

The Customs Union, tariff reductions and consumer prices

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Summary

Once again, a rancorous debate has flared over whether the UK should remain within 'a' or 'the' customs union with the EU following Brexit. Leaving the EU Customs Union would likely create additional costs for UK firms trading with the EU. However, it would also give the UK greater freedom to adjust tariffs on imported goods, and to strike new trade agreements with other countries. Advocates of the unilateral removal of tariffs see it as an opportunity to lower prices for UK consumers and to reduce the cost of living. This briefing note provides an estimate of the scale of the gains consumers might expect if the UK were to leave the Customs Union and reduce its tariffs.

Currently, the average tariff applied on the sorts of goods the UK imports is not particularly high – at around 2.8% if we account for the EU's various agreements with other countries. Under some quite optimistic assumptions about the price changes that are likely to follow tariff reductions, we estimate that complete abolition of all tariffs would reduce prices faced by households by about 0.7-1.2%. This could have additional positive economic benefits in the long run but could also be very damaging for some UK industries in the short run. That is why some have suggested focusing tariff reductions on goods that the UK does not produce itself. This would result in much smaller gains, reducing the total cost of the basket of goods purchased by the typical household by less than 0.4%. This compares with the estimated 2% increase in prices that followed the depreciation in sterling in the wake of the referendum result.

The impact of tariff reductions on consumer prices

Once again, a rancorous debate has flared over whether the UK should remain within some form of customs union with the EU following Brexit. In the midst of this, on 2 March 2018, Theresa May confirmed that it was the government's intent to leave the EU Customs Union, though a number of key issues over what exactly the new customs arrangements are likely to be have yet to be resolved.

The debate

Leaving the Customs Union would allow the UK to operate an independent trade policy, and it is the additional freedoms associated with this that those who wish to leave the Customs Union often focus on. These would include the ability to adjust tariffs on imported goods and to strike trade agreements with third countries. (As a member of a customs union with the EU, the UK could still strike deals with other countries, but only if they did not mean that the UK adopted different customs regulations from the EU – for example, it could sign agreements with other countries facilitating trade in services). Leaving 'the' EU Customs Union could either mean a complete break with current arrangements, which would give the UK complete freedom to adjust tariffs as it wished (subject to World Trade Organisation – WTO – rules and commitments), or mean entering a partial customs union such as the EU's current customs union with Turkey (which does not cover agricultural goods). The latter arrangement could, of course, only be introduced subject to agreement with the EU's remaining members.

Those against leaving the Customs Union point out, on the other hand, that leaving it would involve substantial additional costs to trade with the rest of the EU. Customs and rules-of-origin checks would be imposed on trade flows of goods between the UK and the EU, causing delays and disruption to firms' supply chains. These checks are likely to be important as the EU is a major trading partner – accounting for 55% of the UK's imports of goods and 48% of its exports of goods¹ – and the sort of administrative costs implied by not being within a customs union have been shown to have significant effects in inhibiting cross-border trade.² Moreover, such checks would likely create particular difficulties at the UK's land border with the Republic of Ireland.

Tariffs and tariff reductions

Given that these costs are likely to be significant, it is important to get a sense of what benefits there might be for the UK. In this briefing note, we focus specifically on the benefits the UK might enjoy from being able to set its own tariffs. Unless the UK were to renegotiate trade agreements that the EU has with other countries, WTO rules mean that its freedom to change tariffs would largely be in one direction: downwards. Some have argued that the UK could use any new freedom of action to unilaterally reduce all tariffs to zero, or else introduce general tariff reductions. However, experience suggests that these can be politically difficult. Although economists view tariffs as particularly distortionary means of raising revenue, most countries around the world opt to provide at least some protection for domestic producers against foreign competition. A quick scan of

¹ Author's calculations using tables B6, B6B and B6B_2 in <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/datasets/unitedkingdomeconomicaccountsbalanceofpaymentscurrentaccount/current>.

² See, for instance, C. Hornok and M. Koren, 'Administrative barriers to trade', *Journal of International Economics*, 2015, 96, S110–22.

international tariff schedules shows that developed countries appear especially keen to protect their agricultural sectors.

This protection may be why post-Brexit tariff reductions are sometimes called for specifically for those goods that ‘the UK does not produce’.³ Another option might therefore be a less radical ‘fine-tuning’ of the UK’s current tariff levels that sought to balance the interests of consumers and existing producers of certain goods in some way. This might mean the UK leaving some tariffs as they are while reducing tariffs on certain imported goods for which there are no (or few) domestic producers. Ideally, these would be the sorts of goods that the UK currently has to import from the EU due to high tariff barriers on imports from the rest of the world. It is easy to think of examples of such goods – oranges and olives spring to mind. (Though, even then, tariff cuts might still affect UK producers to an extent – for instance, if UK consumers considered imported oranges to be substitutes for UK-produced apples.)

To get an idea of how much scope there might be for the UK to engage in more selective tariff reductions of this kind, Table 1 shows the imports, exports and tariffs for different categories of goods. For each product category, column 1 shows the value of the UK’s imports from the rest of the world (including the EU) and column 2 shows the value of the UK’s exports. It can, for instance, be seen that the UK imports 13 times as much in wood products as it exports, but is a net exporter of chemicals. This table only shows data on goods trade, for which the UK has a substantial trade deficit in most categories. Services (which in 2016 accounted for 26% of the UK’s imports and 45% of the UK’s exports) are not subject to tariffs and so are not included in this exercise.⁴

Columns 3 and 4 show the tariff barriers that the EU has put in place on imports in each product category. We report two types of tariff. The EU’s ‘most-favoured nation’ (MFN) tariffs are the maximum tariffs the EU applies to other WTO members, even if they do not have a trade agreement with the EU. Focusing on these tariffs only would exaggerate the amount of protection the EU applies on imports, as they ignore the various trade agreements the EU has signed. These include its deals with the European Free Trade Association (EFTA) countries, its customs union with Turkey and its bilateral deals (for example, with South Korea). In addition, the EU extends preferential access to many developing countries through agreements such as ‘Everything But Arms’ and the ‘Generalised Scheme of Preferences’. These agreements either waive tariffs and import quotas or reduce them.

To account for these various arrangements, we also show the ‘effectively applied’ tariff, which in this case is an average tariff rate exporters in different countries would pay to sell into the EU market including the impact of any tariff reductions resulting from the EU’s trade agreements (weighted according to each country’s importance in the EU’s overall imports). These are considerably lower than the EU’s MFN tariffs, indicating that it is important to take the EU’s trade agreements into account in these sorts of exercises.⁵ However, just as focusing on the EU’s MFN tariffs may exaggerate the degree of

³ See, for example, <http://brexitcentral.com/read-full-text-jacob-rees-mogg-brexit-speech/>.

⁴ Author’s calculations using tables B6, B6B and B6B_2 in <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/datasets/unitedkingdomeconomicaccountsbalanceofpaymentscurrentaccount/current>.

⁵ Our data come from 2016 and so will not include recent agreements (such as the recent EU–Canada trade deal).

Table 1. UK tariffs and imports of goods, 2016

Goods	(1) Imports (£bn)	(2) Exports (£bn)	(3) EU tariffs, MFN (% of value)	(4) EU tariffs, effectively applied (% of value)	(5) Percentage of products with applied tariffs ≥10%, by value	(6) Percentage of products with 'low domestic production', by value
Electrical equipment	99.0	64.6	1.54	0.98	0.0%	25.1%
Transport equipment	71.8	54.9	7.07	3.29	0.0%	15.7%
Precious metals	52.4	21.1	0.15	0.07	0.0%	2.4%
Chemicals	45.7	46.1	1.89	1.18	0.3%	9.8%
Mineral products	31.3	19.7	0.72	0.57	0.0%	12.3%
Textiles	23.8	8.8	10.72	5.63	3.5%	27.8%
Prepared food	22.6	13.7	18.36	12.19	37.5%	47.6%
Base metals	20.2	14.7	2.65	1.65	0.0%	34.6%
Plastics	16.3	9.9	5.45	3.53	0.0%	14.2%
Optical equipment	14.7	13.5	1.02	0.77	0.0%	5.3%
Misc. manufactures	14.4	4.7	1.71	1.35	0.0%	34.7%
Vegetable products	12.3	2.5	11.06	5.61	20.8%	84.8%
Animals & animal products	9.2	4.8	32.18	23.39	61.3%	44.7%
Pulp of wood	7.7	5.4	0.00	0.00	0.0%	32.4%
Footwear	5.5	1.8	11.01	8.28	41.3%	5.3%
Wood products	5.0	0.4	1.82	1.11	0.0%	94.5%
Ceramics	4.5	2.1	3.98	2.76	3.0%	45.4%
Leather products	2.8	1.2	4.44	3.06	0.0%	1.4%
Works of art	2.8	5.3	0.00	0.00	0.0%	0.0%
Oils & fats	1.3	0.5	12.72	9.25	20.6%	57.9%
Arms & ammunition	0.1	0.2	2.86	1.98	0.0%	0.0%
Category not known	8.0	8.9	-	-	-	-
Total	471.3	304.3	4.63	2.82	4.4%	21.9%

Note: Trade data from UN COMTRADE database. Tariff data from UNCTAD TRAINS database. Product categories are Harmonised System (HS) section headings and sorted according to the value of imports. Imports and exports include goods imported from and exported to all trade partners (including the EU). All tariffs are inclusive of *ad valorem* tariff equivalents (converting specific duties and tariff rate quotas into *ad valorem* rates for ease of comparison across categories). Low domestic production in column 6 is defined as a case where the UK imports five times more than it exports within a given six-digit HS product category. Data on service trade are not included. Tariffs in the 'total' row are weighted averages, using the value of UK imports as weights (the weighted averages in the final row are not an exact weighted average of tariffs in the preceding rows as tariffs are unknown for some imports). Goods for which an *ad valorem* tariff cannot be calculated (around 2% of total imports) are excluded from the tariff calculations.

protection, the applied tariffs may underestimate the impact of tariff reductions on the cost of imported goods. This is because countries that enjoy preferential access to the EU market may charge higher prices than other producers, as they benefit from the fact that other low-cost competition must pay the MFN tariff in order to compete in the same market. In practice, the impact of the EU's tariffs on UK import prices will likely lie between the effects of these two tariff rates.⁶

Finally, it should be noted that in the event of a 'WTO rules' Brexit without a trade agreement with the EU, it is the MFN tariffs that would be applied to UK exports to the EU. The tariffs that would apply to the UK's exports and imports of goods to and from countries with which the EU has trade deals under these circumstances are uncertain, and would be subject to negotiation with the relevant parties.

Looking at the range of tariffs, the first thing to note is that they are relatively low on average (at 2.8% for applied tariffs and 4.6% for MFN tariffs). Completely abolishing these tariffs would be unlikely to reduce the average cost of imports of goods by more than the higher of these – and not all imports are goods. To put these figures in context, the depreciation in the UK's effective exchange rate since the referendum has been around 8% – increasing the sterling costs of imports by the same amount.⁷

To work out the impact that general tariff reductions have on overall UK consumer prices, we need to account for two factors:

- 1) **The 'pass-through' of tariff increases into both domestic and import prices.** We will assume that this is 100% (meaning that if tariffs on imports of a given good fall by say 5%, then the wholesale prices charged by UK and all foreign producers of these goods selling to the UK market would fall by the same amount).⁸ In practice, pass-through is likely to be less than this, for two reasons. First, UK firms are likely to produce goods that are imperfect substitutes for imports, allowing them to hold their prices above those of imported varieties without losing their entire market share. As a result, they may not need to cut their prices as much as the fall in the price of imports in the event that tariffs were reduced. Second, foreign exporters might see tariff reductions as a reason to raise the prices they charge UK consumers and increase the profits they make per good sold. Both factors would lessen the impact of tariff reductions on domestic prices, but we do not attempt to account for them here. This means that our estimates of the beneficial impact of tariff reductions on prices will tend to err on the side of being overly optimistic.

⁶ These tariffs do not include anti-dumping duties that are levied on goods which are deemed to be sold into the EU market below production cost or other 'temporary trade barriers'. The trade-weighted value of such duties was 1.91 percentage points in 2013 and the simple average tariff was 2.98 percentage points. See World Bank, 'Temporary trade barriers update through 2013', 2014, available at <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTTRADERESEARCH/0,,contentMDK:23585282~pagePK:64168182~piPK:64168060~theSitePK:544849,00.html>. It has been proposed that the UK establish a 'Trade Remedies Authority' to apply its own anti-dumping duties if needed after Brexit, suggesting that such tariffs may not be eliminated even if the UK left the Customs Union (see, for instance, <https://www.parliament.uk/business/committees/committees-a-z/commons-select/international-trade-committee/news-parliament-2017/uk-trade-remedies-authority-launch-17-19/>).

⁷ This figure was obtained by comparing the sterling effective exchange rate between June 2016 and December 2017 using series BK67 from the Office for National Statistics.

⁸ This assumption would hold under assumptions of perfect competition in product markets and perfect substitutability between imported and domestic varieties of different products.

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- 2) **The total share of households' final consumption spending affected by a tariff change.** This is the sum of:
- a. **The total share of household final consumption spending that goes to UK producers of tradeable goods.** According to the 2014 input-output tables, this was 5.6% in 2014.⁹ This is not the same as the amount households *spend* on UK-produced goods, as the retail prices households actually face will also reflect costs of distribution, storage, marketing and the profit margins of wholesalers and retailers. These latter costs will not be directly affected by the tariff changes and so should not be included. For instance, we would not expect the price of a can of beans purchased in the supermarket to fall by 3% if the tariff levied on cans of beans fell by 3%, because much of the cost of beans bought by consumers is made up of retail and other overheads. Rather, the effect of the tariff fall would depend on the change in the price of the good *before* retail margins and other costs had been included in its final price. The input-output tables account for this by separating out households' consumption of services from the 'retail' and 'wholesale' industries from their consumption of output from goods-producing industries (such as manufacturing and farming).¹⁰
 - b. **The total share of household final consumption spending that goes to the producers of imported goods.** This is defined in the same way as the above share of spending going to UK producers of goods. According to the ONS 2014 input-output tables, this share was 12.5% in 2014.
 - c. **The total share of household final consumption spending that *indirectly* goes to UK goods industries because UK service industries use some goods as inputs.** This is important to take into account as UK service industries may lower their prices in response to tariff reductions if the inputs they use become cheaper. We also need to take into account the fact that UK service industries may purchase services from other service industries, whose costs are in turn lowered by reduced costs of the goods they use as inputs (and which may in turn purchase from other industries with reduced input costs, and so on). For example, we would want to account for the fact that a tariff change may affect the price of UK-produced cement, which would lower the input costs of the construction industry. This in turn may reduce the costs of retailers, and this reduction in costs may be passed on to final consumers (as well as other industries that make use of retail services). To address this properly, we must take into account the impact of the full cycle of cost reductions for different producers and their knock-on impact on producers who they supply to. Accounting for all of these links and using the input-output tables, we can calculate this share as 4.0% in 2014.¹¹
 - d. **The share of spending on UK services that *indirectly* goes to the producers of imported goods because UK service industries use imported goods as inputs**

⁹ Input-output tables for 2014 are taken from https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltables_detailed. Goods industries are defined as those with Standard Industry Classifications 01–32.

¹⁰ For an explanation of the treatment of retail trade in the National Accounts, see http://ec.europa.eu/eurostat/statistics-explained/index.php/Building_the_System_of_National_Accounts_-_supply_and_use_tables.

¹¹ We explain the calculations behind this in the appendix.

(and again purchase from service industries, which have also seen reductions in the costs of imported goods inputs). Using a similar approach to that used to calculate the share of domestic goods in services output in c above, we find that this share also happens to be 4.0%.¹²

The sum of these figures is 26.1%. That is, around 26.1% of household consumption spending is potentially affected by tariff changes.¹³

Under the assumption of full pass-through, multiplying 26.1% by the current tariff gives us an estimate of the impact that complete abolition of tariffs would have on consumer prices in the UK. The estimate is roughly 0.7% if we use the average applied tariff or 1.2% if we use the average MFN tariff.¹⁴ These figures give an (optimistic) range for the possible one-off fall in prices that would follow from abolishing all tariffs. To put them in context, the estimated rise in prices resulting from the fall in the value of sterling since 2016 was 2%.¹⁵

For which categories of goods would the government be most likely to be able to reduce tariffs at the greatest benefit to UK consumers and at the least cost to current UK producers? To answer this question, we need to identify what proportion of products have low rates of domestic production. To determine this, we would ideally look at which goods UK industries produce, but such data are not available at the same level as cross-border trade statistics and at the level at which tariff rates are set (which can go down to the level of, for example, different kinds of green tea and lower). Instead, we can ask whether there are products for which the UK imports much more than it exports. We choose 'much more' to mean that the value of imports of a product is at least five times the value of the UK's exports of it. Such goods accounted for around 22% of the total value of the UK's imports in 2016.

The average tariffs that currently apply to those goods for which the UK has low domestic production are slightly higher than those that apply to other goods, at 4.3% when one uses the EU's current applied tariffs and 7.2% when one uses the EU's MFN tariffs. Using a

¹² See the appendix for details of the calculations behind this figure.

¹³ Total spending here includes the imputed rental spending of those who own their homes. This is because purchases of housing are a significant expense and therefore account for an important fraction of households' living costs. Owner-occupied housing costs are included as an element in the CPIH measure of inflation (with a weight in 2018 of 16.8%; see ONS series L5PA, available at <https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l5pa/mm23>). If we were to exclude owner-occupied housing costs, the share of spending that is affected by tariff changes would increase to 31.6%. Consequently, the reduction in the cost of living would also increase to 1.5% if we were to use the average MFN tariff or 0.9% if we were to use the average applied tariff. We exclude consumption of services from non-market providers and non-profit institutions serving households (NPISH) as these are not provided at market prices (and are often provided to households for free). These providers account for a very small proportion of total household consumption. In addition, for simplicity, we use spending by households defined at 'basic' (that is, pre-tax) prices. Proportional taxes would tend to increase the price changes associated with a given change in tariffs (but with a cost to the government in terms of reduced tax payments, which would have to be recouped by other means). Specific duties such as alcohol, tobacco and fuel duties would serve to reduce the importance of production industries' output in the total value of consumer spending on final products.

¹⁴ These numbers are similar to model-based estimates of around 1% for the price *increase* that would be associated with the imposition of MFN tariffs on the UK's imports from the EU. See S. Clarke, I. Serwicka and L.A. Winters, 'Will Brexit raise the cost of living?', *National Institute Economic Review*, 2017, 242(1), R37–50.

¹⁵ Page 61 in Office for Budget Responsibility, *Economic and Fiscal Outlook: November 2016*, 2016, <http://budgetresponsibility.org.uk/efo/economic-and-fiscal-outlook-november-2016/>.

similar calculation to that used above, and again assuming full pass-through, the reduction in consumer prices from eliminating tariffs on these products only would be 0.2–0.4%.

We can use Table 1 to look at which products are most likely to be treated as having low domestic production (by our measure). The category with the highest share of products with low domestic production is wood products, followed by vegetable products, oils & fats and prepared food. Goods included in these latter three categories are often subject to high tariffs. The average tariff charged on imports of vegetable products is 5.6%, and 21% of imports in this category face an average applied tariff of 10% or more. For prepared food, tariffs are higher still: the average tariff is 12.2%, and 38% of imports are subject to a tariff rate of at least 10%.

Within the prepared food category, it is perhaps not surprising that there are many individual products with both high tariffs and low domestic production. Individual examples include pasta, bulgur wheat and certain types of cane sugar (the last is subject to a particularly high *ad valorem* equivalent tariff of 81%). Examples in the vegetable products category include ‘corn (maize) flour’ and ‘broken rice’.

However, these sorts of products account for a small share of the UK’s total imports. This may be partly because high tariffs themselves deter imports from certain locations, though this would only be true to a lesser extent for imports from the EU (which, of course, currently enter the UK tariff free). Taking together all products that have both high tariffs (defined as having an applied tariff of 10% or more) and low domestic production reveals that they account for just 2% of the UK’s total goods imports (with a total value of £9.9 billion). If we were to adopt a more expansive definition of ‘high’ tariffs – say greater than or equal to 5% rather than 10% – then this figure would be just over 4% (£19.7 billion).

These figures are not particularly large. Cutting these tariffs only would only have a small impact on the total cost of the basket of goods purchased by the typical household.

This suggests that the scale of ‘quick wins’ from running an independent trade policy is relatively small. Tariff reductions on just those goods for which the UK has low domestic production would reduce prices only by at most 0.4%. Complete abolition of all tariffs would have bigger, but still relatively small, effects on prices – cutting them by between 0.7% and 1.2% at most.

Put simply, this is because most of the UK’s imports are of products on which the effective tariffs that are charged are already quite low. Products that would face a tariff rate of 10% or more if imported from outside the EU account for only 4.4% of the value of the UK’s total goods imports. Calculations using our import and tariff data also imply that 39% of goods imports are products that would enter tariff free even if imported from outside the EU.

The immediate impact of tariff reductions on consumer prices is one of many issues that matter in the debate around the UK’s continuing membership of the Customs Union. Generally speaking, tariff reduction might well be economically beneficial in the long run, reducing the costs of imported inputs into production, increasing competition and encouraging innovation. However, the short-run costs to UK producers are likely to be

significant. Cutting tariffs may have further drawbacks. For instance, the UK may have strategic reasons for not implementing unilateral tariff reductions. In the short run, we may want to keep high tariffs on some goods that we do not produce in order to offer up such tariff reductions as part of negotiations over new free trade agreements with other countries – offering, for example, to reduce tariffs on oranges only if other countries open up their markets to UK exports in some respect.

Crucially, any benefits that might accrue to consumers from running an independent tariff policy also need to be set against the inevitable costs to UK trade that would result from leaving the Customs Union. Firms will likely be affected by customs delays and storage costs that would result from the erection of customs barriers on trade with the EU. New regulatory differences between the EU and the UK are also likely to create various non-tariff barriers to trade. Such changes would, other things equal, be expected to increase costs for consumers and work to offset the (already rather limited) gains from tariff reductions.

Appendix

Tariff changes are assumed to affect final *goods* prices. They may also affect service industry prices as these industries use goods from other industries as inputs. What is more, if service industries make use of inputs from other services, their service input costs may also be affected (and in turn their suppliers' input costs may be affected, and so on). This will affect the price they charge to final consumers of services. However, we assume that goods prices will not change by more than the tariff change (and so will not be further affected by changes in input costs whether from service or goods industries). This is because export demand for these goods would increase if their price fell below the 'world price' of the product, inducing firms to increase prices until they are the same as those of foreign imports. Our assumption that goods prices will fall no further than the tariff change is consistent with the assumptions underlying full pass-through of tariffs to domestic and import prices, as discussed in the main text.

To calculate the impact of changes in tariffs on the prices of service industries, let A represent the (transpose) of the matrix of input-output coefficients taken from the ONS input-output tables. Each element of this matrix a_{ij} represents purchases by industry i from industry j – giving the value of inputs from j needed to produce £1 worth of i .

Let A^S be the submatrix of A representing service industry purchases from other service industries. If N_S is the number of service industries, then this is an $N_S \times N_S$ matrix.

Let B represent purchases of service industries from goods industries (another submatrix of A). If N_G is the number of goods industries, then this is an $N_S \times N_G$ matrix.

The value of goods inputs that are either used directly in the production of a service input or used indirectly by those supplying services to that industry is then given by

$$(1) \quad B + A^S B + (A^S)^2 B \dots = (I - A^S)^{-1} B,$$

where, for example, $A^S B$ gives the amount of goods each service industry *indirectly* buys through its purchases from other service industries (and $(A^S)^2 B$ gives the amount of goods those industries in turn indirectly buy from their suppliers, and so on).

Summing across the rows of $(I - A^S)^{-1} B$ gives a vector of the total value of goods inputs that are used directly or by service suppliers to each service industry. This can be obtained by post-multiplying the left-hand side of (1) by an $N_G \times 1$ vector of 1s (denoted ι):

$$(I - A^S)^{-1} B \iota.$$

We then pre-multiply the resulting vector by the transpose of the vector of UK spending on service categories f to obtain the total value of inputs whose costs are affected by tariffs embedded in UK households' demand for service industry products:

$$(2) \quad f'(I - A^S)^{-1} B \iota.$$

Similarly letting M denote inputs of imported goods used by each service industry (also $N_S \times N_G$), the total value of imported goods inputs that are used either directly by service industries or by service suppliers to service industries is given by

$$M + A^S M + (A^S)^2 M \dots = (I - A^S)^{-1} M,$$

which can be used to obtain an analogous expression to (2):

$$f'(I - A^S)^{-1} M_L.$$

Finally, we divide each of these by total consumer spending (on all goods and services – including imports) to obtain the percentages reported in the text (in both cases 4.0%).