Japan is the only country which experiences an improvement of its self-sufficiency rate.

Simulation 2.2: Five-percent reduction in F&A import tariffs

Japan, as a net F&A importing country, benefits substantially from its own reform as the gains of increased allocative efficiency outweigh the negative effects of terms of trade shifts and the country experiences a significant welfare improvement. Due to the price decrease of imported goods the consumers' surplus increase dominates the producers' surplus loss and the country gains from trade liberalization. For the recipient economies, welfare results from Simulation 2.2 show that the impact pattern of Simulation 1 is largely preserved but intensified. All recipient regions experience increases in economic welfare with the exception of IND, although the loss is very small.

In terms of real GDP Japan shows the greatest rate improvement of all regions since it also bears the largest allocative efficiency gain.

Rising world prices for F&A products represent a negative terms of trade shock for Japan and the country experiences the greatest F&A terms of trade deterioration of all regions, which is consistent with the basic economic theory that states that for a country engaging in its own tariff liberalization, the terms of trade effect is negative, ceteris paribus, and increases along with the economic size of the country. This occurs because a tariff reduction increases the world price of imports and decreases the domestic price for the imported good, producing a substitution effect of imports for domestically produced goods. The decrease in the domestic consumption of domestically produced (exported) goods then reduces its price relative to world prices and the terms of trade for the country reducing the tariff deteriorates.

Japan is the only region where output contracts. All remaining regions see their F&A sectors expand as a result of Japan's trade liberalization. The volume of world trade expands and the price of world trade decreases. As a result, both consumers and producers in the world enjoy a greater flow of traded goods at lower costs in general.

Production in Japan is discouraged by the decrease in prices for the domestically produced goods and the country experiences a deterioration of its self-sufficiency rate.

VII. CONCLUDING REMARKS

Using macroeconomic data on 9 recipient regions of Japan's outward FDI in food and agriculture (F&A) for the time period 1989-2004, we confirmed that increases in Japanese FDI can contribute to enhance F&A production in some of the regions considered, although the impact is small. A 1% increase in FDI results in a 0.03% increase in the F&A output of Korea, a 0.04% increase in Australia and New Zealand, a 0.016% in the NAFTA region and 0.008% in EU25. However, Japanese FDI does not seem to exhibit any significant effect in the F&A productive sectors of China, India, ASEAN, MERCOSUR and the Rest of the World. There might be two possible explanations for this. Firstly, during the period considered, 80% of the total outflows of Japan's F&A FDI concentrated in the EU25 (44%), NAFTA (26%) and Australia and New Zealand (10%). Secondly, these regions are characterized by more favorable macroeconomic frameworks which give them the greater ability to absorb the knowledge spillover effects of FDI. Moreover, while government size does not seem to be significantly associated with F&A production in the recipient regions, gross domestic product per capita, labor force and gross fixed capital formation, all positively affect the recipient regions' productivity.

Following, applying the Global Trade Analysis Project (GTAP) Model we assessed the worldwide implications of the previous findings in a multi-country, multi-sector, general equilibrium framework. We found that Japan's FDI is welfare-improving in both supplier and in those recipient regions able to rip the benefits of technological spillovers caused by Japan's FDI.

Concerns that outward FDI could have a boomerang effect in Japan seem to be justified. Increased F&A imports discourage Japanese production and the country experiences a deterioration of its self-sufficiency rate. It should be mentioned, however, that while this was the situation back in 2004, the baseline year of the GTAP database used in the analysis, this is not the case at the moment. By investing abroad, Japanese enterprises which have lost competitive advantage in Japan are able to lower operating costs through the procurement of cheap raw materials and production factors. However, rather than aiming at increasing sales in their home country, their interest nowadays is more focused on boosting the scope of their business. As a result, Japanese F&A corporations with overseas subsidiaries currently export about 10% of its produce back to Japan while the better part is either sold domestically or exported to third countries (MIC, 2010). Fears of a hollowing out in the sector are now unjustified as the revitalizing effect of FDI seems to be dominating the boomerang effect, setting the grounds for growth and productive progress in the Japanese agribusiness, generating the potential to enhance Japan's self-sufficiency of F&A rather than to deteriorate it.

Allowing for the worldwide macroeconomic effects of Japan's outward FDI, we then analyzed the impact of unilateral changes in Japan's import protection policies on Japan's F&A consumption and production. Our main findings can be summarized as follows. The unilateral policy changes effect dominate the effects

of FDI-induced output expansion confirming that the impact of Japan's FDI on recipient economies is small. A 5% import tariff increase makes Japanese consumers worse-off since it increases the price for the imported goods, decreases F&A availability within Japan and negatively affects the variety of the Japanese diet. The effect is positive for Japanese producers since increased protection allows them to expand output and revitalize the sector. There is also a positive effect for the economy as a whole since improves the country's self-sufficiency rate. On the other hand, a 5% import tariff reduction has a direct positive impact for Japanese consumers since it decreases the prices for the imported goods increasing F&A availability and the variety of their diets. There is a bearing impact, however, on Japanese producers since higher competition induced by reduced protection leads to output reductions and the shrinkage of the sector. There is also a negative effect for the economy as a whole since the country experiences a deterioration of its self-sufficiency rate.

Limitations and Future challenges

The implications of this study should be carefully interpreted and the findings should be considered in the context of the assumptions used to generate them. There are major limitations that prohibit us from drawing decisive conclusions.

The first one is related to the parameters of the estimated productivity response used in the CGE model. As asserted by Graham and Krugman (Graham and Krugman, 1989) the macroeconomic outcomes of FDI, a microeconomic behavior, should be evaluated in a general-equilibrium framework. We acknowledge that, in theory, Japan's outward FDI in F&A may exert an indirect impact on other production sectors as well. However, at this stage, since there is no other evidence to draw on, we assume that the impact on the F&A sector dominates the intersectoral impact and we adopt our simplified partial equilibrium regression estimates as proxies to assess the general equilibrium effect on F&A output in recipient regions. Future econometric research and sensitivity analysis concerning these parameters would be desirable.

As for the unilateral changes in Japan's import protection measures, richer implications could have been derived had other agricultural policy measures, such as TRQs, import controls and subsidies also been modeled. We can certainly expand the scope of the analysis in this direction.

The following limitations are related to the database used and the GTAP model framework. As mentioned, since the database employed in this analysis dates from a few years ago, we consider that it is not capable to reflect the more recent FDI-induced revitalization of the Japanese agribusiness and its potential to improve, rather than deteriorate, the country's self-sufficiency. Furthermore, simulations are run as comparative statics and the model does not identify the paths taken. Therefore, results should be interpreted as representing the change in the economic system that would occur given the proposed shock. Moreover, factors of production, labor and capital, are assumed to be mobile among sectors within a

country but immobile across borders, although such an assumption of international immobility of factors is unrealistic in an age of globalization. Therefore, the effects of FDI can not be satisfactorily incorporated into the model. And finally, the high degree of aggregation in our model does not allow us to draw richer conclusions, particularly with respect to the effect of the different shocks applied on the self-sufficiency ratio at a more product-detailed level.

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