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The Art of Exceptions: Sensitive Products in the Doha Negotiations*

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Abstract

It is necessary for multilateral trade negotiations to include exceptions to accommodate politically sensitive sectors. However, given the highly concentrated distribution of agricultural protection, too many exceptions put at risk the objectives of World Trade Organization. This paper assesses the delicate balance required, based on the case of agricultural trade protection in Europe and Japan, two countries where tariff dismantling in the agricultural sector is a particularly sensitive issue. Since agricultural border protection is heterogeneous, we avoid aggregation bias by extending a multi-country computable general equilibrium model to the product level. This allows us to combine the assets from general equilibrium and partial equilibrium modeling, and to take explicit account of interdependencies and trade policies. The results suggest that consideration of sensitive products strongly limits the potential gains from a possible agriculture agreement at Doha. Moreover, there is no aggregate trade-off between decreasing tariffs and increasing/opening quotas. To achieve "substantial" market access improvements in the agricultural sector, the objective should be most favored nation tariff reduction.

Keywords: Agricultural trade, Doha Development Agenda, CGE model, disaggregation, sensitive products, tariff-rate quotas.

JEL Classification: C68, F13, F17, Q17, Q18.

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1 Introduction

World Trade Organization (WTO) negotiations are supposed to set general rules for reducing trade barriers. To meet this objective, a formula-based approach was adopted in the Doha round (Francois and Martin, 2003). The formulas specify by how much each protection level should be cut. However, there are numerous exceptions to this principle since each country's political priorities stipulate a high level of protection for certain sensitive sectors. In this article, we deal with the agriculture negotiations, which agreed to the introduction of sensitive products, which would be exempt from the strict discipline imposed by the formula approach. These products are allowed more flexible treatment in relation to market access, and are subject to lower tariff cuts than specified by the formula; however, in exchange, tariff rate quotas (TRQ) will be opened to ensure (at least some) "substantial" improvements in the market access for each product.

The aim of this paper is first, to determine to what extent sensitive products undermine the Doha Round ambitions, and second to evaluate the trade-off between TRQ and tariffs in relation to improving market access. Modes of market access for agricultural products provide an appropriate entry to analyze negotiations. On the one hand there is large consensus among scholars on the fact that most (two-thirds) of the welfare gains from a Doha agreement (Brockmeier and Pelikan, 2008) or from full liberalization (Martin and Anderson, 2006) would come from the removal of tariffs on agricultural products. On the other hand, these welfare gains would be realized only through a substantial reduction of those barriers. The potential gains from liberalization of agriculture, however, would be strongly reduced by the numerous sources of contention in the sector (i.e., sensitive products, safeguard mechanism) and, due to the highly skewed distribution of protection, allowing for even a small number of tariff lines to be treated as sensitive products, would have a strong effect overall (Anderson et al., 2006; Bouët et al., 2007; Decreux and Fontagné, 2008; Decreux, 2009).

The role of the flexibility is often taken into account in assessments of WTO negotiations; in this study we try to improve its treatment. In some studies, sensitive products are identified at the HS6 level at which tariff cuts are implemented for both sensitive and non-sensitive products. The new applied tariffs are then aggregated at a higher level and the simulations are run at this aggregate level. In this paper, we extend a computable general equilibrium model (MIRAGE) to the 6-digit level of the harmonized system (HS6), so as to avoid the well known aggregation bias (Anderson and Neary, 1996). Moreover, we explicitly model, in their original form, the quite complex border protections applied to this sector, i.e., combination of bilateral TRQ, multilateral TRQ, and ordinary tariff duty.

The economics of TRQ is quite complex. Their effectiveness depends on a number of economic (e.g., level of constraint imposed by the quota, and the relative competitiveness of export suppliers) and legal (e.g., the way quotas are allocated to exporters, and the procedures involved in allocating quota rents) issues. Taking account of all those elements is challenging. Overall, modeling them inevitably means adopting some simplifications. Previous works normally take TRQ into consideration through an *ad valorem* equivalent (AVE) representation and/or exogenous quota rents, which provide huge simplification of the reality. TRQ, in fact, combine a quantitative restriction and a two-tier tariff regime. Below the quota, imports under licenses face

a preferential (in-quota) tariff and above the quota, the tariff applied equals or is very close to the (often prohibitive) most favored nation (MFN) duty (out-of-quota tariff). Given the strong non-linearities in the market access instruments (Boughner et al., 2000), working just with AVE severely distorts the results (Jørgensen and Schröder, 2007).

Among the few analyses of trade policy that explicitly consider TRQ, we draw on Grant et al. (2009). Their partial equilibrium model focuses on dairy products, and they highlight the important interaction between bilateral and multilateral TRQ opening. But their framework simplifies this aspect, since they use as a benchmark a situation without multilateral TRQ, while in their liberalization scenario they allow for multilateral TRQ opening or bilateral TRQ extensions. In our study, we model and analyze a more realistic situation, since in the calibration we introduce multilateral and bilateral TRQ at the same time, as is the case in reality.

Unfortunately, since the numerical requirements implied by working at the HS6 level do not allow us to model all imports at this level of detail, we focus on the European and Japanese markets. Both markets present high levels of agricultural protection and an important use of TRQ. Moreover, because of this high protection, these countries would be the main source of the welfare gains from developed countries agriculture liberalization (Féménia and Gohin, 2009).

The article is organized as follows. In Section 2, we discuss the structure of agricultural trade policies in Europe and in Japan, highlighting the peculiar role of TRQ, and outline WTO proposals for agricultural market access. Section 3 presents our modeling approach and describes the data. Section 4 discusses the results of the simulations of full and WTO liberalization. Section 5 concludes.

2 Patterns of agricultural protection and multilateral negotiations

2.1 EU and Japanese protection

Market access in agriculture presents some peculiarities, reflecting the position of this sector in the political economies of countries as well as the late inclusion of agriculture in the multilateral arena.[1] Firstly, the agricultural sector is relatively more protected than other sectors (with a world average applied tariff equivalent of 18.9% in 2004 versus 4.5% in manufacturing).[2] Secondly, the protectionist bias in agriculture increases with the country's level of development. If we consider average protection rates, rich countries impose more protection on their agriculture: they tax agricultural imports seven times higher than manufacturing imports (the world average ratio is 4.5). This shows that as economies develop, they tend to shift from taxing to protecting agriculture relative to other sectors. The situation differs among the developed countries, Japan and the EU impose stronger protection than the USA: respectively 22 and 8 times versus 4 times higher. Tariff dismantling is a particularly sensitive area in the EU and Japan while the US is more concerned with its own commitments to internal support for agriculture.

[1] The Uruguay Round (1986–1993) is the important breakthrough that brought agriculture back into GATT disciplines.

[2] The applied tariff is calculated from preferential agreements where they exist, or from the applied MFN.

Although average tariffs may be relevant synthetic indicators, they often hide quite heterogeneous situations. In this respect, developing economies tend to adopt more protectionist, but simpler policies than the complex and heterogeneous tariff schedules of high-income countries. The tariff structures of most (particularly developed) countries show remarkable degrees of dispersion, with tariff peaks concentrated in a very small number of agricultural tariff lines, which explains why even a small percentage of sensitive products can significantly limit market access improvements.

Figure 1 represents the cumulative frequency of applied tariff equivalents for agriculture and food products, which include protection provided by TRQ. A significant proportion of these products enters duty free (e.g., 15% in the EU and 20% in Japan) or at very low duty. For other products, high protection rates may apply. This is particularly true of Japan, where 8% of agricultural products faces tariffs higher than 100% in AVE.

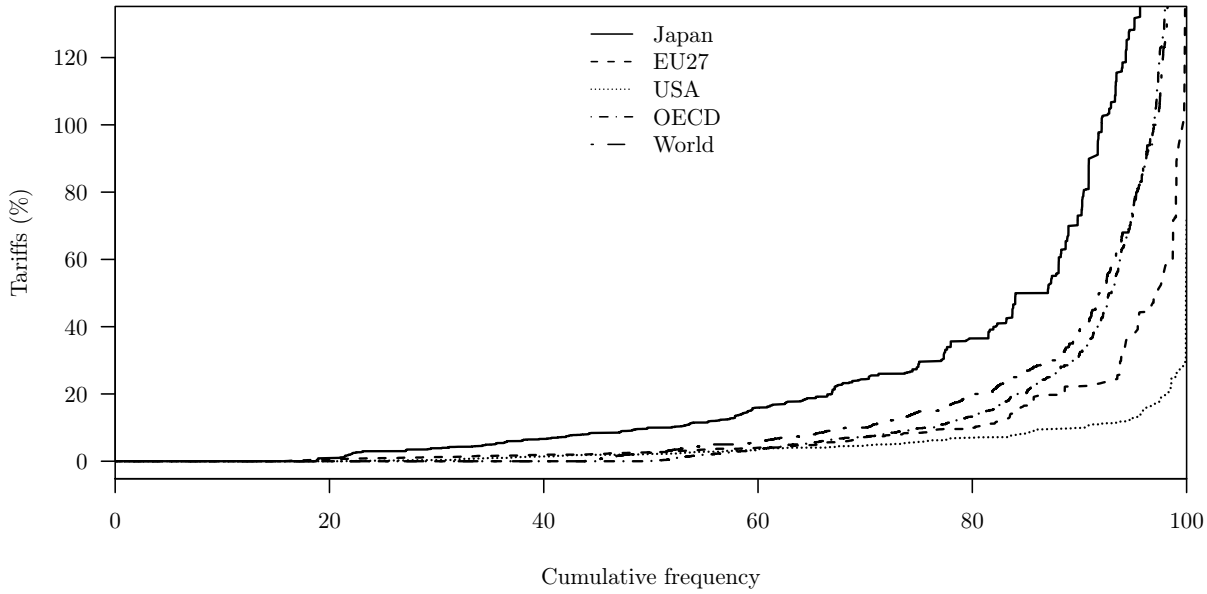

Figure 1. Tariff equivalents cumulative frequency for agricultural products, 2004. Proportion of trade flows (on the x-axis), computed with the value of imports of the reference group (Bouët et al., 2008), for which AVE duties are inferior to the level represented on the y-axis. *Source:* MAcMap-HS6.

Another peculiarity of the agricultural sectors in developed countries is the wider range of existing protectionist instruments, including simple *ad valorem* duty, specific tariffs, and multilateral and bilateral TRQ. TRQ were established during the Uruguay Round Agreement on Agriculture, with the purpose of enhancing or maintaining the market access conditions in agriculture for developing countries to developed ones, following the decision of tariffication of non-tariff barriers.

Since then, TRQ have been applied extensively to agricultural trade, both within the MFN framework and under preferential bilateral agreements,[3] despite the increased market access created by this instrument being very limited (Abbott, 2002). Currently, the agricultural products afforded the highest protection are subject to TRQ.

[3]However, trade under bilateral TRQ remains small compared to trade under MFN TRQ

The degree to which tariffs and TRQ affect various sectors in the EU and Japan is presented in Table 1. Several points emerge from this table. Protection is highly uneven across sectors and countries. In the case of the EU, the most heavily protected sectors are dairy products, cattle meat, and sugar, and in the case of Japan they are rice, wheat, other crops, and oil seeds. In both countries protection of agricultural products is achieved more frequently by the application of TRQ than simple tariffs. A large part of this protection comes from multilateral TRQ,[4] which is the only form of TRQ applied in Japan.

Table 1. Average and type of protection by agricultural sector, 2004.

Sector	European Union				Japan			
	AVE	BIL	MFN	Tariff	AVE	BIL	MFN	Tariff
Beverages and tobacco products	13	0.73	0	0.27	15	0	0	1
Cattle, sheep, goats and horses	57	0	0.99	0.01	34	0	0	1
Dairy products	398	0.86	0.13	0.01	150	0	0.79	0.21
Meat: cattle, sheep, goats and horse	181	0.3	0.54	0.16	44	0	0	1
Oil seeds	0	0	0	0	239	0	1	0
Other animal products	22	0	0.93	0.07	11	0	0	1
Other crops	4	0.04	0	0.96	362	0	1	0
Other food products	36	0.27	0.57	0.16	61	0	0.81	0.19
Other grains	107	0	0.83	0.17	147	0	0.79	0.21
Other meat products	45	0.15	0.77	0.08	54	0	0	1
Paddy rice	76	0	0.81	0.19	945	0	0.46	0.54
Plant-based fibers	0	0	0	0	0	0	0	0
Processed rice	118	0	1	0	868	0	0.5	0.5
Sugar	195	0	0.83	0.17	190	0	0	1
Sugar cane, sugar beet	2	0	0	1	0	0	0	0
Vegetable oils and fats	73	0.96	0	0.04	4	0	0	1
Vegetables, fruit and nuts	54	0.07	0.88	0.05	237	0	0.97	0.03
Wheat	33	0	0.66	0.34	343	0	0.45	0.55
Wool, silk-worm cocoons	0	0	0	0	124	0	1	0

Notes: Column AVE presents the average *ad valorem* equivalent protection in the sector as a percentage. Columns Bil, MFN and Tariff represent the shares in overall protection of bilateral TRQ, MFN TRQ and tariffs.
Source: MAcMap-HS6.

Almost half of Japanese TRQ (e.g., processed rice and wheat) and EU TRQ (e.g., sugar) lead to out-of-quota imports. Due to prohibitive out-of-quota tariffs, particularly for Japan, TRQ appear a very restrictive policy instrument: 1.5% of Japanese imports enter under a TRQ regime, against 7% in the EU case.

2.2 Agricultural market access in the multilateral negotiations

Successive Doha rounds of negotiations have agreed a set of issues. Although exact numbers remain to be negotiated, WTO members are agreed about the adoption of certain key principles to improve market access in agriculture (WTO, 2008). For the developed countries, the agreement is that bound tariffs should be cut according to a tiered formula, with four bands of

[4]The exceptions for the EU are beverages and tobacco, dairy products and vegetable oil and fats, where bilateral TRQ are more frequent.

reductions with inflexion points set at 20%, 50% and 75%. Harmonization of tariff levels is to be achieved through deeper cuts to the higher tariffs: 50%, 57%, 64% and 70%, respectively. Some exceptions to this general formula can be introduced by selecting some sensitive products (4% of tariff lines in the latest negotiations) for which trade opening will be more limited.[5] Developed economies must concede a duty-free, quota-free access to Least Developed Countries' (LDC) exports.[6]

Since the Doha agenda requires that "substantial improvements in market access should be achieved for all products" (July package WTO, 2004), sensitive products are not exempt from commitments. Improved market access for these products is based on the same formula as for standard products, but is applied at lower levels. Countries also have some flexibility to combine a smaller tariff cut with a larger duty free access under TRQ. If a country chooses to apply two-thirds of the scheduled formula, it is obliged to ensure an additional market access through a small TRQ expansion or creation. For one-third of the tariff cut, it is required to compensate the small tariff reduction by large TRQ increases with new access opportunity of no less than 4% of domestic consumption. There is another possibility between these two extreme cases: application of half of the formula with medium TRQ expansion.

The flexibility allowed to sensitive products is limited by a constraint on the minimum average cut on the final bound tariff. This clause is applied only if, after application of the main formula on non-sensitive lines and the deviations on sensitive products (taking into account the modalities for tropical products and tariff escalation), the average tariff cut is less than 54%. An additional effort shall be asked to these countries across all bands and in a proportional way in order to reach this target.

A Special Agricultural Safeguard (SSG) for developed countries (currently provided for in the Uruguay Round Agreement) is still under negotiation.

3 The model

3.1 The MIRAGE model

We use the multi-sectoral and multi-regional CGE MIRAGE model (Bchir et al., 2002; Decreux and Valin, 2007), which has been developed and is used extensively to assess trade and agricultural liberalization policies (e.g., Bouët et al., 2005, 2007). MIRAGE has a sequential dynamic recursive set-up and imperfect competition modeling. Since our interest is in detailed trade flow modeling, which is very demanding of computational power, we focus only on comparative static and perfect competition. The macroeconomic closure consists of fixing the share of each region in global current accounts imbalance at their initial value.

Each sector is modeled as a representative firm, which, in fixed shares, combines value-added and intermediate consumption. Value-added is a bundle of imperfectly substitutable primary

[5] Developing countries have greater flexibilities through special products.

[6] Considering the non reciprocal preferences that the triad already grants to developing countries, especially LDC (e.g., Everything but arms provision in the case of the EU), or due to the increasing North-South bilateral agreements (e.g., EU-ACP preferences), a limited impact can be expected from this LDC initiative.

factors (capital, skilled and unskilled labor, land and natural resources). All primary factors are in fixed supply. Capital stock is assumed to be perfectly mobile across sectors, which represents the long run adjusting possibilities of a capital market. Skilled labor is perfectly mobile across sectors, while unskilled labor is imperfectly mobile between agricultural and other sectors. Land is assumed to be imperfectly mobile between agricultural sectors. Finally, natural resources are sector specific.

A representative consumer saves, in each region, a fixed part of his income. The rest is spent on commodities according to a LES-CES function. Products are distinguished according to their geographical sources (Armington hypothesis), using the GTAP Armington elasticities estimated in Hertel et al. (2007).

3.2 The HS6-level submodel

The MIRAGE model is extended to accommodate for trade at the HS6 level through a combination of constant elasticity of substitution (CES) and transformation (CET) functions as in Anderson (1998). We use the following indexes: i for the GTAP sector level; h for the HS6-level; and r and s for the exporting and importing countries. Aggregate exports, $X^a_{i,r}$, are disaggregated at the HS6 level with a CET function:

$$X^a_{i,r} = Q^{CET}\left(X^d_{h,r}\right), \tag{1}$$

where $X^d_{h,r}$ is the export at detailed level. Detailed imports, $M^d_{h,s}$, are aggregated with a CES function:

$$M^a_{i,s} = Q^{CES}\left(M^d_{h,s}\right), \tag{2}$$

with $M^a_{i,s}$ aggregate imports.

Agricultural products are assumed to be differentiated by country of origin (Armington, 1969). So HS6-level bilateral trade flows, $M_{h,r,s}$, are combined with a CES aggregator to build total detailed trade flows:

$$M^d_{h,s} = Q^{CES}\left(M_{h,r,s}\right). \tag{3}$$

As for their corresponding quantities, prices are aggregated with CES and CET functions:

$$P^{M^a}_{i,s} = P^{CES}\left(P^{M^d}_{h,s}\right), \tag{4}$$

$$P^{M^d}_{h,s} = P^{CES}\left(P^{M}_{h,r,s}\right). \tag{5}$$

The cost, insurance and freight price, $P^{CIF}_{h,r,s}$, is given by the export price, $P^X_{h,r}$, multiplied by 1 plus tax/subsidy on export, $tax^X_{h,r,s}$, plus transport costs,

$$P^{CIF}_{h,r,s} = P^X_{h,r}\left(1 + tax^X_{h,r,s}\right) + \mu_{h,r,s}P^{Trt}, \tag{6}$$

where $\mu_{h,r,s}$ is the freight required to ship one unit of commodities h on the route r to s.

International freight is provided by a global competitive sector at price P^{Trt}.

Each trade flow can occur under three possible regimes: simple *ad valorem* tariff,[7] country specific TRQ or MFN TRQ.[8] The active regimes are the most profitable for the exporter. An exporter chooses to export under the lowest tariff, or tariff equivalent after considering quota rents. The choice is expressed as zero-profit conditions in complementary format. For trade under a tariff, the condition is[9]

$$P^{CIF}_{h,r,s}\,(1+\tau_{h,r,s}) - P^{M}_{h,r,s} \geq 0 \qquad \perp \qquad M^{\tau}_{h,r,s} \geq 0. \tag{7}$$

This means that the left equation holds with strict equality when trade under a tariff, $M^{\tau}_{h,r,s}$, is positive. When this flow is zero, the export price multiplied by the power of the tariff, $1+\tau_{h,r,s}$, is greater than the importing price, so this mode of export is not profitable. This tariff can be either a MFN applied tariff or a tariff resulting from a preferential agreement.

For bilateral quotas, the conditions are

$$P^{CIF}_{h,r,s}\left(1+\tau^{Q^I_{Bil}}_{h,r,s}+\tau^{Q^{pr}_{Bil}}_{h,r,s}\right) - P^{M}_{h,r,s} \geq 0 \qquad \perp \qquad M^{Q^I_{Bil}}_{h,r,s} \geq 0, \tag{8}$$

$$\bar{Q}^{Bil}_{h,r,s} - M^{Q^I_{Bil}}_{h,r,s} \geq 0 \qquad \perp \qquad \tau^{Q^{pr}_{Bil}}_{h,r,s} \geq 0, \tag{9}$$

$$P^{CIF}_{h,r,s}\left(1+\tau^{Q^O_{Bil}}_{h,r,s}\right) - P^{M}_{h,r,s} \geq 0 \qquad \perp \qquad M^{Q^O_{Bil}}_{h,r,s} \geq 0. \tag{10}$$

Equations (8) and (10) should be read similar to Equation (7) for trade under a tariff. There is a small difference for the in-quota condition (8). There are two *ad valorem* tariffs: $\tau^{Q^I_{Bil}}_{h,r,s}$, the in-quota tariff, and $\tau^{Q^{pr}_{Bil}}_{h,r,s}$, the tariff-equivalent quota premium. The quota premium is not a real tariff, it is a conceptual tool that we use to represent the quota rent. When trade does not reach the quota level, the product is subject only to the in-quota tariff. When the quota is binding, demand tends to exceed quota so, to preserve market equilibrium, the price has to rise. This is the quota premium rate that guarantees market clearing. This price excess with respect to the export price charged by the in-quota tariff entails a quota rent, which, we assume, accrues to the importer. Condition (9) defines the premium. For in-quota flows, $M^{Q^I_{Bil}}_{h,r,s}$, below the quota, $\bar{Q}^{Bil}_{h,r,s}$, the premium is null, beyond the quota, it is positive. It reaches a maximum when trade reaches the out-of-quota regime where flows are taxed at a higher rate, $\tau^{Q^O_{Bil}}_{h,r,s}$. In this case, the premium is equal just to the difference between the out-of-quota and the in-quota tariffs and ensures that there is only one price for a given commodity. The part that enters within quota is charged the same as the part that enters out of quota, but for the in-quota trade part of the tariff charge corresponds to the quota rent.

[7] For simplicity, all specific tariffs are converted to AVE.

[8] Trade policy is not defined at the HS6 level, but can be set at a more detail level (e.g., 8 or 10 digits) or at a more aggregated level (a TRQ can include several HS6 lines). Accounting properly for such heterogeneity is very difficult, in terms of both data and modeling work. Here, we simplify the problem by assuming that all trade policies apply to the HS6 level.

[9] Complementarity conditions in what follows are written using the "perp" notation ($\perp$). This means that the expressions on either side of the sign are orthogonal. One holds with strict inequality when the other holds with strict equality.

The conditions are similar for MFN quotas,

$$P^{CIF}_{h,r,s}\left(1+\tau^{Q^I_{MFN}}_{h,s}+\tau^{Q^{pr}_{MFN}}_{h,s}\right)-P^{M}_{h,r,s}\geq 0 \qquad \perp \qquad M^{Q^I_{MFN}}_{h,r,s}\geq 0, \tag{11}$$

$$\bar{Q}^{MFN}_{h,s}-\sum_r M^{Q^I_{MFN}}_{h,r,s}\geq 0 \qquad \perp \qquad \tau^{Q^{pr}_{MFN}}_{h,s}\geq 0, \tag{12}$$

$$P^{CIF}_{h,r,s}\left(1+\tau^{Q^O_{MFN}}_{h,s}\right)-P^{M}_{h,r,s}\geq 0 \qquad \perp \qquad M^{Q^O_{MFN}}_{h,r,s}\geq 0. \tag{13}$$

The difference with bilateral TRQ is that in- and out-of-quota tariffs, and the quota premium do not depend on the exporter, because there is a unique MFN TRQ for every exporter. This can be best seen in condition (12) where all in-quota imports sum to one quota. The MFN TRQ is allocated according to two rules. First, exports under the MFN TRQ are profitable only for countries that either have no other, more rewarding possibilities (where a MFN TRQ exists, it is usually the highest protection, because it is open to all WTO members), or have already exhausted them (when a bilateral quota is binding). Second, the share among exporters under MFN TRQ is defined by the Armington hypothesis.

To enable a better understanding of the following liberalization results, we need to describe the effects of TRQ liberalization. The opening of trade flows under TRQ depends heavily on the initial active regime, which determines the effective protection (Boughner et al., 2000; Ramos et al., 2010). Under the in-quota regime, trade is constrained by neither the quota nor the out-of-quota tariff; liberalization can be based only on a decrease in the in-quota tariff, while changes to the quota level or the out-of-quota tariff would have no effect because of their redundancy under the current regime. Instead, if the quota is just binding (an at-quota regime), the in-quota tariff affects only the quota rent. In this case, increasing the quota level has a direct effect on at-quota flows, while a lowering of the out-of-quota tariff can affect trade flows depending on the size of the tariff cut (i.e., if a small cut has no effect on trade, a sufficiently large cut can promote the switch from an at-quota to an out-of-quota regime). Finally, in an out-of-quota regime, if a cut in the corresponding tariff improves market access, a reduction in the in-quota tariff will have no effect on trade, while an increase in the quota level will become effective only if it is sufficient to exceed existing out-of-quota trade, otherwise it will lead only to a higher quota-rent with no consequence for market access.

Trade flows under the different export modes sum to detailed import demand,

$$M_{h,r,s}=M^{\tau}_{h,r,s}+M^{Q^I_{Bil}}_{h,r,s}+M^{Q^O_{Bil}}_{h,r,s}+M^{Q^I_{MFN}}_{h,r,s}+M^{Q^O_{MFN}}_{h,r,s}. \tag{14}$$

Similarly, the amount of exports from one region must equal the sum of the imports from all other regions,

$$X^{d}_{h,r}=\sum_s M_{h,r,s}. \tag{15}$$

We implement these equations within the MIRAGE model. In order to limit the size of the model, we disaggregate exports to the EU and the Japan at the HS6-level and solve for the complementary condition using the solver `PATH` (Dirkse and Ferris, 1995).

Our modeling approach has three major limitations, which are difficult to overcome. The first is the lack of explicit detailed representations of production and consumption, which is due to non-availability of the data. This issue is addressed in Grant et al. (2009) by imputing demand in relation to import shares, which is not a very satisfactory solution. The second limitation is the inability to consider the extensive margin of trade within a CES framework, a major drawback of applied trade policy analysis (Kehoe, 2005). Goods that are not traded before liberalization are not traded after liberalization. This problem could be very acute in our case since several trade policies could appear to be prohibitive when analyzed at a detailed level, while at an aggregate level prohibitive tariff lines merge with other products. Gohin and Laborde (2006) propose a solution based on non-homothetic demand functions, but this method is applicable only to small-scale problems. Finally, our MFN quota allocation, which is based on the Armington hypothesis, is only a crude approximation of the various administrative methods used for TRQ allocation (de Gorter and Sheldon, 2000). Consideration of all the different allocation methods would be required to determine which country received the quota rents when quotas are binding. For simplicity, in this study quota rents are assumed to accrue to importers.

3.3 Data

The MIRAGE model is calibrated on the GTAP dataset version 7, with 2004 as base year. Our data aggregation isolates all agricultural and food sectors and combines other sectors into three aggregates: manufacturing products, transport, and other services. For the regional aggregation, we retain main agri-food exporters and aggregate the remaining countries and regions according to their preferences in the EU market (see Table 2).

Bilateral trade at the HS6 level is based on the BACI database (Gaulier and Zignago, 2009).[10] GTAP trade data are reconciled by Mark Gehlhar using different methods to BACI, which implies that the data do not perfectly match. Consequently, we rescale BACI trade flows to fit GTAP aggregated data. We represent trade flows at the HS6 level for all agricultural and agri-food imports to the EU and the Japan, that is 684 HS6 products.

Trade policy data are taken from the Market Access Maps (MAcMap-HS6) dataset version 2.[11] For exports to countries other than the EU and the Japan, we apply AVE tariffs aggregated at the GTAP level and weighted using the reference group weighting scheme developed for MAcMap (Bouët et al., 2008). This aggregation is justified by the need to keep the model at a computationally reasonable size.

Regarding HS6-level information, for products that are not subject to TRQ, we calculate AVE tariffs. For TRQ protection, we use MAcMap source data for TRQ aspects (AMAD, 2001; de Gorter and Kliauga, 2006). These sources were checked against WTO notifications about MFN TRQ declarations, and with EU regulations for preferential TRQ. This detailed information allows us to identify preferential and multilateral TRQ. In- and out-of-quota tariffs are all converted to AVE. Since TRQ are generally not defined at the 6-digit level—they can be defined

[10] BACI is the CEPII database for international trade flows at the HS6 level. It provides reconciled values, quantities and unit values based on United Nations COMTRADE

[11] We take into account EU 2007 enlargement to Bulgaria and Romania in relation to trade policy.

Table 2. Sector and country aggregation

Regions	**Sectors**
Argentina	**Primary agriculture**
Brazil	Cattle, sheep, goats and horses
Canada	Oil seeds
Chile	Paddy rice
China	Plant-based fibers
Egypt	Raw milk
European Union (27 countries)	Sugar cane, sugar beet
Hong Kong	Vegetables, fruit and nuts
India	Wheat
Indonesia	Wool, silk-worm cocoons
Japan	Other animal products
Korea	Other crops
Malaysia	Other grains
Mexico	
Morocco	**Processed food**
Russia	Beverages and tobacco products
Singapore	Dairy products
Switzerland	Meat: cattle, sheep, goats and horse
Thailand	Processed rice
Ukraine	Sugar
United States	Vegetable oils and fats
	Other food products
Oceania[a]	Other meat products
Rest of EFTA[b]	**Manufacturing products**
Countries under EU preferences[c]	**Services**
	Transports
Countries without preferences[d]	Other services

Notes: Classification based on free trade agreements and regional trade agreements signed between the EU and other countries in or before 2004.
[a] Australia, New Zealand and Rest of Oceania.
[b] Norway and Rest of EFTA.
[c] Central Africa, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Rest of the Caribbean, Rest of Eastern Africa, Rest of Western Africa, Senegal, Tanzania, Tunisia, Turkey, Uganda, Zambia, Zimbabwe.
[d] All remaining GTAP countries and regions.

at the tariff-line or a more aggregated level—we redefine all TRQ at the HS6 level. For imports under the at-quota regime (bilateral or multilateral) at the base year, a premium rate is charged over the inside tariff rate. Since the premium level is unknown, we choose the average of the in-quota and out-of-quota tariff rate to calibrate the premium. Because retaining bilateral TRQ for aggregated regions would have little meaning, we convert all bilateral TRQ to AVE tariffs for aggregated regions. To limit the bias introduced by this policy aggregation, we aggregate regions according to the preferential schemes they benefit from.

In the absence of more precise data, we use GTAP-sector level data from the GTAP database for export tax/subsidy and transport costs for the corresponding HS6-level product. The elasticities of substitution between HS6-level products for import at the GTAP level (Equation (2)) are calibrated using import demand elasticities from Kee et al. (2008) (see appendix for details of this calibration). For substitutability between sources of imports, we use the GTAP elasticities estimated in Hertel et al. (2007). Since the substitution between sources increases with the level of disaggregation (Imbs and Méjean, 2009), we augment GTAP elasticities by 20% to allow for our more detailed modeling. There are fewer available sources for the calibration of elasticities of transformation corresponding to Equation (1). Anderson (1998), based on no empirical foundation, takes the elasticity of transformation as equal to 5. In Grant et al. (2009), the elasticity of transformation is arbitrarily assumed to be equal to 4 for dairy products. We follow these authors, assuming an elasticity of transformation equal to 4 for all products.

3.4 Trade liberalization scenarios

We evaluate five scenarios. A full liberalization of agricultural market access in the EU and the Japan is implemented to serve as the benchmark for potential gains.[12] The remaining four scenarios analyzed are variants of the Doha Development Agenda (DDA) proposal of December 6, 2008 (WTO, 2008), but we apply them to the two countries and to agricultural and food products. We implement the Doha scenario following the state of multilateral negotiations, as described in Section 2.2, using the methodologies in Decreux and Fontagné (2008) and Decreux (2009). The various Doha scenarios differ in their treatment of sensitive products. The first scenario (called D^*) considers a Doha agreement without sensitive products. The next three include sensitive products, but introduce the flexibilities agreed in the negotiations: tariff cuts of one third ($D_{1/3}$), one half ($D_{1/2}$), and two thirds of the normal cuts ($D_{2/3}$). Table 3 sums up these scenarios.

Table 3. Liberalization scenarios

Scenario description		Name
Full market-access liberalization		FL
Doha	Without sensitive products	D^*
	Cut on sensitive products = 1/3 of normal cut	$D_{1/3}$
	Cut on sensitive products = 1/2 of normal cut	$D_{1/2}$
	Cut on sensitive products = 2/3 of normal cut	$D_{2/3}$

[12] We follow the WTO definition of agricultural products, available p. 48 of `http://www.wto.org/english/res_e/booksp_e/agrmntseries3_ag_2008_e.pdf`.

Sensitive products are selected according to the political-economy approach described in Jean et al. (2009). For these products, TRQ must be created or expanded in proportion to domestic consumption. So we need information at the HS6 level. We draw on the work of Decreux and Fontagné (2008). Their data are not homogeneous across countries and HS6 lines, because the base year varies from 2001 to 2007. Both EU and Japanese domestic consumption data correspond to a 2002–2004 average; the EU source is EUROSTAT, and Japanese data come from national sources (Japan Statistical Yearbooks). Whatever the imperfection of our database, it provides a reasonable approximation of domestic consumption essential for a Doha scenario. The creation of new TRQ and the increase in current multilateral TRQ need to ensure extra market access equivalent to at least 4% of domestic consumption calculated at tariff line level. All the particularities of TRQ expansion and creation detailed in the proposal are included in our DDA scenario.[13]

4 Results

In this paper, we do not devote much discussion to the general effects of the Doha Round, which differ little from other studies that use the MIRAGE model, such as Decreux and Fontagné (2008) and Bouët and Laborde (2010). We concentrate on our main objective, the detailed trade effects.

4.1 Full liberalization

Our detailed modeling highlights an important result: everything hangs on a few products. If custom barriers in agriculture were eliminated, the additional imports in Europe and Japan would be concentrated on a small number of products. Figure 2 shows that the first 30 products (4.4% of agricultural products in the HS6 nomenclature) represent 69% and 88% of a potential import increase in the EU and in Japan. 95% of Japanese import increase would come from 68 products, and in Europe would come from 121 products.

The products most affected by trade liberalization would be those currently afforded the highest levels of protection and which are frequently subject to TRQ. Trade flows previously under MFN TRQ concentrate 33% of the cumulative trade increase, while the contribution of trade flows formerly under bilateral TRQ would be smaller (3.3%). For dairy products, the concentration of the increase in lines under MFN TRQ would be 67% in Europe and 20% in Japan. Increased processed rice and wheat imports in Japan stems almost exclusively from liberalization of lines under MFN TRQ.

In Japan, trade variations are concentrated in rice (40% of trade changes) and meat other than cattle meat. For rice, the openness of the sector can be easily affected by selecting as sensitive

[13]For lines without TRQ, we create a TRQ equivalent to 4% of domestic consumptions. For lines with multilateral TRQ and a current market access lower than 10%, we increase TRQ by an extra 4% of domestic consumption. If existing TRQ already represent 10% or more of consumption, countries can increase quotas by an amount equivalent to 3.5% of domestic consumption. Finally, if the current WTO TRQ represents more than 30% of domestic consumption then the quota expansion has to be equivalent to 3% of domestic consumption.

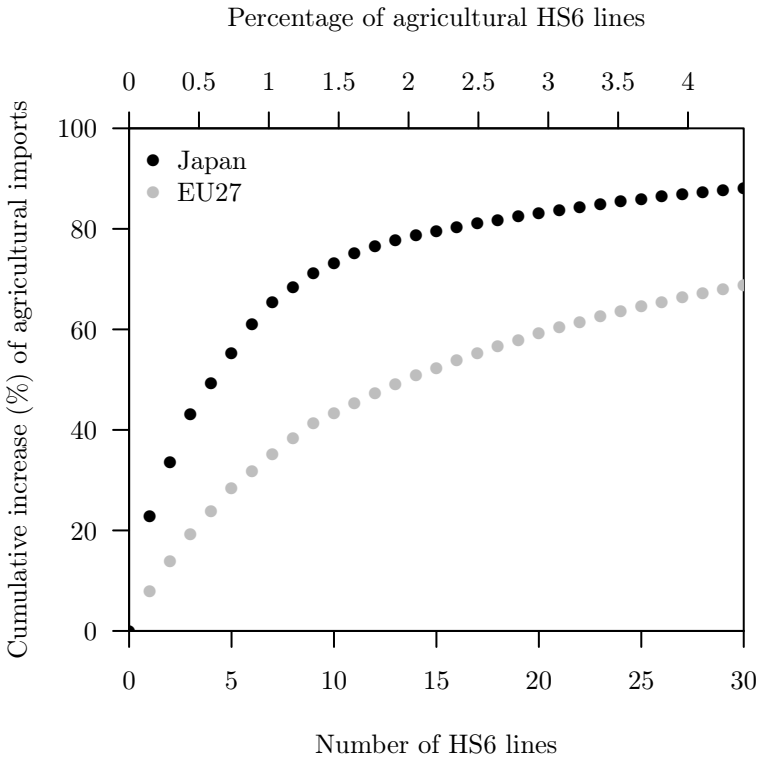

Figure 2. Concentration in a few products of the effect of full liberalization

products all the tariff lines concerned (only 4 HS6 products). Moreover, given the small number of lines involved, classifying all of them as sensitive does not greatly compromise the selection of other products in different sectors. In Europe, trade variations concern mainly cattle meat and dairy products, both covering numerous HS6 lines and requiring a more careful choice to maintain a certain level of protection. Among the first 30 HS6 products for trade variations in Europe, 8 are cattle meat and 8 are dairy products. In both Europe and Japan, sugar appears to be an important potential source of trade increase following full liberalization.

4.2 Doha liberalization

Table 4 presents the global effects of various European and Japanese agricultural market access liberalization scenarios. It shows that a Doha agreement without sensitive products would generate half the welfare gains of full liberalization and a third of the increase in agricultural imports. Introducing 4% of sensitive products substantially reduces the remaining gains.

Table 4. Global effects on welfare and imports from European and Japanese agricultural liberalization (% change)

	Full market access	Doha			
	liberalization	D^*	$D_{2/3}$	$D_{1/2}$	$D_{1/3}$
Welfare	0.129	0.065	0.044	0.035	0.028
Agricultural import	8.847	2.789	2.058	1.809	1.626

Also, comparing the different alternatives for the treatment of sensitive products in the Doha negotiations, we find that there is no aggregate trade-off between opening/enlarging TRQ and decreasing tariffs. None of these choices are equivalents in terms of welfare and trade results and thus, we converge with the traditional conclusion that: *the smaller the tariff cuts, the smaller will be the gains.*

As explained in Section 3.2, the effects of TRQ liberalization depend greatly on the regime in force. Under the in-quota regime, the in-quota tariff is the only effective instrument. Under the at-quota regime, increasing the quota level is the best option. And in the out-of-quota regime, the out-of-quota tariff is the only effective instrument. These considerations matter for WTO liberalization, because of the flexibility given to liberalization of sensitive products. For these products, a higher tariff cut can be traded for a higher quota level. So developed countries can choose strategically for each sensitive product their opening style depending on the quota regime in force.[14]

In light of this discussion, the previous results can be explained. If there is a limited trade-off between higher quotas and lower tariffs, this means that the binding constraint on agricultural trade will more often be out-of-quota tariffs rather than quota level and the higher quota is not high enough to exceed the out-of quota trade. Indeed, from the data we see that there is much trade activity in the out-of-quota regime, despite the prohibitive level of protection. And for half of sensitive products the quota increase is inferior to the existing out-of-quota trade.

Table 5 presents the effects of liberalization at sector level. Although the various computations are at the HS6 level, for reason of space we present the results at a more aggregated level; however, it should be borne in mind that there is strong heterogeneity among the products within each sector. Below, we provide some tentative insights into the heterogeneous impacts of liberalization on agricultural sectors.

We can distinguish different groups of sectors, according to the effect of liberalization on trade flows. Because only a limited number of products can be selected as sensitive, some sectors are not affected by the introduction of sensitive products or the different treatment proposed for their liberalization. This first group is composed of Beverages and Tobacco, Other food products, Other animal products and Vegetable oils and fats for the EU, and Oil seeds and Vegetables and Fruits for Japan. For this group, scenarios D^*, $D_{2/3}$ and $D_{1/3}$ are substantially equivalent.

The second much smaller group (Vegetable and Fruits for the EU and Dairy products for Japan) includes sectors where there is a significant difference between provision/non-provision of special treatment for sensitive products (compare D^* and $D_{2/3}$), while the flexibility involved with their liberalization is substantially irrelevant (compare $D_{2/3}$ and $D_{1/3}$).

Finally, the third group includes sectors where choosing between deeper tariff cuts or bigger quotas has important effect. This group can be split in two subgroups: those sectors where greater quota enlargement leads to an increase in imports (i.e., changes in imports are greater

[14]Note, however, that we have not tried to optimize protection levels by choosing strategically which products would be better for the different options: 2/3, 1/2 or 1/3 normal tariff cut. Such a strategic choice would further reduce the gains we could expect from a Doha agreement.

Table 5. Change in sectoral imports from liberalization

Sector	European Union				Japan			
	Value	D^*	$D_{2/3}$	$D_{1/3}$	Value	D^*	$D_{2/3}$	$D_{1/3}$
Beverage and tobacco	41,603	1.4	1.4	1.3	4,574	8.5	8.2	7.8
Cattle, sheep, goats and horses	3,876	−2.9	−3.1	−2.6	168	0.4	8.2	15.1
Dairy products	26,430	14.0	7.1	5.4	1,718	41.2	38.4	37.3
Meat: cattle sheep, goats and horse	14,957	42.0	39.7	31.9	4,608	52.0	35.3	20.2
Oil seeds	11,947	−1.8	−1.6	−1.4	3,615	−1.5	−1.5	−1.4
Other animal products	10,563	−0.4	−0.4	−0.3	1,384	−11.4	−7.5	−4.0
Other crops	31,039	6.0	3.4	2.0	4,350	−8.9	−5.3	−2.6
Other food products	118,267	3.2	3.4	3.3	34,663	0.7	2.3	3.8
Other grains	5,864	2.0	0.8	0.2	3,538	5.4	2.8	1.1
Other meat products	23,978	8.5	8.4	7.1	8,563	54.9	38.4	24.0
Paddy rice	738	25.5	26.8	30.0	22	−45.5	−24.2	−7.4
Plant-based fibers	2,695	−1.4	−1.1	−0.9	462	−1.8	−1.2	−0.9
Processed rice	1,494	15.9	34.0	47.1	56	493.1	180.9	57.2
Sugar	5,820	22.7	10.0	8.5	580	228.7	110.0	52.0
Sugar cane, sugar beet	54	70.9	72.1	72.9	6	−46.5	−28.8	−15.4
Vegetable oils and fats	21,856	4.1	4.3	4.4	1,907	−1.8	0.4	2.1
Vegetables, fruit and nuts	50,761	1.5	0.8	0.6	4,957	4.1	4.0	4.1
Wheat	5,866	3.7	−1.6	−1.2	1,805	50.4	29.4	12.6
Wool, silk-worm cocoons	1,749	−2.0	−1.5	−1.1	38	−22.5	−14.2	−7.9
Total agricultural sectors	379,557	5.7	4.7	4.0	77,517	17.0	11.4	8.0

Notes: Value columns represent the value of trade flows before liberalization. The remaining columns show the percentage changes for the different Doha scenarios defined above.

under $D_{1/3}$ than $D_{2/3}$), and those sectors where only a large tariff cut matters (results at the aggregated level due to the large number of agricultural sector involved). For the former case, more frequent in Japan (Other crops, Other Food Products, Paddy rice and Wool and Silk-worm cocoons) than in the EU (Paddy rice and Processed rice), the fact that a quota enlargement could lead to a greater market access than a large tariff cut means that the initial quota is binding and the effect of a cut in the out-of quota tariff would not be sufficiently important to promote a switch from the at-quota to the out-of-quota regime. For the latter case, where only a tariff cut matters, most of tariff lines are initially in the out-of quota regime and the level of quota expansion compensates for the trade increase under a cut in the out-of-quota tariff. These sectors refer mainly to sensitive products where potential improvements in market access could be reduced. This is particularly true for the Japanese case (e.g., Meat sectors, Other grains, Processed rice, Sugar and Wheat), while the effect on the EU sectors on average would be more limited (with the exception of Dairy products and Sugar).

We stated above that there is no aggregate trade-off between tariff cuts and quota openings in the liberalization of sensitive products. At the sectoral level, however, we can observe instances of trade-off because the effects depend on the binding instruments. And since, on average, the out-of-quota tariff is the more binding constraint, the trade-off disappears at the aggregate level.

5 Conclusion

Modeling the complexity of the Doha proposal in agriculture constitutes a challenge and has resulted in many scholars opting for simplicity and working with trade and protection at an aggregated level. Some consider the distinction between TRQ and simple tariffs but with the limitation of representing the multilateral TRQ in a bilateralized way and applying it only to a particular sector (e.g., Dairy products). Our approach tries to improve on this research. We include the possibility to treat trade and its protection at the HS6 level, looking at the impact on many sectors and many countries within a CGE framework, which is necessary to enable a proper evaluation of a Doha proposal.

These improvements in agricultural policy modeling shed some light on the implications of the treatment of sensitive products in the Doha Round by evaluating the different alternatives available to developed countries to achieve market liberalization. Due to computational limitations, we consider only agriculture liberalization in the European and Japanese markets.

We ran different scenarios: full trade liberalization as the benchmark and four other Doha scenarios, considering or not sensitive products or including sensitive products differing in their deviation from the main tariff-cut formula compensated by different alternatives of quota level expansion. The benchmark scenario shows that trade gains are concentrated in a very limited number of HS6 products. Four lines (just over 0.5% of HS6 products) explain half of the import increase in Japan while in the European markets half of import increase corresponds to 2% of HS6 products. This means that selecting 4% of tariff lines as sensitive products greatly limits agricultural trade liberalization, hindering the ambitions of the Doha Round.

Possible improvements towards liberalizing agricultural sectors are further reduced by the flexibility allowed to sensitive products. As the Doha scenarios show, the different options for sensitive products are not always equivalent in terms of market access and depend on the initial effective TRQ regime. For more than a half of tariff lines under TRQ only a cut in the out-of-quota tariff can guarantee considerable liberalization. In fact, despite the high levels of protection, these tariff lines are initially within the out-of-quota regime. In this framework while a reduction in the corresponding tariff improves market access, an increase in quota levels becomes effective only if it exceeds the existing out-of-quota trade, which does not apply to our case. On the contrary, quota expansion provides a higher level of imports in a few sectors, for which the initial quota is binding and the cut in the out-of quota tariff is not sufficiently important for a switch from the at-quota to the out-of quota regime. We converge with the traditional conclusion of: *the smaller the tariff cuts, the smaller will be the gains.*

Appendix

Kee et al. (2008) estimate GDP-maximizing import demand elasticities, which take account of general equilibrium effects. In a model such as MIRAGE, it is difficult to derive analytically general equilibrium consistent import demand elasticities. We can only determine import demand elasticities corresponding to two CES nests: substitution among HS6 products, and substitution between domestic and imported products. The contribution of higher level nests should be

limited, because it decreases with the budget share of the HS6 product in these nests, which is small in the case of agricultural products.

In nested CES functions the own-price elasticity of demand for one good is linked by a simple relationship to the elasticities of substitution and the share of the good in each nest. Because the corresponding prices are initialized to 1, the uncompensated own-price elasticity ($\eta^u_{h,s}$) of an HS6-product import is given by

$$\eta^u_{h,s} = \sigma_i^{M^d}\left(a_{h,s}^{M^d} - 1\right) + \sigma_i^{ARM} a_{h,s}^{M^d}\left(a_{i,s}^{M} - 1\right) - a_{h,s}^{M^d} a_{i,s}^{M}, \tag{16}$$

with $\sigma_i^{M^d}$, the elasticity of substitution between HS6 products to calibrate; σ_i^{ARM}, the Armington elasticity of substitution between domestic and imported products (taken from the GTAP database); $a_{h,s}^{M^d}$, the HS6-product import share in the corresponding GTAP sector imports; and $a_{i,s}^{M}$, the import share in demand.

We consider that elasticities of Kee et al. can be confounded by uncompensated elasticities. We calibrate the elasticities of substitution by minimizing the squared discrepancies between target elasticities, $\bar{\eta}^u_{h,s}$, and calculated elasticities weighted by the trade ($w_{h,s} = P_{h,s}^{M^d} M_{h,s}^{d}$),

$$\min_{\sigma_i^{M^d}} \sum_{h,s} w_{h,s}\left(\eta^u_{h,s} - \bar{\eta}^u_{h,s}\right)^2,$$

subject to (16). The first order condition gives

$$\sigma_i^{M^d} = \frac{\sum_{h\in i,s} w_{h,s}\left(a_{h,s}^{M^d} - 1\right)\left\{\bar{\eta}^u_{h,s} + a_{h,s}^{M^d}\left[a_{i,s}^{M} - \sigma_{i,s}^{ARM}\left(a_{i,s}^{M} - 1\right)\right]\right\}}{\sum_{h\in i,s} w_{h,s}\left(a_{h,s}^{M^d} - 1\right)^2}. \tag{17}$$

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