CESSA WP 2014-03

Japan's newfound trade deficit: How much of it is due to new energy imports?

Craig R. Parsons
Yokohama National University

July 2014

Center for Economic and Social Studies in Asia (CESSA) Working Paper
Downloadable from:
http://www.econ.ynu.ac.jp/cessa/publication/workingpaper.html

Center for Economic and Social Studies in Asia, Department of Economics
Yokohama National University

Japan’s newfound trade deficit: How much of it is due to new energy imports?

Table of Contents

1. Introduction

Immediately following the triple disaster of March 11, 2011, Japan went from being a country with a goods trade surplus for three decades to a country with a huge trade deficit, in the matter of a few months. That persists to the present day. One might think that this is all or mostly due to the massive increases in energy (gas and oil mostly) following the shutdown of nuclear reactors in the post-Fukushima Japan. But this only tells half of the story. There have been other dramatic changes occurring in Japan's import structure over these same past three years. It is one of the goals of this paper to determine the main changing components of Japan's new found deficit and to determine if this deficit will continue in the future, with and without nuclear power.

A changing Japan

Japan imports more than 8000 tariff lines of goods at the 9-digit HS level in the Japan Customs data. Naturally, the largest single line goods are energy-related. If we look at table 1, we see of the top ten items imported, seven (5) were energy related (gas or oil.) Iron ores (for steel) and copper were another two in the top ten. These two have been historically been in top 10 or close, as well. But two categories are very new to the top ten list: "cell phones for wireless networks…: and "other medicants". The former is smartphones, among other things, while the latter is many medicines, with vaccines being a large part of that category.

These ten very narrowly defined categories account for 31 trillion yen of a total goods import bill of 81 trillion yen in 2013. Almost three (3) trillion yen of the top ten 31 trillion yen is in cell phones and vaccines and other medicaments. And these two narrow categories are rising 20% and sometime 30% in value terms each year. "Other Medicaments" was also in the top ten in 2010, but its value has risen over 40% in three years. "cell phones" were ranked 14th in 2010, but has increased *366%* since 2010.

Table 1: Top Ten Imported goods at nine-digit level (2013)

HS code	Brief Description	Value (trillions of yen)
'270900900'	"Petroleum Oils, crude"	14.2
'271111000'	"Petroleum Gases, Natural Gas"	7.1
'851712000'	*Telephones for cellular network*	**1.6**
'271012181'	"Petroleum Oils, non-crude"	1.6
'260111000'	Non-agglomerated iron ores	1.5
'270112099'	Coal	1.1
'260300000'	Copper Ores	1.0
'000000099'	Other, no description	.99
'300490029'	*Other medicaments*	**.98**
'271112020'	"Petroleum Gases, Propane"	.81

Source: Japan Customs data

If we look at the top 50 imported goods, again, very narrowly defined, these account for *half* of Japan's total goods imports in 2013.[1]

This paper will search across all 8000+ lines to search for those products which have seen dramatic surges in recent years. Some are due to the disaster, but others are not. As such, this paper will identify which parts of Japan's newfound deficit are energy-related and Fukushima-induced and which are part of other autonomous trends.

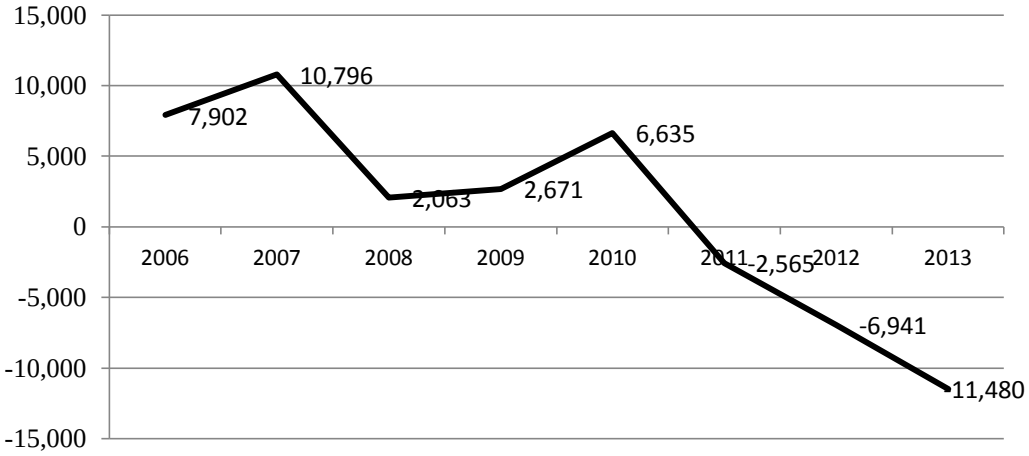
Japan's GDP Japan imported an extra 6.7 trillion yen in energy in 2012 relative to 2010 energy imports. Japan first dipped into sustained deficit territory in 2011 with a 2.6 trillion yen trade deficit for the troubled year of 2011, when in March, a 9.0 quake rocked Japan and brought on a deadly tsunami and nuclear meltdowns in three reactors. Later that year, many Japanese firms who have operations in Thailand were disrupted by the massive flooding in that country. In 2012, Japan's trade deficit grew to 6.9 trillion yen (69 billion dollars at 100 yen to the dollar) in 2012. For 2013, Japan an eleven (11.5) trillion yen trade deficit. Obviously, the new fossil fuel imports as Japan shut down all of its nuclear reactors is the bulk of this ahistorical deficit.

Japan consistently ran trade surpluses since the mid-1980s right until 2010, when it still had a trade surplus of 6.6 trillion yen.[2] If "new" energy imports are 6.7 trillion, how did Japan go from a surplus of more than 6 trillion yen to a deficit of more than 6 trillion yen in two short years? (See Figure 1 for goods trade deficit in recent years.)

[1] The dispersion of trade roughly follows a simple Zipf's law. The value of imports of the second largest category is half of the first, exactly (14 trillion, then 7 trillion). The tenth largest category is 1/17th the size of the first (it should be $1/10^{th}$ to be a perfect fit), the 50^{th} largest category is about $1/80^{th}$ of the largest (Zipf would predict $1/50^{th}$) etc. The 100^{th} is $1/150^{th}$ of the largest (it "should" be $1/100^{th}$). Data for 2010 also, very roughly follows this pattern, with the second largest being one-third (rather than half) the largest category and the 100^{th} largest being $1/116^{th}$ as large as the largest category.

[2] Japan's annual trade surpluses were between $20 and $100 billion in the late 2000s. Occasionally, Japan will run a monthly trade deficit, especially in the winter, and when oil prices are high. Also, the global recession in 2008 hammered Japanese auto exports, creating a monthly deficit, even before the disaster. Even here though, Japan finished for the year (2008) with a $21 billion surplus, and then a slightly smaller surplus of $27 billion in 2011 (converted at 100 yen to the dollar).

Figure 1. Trade Balance (goods) in billions of yen
Source: Japan Customs



One question this paper hopes to answer is whether or not Japan would return to a trade surplus country if it simply switched back on all, or most, of its nuclear plants?[3] The above figures suggest not, but how can this be? In 2013 many financial journalists were opining that Japan's trade deficits were partly a product of "structural issues and higher energy bills" (from a somewhat weaker yen). [4] A Bloomberg news article states, "Japan's trade deficit swelled to a record 1.63 trillion yen ($17.4 billion) on energy imports and a weaker yen, highlighting one cost of Prime Minister Shinzo Abe's policies that are driving down the currency."[5] But is energy (and a weak yen) the only significant change in import behavior during this unusual time in the history of Japan's trade balance? In what sectors, and how big are these "structural changes"? The last four years have been tumultuous for Japan, but for the world as well. The Global Financial Crisis (GFC) in late 2008 and the ensuing Great Trade Collapse shook up Japan trade and GDP growth. Finally getting back on track in 2010, Japan's northeast region was devastated by the East Japan Earthquake (EJE) on March 11, 2011, then the ensuing tsunami and nuclear meltdown. This "triple disaster" took away nearly 20,000 lives, but also temporarily interrupted various production networks through direct damage and also energy blackouts, brownouts, and induced conservation efforts.

Then, in the autumn of 2011 many Japan MNCs were again affected by the massive flooding in Thailand. Now that Japan is somewhat surer footing economically, will Japan continue to run trade deficits? Will these deficits continue even if Japan puts nearly all of its

[3] A return to the use of nuclear, at least to some extent, now seems inevitable. In April 2014 Japan's Diet approved a new energy plan which envisages the use of nuclear energy again. However, at the time of this approval, all nuclear plants were still in shutdown. See "The Diet Approves Energy Policy", an online article by "Forum on Energy, sated April 17, 2014 and last accessed April 23, 2014. Link is here: http://forumonenergy.com/2014/04/

[4] Online FT article, "Japan records it largest trade deficit by Jonathan Soble Jan 24, 2013. The article can be found here: www.ft.com

[5] From: http://www.bloomberg.com/news/2013-02-19/japan-export-gain-fails-to-prevent-trade-deficit-reaching-record.html by James Mayger and Andy Sharp February 20, 2013.

nuclear power plants on line again? Or are there are also other trends, disaster-related or other, that have occurred, that have set Japan on a path of sustained trade deficits in the future?

This relates to a second goal of the paper. The triple disaster and Thai flooding seriously disrupted both consumer and firm behavior in 2011 and 2012. Radiation fears caused consumers to import bottled water and some other foods in massive quantities. Foodstuff purchases shifted away from regions near Fukushima, to western Japan, northern Hokkaido as well as importation of more foreign foodstuffs. Did these *temporary* change result in any *permanent* shifts in the nature of Japanese importation of foods? Firms too, were forced to either shut down production, or re-sources, as some of the usual networks were unavailable. Did this open any new trade networks that may not have existed before? If so, did this generate any permanent shift in the import pattern of firms? A detailed examination of food, as well as all other imported goods at the 9-digit level will examine whether or not such temporary "surges" in imports which occurred in 2011 may have resulted in new, higher levels of imports for some goods. If so, this may explain part of Japan's newly found deficits.

A third goal of the paper is simply to summarize what is going on in the energy sector during Japan's nuclear shutdown period. What types of fuels are being imported, in what quantities and from what countries? Old suppliers have, of course, ramped up exports to Japan (at a hefty premium in most cases), but new suppliers have come on to fill the gap.

After parsing out exactly which sectors seem to have had permanent changes and which were transient, this paper will address the larger question of Japan's future trade deficits. One interesting finding, among many, is that despite the massive shock to the Japanese economy of the triple disaster, other changes are occurring naturally through supply and demand developments which have much larger implications for Japan's future trade balance. Put another away, aside from the "elephant in the room" of energy imports, Japan imports (and exports) have been surprisingly resilient, with very little permanent change. This is consistent with some of the recent disaster and trade literature, notably Kimura and Ando (2012) and Wakasugi and Tanaka (2013) reinforces two very different stylized facts in the trade literature: (1) trade networks for developed countries are highly resilient, but at same time; (2) the "kaleidoscopic comparative advantage" (Bhagwati, 2005) in the international economy, for some products, is spinning faster than ever.[6] This second effect appears to have a larger impact, in the short run and the long run for Japan's trade deficit, than any disaster-related change in sourcing.

The detailed, but admittedly eclectic, summary of the effects of the triple disaster on Japan imports will also contribute to the small, but growing disasters and trade literature in several important ways. First, efforts to generalize effects of disasters on trade, often across a large sample of countries misses the point that each disaster is very different, and there is no one "model" to explain. One could argue that Japan's imports have been very resilient to the triple

[6] This kaleidoscope phenomenon is, as Bhagwati puts it, "Today, you have it *(comparative advantage in some good)*; but in our state of knife-edge equilibrium, you may lose it tomorrow and regain it the day after. Boeing might win today, Airbus tomorrow, and then Boeing may be back in play again." This seems very true in products such as portable music devices and cell phones, where Japan used to dominate, but now does not. (Italics inserted by this author.)

disaster. But, of course, if we consider energy as well, the answer is exactly the opposite: the disaster has changed Japan from a trade surplus country of three decades to a deficit country, in the blink of an eye, for the foreseeable future. Also, some disasters effect imports (Japan 2011) more and some effect exports more. Efforts to generalize across countries must be treated with skepticism. Very little policy implications can be drawn from such broad and aggregated studies. Second, at least in the case of Japan's 2011 triple disaster, we can see clearly that large, but temporary effects of the disaster on the economy may be short-lived, but indirect, secondary effects, can sometimes be far more important. These secondary effects may be economic, but can often be political. An example of the former is Japan's 2011 quake and ensuing meltdown. The meltdown and radiation leaks caused a radical shift in Japan's energy policy, and therefore, as a country bereft of fossil fuels, its trade balance. More strictly political examples (see Samuels, 2013) of the latter would include Japan after the 1923 Great Kanto Earthquake, where it has been argued that the disaster relief provided by the Japanese armed forces altered the mindset of the civilian population such that it was more amenable to military rule and set the stage for a more militaristic Japan, and ultimately the Great Pacific War.

The short-term costs of large scale disasters in terms of suffering and loss of life are large, almost by definition. The loss in productive capital stock can also be large, but at least for developing countries, this seems to bounce back, along with trade, for developed countries (Gassebner et al, 2010). The long term effects are hard to discern, at each disaster can be very different. Hopefully, by examining the tragic case of Japan 2011 in detail, the long-run implications for Japan's trade balance can be made a bit clearer.

The paper proceeds as follows. Section 2 summarizes Japan's recent trade deficit. Section 3 discusses potential sources of import Surges and theories of switching. Section 4 gives a brief summary "disasters and trade" literature. Section 5 gives a detailed account of the change in import levels during the year of the disaster and the years that follow. This section will be divided into three broad categories: Food, Energy, and All other commodities. Food and Energy will be examined separately because of the unique way consumption of these goods was affected. Food demand was affected by radiation fears which caused a shift away from Eastern Japan, and in some cases, all Japanese foodstuffs. Energy and its shift is, of course, largely a political decision. That fact as well as its prominence in the trade deficit deserves separate treatment. All other (non-food, non-energy) commodities will be examined at a detailed (9-digit level) to identify what major categories of goods may have experienced import surged during these tumultuous times. After identification of these surge categories, we will attempt to determine whether these surges are permanent and whether or not they may have been disaster-related. Section 6 will summarize the findings will prognosticate on the medium and near future of the Japanese trade deficit.

The question this paper would like to answer is whether or not these shocks, coupled with a high yen, may have had sufficient leverage to create high import demand for some goods. The disaster created a certain degree of artificial demand. Coupled with a higher yen at that time, and flexibility of importers to source differently, made some switching easier than otherwise. But did

this switch generate "experiential" effects and well as "lock-in" effects which made those import spikes more permanent? In other words, did the shock change firms and consumers purchasing behavior in any long-run permanent way? While, in some respects it may be too early to tell, but a close look at the detailed data for the two and half years following the disaster should lead to some compelling evidence, one way or the other. .

2. Unprecedented Trade Deficits in Japan

Japan remains in trade deficit in 2013, with an unheard of 11.5 trillion yen goods debt for the year. Note that the Japanese historic surplus had already fallen due to poor demand for its exports in the US, Europe and the world. Also, higher energy and food prices increased the value of imports. The final straw was Fukushima, where massive increases in energy importing together with lingering global slump and high oil prices pushed Japan in a clear and persistent goods trade deficit.

Despite a recovery in exports (and therefore imported inputs to some extent) energy imports far outpaced this, resulting in the deficit. Energy imports as a share of total imports rose from 29% in 2010, to 35% in 2012, and were a mere 25% before the higher energy prices and the mega-quake. (Source, Japan MOF, Trade Statistics: customs.go.jp) Clearly, if Japan continues to spurn nuclear and depend on fossil fuels, its deficit will persist. But, what about non-energy imports. Are there are any persistent changes to be observed there?

Japan imported 17.4 trillion yen of "Principal commodity 3, "mineral oil" (which includes petroleum and natural gas) in 2010. That figure was 24.1 trillion in 2012. This suggests that if Japan held at pre-disaster (i.e. 2010) levels of energy imports, they would importing 6.7 trillion yen less imports in 2012. This is very close to the amount of Japan's goods deficit in 2012, i.e. 6.9 trillion yen according to Customs' data. Thus, in 2012, we may have been able to say something like, "if oil prices fall for Japan (Japan was and still is paying a huge premium for imported natural gas, as discussed elsewhere in this paper), and as new oil and gas continues to pour out of North America, and things settle down in the Middle East, Japan could return to merchandise trade surpluses, albeit small ones". But the trade deficit only increased in 2013. And much of this increase in 2013 (and increase in the deficit by 66% on the 2012 level) was *not* from new energy imports, as will be seen in section 5 of this paper. It appears Japan's trade deficit, with or without nuclear energy is here to stay for a while.

Of course, Japan has long run deficits in services. In dollar terms these were 50% higher in 2012 than 2008 levels, over 30 billion dollars. This could mean Japan is destined to run a trade balance deficit (goods and services combined) indefinitely in the future.[7] If the current

[7] The predictions of some macroeconomists in the 1990s (see Kasa, 1997) of Japan running current account deficits in the first decade of the 2000s are still premature, though predictions of Japan running a trade deficit by now (mostly through the effects of ageing on national savings and eventually on trade balances) seem eerily on target. Because of high foreign income coming back to Japan, Japan still runs a (large) current account surplus. Since 2005 Japan's income has consistently been large than its trade surplus. In 2012, Japan's income portion of its Balance of Payments was or 14 trillion yen. Japan's Goods and Service deficit was 8.3 trillion yen, and current transfers were a

inflationary targeting by the Bank of Japan further depreciates the yen, this may mitigate this a bit. Also, a stronger Europe in the future (modest growth of less than 1% recession is predicted by the IMF in 2015) would also boost Japanese exports somewhat. In the medium and long-run, ageing demographic considerations are likely to drive down Japan's (historically) high savings rate, and only deepen any existing deficit (as argued by Horioka, 1991 *inter alia*).

The "nuclear" question is an important issue in the larger question of global re-balancing, though most of Japan's surplus in this case is simply transferred to other historically surplus nations (i.e. oil producers). However, not all of the beneficiaries of Japan new demand for oil and gas are surplus nations. This will be explored to some extent in section 5 of this paper. But, what may be of greater interest is whether or not the unexpected and very much unwanted crash course in alternative sourcing of many imported goods resulting in any lasting changing in behavior by either firms or consumers or both. This question will be addressed in the detailed analysis of food, water, and other non-energy imports in the rest of a very large, section 5 of this paper. While each sector has an interesting story, in general, the answer to the preceding question is, "no". The high, temporary increases in a number of commodities following the quake, coupled with a strong yen seems to have done little to change the long-run stickiness of Japanese import behavior. It is the explanation of such potential sources of these changes, to which we now turn.

3. Potential Sources of Import Surges, Theories of Switching and Learning

A survey by METI (METI, 2012) in July 2011, found that of 603 firms surveyed, 70% of these firms' procurement was "affected" by the earthquake. Of these affected firms, 23% switched at least some of their procurement to foreign sources. So, it was not just consumers that altered buying behavior in the wake of the disaster. But was this "import penetration" for firms, and new consumption behavior by some individuals significant in volume terms? If so, was it permanent? Did these changes that occurred in 2011 results in some persistent behavior which remains today?

Reasons why an increase in import penetration of a particular good may *arise* are many. Ultimately, it must come from one or some combination of three aspects of the market: 1) demand shift; 2) changes in supply, foreign or domestic and 3) additional changes in relative prices, through exchange rates. Whether these changes are large enough to overcome any switching costs is one important consideration explored in more detailed below. Clearly, in many food and energy products it clearly was.[8]

---

little more than 1 trillion yen. Even with the unusual energy imports these past two years, Japan still has a CA surplus in 2013. But the fall has been dramatic. A CA surplus of 191 trillion yen in 2010, fell to 101 in 2011, 47 in 2012, and 32 trillion yen in 2013. The "income" and "service" components of the CA are holding fairly steadily, so indeed, most of the drop is coming through a much larger trade deficit.

[8] Domestic income growth is an important fourth factor. The Japanese recession in 2009 due to the GFC and subsequent rebound is seen in falling then rising exports as well as imports. However, by 2010, a year before the disaster, GDP growth had leveled off, and with the crisis in Europe still lingering. As such, any brief upticks in

Whether these import surges that did occur will be *persistent* depends on mainly three factors: 1) is the initial reason for the change persistent? and 2) did the temporarily induced change in behavior have any "experience good" effects. E.g. did Japanese consumers who never bought foreign beef, or bottle Evian before, perhaps because of higher prices, say, after purchasing the foreign product during the peak of the crisis say to themselves, "hey, this is better than I thought!" As such, this is a sort of informational discovery and "experience good" issue.[9] 3) If *reverse* switching costs are high, or some other "lock-in" occurs, persistence is more likely. While this may not apply to the new consumer of Evian, it may apply more strongly to those users of particular types of energy, or firms that may have sourced domestically in the past, but switched to foreign producers during the crisis.

Returning to the question of *why* certain imports increases occurred, we can address (and to some extent dismiss) the third potential source of import increase: relative prices. First, Japan did experience a stronger yen, at least in the first year after the disaster. This would normally increase imports, although Japanese imports (and many countries) are often found to have only about "half" of any currency appreciation passing through to lower import prices, at least in the short-run. See Otani, Shiratsuka and Shirota (2003) for estimates for Japan. To the extent that this stronger yen is perceived as more permanent, the effects should be stronger. But it not clear what businesses and consumers felt about the yen at that time (late 2011). Economists often argue a stronger yen is inevitable given Japan's large current account surplus (need cite), but at the same time, there has been much talk, and finally, under PM Abe regime implementation of, inflation targeting, which would and did depreciate the yen, at least in the short to medium run. In the very short run, if a temporarily strong yen overcomes some switching costs or other barriers to imports, there may well be some persistent change in behavior. Whether or not the 10% or appreciation is sufficient is debatable. The nominal yen appreciated vis-à-vis the dollar by 35% between from January 1986 until June 1987 following the Plaza (1985) and Louvre Accords (February 1987). Japan's merchandise trade surplus did fall, in yen terms, by about 20%, but it took three years to do so. In summary, the temporarily strong yen may have help nudged any imports in the upward direction. But alone, this may have done little.

Switching Costs literature: some highlights

There is a huge body of literature in micro and industrial organization, in transactions costs economics, and in trade theory with respect to "switching costs" and related concepts.[10] In a world with no frictions, markets would immediately respond to even small changes in relative prices and other demand and supply forces, and just a quickly revert back if those conditions revert. In the real world, additional costs may interrupt these market forces. A lowering of such

---

Japanese GDP in late 2011 and 2012 could not account for large surges (typically over 20%) in the products examined here.

[9] "Experience goods" was a term attributed to Nelson (1970).

[10] In trade and with application to Japan, in the context of small import subsidies the Japanese government was giving in the early 1990s, see Greaney (2000).

friction naturally allows quicker and fuller adjustment. In the past, Japan, rightly or wrongly has been accused of excessive rigidity in its purchasing practices, especially with foreign imports. (See Bergsten, 1993). A large enough currency swing (such as that in the 1980s), or dramatic change in demand preferences may be sufficient to overcome whatever frictions, costs, cultural, institutional, contractual, or other barriers that may lie in the way of change. In short, conditions may change so much that it is now profitable to change behavior, whether it be switching to a gas stove, rather than oil in the US because of cheap gas and expensive oil, or to buy that imported car with the steering wheel on the "wrong" side of the car, because an exchange rate appreciate makes the car a huge bargain.

Klemperer (1987) states that there are three types of switching costs one can encounter: (1) transaction costs, (2) learning costs and (3) "artificial" or contractual costs. There are likely more, but this simple taxonomy should serve the purposes of this paper well. An example of transaction costs Klemperer gives is that of changing your telephone service provider. The time and effort to cancel one carrier and sign up for another might not be worth the few cents savings you might get on long-distance calls. Naturally, the larger the price differential, the more likely you are to make the effort to switch.

The second type, "learning costs" as switching costs, can be applied to brands of good, for one. For example, the second computer you buy might be an Apple because the first computer you bought was an Apple, and you already know how to use it. There would be learning costs to buying an IBM clone, or to use a more modern analogy, you buy another iPhone, rather than a cheaper Android-based Samsung smartphone. Here there, is a subtle, but important difference from another concept we will employ in this paper, namely "models of learning". Models of learning operate on the demand side, perhaps through advertising (e.g. Spence, 1981) which raises "all consumers' willingness to pay" (not just the solitary Apple consumer). Here, there may be informational discovery, perhaps from other consumers who provide more information on the heretofore unknown products. This paper will consider both a very real possible in the context of any Japanese import surge, whether it be consumer final goods, or a firm's intermediate inputs.

Consider a fabricated example of a (Japanese) firm who generally does not purchases foreign inputs, perhaps because the user's manual or specifications are all written in English, or German. The learning costs add something to the cost of the product and may deter purchase of the foreign good, despite a small unit cost savings. Then, disaster strikes, perhaps interrupting the domestic (Japanese) product becomes available (e.g. the plant was located in Tohoku), now the cost of the domestic product, for a time, is infinite, and the switching/learning costs, becomes secondary, or irrelevant. Will the firm revert to the old domestic product after being forced to switch and buy the foreign product? After all, now they have sunk the time and effort into reading the German instructions, and if it is cheaper, why go back? Examples could just as easily be made for consumers.

But the above "learning costs" example is distinct from "models of learning". To use the advertising example, but turn it on its head, because of radiation concerns, there could be a

negative willingness to pay for Japanese agriculture goods. This, of course, has a *positive* willingness to pay for foreign presumably safer, foodstuffs. To one example which will be explored later, American and Canadian beef has been scarce in Japan, because of BSE concerns. However, when Japanese consumers nationwide discover that thousands of domestic stock and their feed are irradiated, perceptions shift, and a demand for foreign beef may rise. This is an important possibility we will explore, but differs from the IBM/Apple variety of switching (or conversely, lock-in.)

A final, important, related idea to "learning" is the idea of "experience goods". In theory (Nelson, 1970), if the consumers does not have perfect information on an un-consumed good (again, consider US beef) and they must purchase ("experience") that item to know the quality (or utility they may derive from it), the consumer faces a loss of expected utility from switching from the brand they know to the brand they have not. This loss in utility may be small, but nonetheless, it is a possibility, we will consider.

The third type of switching cost is "contractual". Here, re-using the iPhone example, consumers may be unwilling to abandon their iPhone for a newer and cheaper smartphone from, say, Samsung, because they are locked into a two-year contract on the iPhone. There are costs to breaking the contract. This applies equally well to firms who may have long-term relationships, with or without formal contracts with certain suppliers and are hesitant to switch, for monetary, legal, or even social penalties. [11] When disaster strikes, those contracts may become moot (the supplier's factory might be destroyed), or the relationship's interpretation may become more flexible in light of such dire circumstances.

With all of the above types of switching and learning, there is a second question of "reversion". If the switch is made, will they switch back, one things settle down, things comes back online, etc. With this in mind, we consider various possible sources of import surges and whether they might be permanent or transitory.

Demand Shifts in Food

As far as the demand shifts, these were clearly present, at least temporarily. For the retail consumers the obvious change was aversion for many (especially in Kanto) of Japanese food, water, etc. for fear of radiation contamination. This is a standard demand shift down for Japanese products, and simultaneously a demand shift up for foreign goods. Also, this occurred regionally, with demand for Eastern Japanese food and water products falling and west and southwest (and far northern Hokkaido) food demand rising. So, as to the second question as to whether these import surges in food will be permanent or persistent, we must ask the three "follow-up" questions laid out above. First, are the radiation concerns still present? For foodstuffs from Fukushima and the surrounding regions, the fears are still high, no doubt. For overall non-Fukushima proximity Japanese foodstuffs, fears have largely subsided. One survey (Burch,

[11] See Asanuma (1989) for dated, but seminal and detailed study of relationships among Japanese auto and electronics makers and suppliers implementing Williamson-style New Institutional Economics methods.

2012) not surprisingly, finds less anxiety (or even no anxiety, especially among college students in the Kansai region) towards foodstuffs that are not from Fukushima and surrounding areas. A repeated survey over several months of thousands of consumers across Japan, in 2011 and 2012 finds that anxiety levels about radiation have fallen, but are still high.(See Hosono, Kumagai, Sekizaki, 2013)

So, this demand spike in foreign goods would have fallen considerably by now. Second, has there been any "product discovery" which has resulted in a sustained increased in foreign foods? This will be explored to some extent as we examine the product by product data. But, in short, it seems that this has not been the case as most all foodstuff products has reverted to historical import levels, or historical trends. Third, are there any high switching costs which might prevent consumers from reverting back to their old habits? The switching costs for the retail consumer intuitively seem quite small; one can easily choose to grab the domestic or imported beef 'off the shelf' in the supermarket. Even large retailers like Aeon, appeared to be able to quickly stock their shelves with imported goods (such as Korean bottled water), then when radiation fears subsided, they just as quickly disappeared.

Demand Shifts in Energy

The same characterization clearly cannot be giving to the energy sector. The decision to shut down all nuclear reactors was the political outcome of the Government, the local communities housing the reactors, and the general will of the people of Japan. Whether this will persist, depends almost entirely on how this political decision plays out. On this, much has been written. (see Samuels, 2013) For the purposes of this economic paper, the answer to this first question is simple: this demand shift (for foreign fossil fuels, mainly natural gas) will be permanent until politics decides otherwise. Having said that, the there is a wide range possible outcomes. Japan could return to business as usual, restarting nearly all nuclear plants. Or they could restart a portion of them, say half. But, this question of "should we return and if so, by how much?" is also coupled with a question of the appropriate, or politically and economically feasible time frame. It seems very unlikely that Japan will remain in complete shutdown indefinitely. It is simply too costly in terms of GDP.[12] The non-use of its nuclear power plants capacity is the equivalent of sacrificing over one percent of GDP per year, every year indefinitely.[13] Economic reality may very well dictate the political outcome, but again, to what degree is a hard to discern. As far as the second two "follow up" question, again Energy and Food are quite different. Are there any "experience good" effects to switching energy sources? There are likely to small, if any. However, switching costs are clearly important, and often large. Power plants, firms, and even some residential owners can switch energy inputs, as prices and availability change. And many

[12] Direct economist costs are not the only issue, of course. Schnell and Weinstein (2012) estimate that potentially thousands of deaths per year could occur so long as Japan continues to burn fossil fuels rather than turn back on its nuclear power.

[13] Japan's GDP is roughly 500 trillion yen or 5 trillion dollars. In 2012, Japan had roughly 7 trillion extra imports of energy because of the shutdown as discussed earlier in the paper.

do change, so long as the switching costs are smaller than savings. For TEPCO to fire up old fossil burning electricity plants in lieu of nuclear plants, so long as the capacity is there (which, so far, it appears to be), or to draw upon more hydro (that is often used for baseload generation), may not incur very large switching costs. They are doing it by necessity now, but it may not be very costly to switch back to nuclear if the politics continues to move in that direction. And if this occurs, *switching back* will incur costs as well. It may not be economically wise to go back to nuclear generated TEPCO electricity even if the politicians decided to switch them back on, especially if the price of natural gas imported by Japan falls considerably (see section 5.2 on potential increase in exports of gas from the US to Japan).

Demand shifts in other industrial inputs

Here too, I think conventional wisdom would suggest that most of the disruptions in these products occurred on the supply side, and as such will be addressed below. Concerned of radiation of industrial inputs sourced from regions near Fukushima by firms are probably far less than for final consumption goods, especially food.[14]

After such change in sourcing occurs, however, the second two issues would come into play, experiential effects and reverse switching costs: Experiential effects may or may not be large. Being forced to outsource from new suppliers, foreign or domestic, may open up new channels and networks, firms did not conceive of before, or did not know about before. Acquiring any market knowledge is costly. Japanese firms have been reluctant to do before, but the necessity induced by the disaster may have forced some firms to make the leap. Put another way, they would have never incurred the costs of searching for alternative suppliers, especially abroad. But with no other options, some firms no doubt did have to put in the time and money to secure new sources for certain imports. For some goods the search and switching costs might be low, but for many Japanese firms which produce many sophisticated and/or high precision goods, this may have entailed high costs. For example, perhaps a small producer of batteries needs a certain rare earth good that he gets from an established supplier in China. But then, because of the politics, Chinese rare earths become unavailable at any price. He has to seek and establish a new contact, perhaps in Vietnam, or Mongolia. Language barriers must be overcome, new faces learned, and new import paperwork all have to be done from scratch; something they would rather not do so. But perhaps after doing so, out of necessity, they find the Vietnamese supplier is just as cheap, or perhaps cheaper than that in China and perhaps more reliable.

[14] But industrial inputs can and were contaminated too. See the January 17, 2014 article in the Japan Times detailing the over 5000 tons of highly radioactive crushed stone used in foundations for condominiums which were shipped from a quarry in the restricted zone in Fukushima. The article can be accessed here: http://www.japantimes.co.jp/text/nn20120117a1.html?goback=%2Egde_2170900_member_127196678

Supply Shifts in Foodstuffs

Some of the slack caused by elimination of much of Fukushima and some of the surrounding areas as a source of agricultural products due to radiation was be picked up by the rest of Japan, and some by increased imports (though these are often restricted by import quota). In a simplistic model where non-Kanto plan agricultural goods were perfect substitutes for Kanto (Fukushima, Ibaraki, etc.) goods, we might imagine that a good deal of the slack would be absorbed by the rest of Japan. But, this regard, I think it is best to regard Kanto consumers as "large country", which would push up prices for these goods throughout Japan. As such, general skepticism of all Japan foodstuffs, especially in 2011, coupled with the shortage of Fukushima, should have driven up demand for food imports, which of course, it did.

Some of Kanto agricultural production has come back online. To this extent we can expect, in theory, this shortfall to continue to be picked up partly by the rest of Japan and partly by imports. But what "experience effects" and "reverse switching effects".[15]As with the demand discussion on foodstuffs above, experience effects has the potential for being large, but the data does not reveals any large permanent shifts, but rather temporary surges. Reverse switching costs also appears not to be very important.

Having said that, we cannot rule out the indirect effects which disasters sometimes bring about. It will be argued that the Triple Disaster may have sped up the relaxing of BSE-related restrictions of beef, and even sped up TPP negotiations, both of which may have long run implications for Japanese imports for food. More on this is contained in the data section below.

Supply Shifts in Energy

There was a small negative supply shift as the reactors in Fukushima were knocked out of commission permanently. However, some of this shortfall could and has (and higher cost) from other domestic sources, including hydro and renewables, but in reality, most comes from imported fossil fuels. The larger "shift" was already described as a "demand" shift in the non-preference for nuclear power generation at present. This could, of course, could be seen as a Supply shift (where price of nuclear electricity is, for now, at an infinite price), but the analysis in the same. Experiential effects are small, but reverse switching costs could be significant.

4. Literature on Disasters and Trade

The literature on disasters and trade is still confined to a handful of papers. Some papers have used gravity models to assess the impact of disaster on trade. Gassebner, Teck and Teh (2010) employ data on 170 countries over 40 years (1962-2004) and examined both imports and exports. This paper finds that trade is affected far more in developing countries struck by natural

[15] Experience goods was a term introduced by Nelson in "Information and Consumer Behavior", 78(2) Journal of Political Economy 311-329 (1970). It refers to a good (or service) whose quality and/or characteristics are difficult to observe in advance, but which can be ascertained after consuming them.

disaster, than for developed countries such as Japan. While this result may be true, often a more detailed analysis is needed which cannot be captured by the broad brush of a gravity model. This paper will closely examine Japan, a developed country. Moreover, as disasters sometime affect imports (Japan, and energy) more than exports (the Thailand floods), or at least in very different ways, there is great value in closely examining a single country, and a single aspect of trade, i.e. either imports or exports, separately. A second, shorter analysis by Andrade da Silva and Cernat (2012) is narrower in scope, as it only examines the effect of disasters on developing countries' exports (i.e. they do not examine imports nor do they examine the effects of disasters on developed countries.) They too find that the effects on developing exporters large, at least for small, developing countries.

In the wake of the 3-11 disaster, at least one paper on the effects of that disaster on Japan's imports was written. Kimura and Ando (2012) examine the effect on Japan exports at a very detailed level after 3-11. For a detailed examination of the effect of the disaster on firms (of which many are engaged in international trade) see Wakasugi and Tanaka (2013).

5. Sectoral Analysis of Imports

This section will give a very detailed look at nearly every commodity that Japan imports, but with a particular focus on those goods who were obviously impacted by the triple disaster. Starting with a close look at Japan's dramatic rise in imported energy, we will examine, in turn: food, manufacturing, chemicals, services broadly, and finally rare earths, which have seen dramatic changes during this time, not because of the disaster but from Japan-China political friction.

5.1 Food and Foodstuffs

Japan is the larger importer of food in the world.[16] Historically, food has comprised of about 7% (2012) of Japanese total imports (Japan customs data). 60% of Japan's total food consumption (in caloric terms, see footnote 5 below) comes from abroad. Japan's annual food imports is over 5 trillion yen; compare to Japan's energy imports in 2012 of 24 trillion yen. So, while energy imports of the lion's share of the deficit, food is no small amount. Given the concerns over radiation in 2011, the behavior of food imports deserves a closer look.

The most severely affected parts of Tohoku (Iwate, Miyagi, Fukushima) contributes about four percent (Hayashi, 2012) to Japan's total GDP. If we expand the affected area to also include Ibaraki (just south of Fukushima) and Aomori (north of Iwate) these five prefectures the region accounted for 21% of marine fisheries and other aquaculture and 17% of all agricultural production by volume (in 2007) according to a study by the US Congressional Research Service (Johnson, 2011). The tsunami dumped saltwater sludge on huge swaths of otherwise fertile cropland near the ocean. The radiation contamination around Fukushima made shipments of

[16] See http://www.fas.usda.gov/country/Japan/Japan.asp (accessed September 24, 2013)

many goods from certain designated areas as prohibitive, both within Japan and for export. Radiation fallout was detected throughout Eastern Japan, spiking well above recommended safe levels in the vicinity of Fukushima, but also in the greater Tokyo area, bringing about a rush for bottled water. Domestic supplies (from more distant Hokkaido, for example) and imported bottled water quickly sold, but retailers were fairly quick to import more. Extremely high levels of radiation spilled into the oceans as well. As much of Japan fish are caught off the shores of Fukushima, or at least the fish travel nearby as part of their natural movement, imported fish rose as well. The Tohoku area is also well-known for local delicacies such as oysters farmed off the Tohoku coast, beef tongue in the Sendai area, etc. More generally, beef and other products were affected either because the cattle were being exposed to radiation directly, or indirectly through hay and other grains which were sourced from the radiated area and quickly soaked up radioactive material. We will now examine the overall picture and then each of these products in turn.

5.1.1 Overall Food, Foodstuffs, and Beverages

Shortly after the quake and the announcement of the radiation leaks various domestic agricultural shipments were ordered to a halt. At this time, food imports spiked.[17] Looking at "Food" (Principal Code 0 in the Japanese Customs data) we see (in Figure 2) imports rose from a historical level of approximately 400 billion yen (*per month*) to over 500 billion yen by May of 2011, two months after the quake. [18] This represents a nearly 20% increase, which was, no doubt, in part due to alternative sourcing amid radiation fears and other general shortages of various fruits and vegetables usually sourced from the Kanto plain and Tohoku. But Japan's import bill has been over 500 billion yen before. When world food prices rose in 2008, this no doubt pushed up Japan's nominal food bill. The Global Financial Crisis of 2008 and related trade collapse caused food imports and imports, in general, to fall. So, much of the higher levels of imports in 2012 and 2013 can be viewed as a resumption of a previous, longer trend of higher food imports in Japan. At the same time, world food prices were about 10% lower in 2013 than in 2011. They continued to fall slightly in January 2014 so this could account for some of the drop.[19] While food prices (indexed in dollars) have been fallen since 2011, the yen has appreciated, raising the Japanese food import bill. At the same time, the weaker yen presumably has a price effects and reduced demand for imported food. Fear of overall radiation exposure (remaining "hotspots") as

[17] For a comprehensive list of various regions and products in which shipments were halted by order of the Japanese government due to radiation concerns see The Japanese Ministry of Health, Labour and Welfare: http://www.mhlw.go.jp/stf/houdou/2r9852000001a3pj-att/2r9852000001a3rg.pdf. This page is only in Japanese but a summary, in English, in a Wikipedia entry appears fairly accurate and easy to follow.

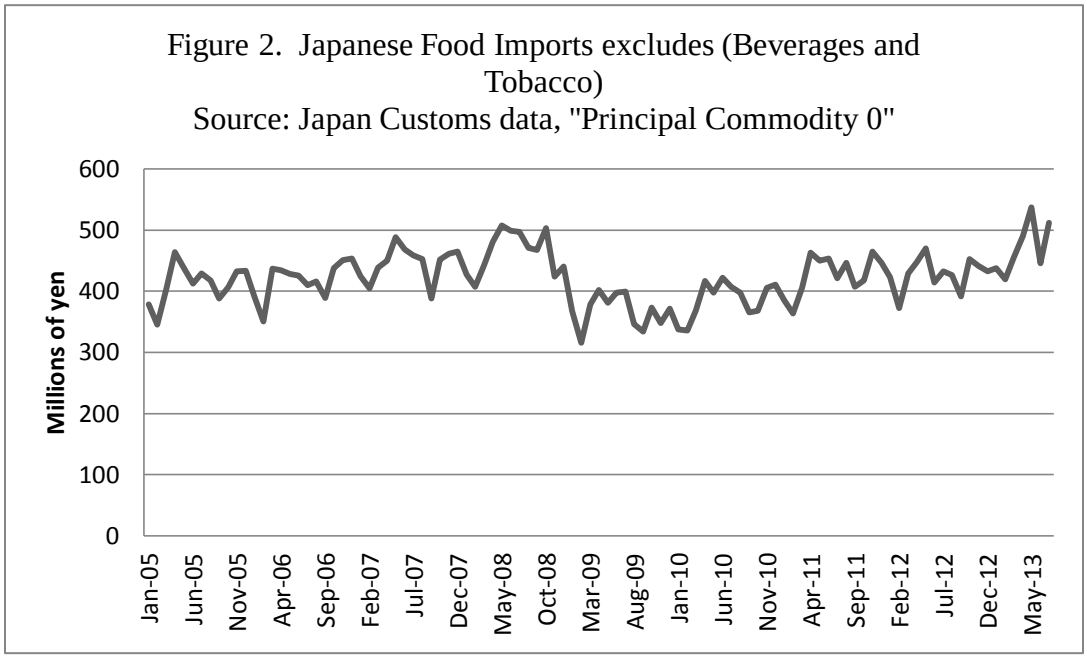
[18] This paper uses Japan Customs data for most figures, tables and discussions. Most of the data is available online at www.customs.go.jp. It is presented it two ways: one by "Principal Code", a Japanese classification, and, by the HS code, at a 9-digit level. It is sometimes easier and more useful to use one code or the other for data purposes and it will be noted which code ("Principal" of "HS") is being used throughout the paper. The website also has a detailed concordance between the two classification systems.

[19] See the UN's Food and Agricultural Organization World Food Price Indices at www.fao.org/worldfoodsituation/foodpricesindex/en/

well as food contamination in Fukushima prefecture may remain high, but have likely decreased considerably elsewhere in Japan.

Without a longer time series and without a single unit of quantity for various foodstuffs, it might be impossible to disentangle these various effects. Perhaps, at some later stage import demand function can be estimated. For the present paper, we will simply state that overall, it appears that the spike in overall imports of food seems to have returned to historical levels. Indeed the shock of worldwide recession had a much larger effect on these imports than the disaster.[20] However, this is a broad category, and it is still may be the case that some food sectors have seen sustained increases in their import levels. We now turn to this more detailed examination of food, where in most cases we can also look at real quantities of imports over time.

Figure 2. Japanese Food Imports excludes (Beverages and Tobacco)
Source: Japan Customs data, "Principal Commodity 0"

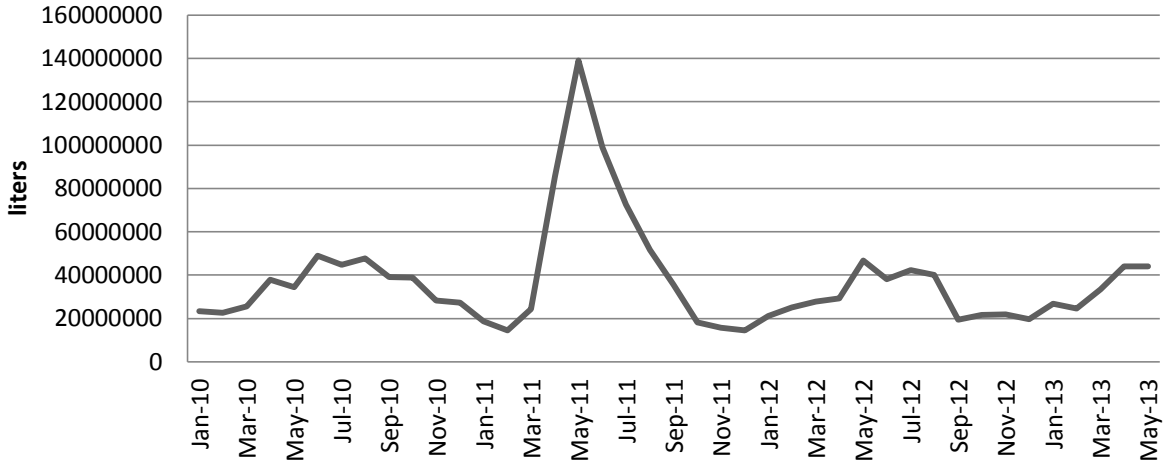


5.1.2 Water

Bottled quickly sold off the shelves in Tohoku and the Greater Kanto area when news hit of the radiation leak. News that the Tokyo water supply was contaminated hit the news March 20th. Shelves of bottled water were emptied by that afternoon.[21] Domestic bottled water was often left on the shelves, however, if sourced from Eastern Japan, including Mt. Fuji-sourced water.[22] Retailers were quick to find alternative bottled water sources.

[20] Kimura and Ando (2012) compare and contrast impact of the GFC and 2011 EJE on Japanese exports. They find, naturally, both have a huge temporary effect.
[21] "Tokyo tap water has trace level of radiation". The Japan Times. 20 March 2011. Retrieved 20 March 2011.
[22] Author's observation.

Figure 3. Total Japanese Imports of Bottled Water (liters)
source: Japan Customs (HS 2201.10)



Korean bottled water, historically not a large exporter of bottled water to Japan, or anywhere, soon showed up on supermarket shelves. Korean imported water was up from 450,000 liters in May 2010 to almost 23 million in May 2011: *fifty* times the historic levels. Looking at Fig. 3 above, we see the rise in imported water was dramatic, quadrupling in May 2011 from May of the previous year. Nearby Taiwan also supplied nearly 2 million liters. Malaysia and Indonesia also shipped over 500,000 and 100,000, respectively. Traditional suppliers (France, US, Canada, Italy and Germany) exports were also up. China, in contrast only supplied 150,000 liters or so in May 2011. However, in the previous year, this has been nearly zero, so it cannot be said that China did not pitch in to meet demand. Unusual suppliers came to the rescue as well. United Arab Emirates shipped over 2 million liters in May 2011. But the UAE was already a bit unusual prior to the quake having shipped over 800,000 liters in May 2010. Whether this desert country truly has a comparative advantage in bottled water is another interesting story, perhaps. But this surge is apparently not persistent beyond a year or so. So, it would seem that fears of water quality have been allayed, at least outside of the Fukushima area. Also, while imported water seems to fallen back to historic levels, an already increasing (pre-quake) domestic supply of bottled water, from Mt. Fuji, Hokkaido and elsewhere continues to rise. (See JETRO report, 2011). Because of a lack of regional bottle water consumption, unknown elasticities between domestic and foreign bottled water, and the general upward trend in bottled water consumption prior to the quake, it is difficult to say whether or not the quake sped up this trend towards more consumption of bottle water.

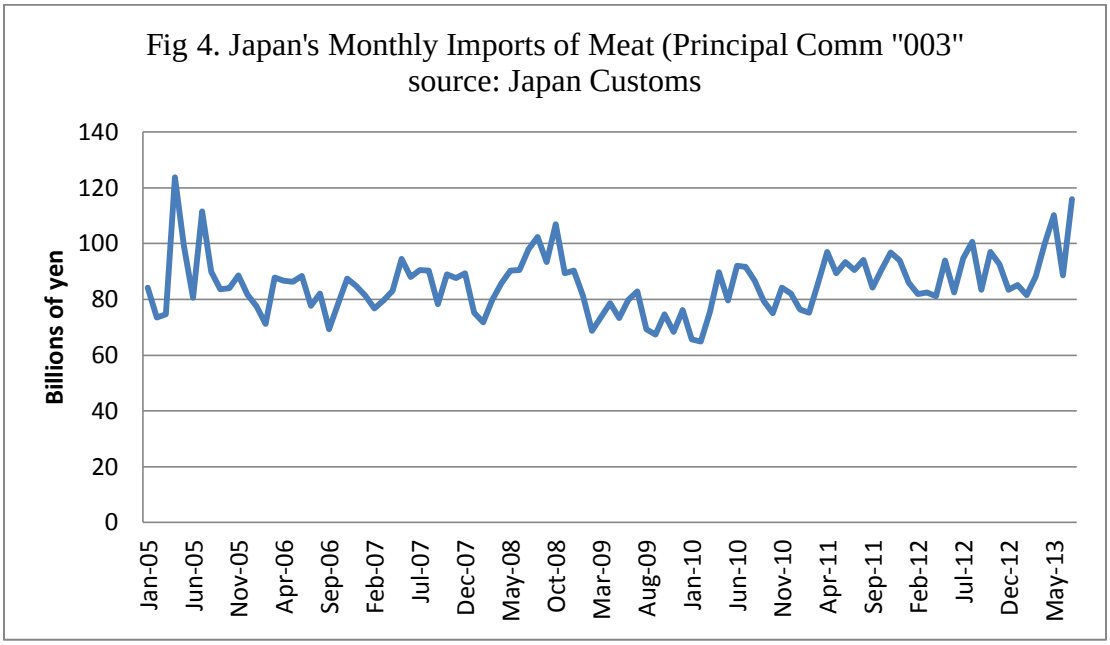
What can be said, however, is that it does *not* appear that the surge in water imports has created any significant increase in demand for foreign water, or even alternative foreign suppliers. Again, refer to Figure 3 where the spike seems to fallen to its historic levels. Korean bottled water imports have fallen back to pre-quake, low levels of about 450,000 liters a month and only a few percentages points of total bottled water imported by Japan. Taiwan exported almost nothing in 2013, and the same historical exporters still have several percent of the market share.

US and France (large beneficiaries of the increased demand) are still the major exporters accounting for nearly 90% of the market.

Lastly, one could argue that those living closer to Fukushima would import more water than those far away. However, even here, a quick comparison of port level data (Hakata in southwest Fukuoka, Kyushu, and Yokohama in the east) yields no stark differences. Yokohama is importing about 12% more in the first half of 2013 than they were in the first half of 2010, but Hakata is importing 16% more. Again, overall water imports are not discernibly higher than historical levels, so unless this persists indefinitely, it could be attributed to a host of factors other than the disaster.

5.1.3 “Meat and Meat Preparation” (Principal Commodity Code 003, a subset of 0: “Food and Live Animals”)

Fig 4. Japan's Monthly Imports of Meat (Principal Comm "003"
source: Japan Customs



Japan imports approximately 100 billion yen or (roughly 1 billion dollars) worth of all meats (non-seafood) per month. Of course, like most agricultural products, there are a variety of tariff barriers, tariff-rate quotas, etc. In addition, in the case of beef, Japan has changed its policy several times in the past decade with its handling of US (and Canadian) beef in the light of BSE concerns since late 2003. A look at the monthly data in the above Figure 4 suggest there was no significant increase in meats imports, despite beef shipments from Fukushima cesium-tainted cattle being halted and as well as more general concerns that all of Japan’s livestock may have

been potential contaminated through tainted straw and other feeds.[23] Even a small uptick in March and April of 2011 was already on a small local upward trend in February. Also considered the large seasonally variation in meats and many agricultural products, anything attributed to the disaster would be pure speculation.

This lack of discernable change is surprising considering the results of one survey of over 4,000 people in Japan (Oct-Nov 2011) which found 40% of those survey had a lower willingness to pay to Fukushima area beef even if no radiation was detected (Hosono, Kumagai, Sekizaki, 2012). If there was radiation found to present, those with a lower willingness-to-pay (WTP) rose to 70%. It may, however, that those consumers simply switched to other domestic sources of beef, and/or other sources of meat deemed safer.

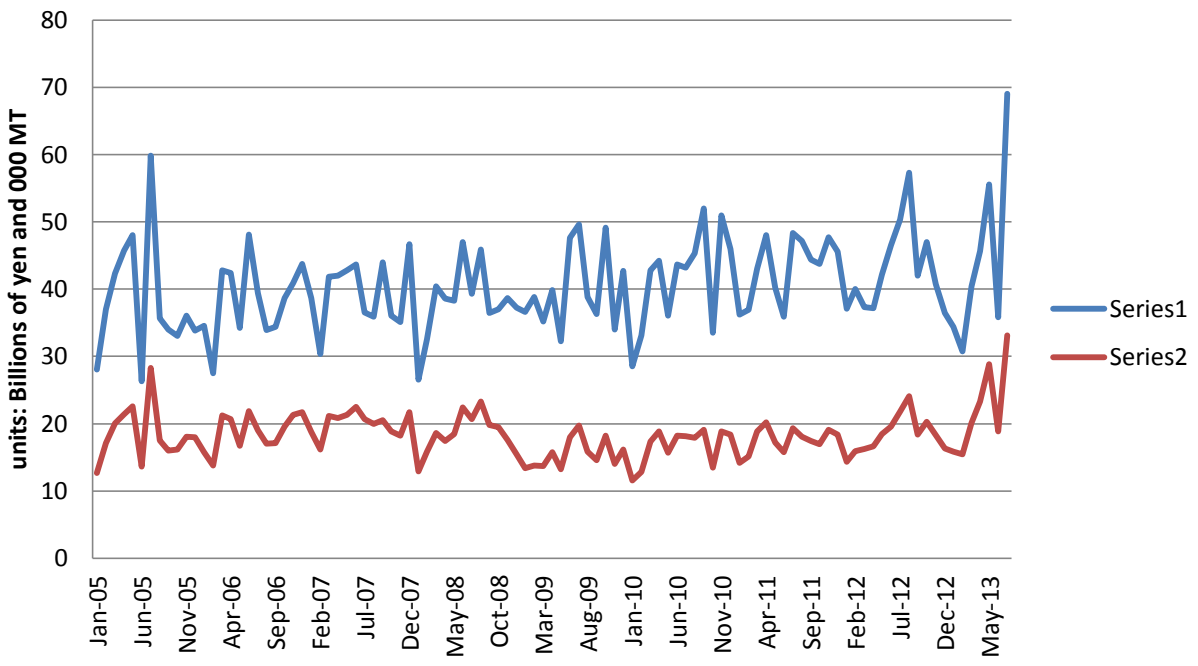
Beef Imports, BSE and PR by US ranchers

However, if we consider the imports of beef specifically, an interesting political economic story can be told within the context of the disaster. Beef accounts for roughly one-quarter to one-third of all "meats". About 60% of Japanese beef consumption comes from abroad.[24]

[23] "The Japanese government says rice straw used for cattle feed contaminated with radioactive cesium has been found in 10 prefectures across the country. Beef produced from cattle fed the contaminated straw and shipped out from farms has already been distributed to almost all prefectures."
"On Tuesday, the government suspended shipments of beef cattle from Fukushima Prefecture after high levels of radioactive cesium were detected in beef shipped from the prefecture. One beef sample contained radioactive cesium in amounts 9 times the government standard." Both quotes from article entitled, "Contaminated rice straw found in 10 prefectures" July 11, 2011, from NHK's online site: http://www3.nhk.or.jp/daily/english/21_05.html

[24] Cite: http://www.usitc.gov/publications/332/pub4033.pdf

Fig 5. Monthly Japanese Imports of Beef
sourfce; Japan Customs (Series 1 is Value and 2 is Quantity)



While not dramatic in the Figure 5, one can glean increases in quantity and value of beef imports early in 2012. At the same time, this spike (the figure includes data up to and included July 2013) in 2013 seems roughly the same as levels in 2005. What is going on here? In short, Japan relaxed its restriction on older beef in March of 2012, which it had implemented since 2003 in an effort to avoid potential BSE-cattle and beef. Was the relaxation in policy due to the disaster? The counterfactual is highly unlikely. That is to say, one would be hard-pressed to argue that Japan would *not* have relaxed the restriction if the disaster had not occurred. Diplomatic efforts by the US and Canada had certainly been made before 3-11.

At the same time, evidence suggests that atmosphere in a post-disaster Japan may have played a role in *speeding up* the eventual relaxation of the "21 months or younger" restriction. At least four political events pushed in that direction.

First, President Obama and then-Prime Minister Noda met at the yearly United Nations general assembly and two issues at the top of their agenda were BSE and the military alliance.[25] Second, Canada PM Harper visited Noda (and also flood-stricken Thailand) in March of 2012 and discussed beef issues.[26] Third, earlier, US ranchers (The US Meat Export Federation) mixed altruism with an implicit PR campaign in July of 2011, flying to Japan and cooking nearly

[25] See "The Noda-Obama Meeting and the US-Japan Security Alliance" by Stephen Harner dated September 24, 2011 in www.forbes.com accessed August 2013.

[26] See "Harper in Japan for Trade Talks after Thailand Visit" dated March 24, 2012 at CTV News http://www.ctvnews.ca/harper-in-japan-for-trade-talks-after-thailand-visit-1.786697#ixzz2ajWaitAf accessed August 2013.

100,000 American sirloin steaks (and pork) meals for the residents in the devastated at over 30 locations in the Tohoku region.[27] Fourth, there appears to have been a small *quid pro quo* where the US agreed to resume importing *Japanese* beef which had banned for two years. The Reuters article writes, "The United States has given Japan's beef a clean bill of health on the foot-and-mouth concerns. Japan is also reviewing its curbs on U.S. beef imports as global concern over mad cow disease ebbs."[28]

As mentioned above, the US government and private interest groups made continuous efforts to increase exports. Japanese retailers, with a strong desire to gain more access to US beef again, were also making efforts to increase US imports, even before 3-11.[29]

Again, while the disaster clearly did not result in a huge spike in beef or other meat imports, it seems to have sped up what had been a very slow negotiation. Beef imports were over 200 billion yen in 2012 and rising in 2013. At the current rate, 2013 may end up with 300 billion yen or 3 billion dollars more worth or beef, mostly form the US and Canada. If one assumes that the US will soon return to pre-BSE levels (over 700,000 metric tons, valued at nearly 3 billion dollars) this means the new importing regime has added roughly a $1 billion to Japan's $70 billion trade deficit. So, beef alone added more than 1% a year to the deficit.
The case of beef is interesting, because as we will see, sometimes the direct effects on trade of a disaster are large, but short-lived. But other political changes are set in motion that can be (1) sometimes much larger, as in the case of Japan's energy imports, and (2) essentially irreversible, as in the case of beef.

The indirect effect of disasters on political constraints has been mentioned earlier in this paper. As Samuels (2013) says on page 43 of his book,
"…when constraints on choices 'soften' or 'relax' for short periods…due to exogenous circumstances such as…natural disasters…"

As Samuels (2013) goes on to argue in his book, there appear to have many missed opportunities for real change in Japan following 3-11, but for small economic issues, such as beef and BSE, and perhaps larger economic issues, like Japan's participation in TPP, the space created by 3-11 may have large policy implications, not only for energy, for other sensitive import-competing sectors in Japan.

Disaster-induced policy change is not unknown in Japan's history. As Samuels (2013) argues, the Kanto Great Earthquake of 1923 brought in martial law first to deal with the quake. But then, as a result, Samuels and others argue that the Japanese citizenry become comfortable with a military in charge and a previously decline in popularity of the military, enjoyed an increase, ultimately setting Japan on a disastrous path to war. This, the line goes, made the rise of a militaristic state and the end of the brief Taisho democracy less distasteful and perhaps for

[27] See http://www.nebraskacorn.org/news-releases/nebraska-delegation-supports-sales-of-u-s-beef-in-japan/ dated July 11, 2011 and accessed August 1, 2013.
[28] "Japan resumes beef exports to U.S. after 2-year halt" Reuters.com online, updated August 24, 2012, accessed August 1, 2013.
[29] See "Japan supermarket chain resumes sales of US beef", Reuters online dated March 29th, 2007, accessed August 2013. Prior to 3-11, US exports of beef to Japan were roughly half of historical levels and even dropped to zero in 2003. See http://www.reuters.com/article/2007/03/29/idUST13960720070329

some, more appealing. Can we argue, on a much smaller scale, that the disaster hastened the relaxation of restrictions on US beef?

Pork (Principal Code 00305: "Meat of Swine/Wild Boar")

There is no upward trend in pork imports. Indeed, in 2011 and 2012 total tonnage of pork fell slightly. So, it seems this sector has not been affected by the disaster or radiation concerns.

Chicken/Poultry (Principal Code 00307: "Meat of Fowls")

Chicken and other poultry imports do rise somewhat during this period.

Table 2. Imported Poultry

	Unit: tons						
	2007	2008	2009	2010	2011	2012	
	351778	426094	331090	420254	471841	425306	
Source: Japan Customs							

Total tons imported in 2011 are 12% higher than in 2010. However, if this was a small surge, it did not last. In 2012, pork imports were back to 2010 levels. Moreover, pork imports are down from highs of up to 500,000 tons in 2000s. As such, it is hard to attribute much to the disaster.[30]

To conclude this sub-section on meats, aside from the possible acceleration of negotiations in beef, imports do not seem to have been largely affected by the disaster. It could still be that Japanese consumers switched from beef to pork or chicken, because of the radiation scares in cattle. Or, to the extent that cattle ranchers in other areas of Japan can "acceleration production" (take to slaughterhouse ahead of schedule due to increased demand), there was likely some intra-country substitution. While, important, all the detailed data on this is not yet in and in any case, is not the focus of the present paper. In summary, the secondary effect on relaxation of beef imports may have added another one billion dollars to Japan's new deficit. This would have happened in any event, but nonetheless may have caused a "front-loading" of beef imports to an already huge, mostly energy-driven, trade deficit.

5.1.4 The effect on Vegetables, Fruits and other "banned" foods

"Fruits and Vegetables" accounts for roughly 15% of all Japanese imports. There was no discernable trend up or down over the pre-disaster and post-disaster period in this aggregate category.

[30] While beef and pork are primarily supplied by Australia, US and Canada (and Denmark for pork), over 90% of chicken imported by Japan comes from Brazil. Strict import quotas keep this major cattle producer from making any inroads in beef or pork.

However, because of radiation in and around Fukushima Dai-Ichi, bans of certain foods (and seafood) were implemented. For agricultural goods, many goods (a partial list follows) were marked by the Japanese authorities as banned from production in certain regions in and around Fukushima. Some of the bans were later relaxed or lifted. Some are still in place. These bans have two effects. First, the reduction of production in the Kanto region, ceteris paribus, implies that demand from elsewhere in Japan and possibly foreign imports should increase. Also, as the labeling as to the origin of fruits and vegetables is not always clear and at times not trustworthy, some Japanese (and foreign) consumers may refrain from all Japanese agricultural products and opt for foreign substitutes.[31] [32]

In this subsection, we will simply examine the major items which were banned and see if there was any noticeable temporary and/or permanent increase in the importation of those goods.

The impact on imports of major items (not exhaustive) where shipments in Japan were restricted are examined below. Other items very specific to Japan (for example, chrysanthemums (*kiku*) which are edible), *kakina*, and "*warabi*" which is translated as "bracken", are plants that exists elsewhere in the world, but are generally not cultivated nor exported to Japan) are not examined here as the import values are tiny or non-existent.

Raw Milk

The Principal Commodity (00501) "Milk and Cream" shows no rise over the 2009-2013 period in quantity (MT) terms. It is flat or even decreasing.

While raw milk is not imported into Japan, powdered milk, cheeses, butter and other dairy products are. As the domestic supply of milk and stock of dairy cows was severely affected the disaster, inroads were made in butter. We will examine a few of these dairy products in turn.[33]

Butter (Princ Commodity 00503)

Imports of butter clearly benefitted from the disaster. Although as domestic production returns, it appears no long run inroads or permanent foreign outsourcing has occurred. However, this is not because buyers of foreign butter have switched back to old buying habits and preferences, but rather because the Japanese government temporarily relaxed serve tariff rate quotas (TRQs) to make up for shortfalls in domestic production. In 2013 these TRQs (and safeguards) were put back into place, and imports have dropped again. Presumably, some buyers in Japan enjoyed the

[31] False labeling incidents (by supermarkets, restaurants, food distributors and hotels) of food existed before the disaster, during and after, for a variety of reasons. See the online Japan Times article, October 31, 2013, entitled, "More restaurants tied to food fraud" for a fairly recent example. One possible benefit of the Fukushima disaster for the consumer may be more transparent labelling across Japan.

[32] For an article on the short runs gains for some exporters in South Korea, see the July 29, 2011 Bloomberg online article here. http://www.bloomberg.com/news/2011-07-28/radiation-free-food-delivers-japanese-sales-boom-to-south-korean-exporters.html by Eunkyung Seo and Sarina Yoo.

[33] For a summary of recent market developments in Japanese dairy see here: http://www.thedairysite.com/reports/?id=64 Accessed April, 17, 2014.

lower prices of foreign butter and had the TRQs remained relaxed imports would have persisted.[34]

Table 3. Imports of Butter	MT	Princ Comm 00503
2007	14453	
2008	20052	
2009	355	
2010	3492	
2011	16849	
2012	10633	
2013	4607	

Powdered milk, skim milk, etc.

If we look at HS 0402 which contains a variety of powdered milks, there is no apparent surge. Roughly 33 million KG are imported every year (likely due to quotas) and the quantity even falls somewhat in 2011, to 29 million KG. It is back to 34 million in 2013.

Spinach (fresh), HS 070970000.

Japan only imports a tiny amount of fresh Spinach. 8,604 KG in 2012 and 6,021 KG in 2013. The total value is only about 10,000,000 yen.

However, Japan imports great quantities of *frozen* Spinach (HS 071030000).

Table 4. Imports of Frozen Spinach	Millions KG	Value (billions of yen)
2007	24	3.5
2008	23	3.1
2009	22	2.7
2010	27	3.2
2011	33	4.1
2012	32	4.1
2013	35	5.2

Levels of imported spinach are higher than historical levels, but there was a significant uptick prior to the disaster. As such, it is hard to attribute this to the disaster alone. Higher unit prices for spinach together with higher imports have added roughly 2 billion yen to Japan's import bill each year, just in frozen spinach. When we look at quarterly data, there was a significant spike in April-June jumping from a fairly constant 7 million kg or so each quarter to 11 million. But then, just as quickly, (July-Sept, 2011) imports of spinach fell back to 7 million KG or so. With the

[34] For a summary of Japan's dairy market see this article: http://www.thedairysite.com/reports/?id=3090, last accessed April 17, 2014.

monthly evidence, it appears there was a surge due to the disaster, but very short-lived. The great imports of frozen spinach may simply be part of a larger trend to imports of more frozen food.

Bok Choi (fresh) (Bok Choy, Chinese Cabbage, Napa Cabbage, *Hakusai*) HS 0704.90 030

In 2010 149,268 kg were imported. In 2011 a staggering 757,304 was imported. In 2012, levels were still high at: 348,210, but in 2013, imports were a tiny 29,328. So perhaps there was a surge due to the disaster, but if so, the effect was short lived. The value of imports of Bok Choy in 2011 was 31 million yen, or about $300,000 for the whole year.

Broccoli 0704.90 010 35 million kg was imported in 2010, 36 million in 2011, and 50 million kg in 2012. But it was back down to 35 million kg in 2013. So, perhaps there was a surge, but if so, it was short-lived.

Shiitake HS 0709.59-020 imports in 2008 4.7 million KG. in 2009 4.7, 2010: 5.6, 2011: 5.3, 2012: 5.0, and 2013: 3.8. So, there was no apparent import surge in shiitake.

Carrots (fresh) (HS 070610000, not on restricted list but often sourced from the Kanto plain (Chiba, etc.)

Imports of carrots has been on the rise, but the rise began in 2010, when in quantity terms (KG) imports jumped from 42 million for each of the past few years to 65 million KG in 2010 then over 80 million KG in 2011. It has stayed steadily over 80 million KG in 2012 and 2013. Whether this is extra boost is disaster related, or simply a continuation of foreign sourcing is not unknown. Japan imported 4.5 billion yen of carrots (fresh) in 2013. This is still a small portion of all carrots consumed in Japan. In 2013 Japan shipped 43,000 tons (43 million KG) in the single month of December (again, we will take this opportunity compare unit values: domestic carrots 146 yen/KG in December 2013, imported 61 yen/KG; the tariff on carrots is only 3% and there are no import quotas).

Natto is made of soy beans. It is made domestically, but often the soy beans are imported. But, of course japan imports a huge amount of soy beans for a number of reasons. Nonetheless the region near Fukushima is known for its soy beans and *natto* production. So, let's see if there is any detectable change in imports. HS 1201 (soya beans) shows a slow decline over the 2008 to 2013 period. So, no increase in imports was detected.

Next we will examine Vegetables (fresh and frozen) at an aggregate level to see if there was any general trend.

Vegetables (Principal Code 00103)

Table 5. Import of Vegetables	MT (Billions of tons)	Value (billions of yen)
2009	2.3	334

2010	2.6	368
2011	2.9	395
2012	3.1	442
2013	2.8	483

Also, due to a combination of higher international foods prices and more trade in general, food import bills for all importing countries has been on, aside from abrupt drop after the peak in food prices in 2008, a steady upward trend until at least 2010. (Source: FAO Statistical Yearbook, 2012, Chart 49, p. 103: link here: http://www.fao.org/docrep/015/i2490e/i2490e02b.pdf). So, it would seem Japan's behavior, despite the shock, is not any different than global trends. Note, however that as far as Japan's deficit is concerned, the increase in world food prices, and Japan as a major importer of foodstuff, this effect is palpable. From 2010 to 2013, despite quantity of Vegetables relatively unchanged, the value has risen 30%, amounting to an extra 100 billion yen deficit.

Fresh vs Frozen Vegetables

Of Principle Commodity 00103, the subcategory 0010301 is fresh and 0010303 is frozen. Perhaps, imports, which are often frozen, are on the rise?

594 million kg were imported in 2009, 653 million in 2010 and 697 in 2011. In 2013 703 million kg were imported. So,there does not appear to have been a surge, but rather a rising trend which preceded the disaster.

However, one could argue, looking at the rough quantities that perhaps there was a temporary surge in some products, given the large jumps in 2011 and 2012.

Fruits

As the large majority of Fruits are imported already in Japan (save for "mikan", the mandarin orange and some other local citrus fruits such as the *yuzu*), we will not focus on them here.

We will take a look at Apples and Strawberries, however, as there is a large production of these fruits which occurs in Tohoku or Kanto.

HS 0808.10 Apples

Japanese imports of Apples had a dramatic increase in 2012. Whether this was due radiation concerns, or the poor harvest in fall of 2011, or both, is not certain.[35]

In 2009 Japan imported a mere 63,000 kg of apples. In 2010, that figure was 134,000. In 2011, Japan imported 148,000. In 2012, 1.9 million kg of apples were imported. This is a more than tenfold increase. In 2013, 2.3 million kg of apples were imported. So, so far this massive surge is sustained. Of course, the value is still tiny, roughly 500 million yen, or 5 million dollars. Japan still has a 17% WTO rate on imported apples as well as phytosanitary standards which apparently keep the domestic market quite large. Of course, Japanese apples are prized for their high quality, and often brand recognition and are not perfect substitutes for foreign apples. Japan shipped over 700,000 metric tons (data available at www.maff.go.jp) of apples in 2012, so even 2 million KG of imports is a small market share.

Exports of Japanese apples, a delicacy, have dropped due to radiation concerns (see article in footnote 35.)

In 2010 Japan exported 21 million KG of apples. In 2011 that figure was still 18 million. IN 2012 that was more than halved to 9 million kg. In 2013, exports rebounded to 1.9 million. The value of these exports in 2013 was 7.2 billion yen. Not a small amount, but only less than 1/1000th of Japanese deficit that year. (This works out to a unit price of 368 yen per KG exported, for those who might be interested. Only four countries are destinations: HK, Taiwan, Singapore and Thailand, with the first two accounting for more than 98% of the apples.)

HS 0810 Strawberries (fresh) Strawberries saw no observable change in imports. There may, of course, been switching to other strawberries within Japan. Kyushu, Aichi prefecture are two major producing regions.

In summary of Food imports

Imports of Japan's Food and Live Animals, Principal Commodity ("0") was 5.7 trillion yen in 2013. It we made heroic assumption that all foods in this category have risen the same 30% (in value terms) or so in the recent, post deficit years, this would add 1.7 trillion to Japan deficit of 11.5 trillion yen goods deficit in 2013, more than 10% of the total deficit. This is, of course, compounded by a weaker yen is the global trade in food is generally in dollars. Perhaps more importantly many food prices have been on the rise globally, adding to Japan's import bill.

[35] See "Aomori's apples getting squeezed by sharp drop in exports" Yuriko Suzuki, *Asian Wall Street Journal* online, October 6th, 2012 this article for both the poor harvest of 2011 and declining exports of apples to Taiwan http://ajw.asahi.com/article/business/AJ201210060009. Last accessed April 17, 2014.

An in-depth look at a single fruit: the Banana

Like many fruits and vegetables, banana imports rose after the disaster. Perhaps there was a switch away from other Japanese fruits, or Japanese foods, in general. As virtually all bananas are imported, from countries far from Japan, radiation concerns should have been nil. Imports of Bananas (from Japan Customs data: this time in Metric tons, rather than value) imports jumped by about 10% for the next few months. Afterwards, imports seem to fall to something like historical levels. Overall imports (again in quantity) in 2011 (annual) were actually lower than in 2010. Indeed, they were even lower than in 2009.

But, 2009 was a special year for bananas. In March 2008 a book came out extolling the benefits (of losing weight) by a regimen including a daily banana.[36] In April of 2008 imports of bananas jumped 14%, and continued to remain high, ebbing and flowing, both from the gyrations of the media with respect to the banana diet, and other world and Japanese market forces no doubt. This continued into 2009, where banana imports hit a peak of 1.25 million metric tons as compared to roughly 1 million in 2006 and 2007: a 25% increase. In 2012, imports were about 1.1 million tons, roughly the same as in pre-quake (post-banana diet) 2010. The point is not to make light of either the diet, or the disaster, but rather to emphasis two things: (1) a variety of shocks affect particular commodities, and it appears from this example, that a diet craze had a larger and longer impact than the disaster effect; (2) both shocks, demand-side, in this case were temporary. Japanese (and probably other countries) consumers' patterns are very persistent in the medium run (say, five years or so). Shocks tend to be temporary. This is not to say that the bananas growers (or water exporters) will not experience a one-time windfall gain. They will. But any long-run effects on trade balances will be virtually nil.

The devastating effect on farming in the affected regions

Farmers are hurting in the three regions with incomes roughly half what they were before the quake, even two years after.[37] Some regions are slowly recovering. While the impact on overall food imports seems small, or when large, only temporary at best, a great deal of re-sourcing within Japan occurred. The most detailed regional agriculture surveys have not been conducted yet. When this becomes available we will have a better sense of how much shipments to regions like Tokyo for example, have increased from distant places like Kyushu, instead of the far closer (but close to Fukushima) Kanto plain. This too, may have been largely a temporary phenomenon as radiation testing becomes more widespread and trusted. Most large retailers have returned to source more from the Kanto plain, and even Fukushima prefecture.[38]

---

[36] Toyama, Michiko, "Japan Goes Bananas for a New Diet" October 17, 2008, online article (time.com) found at: http://content.time.com/time/world/article/0,8599,1850454,00.html#ixzz2b7TW3dSU

[37] http://www.maff.go.jp/j/tokei/sihyo/data/06.html#3

[38] See online Asahi Shimbun article, dated November 30, 2011 about Aeon (a large grocer and general retailer) increased radiation testing of its produce, but also its commitment to buy from areas like Fukushima, so long as they have been deemed safe. http://ajw.asahi.com/article/0311disaster/recovery/AJ201111300072a

5.1.5 Seafood (Principal Commodity code 007: "Fish and Fish preparations")

The triple disaster of earthquake, tsunami and radiation probably had a larger regional impact on fishing than any other sector. Coastlines, boats and ports were destroyed or swallowed up by the earthquake and tsunami in Iwate, Miyagi and to a lesser extent in Aomori, which lies further north. Fukushima and Ibaraki, to the south, were also affected. On top of that, radiation leaks from Fukushima into the surrounding oceans shut down fishing from Fukushima, but also cast doubt as to the safety of any fish swimming off Japan's eastern coast. Fishing was shut down for a year and half in Fukushima due to radiation concerns.[39]

If we consider overall seafood production in Japan, it had already been in slow decline prior to the disaster. In the years preceding the disaster, overall seafood production in Japan was about 5.5 million tons. In the year of the disaster, however, overall production dropped 10% and remained flat in 2012 as well. In the three most affected regions, in 2011 Iwate, Miyagi and Fukushima fish catches were: 58%, 57% and 63% of 2010 quantities caught. In 2012, these figures were 74% 68% and 54%. In short, these regions have far from recovered.[40]

Table 6. Overall Japanese Production of Seafood (both wild and farmed seafood)

	Unit:tons
2002	5,879,913
2003	6,083,147
2004	5,775,474
2005	5,764,540
2006	5,734,975
2007	5,719,928
2008	5,592,327
2009	5,432,070
2010	5,312,722
2011	4,766,008
2012	4,864,275

Source: www.maff.go.jp

The effect on the local economy, along with a devastated agriculture, is not in doubt. Wider fears of contamination of all Japanese seafood also existed. After all, fish do not just swim in the waters off Fukushima Dai-ichi. How did consumers react to these concerns? Several possibilities exist and all may have occurred to some extent. One, a lower level of seafood

[39] "Trial operations (of fishing near Fukushima) suspended for 15 months amid the nuclear crisis, restarted in June 2012 only to be halted Aug. 28 after Tokyo Electric Power Co. disclosed the water leaks…" in Japan Times online article, September 25, 2013 "Trial fishing resumes off Fukushima after radiation tests". Accessed September 27, 2013.

[40] Data collected from various tables on seafood production are available at: http://www.e-stat.go.jp.

consumption may have occurred. While radiation was detected in many agricultural products, the levels in the water around Fukushima were astronomically high.[41] Did Japanese switch away from fish to other protein sources deemed safer? Two, switching toward foreign and/or non-Pacific seafood may have occurred. For example, Japan may have imported more shrimp from Thailand or more Salmon from Norway. Third, consumers may have simply shifted to consumption of more seafood from other parts of Japan, as occurred in agriculture.[42] The following will attempt to address these three points, but the challenges are great, one, because such detailed consumer data is not generally available, and two, because there is so much regional, seasonal, and country-wide fluctuation in the supply of various fishes. Isolating and identifying the "Fukushima effect" may be impossible. As we explore and discuss these issues for all major varieties of seafood, the focus of this section, and indeed this paper will be: have any of these changes had a discernible effect on Japan's *importation* of fish in general, and any fish, in particular?

Total fish "production" of fish prior to the quake

Eastern and Northeastern Japan have a number of major fishing ports which were devastated or otherwise affects by the tsunami, the radiation leaks, or both. Overall "production" of fish in Japan in 2005 was 5.6 million tons of fish. This was on slow decline, so that by 2010, the catch was 5.2 million tons. In 2011, the year of the quake, it dropped to 4.7 million tons.[43] The figure bounced back ever so slightly to 4.8 million tons in 2012. How much of this is due to variations in supply side factors of the fish themselves (bumper "crop" years, etc.) and much is due to the disaster is difficult to entangle, but some attempt will be made here. Also, some regional data (such as for Iwate, a major fishing region and suffered severe damage from the earthquake and ensuring tsunami) is not included in the most recently released surveys. As such, it is too early to tell how large an impact the disaster will have on Japanese fishing, which was already in decline.

Before proceeding to look at the detailed data, some general facts will prove useful.

Imports of "Seafood" (Code 007, in Japanese customs) amounted to roughly 20% of all "Food and Beverages" imports. Japan imports more than 1 billion dollars of seafood per month and imported a total of 1.4 trillion yen (about 14 billion dollars) in 2012. This is a sizeable portion of Japan's 2012 deficit of 6 trillion yen (which rose to 11 trillion yen in 2013). Japan does produce a significant amount of fish: about 4 million tonnes per year. But it is the second

[41]See online Reuters article, dated February 8, 2014 "Fukushima radiation levels underestimated by five times – TEPCO" at: http://rt.com/news/fukushima-radiation-levels-underestimated-143/

[42] See Bachev and Ito (2013) at http://mpra.ub.uni-muenchen.de/49462/1/MPRA_paper_49462.pdf. Full cite in references section.

[43] See MAFF's 2012 *Gyougyou Keiei Chousa* available online at http://www.maff.go.jp/j/tokei/kouhyou/gyokei/pdf/gyogyou_keiei_12.pdf

highest importer of fish, importing nearly 15 million tonnes a year.[44] Has it contributed significantly to Japan's *increase* in its deficit? One might expect that news of radiation leaks into the ocean and contamination of various seafood products of the eastern coasts of Japan in 2011 would dampen demand for Japanese seafood. Was this, in fact the case? One challenge and feature unique to fish, is that they tend to move around. What may be labeled Tuna caught off the coast of Baja California may have, at some point passed by the waters of Fukushima.[45] As such, a closer look at the imports of various major seafood products in the post-Fukushima time frame may help us answer some of the above questions, but often the challenge of "origin" still remains.

But first, let's look at overall seafood demand and import demand.

Total imports of fish (see Figure 6 below) might suggest a reversal in 2011 and small uptick in imports after a period of slow decline fish imports. But it would premature to attribute any of this to the radiation concerns. Seafood, like agriculture, is subject to strong seasonal effects on the supply side. At the same time, Japanese consumption of seafood has seasonal as well as pro-cyclical components. More seafood is consumed in December and January (end of the year celebrations and well as New Year's Day celebrations), and more seafood (especially shrimp) is consumed when consumers are more prosperous and eat out.[46] The seafood industry is constantly developing, with more shrimp and catfish coming from Thailand and Vietnam (both because of FTAs and better exporting efforts) and more Salmon from Norway and elsewhere, both from more production and from marketing.[47]

Moreover, again looking at Figure 6, it seems that an uptick in 2011 was short-lived. Overall Fish imports seem steady, or even declining. This amount of imports is, of course, significant. Imported Fish accounted for 1.5 trillion yen in all of 2013, more than 10% of the Japanese trade deficit in 2013.

Any effect on overall Japanese consumption?

With the radiation off the shores of contamination, at least some Japanese seem to have altered their behavior towards consumption of seafood, but has this returned to previous levels, or

[44] The US is number one, with just over 15 million tons imported. China was third in 2010 with approximately 10 million tonnes imported. Here, as in the Japanese customs data includes fish such as tuna, but also crustaceans, etc. Source; FAO Annual Yearbook 2010 Fishery and Aquaculture Statistics.

[45] "Radioactive bluefin tuna crossed Pacific to U.S." May 28, 2012. This article on radioactive tuna which passed through Fukushima waters and travelled to Baja California, their usual route, can be found here: http://www.cbsnews.com/news/radioactive-bluefin-tuna-crossed-pacific-to-us/

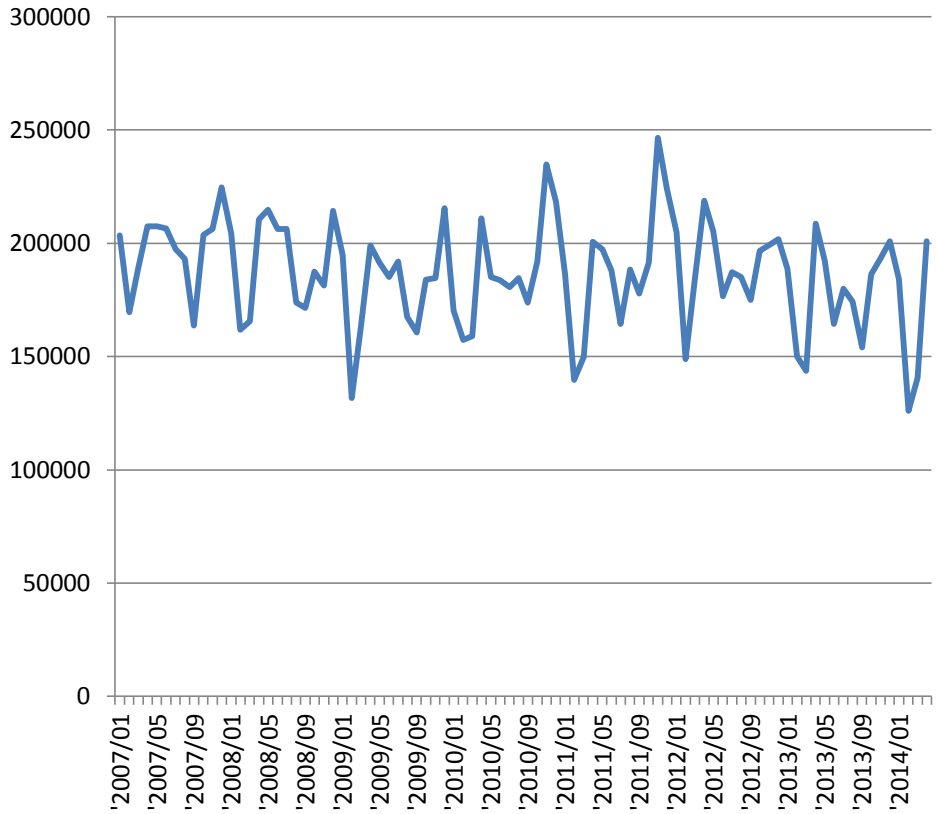
[46] See FAO (2011).

[47] See http://www.fao.org/giews/english/fo/index.htm#2010 or any of the FAO periodical report on the seafood industry for summaries of these and many other developments.

persisted? Also, has there been a shift away from seafood to other protein sources (foreign or domestic) due to the real and perceived risks to seafood?[48]

Figure 6. Monthly Imports of Principal Code 007 (Fish and Fish Prep)

Source: Japan Customs



The slight decline in imports is also consistent with an overall trend of Japanese spending less on fish overall and as a share of their food budget. Examining the household expenditure survey data (for two or more people in a household; see www.stat.go.jp) from 2000 to the present day, several things are apparent: 1) Japanese are spending less in yen terms overall

[48] While labeling of foods and its sources has increased in Japan and other developed countries, but before and certainly after the disaster, things are not always as transparent as they seem. This is perhaps most pronounced for seafood. After, what is the origin country of "Pacific tuna", which may have spent part of the year swimming off the Baja California coast, then passing by Fukushima and being finally caught elsewhere .

annually on Food; 2) expenditures on "Fish", a component of the "Food" expenditures, has also been on a steady decline in absolute terms; 3) Expenditures on "Meat" (does not include Fish) has also been falling in yen terms, though not as dramatically; 4) Fish as a share of Food has been falling, from 11.4% in 2000, to 9.3% in 2010, then to 8.8% in 2012; 5) Meat as a share of Food has been fairly steady, 8.3%, 8.6% and again 8.6% in 2000, 2010 and 2012.

In summary, after examining the import data as well as the domestic expenditure data, it is apparent that fish consumption was falling well before the disaster and has continued to fall, though not dramatically. Also, there has not been any dramatic switching of protein sources. There seems to have been a small uptick in imports of fish in 2011, but it was short-lived. As such, it appears that the disaster has not affected either imports or domestic consumption behavior in any long-term way.

However, examining yet more detailed Fresh Fish products may be of interest, and it is to that which we now turn.

Price Premiums

One good way to assess whether or not radiation fears have caused a shift in behavior towards foreign fish is to look at price premiums. If Japanese consumers suddenly acquire an aversion for Japanese fish, then the gap between foreign and domestic fish should widen (assuming the foreign fish are more expensive.) However, this is not as easy as it may appear at first. Market data often refers to various fishes sold in the Tokyo (Tsukji) market regardless of who or where it was caught.[49] If a salmon was caught by a Japanese fishermen near Chile perhaps, should Japanese consumers be afraid? For many more species, its predominant habitat may not be known. As an initial exploration, we look at two fairly distinct species: salmon roe (Alaska vs. Sanriku "Tohoku") and *sanma* (saury) "exported from Japan" vs "imported into Japan"

Salmon roe ("uni", in Japanese)

The prices are from NOAA (see footnote 45 below for cite), and unlike most fish in the market data, (like Tuna) this makes the distinction between location. Salmon swim upriver, and so despite the ocean sojourn, a "home" can be defined. One might expect the Sanriku salmon more exposed to radiation than those in Alaska because of apparent proximity to Fukushima. However, the data suggested no remarkable change in the premium.

In November 1-9, 2010, Sanriku salmon roe sold for between 2000 and 3500 per kg. The Alaska roe ranged between 2500 and 3000. Apparently, there is a higher variance in Sanriku roe. Taking the average of each, 2,750 yen for Sanriku and 2,750 for Alaska roe, the result is: no

[49] The NOAA Southwest Regional Office data referred to in this subsection can be found here. Last accessed April 22, 2014. http://www.nmfs.noaa.gov/region_swr.htm last accessed August, 2013. NOAA stands for National Oceanic and Atmospheric Administration (in the US).

premium. In October 28-November 15, 2011, Alaskan roe averaged between 3500 and 4000 yen per kg, or a simple average of 3,750 yen. For Sanriku roe 4,200 to 4,800 yen, with a simple average of 4,400 yen. This suggests a significant premium for Japanese roe in 2011. This likely reflects supply-side scarcity, rather than radiation concerns, for this very popular seafood (*uni* in Japanese.) Most salmon, if not from Hokkaido are from Miyagi and Iwate, and are likely to be perceived as far from Fukushima, and relatively safe. So, more likely, this is due to severe production disruptions in Sanriku, the epicenter of the earthquake and 15 minutes away from the devasatating *tsunami*,

Frozen Saury ("sanma", in Japanese)

This fish is one of the main catches for many fishing boats in Japan, and especially in Fukushima and Ibaraki, regions closer to Fukushima Dai-ichi. Other fish may be even more predominant and more like to be exposed to radiation, for example, the bottom feeding coastal fish such as flounder. Unfortunately, the very detailed MAFF data only had data for the imports of this fish. Saury, one of the most common fish caught and eaten in Japan is exported as well as imported. This makes it a reasonable candidate to look at premiums. Here we use unit values calculated from MAFF export and import data.

In 2010, Japan exported 60.3 million kg of saury (*sanma*) for a value of 5.1 *billion* yen. In the same year, Japan imported 3.4 million kg worth 430 *million* yen. This works out to 84 yen per kg for exported saury, which, admittedly may or may not be a reasonably proxy for domestic prices. (Note this is not just Tohoku or Eastern Japan fish, but from all ports.) For imports, of which volume is far less for this particular fish, the unit value works out to 126 yen per kg for imported fish, a slight premium, which may be in part transportation costs. 2012 total catch (Japanese) of *sanma* was: 200 million kg of *sanma* for whole year. (Source: www.maff.go.jp)

In 2011, the numbers are very different: exports of saury/sanma are down and imports are up. Japan exported only 13.3 million kg in 2011 at a value of 1.4 billion yen (unit value: 105 yen, up a bit). Japan imported 5.3 million kg valued a 773 million yen (unit value: 145 yen). So, it appears that coastal destruction and radiation related fishing shutdown have both reduced exports and increased imports for this autumnal favorite fish.[50] It we crudely attribute all the import boost to the triple-disaster, this added 143 million yen to Japan's imports and subtracted 47 million yen in exports. In total, this adds 190 million yen to Japan's nearly 7 trillion yen deficit in 2012.

In 2012, there were 13 million kg exports of saury/sanma valued at 1.3 billion yen. So this is virtually flat. In short, it is difficult to same anything with certainty, especially with this species. There is a great deal of variation from a variety of factors.[51]

[50] The Chinese character (*kanji*) for *sanma* is literally "autumn-sword-fish" as it looks like a silvery short sword and is abundant in the fall.

[51] For a sample of the wild swings see this article by Chris Loew accessed October 7, 2013 https://www.seafoodsource.com/newsarticledetail.aspx?id=22339, which says, "…saury…was in short supply in

Because of the large supply side fluctuation in seafood, as illustrated above, we will use a general search strategy which will be employed more systematically in the later industrial and machinery sections. That is to say, we will identify large import surge items in 2011 and see if 1) there are sustained in 2012, and 2) if anything can be attributed to either the tsunami, radiation, or both. Then, we will discuss Japanese fish imports in the context of Japan's deficit.

In quantity (and value) terms, by far the largest three fresh fish imported are: "albacore and tuna", "salmon" and "shrimps, prawns, lobster". Over 200 million kg of each of these three "fish" were imported in 2010 (source: Japan Customs). The next biggest item was "cuttlefish" in which 80 million kg was imported. As the table below showed, none of these fish experienced and increase in quantity terms greater than 20% in 2011, though some did in 2012, relative to 2010. Because overall quantity of fresh fish imports was flat, we will examine the three "fish" that experienced a somewhat sustained increase in 2011 and 2012. From the table below, we see they are: "salmon", "crabs" and "cuttlefish".

Table 7. Major Imported Fish products (source: Japan Customs)

Principal Commodities and Code	kg imported 2010	2011 (kg)	2012 (kg)	2011/2010	2012/2010
Fish, Fresh (Total)	1876735523	1,858,992,437	1,887,164,961	0.99	1.01
0070101 ALBACORE AND TUNA	218552326	202,650,318	215,645,865	0.93	0.99
0070103 Salmon	235206937	258,361,371	288692342	1.10	1.23
0070105 Spanish Mackerel	6248324	5,332,526	4316477	0.85	0.69
0070107 HARD ROES OF NISHIN	9667224	8,664,796	8400247	0.90	0.87
0070111 EELS	14840806	9,657,610	4677685	0.65	0.32
00701131 SHRIMPS,PRAWNS,LOBSTERS	210308060	209,949,106	205315059	1.00	0.98
00701132 SHRIMPS,PRAWNS PREPARATION	2563867	2,820,862	2310777	1.10	0.90
00701133 CRABS	49224418	49,142,026	62928232	1.00	1.28
00701134 CUTTLE FISH (squid)	80746086	92,300,090	93211345	1.14	1.15
00701135 OCTOPUS	44681573	38,358,782	47431660	0.86	1.06
00701136 SEA URCHINS	12895838	13,216,963	12313151	1.02	0.95
0070115 HERRINGS	91809930	99,410,121	83759176	1.08	0.91
Note: some of the smaller "principal" commodities have been omitted from this table, but not consideration in the analysis. Fresh fish is almost 80% of all fish and fish preparations imported					

early September…because of change in migration route…leading to wholesale prices at Tokyo's Tsukiji market to double or triple year-on-year…"

We now consider each of the three in turn.

Salmon (Principal Code 00703)

In quantity terms, salmon imports rose 10% and 23% relative to 2010 levels. The 2013 data until August (not presented here) is also at almost the exact same levels, month-by-month as 2012, so if any surge has occurred, it appears to have leveled off. Is this uptick due to Fukushima? It is hard to attribute it to radiation concerns. The top five exporters accounted for 94% of all salmon imports in 2010.[52] These were the same four in 2012 and in the same order: Chile, Norway, Russia and the USA. Canada, New Zealand and Australia jostle for a distance fifth place. Chile's share alone was 60% in 2010 and rose to 70% in 2012. If we look at the change in market shares (not shown here), it appears that Chile and Norway have gained at Russia and USA's expense. One could make the argument that Japanese may be buying a bit more from Norway, rather than US, as the US shares the Pacific Ocean (and possibly radiation fears) with Japan. But, so does Chile. One might argue that Chile's farther distance from Japan suggest that their salmon should be safer. It is hard to say how Japanese retailers and consumers perceive Chilean salmon without conducting a survey. As for Chile, a large source of its huge market share gains is a huge rebound in production, after a virus devastated the 2009 catch.[53] In short, supply factors are dominant in the fish market, and salmon is no exception. Attributing anything to Fukushima is fraught with difficulties.

Lastly, to the extent that Japan feel that Hokkaido salmon is safe, and nearly 90% of domestic salmon is from Hokkaido (Fukushima has no salmon; Miyagi, Iwate and Aomori combined account for about 10% of all salmon), it is hard to attribute the uptick in salmon imports to the disaster, nor to any increase in a general downward trend in domestic (especially salmon) production . (See data here which shows a downward trend over time in production of fish, but also of the number of people in the fishing industry in Japan. Like agriculture, this sector is seeing attrition through demographics. See http://www.maff.go.jp/e/annual_report/2007/pdf/jfa_data3.pdf

Expenditures on Salmon, like Fish overall, had been falling over the decade, and even longer (according to household survey data mentioned above). However, while overall Fish expenditures continue to decline in 2011, expenditures on salmon bounced back. While expenditure on all Fish annually fell from 110,868 yen in 2000 to 77,803 in 2012, annual Salmon

[52] While Japanese domestic fisheries production is not small, in salmon (88% was from Hokkaido in 2012) catching 156,300 thousand tons of salmon (or *masu*, another salmon family fish native to Japan) in 2010. Japan imported 235,000 tons of salmon in 2010. Japan's catch fell to 100,000 tons in 2012. However, domestic production is not necessarily consumption. Source: Japan's Ministry of Agriculture, Forestry and Fisheries, accessed October 3, 2013 here: http://www.maff.go.jp/e/tokei/kikaku/nenji_e/87nenji/index.html#nse011

[53] See "Virus, crisis: Perfect storm hits Chile salmon industry" March 11, 2009, by Simon Gardner accessed October 3, 2013 at http://www.reuters.com/article/2009/03/11/us-chile-salmon-crisis-idUSTRE52A56N20090311. Chile actually exports a breed of Atlantic salmon and Pacific salmon (and trout) to world markets. Most exports to Japan Pacific salmon and trout, however. See http://www.globefish.org/salmon-february-2012.html (accessed October 3, 2013.)

expenditure fell from 4,485 in 2000 to 3903 yen in 2010, then rose to 4035 yen in 2011 and 4254 in 2012. This upward trend could be short-lived and may be due to a host of factors possibly including the disaster, but it is of note, since Fish overall (and in nearly all sub-sectors) is falling. It is important to note that overall demand for salmon (and tuna) has been on the rise despite higher prices for tuna and salmon.[54] So, it is just as likely that growing salmon demand in Japan is part of a global change in preferences, as it is due to a "flight to safety".

Crabs (Principal Commodity Code 00701133)

Crab imports show no bounce in 2011, though they are 28% higher in 2012. Most of Japan's imported crab comes from Russia and Alaska, so radiation fears should be small or non-existent. Domestic crab production is generally not in the Tohoku region, so the jump in 28% is likely due to other supply side forces. Of the 49 million kg imported in 2010 about 35 million came from Russia, and between 4 and 5 million for US and Canada. Of the 63 million imported in 2012, So these same top three exports top gained somewhat evenly. Was any of it to fill a gap of Tohoku crabs devastated by the tsunami and radiation fears? If so, it would have been negligible.

Cuttlefish (Squid ,"Ika") (Principal Commodity Code 00701134)

Squid imports seem to have a steady 14-15% rise from 81,000 tons to 93,000 tons. Can this be attributed to the disaster? Perhaps. In 2010, in quantity terms, the ports located in Iwate, Miyagi, Fukushima and Ibaraki accounted for 15% of all squid caught in Japan (32,000 of 218,000 tons). Japan caught 174,000 tons of various squids in 2012. In 2012, these four prefectures accounted just over 17,000 tons, or 10% of all Japanese squid caught. A quick glance suggest that the additional 12,000 tons both in 2011 and 2012 imported, could have been replacing what seems to be a fall in 15,000 tons of squid caught in 2012 relative to 2010 levels.

How much is 12,000 tons (or 12 million kg) of squid worth in additional imports? Squid prices ranged from 200 to 400 yen per kg in 2012, so at 300 yen per kg, this would amount to 3.6 billion yen. No doubt some of the production losses in Tohoku of squid were picked up elsewhere in Japan, and we are ignoring price effects brought on by the increased scarcity. In any event, the "squid effect" would account for 3.6 billion yen of a nearly 6 trillion yen deficit, or less than half of one-tenth of a percent. Large effects the Tohoku squid industry but tiny for the deficit.

The effect on Japanese exports *of Seafood*

Radiative concerns about Japanese seafood abroad also existed. What was the effect, if any, on exports?

[54]Ruitenberg, Rudy, www.bloomberg.com , "World Fish Prices Climb to Record on Demand for Salmon and Tuna" articled dates June 18, 2013, accessed July 30, 2013.

If we look at Principle Code 007 "Seafood and Seafood Prep", in 2009 there were 482,000 MT of exports. In 2010, this figure was 550,000 MT. In 2011 this fell to 408,000 MT. In 2012, 414,000 MT was exported. However, in 2013, the figure was back up 533,000 MT exported. So, there was likely a real negative effect on exports of seafood, but it seems to have passed. These exports amounted to 191 billion yen in 2013, or almost 2 billion dollars. Recall that Japan's total goods deficit in 2013 was 11.5 trillion yen. Seafood exports experience a roughly 20% fall in exports in 2011 and 2012. This amounts to approximately a 40 billion yen loss for each of those years. But this large amount is less than a half a percent of Japan's deficit.

Data is this section also taken from Japanese Ministry of Agriculture, Forest and Fisheries here: http://www.maff.go.jp/j/tokei/kouhyou/kokusai/pdf/yusyutu_1212.pdf

5.2 Energy

As mentioned in the introduction, Japan's entire trade deficit in 2012 of nearly seven (7) trillion yen, was roughly the size of its new, post-disaster energy imports. All else roughly equal, Japan would have no trade deficit (or perhaps a small one according to 2013 data), if it turned all of its nuclear reactors back on. As of September 12, 2013, none of the 50 reactors were online, and while many observers think a return to large nuclear power generation in Japan is inevitable, nothing has been decided politically.[55] A recent energy policy plan submitted by METI was approved by the Diet in April 2014 which included the assumption of nuclear playing some role in Japan's future. It was not specific about how much of a role it would play. See footnote 3 for details.

How much of a drag is this energy import bill putting on Japan's GDP growth? In 2012, Japan's nominal GDP was 475.5 trillion yen in 2010 (worldbank.org database). Crudely and erroneously assuming that Japan could simply switch on all of its reactors and run them for free, this would imply a savings of its import bill of 7 trillion yen in 2012. This would add roughly another 1.5% to the *level* of GDP, *each year.* Put another way, Japan grew 2% in 2012 (on 2011) as it bounced back and the US was also helping pull Japan along. It would have experienced roughly 3.5% GDP growth in 2011 if nuclear reactors were kept online.[56] In addition, the cost of (imported) energy is much higher. Much of this has to do with the fact that Japan is the largest importer of natural gas in the world, and has pushed up prices in gas (and oil). Residential and business electricity rates were raised in 2012 and 2013 between from anywhere from 8% to

[55] One reactor was back online, but was shut down again in mid-Sept for routine maintenance. In the summer of 2013, four utilities applied to restart 10 reactors. (Iwata, 2013)
[56] This, of course, would be only a one-time (one year) boost in the growth *rate*.

15%.[57] This obviously hurts Japan's cost competitiveness and the ability to export. This huge drag on Japan's GDP will continue as long as Japan continues to suspend nuclear power generation.

This section will summarize Japan the nature of energy consumption and energy imports both pre and post-disaster to get a better understanding of how such a radical change in importation of energy effects both Japan and the various exporting nations. Also, this closer look at Japan's current energy import patterns will yield clues as to Japan's future energy import stance, even in the likely event that Japan turns back on a majority of its nuclear power plants.

One tentative conclusion is that despite the clear economic pressure to return to pre-disaster nuclear use, current import patterns as well as new developments on the supply side in the energy world suggest that Japan may never go back to running 50 reactors again, even if the politicians and the general population wanted it.[58] While Japan's current imports of 24 trillion yen of fossil fuels will most likely shrink as Japan slowly turns back on its reactors, and the sharp price premiums Japan is currently paying falls, a larger-than-pre-disaster import energy bill seems part of Japan medium-run future.[59] And even if world prices for fossil fuels fall, perhaps due to more stability in the current volatile Middle East and more exports of US shale gas, etc., the (quantity) share of Japan energy use that is imported is likely to be much higher levels than pre-disaster for the next decade at least.[60]

The general focus of this section will be to answer very broadly two questions: (1) how much increase has Japan seen in its major imported energy sources (Natural Gas, Crude Oil, Fuel Oil, etc. and (2) where, i.e. what countries are these increases coming from? But important caveats are necessary. Fortunately, analysis is eased for two reasons. One, Japan does not import electrical energy, as many, non-island countries, such as the US from Canada. Two, Japan has very little domestic energy sources (some renewables, and some coal and hydroelectric). There is, indeed, some degree of switching between domestic and foreign energy, for example, using more hydro *in lieu* of nuclear shutdowns, rather than importing natural gas or oil to fuel electricity plants, but it is of secondary importance.

At the same time, the following data summary does not capture the many ways in which substitution can and does occur, in the short and long run, at the firm, residential, and government level as prices changes, new technologies become available and government policy towards energy changes (subsidies for solar and electric cars, government support and investment in more alternative energies (wind, solar, geothermal) and the like. So, while the main focus of this section is: How much extra

[57] Rate hikes differ for residential and corporations and across regional electrical companies. See "3 regional utilities to raise household electricity rates" in *The Asahi Shimbun*, August 2, 2013, online, for more information. http://ajw.asahi.com/article/economy/business/AJ201308020054 (accessed Sept 18, 2013)

[58] Another import topic will not explore here is the degree of success Japan has had in new conservation efforts led by the government. While there may be a general feeling that this has been somewhat successful (or widely successful according to Greenpeace and other anti-nuclear groups, there was no reliable estimates available. For one extreme estimate, see here: http://thinkprogress.org/climate/2014/04/10/3425406/japan-energy-efficiency-replacement/

[59] This prediction, which will be elaborated on later in this section, assumes that no miraculous breakthroughs (peace in Middle East, huge Shale Gas revolution, etc.) will occur in Japan's various green energies, nor will fossil fuel prices fall so much.

[60] Plans to restart a reactor in Fukui were blocked in a Fukui District court in a lawsuit filed by local residents. This landmark decision is a bad omen for those who are in favor of restarting nuclear plants. It also suggests that resistance to a return to nuclear is still very real. See May 22, 2014 Japan Times online article, "Fukui court blocks Oi nuclear reactor restart, in landmark ruling" accessed May 22, 2014 here: www.japantimes.co.jp

imports is the nuclear shutdown causing and where are these imports coming from? There are a multitude of import secondary and feedback effects out of the purview of this present paper.

To just touch upon these various, intertwined relations, we will briefly consider the case of electricity generation, which is, of course, a major portion of any economy and until 2011, of which approximately 25% was generated by nuclear power.

The Energy Information Agency (eia.gov) states, of Japan's electrical energy, that[61]:
"…in 2010, 63 percent of which came from conventional thermal fuels, 27 percent from nuclear sources, 7 percent from hydroelectric sources, and 3 percent from other renewable sources. According to the IEA, the share of thermal generation rose to…73 percent of total generation in the first quarter of 2012, the highest on record as LNG and oil supplanted some nuclear power."

So, in short, Japan's nuclear electric power is being supplanted by imported oil and natural gas. We will explore these massive increases in imports of these two energies below. This will give a good measure of the temporary impact of the shutdown on Japan's trade balances. But, there are many subtleties which are not explored here. For example, as prices for energy are driven up by Japan's new found demand, no doubt, firms and consumers are cutting back on consumption to some extent. These types of important price effects are complex and not explored here. Also, as electricity becomes more expensive, some residences are even switching to wood-burning stoves, for example. This, of course, is tiny, but its highlights the many substitutions that can and do occur over time. Japan's new imported energy binge feeds through to all prices and decisions Japanese companies and households face, whether it be the price of gasoline and how much they drive a car, or whether or not a new city bus company buys natural gas, diesel or some hybrid engine to upgrade and ageing fleet.

Even if we focus on companies like TEPCO buying oil *in lieu* of nuclear power to generate electricity, the concomitant price effects will have downstream effects on residential and corporate use, and feedback effects as well. If, for example, TEPCO buys more oil for its fossil fuel burning plants, this has two price effects. First, it likely drives up the price of that oil and other oils in the short run. Second, TEPCO will and has raised the price of electricity generation and passed on some of these higher costs (whether it is to compensate victims, or a fuel surcharge, or both) to residential and corporate users. But, how does the consumer respond in heating their home, for example? Prices and more difficult to measure elasticities of substitution, will dictate how much the resident will use more or less of electric heat (wall mounted AC unit), more or less kerosene for space heaters, or even invest in a wood-burning stove, or a switch to some solar energy. The same applies, perhaps even more so, to businesses, whether they be small or large. And, of course, these effects feed back into Japan overall energy demand or import demand for various energies. These complex cross-substitution and feedbacks effects are important, but out of the scope of this paper.[62]

On larger scale, Japanese energy firms, large individual firms which have their own generation and governments have been pursuing long-run contracts for new and stable supplies of oil, and natural gas especially, well before the disaster. As we will see below, facing exorbitant prices, especially in gas, these efforts have been ramped up considerably. At the same time, while small, the Japanese government has

[61] For a full report on Japan's energy situation as of 2012, see the EIA's report, http://www.eia.gov/countries/cab.cfm?fips=JA .

[62] Colder winters and hotter summers also naturally drive up energy imports for Japan. Japan was, indeed colder in 2011 and 2012 than in 2010. Average "winter" temperatures were, for Nov-Feb: 9.2, 8.6 and 7.6 degrees Celsius in 2010, 2011, and 2012. In the summer (June-Sept), it was: 26.6, 25.7 and 25.8, respectively. So, yes, there were colder winters, but summers were slightly cooler.

been encouraging development of alternative resources. Again, this got a push before the disaster and naturally since the Fukushima crisis, these efforts have gained some more support. So, to reiterate, the following data summary takes this important caveats and limitation in mind to attempt to answer the basic questions of: *how much* new energy imports and from *where*.

Natural Gas

Japan is the world's largest LNG importer, holding about 33 percent of the global market in 2011. (source: Eia.gov) Natural gas and fuel oil have been the major "replacement" energy sources in the wake of nuclear shutdown and thus we will examine this fossil fuel source first. Of course, Japan had already been moving towards the use of more natural gas, rather than oil as a way to emit less hydrocarbons. The disaster has dramatically accelerated those plans, at least for now. Looking at the trade data (Japan Customs), Principal Commodity Code 305 "Gas" in Table 8 below we see the massive surge in natural gas.[63]

Table 8. Japan's import of "Gas" (source: Japan Customs online data)

Gas: Principal Commodity Code 305	Quantity in MT (metric tons)	Value (thousands of yen)
2010	82,151,795	4,251,502
2011	91,005,397	5,678,712
2012	100,514,720	7,025,381
2013	99,611,405	8,131,235

Japan had imported 100 million tons in 2013, this is nearly the same amount as in 2012, despite some claims that Japan imports of gas were falling slightly, as compared to 2012, (Iwata, July 24, 2013). The overall bill in 2013 was higher than 2012, despite constant volume of imports. This may have been unavoidable. Even in the US, natural gas prices rose considerably in 2013 relative to 2012. No doubt with current (as of March 2014) uncertainty in Russia and the Ukraine, gas prices may continue to rise, deepening Japan's trade deficit.

In quantity terms, imports are 20% higher in 2012 than in 2010.[64] Also, relative to 2010, an extra 3 trillion yen of gas was imported in 2012. In the introduction, "new" energy imports relative to pre-quake 2010, were show to be roughly seven (7) trillion yen. Most of this is simply larger quantities, though higher prices are certainly a part of it. In any case, this implies that nearly half of Japan's new, expanded, energy deficit is in gas. A unit value calculation shows a

[63] The vast majority of this category "305" is LNG not LPG.

[64] Different countries used different units, and of course, units of measurement differ across the type of energy. A very useful units converter for most all energy units can be found at http://www.bp.com/en/global/corporate/about-bp/statistical-review-of-world-energy-2013/using-the-review/conversion-calculator.html

The 2012 figure for millions of tonnes of gas can also be converted into cubic feet and is: equals 4824 billion cubic feet, the unit US agencies typically use for gas.

unit value cost of 0.05 in 2010 and 0.07 in 2012, a roughly 40% in import prices of natural gas at the port.

Where is this new three trillion yen (roughly $30 billion a year) coming from? Much is from traditional (who are also geographically closer) suppliers who have increased exports to Japan. But many smaller suppliers have had unexpected export gains to Japan. New, small entrants have popped up as well. For some of these countries, the economic impact for their country can be quite large.

Who were primary exporters of 305 (Natural Gas) in 2010 and 2012? Refer to Table 9 below.

Table 9. Top 20 exporters of Natural Gas to Japan in 2012 and 2010

Rank in 2012	Country	quantity 2012	Rank in 2010	Country	quantity 2010
1	QATAR	19537544	1	AUSTRAL	14440737
2	AUSTRAL	17380130	2	MALYSIA	14035672
3	MALYSIA	14609282	3	INDNSIA	12789413
4	U ARB E	8794441	4	QATAR	10977056
5	RUSSIA	8306162	5	U ARB E	7982601
6	INDNSIA	6187594	6	RUSSIA	6030729
7	BRUNEI	5906043	7	BRUNEI	5848788
8	NIGERIA	4870570	8	OMAN	2859765
9	OMAN	3975651	9	SU ARAB	2055911
10	EQ GNEA	2793047	10	KUWAIT	1301522
11	SU ARAB	2000988	11	IRAN	861042
12	KUWAIT	1789411	12	USA	770054
13	EGYPT	1036719	13	NIGERIA	745562
14	PERU	818586	14	EQ GNEA	538324
15	USA	655562	15	EGYPT	426202
16	NORWAY	475163	16	ALGERIA	149642
17	YEMEN	297219	17	YEMEN	118961
18	TRINIDD	273537	18	TRINIDD	114020
19	ALGERIA	254559	19	NORWAY	45304
20	SPAIN	154819	20	R KOREA	25733

Units: MT

Source: Japan Customs

In the initial months following the shutdown, Japan`s increased demand put sharp pressure on existing gas supply networks. According to the EIA, 20% of all Japan's LNG was purchased short-term or on the spot market.[65] Presumably, this will fall as Japan can negotiate better long-term contracts.

[65] See "Country Report on Japan" found online here: http://www.eia.gov/countries/cab.cfm?fips=ja last updated October 29, 2013.

Despite the massive increase demand for gas in such a short time, it appears that traditional suppliers were able to ramp up supply to meet Japan in its time of need.

18 out of the top 20 (by quantity) suppliers of Natural Gas in 2010 were also there in 2012. (Spain and Peru joined the top 20 and South Korea dropped to 22nd, despite also increasing its exports of Gas to its neighbor Japan.) Iran dropped out of the top 20, because of stricter sanctions towards that country at this time. There was a re-arrangement of the ranking, with number one Australia falling to number two, while number four, Qatar, took the number one supplier title in 2012. A few major suppliers actually reduced their exports to Japan over this two year period, like Indonesia, most dramatically.

Unit prices can also be calculated from the data country by country. See Table 10 below for unit prices and the ratio of 2012/2010 prices. Unit prices themselves are far from uniform, though they fall within a fairly narrow range for most of the top 20 suppliers. The top twenty suppliers supply the nearly all of Japan's gas, so it is no surprise that the average "hike" in unit prices across the top 18 (excluding Iran and Korea) was 37%. The price hikes range from 8% by Norway to a high of 89% by Yemen. This is not to say that Norway is necessarily benevolent and Yemen unkind. Traditional allies and strong suppliers of Gas such as Indonesia, nearly halved exports and had a 76% unit price hike. No doubt a number of factors and forces, both market and political, explain each country's story, and no attempt to elaborate will be made here.[66]

Table 10. Unit Price Ratios in 2012/2010 for Top Twenty Gas Suppliers in 2012

Country in 2012 ranking	quantity in MT 2012	value 2012 (000 yen)	unit price 2012	2012/2010 price ratio
QATAR	19537544	1419779067	72.67	1.24
AUSTRAL	17380130	1155556966	66.49	1.23
MALYSIA	14609282	1075726401	73.63	1.37
U ARB E	8794441	646871045	73.55	1.31
RUSSIA	8306162	494010616	59.48	1.55
INDNSIA	6187594	465913164	75.30	1.76
BRUNEI	5906043	430760684	72.94	1.33
NIGERIA	4870570	328667114	67.48	1.62
OMAN	3975651	194603131	48.95	1.51
EQ GNEA	2793047	210640135	75.42	1.29
SU ARAB	2000988	156887331	78.40	1.22
KUWAIT	1789411	133583739	74.65	1.17
EGYPT	1036719	75472209	72.80	1.21
PERU	818586	55725456	68.08	n/a
USA	655562	49491674	75.50	1.30
NORWAY	475163	33178592	69.83	1.08
YEMEN	297219	20227384	68.06	1.89
TRINIDD	273537	14399481	52.64	1.15
ALGERIA	254559	19748594	77.58	1.46
SPAIN	154819	10715777	69.21	n/a

Note: Spain and Peru had no exports reported in 2010

Source: Japan Customs

[66] Several regressions were done to see if there might be link between the quantity of a country's exports and the price hike. No statistical relationship was found.

Little has been said thus far with respect to yen exchange rate movements. As is well-known, internationally traded fossil fuels are typically invoiced in dollars. At the same, complex, long-term contracts are written up to address exchange rate (and other) volatility. Ignoring any Japanese price response, of which there must have been some, (i.e. demand for energy falling as prices rise), the above story is in quantities, not value, and as such the analysis should hold generally. Having said that, the yen-dollar rate averaged 79.70 in 2011, and 79.82 in 2012 (source: www.federalreserve.org). In 2010, the yen-dollar rate was 87.78, i.e. a weaker yen. In other words, had the yen not strengthened in 2011 and 2012, the unit price hike for gas and energy in general would have been considerably higher.

As exchange-rate pass-through in energy is notoriously high, typically 100%, even in the short run, this appreciation may have mitigated up to 8% higher price hikes in energy.[67] With the Japanese yen now at approximately 100 yen to the dollar, in large part because of PM Abe and the Bank of Japan's shift toward "inflation targeting" in 2013 (i.e. creating inflation of around 2% rather than experiencing 0% inflation, or even deflation) this obviously make the high price of imported energy much higher than 2010, roughly 20% higher, if we assume full exchange rate pass-through in yen terms.

Japan's Premium in Natural Gas

As shown above, Japan has been paying a large premium for its newly acquired natural gas. At the same time, some observers such as Itoh (2013) have remarked that Japan's natural gas premium as much as four times as large as that in the US, quite aside from the disaster-related premium. How can these figures be rectified?

Itoh (2013) writes, "As late as February 2013, Japan paid approximately five times more than the U.S. Henry Hub price per million Btu (British thermal unit), on average, for LNG purchases." In short, the world natural gas market far from integrated, as compared to oil for example. The Henry Hub price, the benchmark for the US market is far lower than what Japan pays, because the US exports virtually none of its natural to Japan or anyone for that matter. The US has enjoyed an age of natural gas, made economically viable by a combination of better extraction techniques in "unconventional gas exploitation" (Tanaka, 2011) such as hydraulic fracturing ("fracking"), as well as high fossil fuel prices. However, the US, typically a natural gas *importer*, has neither the technical ability nor the administrative approvals necessary from the US government yet to *export* natural gas in great quantities. As such, the stark contrast between what the US is paying and Japan is important, but the reasons are apparent. This will change in the near future as will be discussed below.
If we look at the World Bank's Global Economic Monitor (GEM) Databank, we have three prices to compare, those of Japan, the EU and the US. In US$ per mmBTU, in 2010, the prices in the US (Henry Hub) were: $4.4, in the EU $8.3 and Japan $10.8. In 2011, these prices were: $4.0, $10.5 and $14.7 for Japan. So, in dollar terms, Japan was a paying a premium relative to the EU in 2010, and this gap *widened* in 2011as Japan scrambled to fill its nuclear power gap. In 2012 Japan paid a whopping $16.6, with EU's gas rising 10% or so to $11.5. The US price in 2012 was a mere $2.8. So,

[67] That is to say, if the world price of oil in dollars stay constant, and the yen depreciates by 10%, Japanese consumers end up paying nearly 10% more at the gasoline pump and vice versa. See Campa and Goldberg (2002) for estimates for Japan (and other countries).

the figure of "five times" is certainly correct.[68] To the extent that Japan and EU share many of the same supplying countries (OPEC countries, Russia, etc.) it is difficult to say how of the premium Japan is due to overall demand conditions in the rest of the (non-US) world as well as supply-side forces. It is clear, of course, whether in yen or dollars, that Japan is paying a huge premium for its gas and this has clearly been exacerbated in a post-Fukushima world.

The goal of obtaining more gas, at cheaper prices, is being attacked in at least four (4) ways. One, is naturally increasing gas contracts with existing suppliers, big and small, for example, Qatar, Malaysian and Australia, Russia, etc. (big) and Brunei, Equatorial Guinea (smaller). A second is to secure new supplier s like that of Mozambique, in the near future. A third way is to re-negotiate on better terms when contracts come up for renewal in the next few years. In 2011, Japan had no choice but to purchase on the spot markets at high, short run prices.

Russian Natural Gas

Russia was the number five supplier of Natural Gas to Japan in 2012. Import levels in 2012 were 38% higher than in 2010. More Russian gas could flow to Japan as earlier as 2016. Many contract come due again in 2016.[69] However, Russia has recently signed a new gas deal with China, not Japan.[70]

Also, recent events in Russia and the Ukraine, where economic sanctions tighten against Russia, put Japan in a more difficult bind as far as securing natural gas at a cheaper price. At this writing, only narrow financial sanctions have been directed at certain Russian individuals. However, if the US and EU move to prohibit imports of Russian gas, Japan may follow suit.[71]

More broadly speaking, Japan had a $12 billion trade (goods) deficit with Russia in 2013 (source: JETRO), importing $24 billion and exporting roughly $12 billion worth of goods. Naturally most of the imports are energy-related. As large as this figure is, it is eclipsed by the imports from the Middle east as whole (162 billion imports, and bilateral trade deficit of 136 billion dollars. Saudi Arabia alone exports over 50 billion dollars a year to Japan. So what happens in Russia does matter for Japan, but it will not be a deciding factor in Japan's long run energy policy.

---

[68] METI's 2012 Annual White Paper on International Economy and Trade, has a figure on p. 399, which tracks various Natural Gas (and Crude oil) prices, from 2004 until the end of 2011. In 2004 the dollar price in terms of BTU was nearly identical, with US, Japan and UK gas prices roughly the same as the price of oil (again, per BTU). Here too, the huge differential between Japanese prices for Gas and what is being paid in the US for gas is roughly five-fold. The dollar price Japan paid, in 2011, for oil per BTU was roughly 20% higher that of gas. So, not only is gas preferred for environmental reasons, but also cost reasons.
http://www.meti.go.jp/english/report/downloadfiles/2012WhitePaper/2-4.pdf

[69] See www.bloomberg.com article by Inajima, Tsuyoshi and Humber, Yuriy, entitled,"Russia's LNG Rush Gives Japan Strongest Bargaining Chip" dated June 14, 2013. The article can found here:
http://www.bloomberg.com/news/2013-06-12/russia-s-lng-rush-gives-japan-strongest-bargaining-chip.html

[70] See BBC online article here: http://www.bbc.com/news/business-27502186. Of course, this has been a deal in making for over a decade and may not affect Japan as much as it appears.

[71] "Sanctions: What could be the next move?" March 211, 2014, http://www.bbc.com/news/business-26612848 accessed April 12, 2014.

New Natural Gas exports from the US

Until very recently US exported virtually none natural gas. Some was exported from Alaska (North Cook Inlet) to Japan, since the late 1960s and another port, Sabine Pass in Louisiana set up and approved to export. However, since discovery of new sources of natural gas, especially through "fracking", exporter natural gas from the US is now a very distinct possibility in the very near future. Efforts have been stepped up to both build the infrastructure necessary to liquefy and then export natural gas, as well as overcome regulatory hurdles to do so.

Unlike other commodities, to export natural gas to non-FTA countries, two administrative barriers (Department of Energy and then the Federal Energy Regulatory Commission) must be overcome (see Itoh, 2013 article). Japan, eager to secure some of the US newly found "shale oil gas" before the disaster, has stepped up its efforts to speed the process in the wake of Fukushima. (Japan has imported LNG from Alaska since 1969; see Itoh, 2013.)

Indeed, Trade minister Motegi went to Washington in May, 2013 to request "quick approval" to be able to import from the Freeport Texas LNG terminal and met with the Acting US Energy Secretary.[72] It appears to have succeeded, as Department of Energy approval was made later that month.[73] Having said, it appears the DOE has ramped up approval to all non-FTA countries for many ports, the first of which was Sabine Pass, in May of 2011.[74] Whether this was, in part, sped up to for the sake of Japan's increasing energy needs in March of 2011 is not known.

The article by Kumagai (footnote 73) estimates this could results in 2.2 million tons of gas per year to Japan. The US only exported between 600 and 700,000 tons in 2010 and 2012, so this would be nearly quadruple the amount, just from one port. This is still small, in comparison to the largest suppliers in 2012, Qatar and Australia (19 and 17 million tons), but significant, nonetheless, approximately 3% of all Japanese gas imports from one port. Another port (Cove Point, Maryland) recently (September, 2013) received DOE approval to export gas to Japan and elsewhere though this plant, designed to import gas will not yet be ready to export for several years.[75] The Cove Point plant expects a ruling on the second stage of approval, by the Federal Energy Regulatory commission in the middle of 2014. Even if this project is approved, however, it will take years to come online. And there is political resistance already by environmentalists opposed to Cove Point.[76]

---

[72] "Motegi seeks quick US approval of LNG exports", Kyodo, The Japan Times, online May 5, 2013.

[73] "US LNG exports to Japan moves one step closer to reality," published online at The Barrell, by Takeo Kumagai, May 28, 2013. See the full article at: : http://blogs.platts.com/2013/05/28/us-lng-exports-japan/

[74] See full article "US LNG exports to Japan given the go-ahead". Undated article, but accessed in 2013 and most recently accessed again on April 14, 2014. Article can be found here: http://globaltrademag.com/us-lng-exports-to-japan-given-the-go-ahead/

[75] See "Dominion Wins U.S. Approval for Cove Point Gas-Export Hub" Brian Wingfield and Jim Polson, September 11, 2013 online at Bloomberg.com: http://www.bloomberg.com/news/2013-09-11/dominion-wins-u-s-approval-for-cove-point-gas-export-terminal.html.

[76] "Is The Cove Point Liquified Natural Gas Terminal The Next Keystone XL?" by Caroline Selle of the Huffington Post online. Full article can be read here. http://www.huffingtonpost.com/2014/02/21/dominion-cove-point_n_4831723.html Last accessed April 10, 2014.

This raises a point we have seen elsewhere (in beef imports) and Japan energy policy, in general. The disaster has directly impacted infrastructure, capital, lives and firms, shaking up and exports. Many of these production networks have bounced back, or otherwise adapted. But, disaster *often influences policy, which is turn affects trade*, and in this case imports. Without Fukushima, Japan may not have pressed so hard on access to the new US gas exports, but now they certainly have. This will shape Japan imports of energy for years to come. A move towards more gas was already in the works for Japan, but this may have moved up the schedule by years, or even a decade or so. In the next year or so, as more US export terminals come online and Japan becomes closer to deciding how many of its nuclear reactors it will actually turn back on, we will have a decent picture of Japan future imports of energy and therefore a large chunk of its trade balance.

At least one industry magazine estimates that "some 20 percent" of Japan's LNG may come from the US by 2016.[77] Assuming little growth in Japan's slow growing economy and higher energy efficiency, 20% of Japan's 2012 natural gas imports would be 0.20 x 7 trillion yen, or about 1.4 trillion yen per year, just from the US, or $14 billion per year (at 100 yen to the dollar.) To the extent that US gas is far cheaper than other world sources, this might be nearly a pure increase. More likely, however, as other producers (Malaysia, Qatar, etc.) renegotiate long-term contracts with Japan, they would lower their prices to compete with more US gas coming on the world markets.[78] As such, it is virtually impossible to say how much would be new gas imports, and how much of that would be from the US. Overriding all of this, of course, is how many reactors Japan will turn back on. This decision (political, but largely driven by economic reality) in turn will largely determine how much gas is imported from the US or elsewhere. These are very dynamic times in the world gas market and will be for years to come.

Of course, such a move to more US gas is likely due to more than just the disaster. TPP negotiations are well-under way and Japan's now plays a role in them. Also, energy security is linked to broader geopolitical issues such as the US-Japan alliance, which as some have argued are shored up by more purchased by Japan of US gas.[79]

With respect to the TPP, there is a likely endogeneity issue, or at least complementarity going on. Countries that had FTAs with the US need not go through the "double" administration process above to secure energy contracts. So, if Japan is successful in signing onto TPP, this will make securing US gas that much easier. But perhaps US sympathies for Japan's plight of large human loss of life coupled with what non-economists might call price gouging in the energy markets, has made the US more willing to let Japan sign on, despite tough sticking points such as

[77] From a Global Trade online article found at: http://globaltrademag.com/us-lng-exports-to-japan-given-the-go-ahead/. Undated but accessed in September, 2013.

[78] "Many of Japan's existing LNG contracts date from the 1970s and 1980s, and are set to expire over the next decade forcing Japan to renegotiate term contracts or locate shorter term supply…" from US EIA's (2011) Country brief on Japan.

[79] "Increases of LNG exports from the United States to Japan will become a new way to strengthen the alliance, and the impacts extend beyond energy." From Shoichi Itoh's online opinion article at the Brookings Institute dated March 2013 entitled, "Energy Security in Northeast Asia: A Pivotal Moment for the U.S.-Japan Alliance". At: http://www.brookings.edu/research/opinions/2013/03/12-energy-security-itoh

Agriculture. This may an example of softening or relaxing of existing political constraints in the wake of disaster. (See Samuels, Ch.2 page 43.) More generally, the quake make have generated some genuine (at least short-term diplomatic goodwill) which will result in not just more energy imports, but more of everything imported by a TPP-engaged Japan. Of course, with no counterfactual (i.e. no disaster) it is impossible to tell how energy and TPP relations would have developed otherwise.

In-depth: The Impact of Increased Gas Demand on a small country, Equatorial Guinea

For some tiny countries, Japan's new found thirst for natural gas has created huge economic boosts.

Equatorial Guinea in western Africa, was exporting just 31 billion yen worth of gas to Japan in 2010, but in 105 billion yen in 2011 and in 2012 exported 210 billion yen. At 100 yen to the dollar this is roughly 2 billion dollars, rather than 0.3 billion, or an increase in Equatorial Guinea's exports to Japan of 1.7 billion dollars relative to 2010 levels. Equatorial Guinea's entire GDP in 2012 was 17.7 billion dollars. So this should be adding something close to 10% each year to this small country's GDP! In reality, official statistics state that Equatorial Guinea only grew 5% in 2011 and only 2% in 2012 (source: World Bank Indicators). This country's growth rate varies quite a bit, having shrunk by 2% in 2010. This much smaller realized growth is likely due to a number of factors: the Japanese data is CIF in Japan, not FOB from E. Guinea; much of the sales may not stay in Equatorial Guinea, but may go to foreign oil firms; much of the new exports to Japan are certainly diverted exports from other destinations, not purely new exports. Nonetheless, the impact on such exporters must surely be a boon, especially with the huge premium Japan is currently paying.

Update: Has this boon to Equatorial New Guinea persisted? In 2012 2.7 MT of gas were imported by Japan. This fell to 2.2 MT in 2013. This in contrast to the mere 0.5 MT Japan was importing from Equatorial New Guinea in 2010. So, it seems Japan's new surge in imports in this product from this country *has* been sustained. Of course, 2.2 MT is only 2% of all Japanese gas imports. Still, it is significant for this tiny country.

Canada

PM Abe went to start to Ottawa in September of 2013 to set up ministerial negotiations with Canada on their new gas exports from Western Canada to come online 2020. One project by Exxon that has been approved would amount to 30 million metric tons (Mayeda and Penty, 2013). How much of this goes to Japan, or elsewhere is uncertain at this point. Of the 100 million metric tons Japan imported in 2012, Canada was not among the top twenty, but will

likely become one in 2020. METI Minister Motegi was sent to Ottawa to discuss gas imports on October 10, 2013, so it appears, like other initiatives, Japan is moving fast.[80]

East Africa Gas

Mozambique and to a much lesser extent, Tanzania, hold some promise for more natural gas (and coal) to increase Japan import variety and more importantly, lower prices. Some research suggests this could amount to 100 trillion cubic feet or 2500 million (metric) tons. This is a massive stock, if the estimate is correct, but again, it is not clear how much of this Japan will get, and in any case, would not be available for export until after 2018 (Ledesma, 2013).

Path Dependence in Natural Gas?

Several events has occurred which may ensure that any return to nuclear power in Japan will be less than complete, and likely include a larger portion of natural gas. First, new long-term contracts are being negotiated with large and small countries. Also natural gas capacity in Japan is being increased. Second, natural gas prices may well fall considerably, especially if US natural gas is exported in any significant quantities. Third, as long as local and national resistance to nuclear power is palpable, natural gas may remain a large portion of Japan's energy and therefore continue to be large portion of Japan's deficit for years to come.

Petroleum and their Products (Principal Code 303)

This Code contains Crude Oil, Heavy Fuels, Diesel fuels gasoline and other oils. (motor oil, for example)

This data below also from customs.go.jp

"Petroleum Oil, Products" (Code 303, value, mill of yen, quantity not reported in this aggregate)

2010: 10,998,728 yen
2011: 13,640,883 yen
2012: 14,708,975 yen
2013: 16,950,173 yen

So, overall, in yen terms, this continues to rise. A 15% nominal rise can mostly be attributed to a weaker yen however. This can more clearly be seen in the sub-categories of crude oil where quantities of each good are also available.

"Petroleum Spirits" (Princ Code 30301) "*Genyu*" i.e. Crude oil, (Quantity in KL, value in mill of yen)

[80] Official announcement by METI from their website (in Japanese) http://www.meti.go.jp/press/2013/10/20131015009/20131015009.html accessed October 15, 2013. Strangely, this important event is not listed on the English version of METI major news announcements.

2010: 214,617,761; 9,405,876 yen
2011: 208,871,507; 11,414,741 yen
2012: 213,017,864; 12,247,216 yen
2013: 211,749,663 ; 14,244,807 yen

Crude Oil imports, like Natural Gas are simply a huge large portion of Japan's import bill. In 2012, 12 trillion yen, or 12,000 billion yen, or 120 billion dollars of crude oil was imported. All goods imported in 2012 amounted to 700 billion a year! This reflects 17% of all imports (not just the deficit). Of course, this ratio was much higher in the 1980s, and had been on declined. But it reminds us how important imported energy plays in Japan's overall trade balance.

Surprisingly, this category ("Crude Oil") is no higher than pre-disaster levels in quantity. We will see this is not the case for "Fuel Oil" often used in Japanese power plants.[81]

"Heavy Fuel Oil" (used in power plants) (Code 3030307)

2010: 3,062,640 KL 137,775,697
2011: 5,380,884 KL 320,805,039
2012: 9,722,160 KL 618,851,775
2013: 7,394,632 KL 512,940,821
Note: in thousands of yen

So, quantities of Heavy Fuel almost doubled in 2011 relative to 2010. Imports in volume terms peaked in 2012, more than three time the volume of 2010. This has dropped a bit in 2013, compared to 2012, but still more than double 2010 levels.

At around 600 billion yen of fuel imported in 2012 and 2012 compared to 137 in 2010, ultimately, this situation adds 463 billion yen (or more as the yen weakens) to the annual trade deficit, or roughly 4.6 billion dollars in extra Heavy Fuel Oil imports alone. (Recall Japan's total imports in 2012 was 700 billion dollars, so this adds about 0.6%, less than a percent to the total import bill.)

Where does this Fuel Oil come from? There are 14 countries in total, though imports from three are almost nothing. (US, the Philippines and Mauritius). Malaysia, South Korea, and Indonesia accounted for 90% of all Heavy Fuel Oil Imports. In short, Malaysia and Korea are enjoying the lion's share of the Fuel Oil import demand at present.

[81] For an excellent article on fuels used to generate Japan's electricity, see: http://www.eia.gov/todayinenergy/detail.cfm?id=10391

Effect on the Japan-Malaysia Trade Balance

In 2012, Japan had a $15 billion deficit (source: JETRO at https://www.jetro.go.jp/en/reports/statistics/) with Malaysia ($18 exported and $33 imported by Japan). The Fuel Oil export boom is added more than 3 billion per year to that bilateral surplus. To put it another way, the Malaysia surplus vis-à-vis Japan would only be $11 billion or so, without the disaster.

Japan operating inside the frontier

Japan's current decision to not utilize nuclear power and import instead, while understandable given the terribly tragedy of Fukushima, should be seen as a country operating inside its Production Possibility Frontier. It is an undeniable economic loss which must be accepted as the cost of a more potentially safer, nuclear free Japan (whose benefits are not captured in GDP, but are nonetheless very important).

"Petroleum Products= "*Sekiyu Seihin*" (small subset of 30303, includes gasoline, kerosene and lubricating oils among other products. N.b gasoline is HS2710.12.15))

Value, millions of yen

2009: 1,145,133
2010: 1,592,852
2011: 2,226,141
2012: 2,461,758
2013: 967,845

We can see that this category actually jumped before the disaster; it was 56% higher in 2011 than 2010. The value of imports jumped another 38% in 2011 and rose slightly higher in 2012. However, by 2013 levels were lower than even 2009 levels. So, it seems that this import surge of refined oil products was temporary.

Two of the top three exporters in this category are South Korea and Taiwan saw a huge short term (two years or so) boon: the former's exports rising 150% in one year, the latter 400%. Malaysia, the tenth largest suppler also saw a nearly 400% increase in its exports to Japan. Vietnam and Thailand also saw modest increases. China is also one of the top three, but exports actually fell during this time, perhaps because of island disputes or other China-Japan friction during this period.

Coal

In 2012 Japan, was the world's second largest importer of coal (EIA's Country Analysis Brief. At www.eia.doe.gov, last updated on June 4th, 2012)). Japan's own coal production ended in

2002, as such Japan imports essentially all its coal, much of it from Australia (64% of all coal imports, by quantity, dwarfing, the next largest suppliers, Indonesia, China and Russia). Coal provided 25% (Natural Gas was 27%) of all electricity power generation in 2010. However, many of Japan's older coal-burning power plants were damaged in the quake, and thus, in general coal was not used as a substitute for nuclear, in 2011 and beyond.

Examining the Japanese customs data, we see that total quantity has remained fairly flat throughout the disaster, actually falling in 2011. The total value is also large, over 2 trillion yen or a roughly 24 trillion yen energy import bill in 2012. Though large, since it varied little these past few years, it appears that Coal does not play a large part in Japan huge, new, energy-driven trade deficit, and will not be explored further. Three new coal-fired plants (and three new gas-fired) were planned, in addition to the total 61 existing "major" thermal (gas, oil or coal) generation plants and efforts for new, clean-coal are being made, but again the relative importance of coal seems stable, both domestically and as far as trade. Having said that, unless Japan increases both is natural gas import and burning capacities (see Gas section above), and/or switching on more reactors, in the near future, Japan should see a small uptick in coal in the years to come. Japan has approved several new coal-firing electricity plants in 2013, something it has not done for years. It is doubtful that Japan is abandoning its longer run trend towards cleaner gas. One article suggests that this move sends a signal to future gas contract suppliers that cheaper coal is always an option is prices are not "reasonable." (Persily, October 2, 2013)

Also, in an effort to reduce energy import bills, Japan is, however, thinking long-term on its coal contracts. Much of the imported coal is from Australia, but recently Japan is trying to secure some cheaper alternatives when some Australian and other contracts run out in the near future. Mozambique is one such country (Westlake, 2012). Mongolia is another. (METI White Paper on International Economy and Trade, June, 2013, page 24.)

Table 11. Imports of Coal

Coal: Principal Commodity Code 301	Quantity in MT, Million Tonnes	Value (thousands of yen)
2010	185,521,781	2,147,727
2011	176,194,681	2,496,554
2012	186,129.659	2,353,859
2013	193,318,367	2,362,421

If we look at Table 11 above, we see that Japan has now started to import more coal as the nuclear power plants remain off, for now. We see that total bill for coal has remained steady despite only a slight fall in coal prices in 2013 relative to 2011 (www.eia.gov). This may indeed reflect, in part, Japan having secured some better contracts in the last two years.

In summary, use of heavy fuel for power plants have tapered off a bit, coal rose in 2012 and 2013, and natural gas remains high.

Iranian Gas and Oil

Iran accounted for about 1% of Japan imported natural gas (which still ranked it #11 among all exporters of gas to Japan), but this dropped to zero in recent years due to sanctions. In Oil (Principal Code 303), however, Iran supplied almost 10% of Japan's import Petroleum/Oil. As US-Iran relations are seemingly thawing, as of October 2013 after President Obama's historic phone conversation with Iran's new president Rouhani.[82] Japan may very well be able to import from Iran again in the near future.[83] This should reduce world oil prices, and thereby Japan's deficit, slightly. More generally, more stability in the Middle East would also dramatically reduce Japan's deficit. Roughly speaking, a 10% fall in the price of fossil fuels results in a 10% fall in Japan trade deficit.

Update for Iran: 2013 data (303) oil and (305) gas. Imports of Gas for all of 2013 from Iran were still zero. Japan imported 10.4 million KL valued at (671 billion yen) of 303 (Petroleum products) in 2013. All of this was in subcategory 30301, which is the bulk of 303. In 2013 imports of 30301 from all countries was 212 million KL. So, in 2013 Iran imports of oil were only about 5%. Before sanctions, this figure was double, accounting for roughly 10% in 2010 and even more prior to that. If more Iranian oil (and gas) goes back on the world market this will obviously lower energy prices and lower Japan's import bill.

On (ESPO), the Eastern Siberian-Pacific Ocean Pipeline

Russia has invested heavily in ESPO which is projected to go online by 2020 with an annual capacity of 80 million MT tons per year. Earlier, only 50 million tonnes was predicted. Some estimates say that Japan will get 31% of this. If so, this would represent 24 million MT per year of new Russian oil to Japan. This is roughly 10% of all Japan's oil imports. This represents another source of potential cheaper energy for Japan in 6 years. The other two major players would be a return of more Iranian oil, perhaps by end of the 2014 and in the near future, perhaps fracked gas from the US. As such, it seems that Japan is poised for lower energy prices if it decides to remain heavily fossil fuel dependent.[84]

---

[82] "Obama holds historic phone call with Rouhani and hints at end to sanctions," by Dan Roberts and Juilan Borger, in The Guardian, online, www.theguardian.com, accessed October 15, 2013.

[83] Update: relations with Iran seem to e improving. As of mid-April 2014 concerns by major powers such as the US, Russia and others on the development of "heavy-water" nuclear reactor (which can potentially be used for weapons-grade plutonium) have been "virtually resolved". See Reuters article entitled, "Dispute over Arak reactor 'virtually resolved' – Iran nuclear chief" dated April 20, 2014 and available at this link: http://rt.com/news/iran-nuclear-water-reactor-608/

[84] For some articles on ESPO see: "Transneft aims to ship Central Russian oil to Asia by 2020", an online Reuters article here: http://in.reuters.com/article/2014/04/11/russia-transneft-east-idINL6N0N332H20140411 (dated April 11, 2014) and for the 31% figure see, "Completion of the ESPO oil pipeline connects Siberia to the Pacific Ocean" by Ewa January 6, 2013 found here: http://www.osw.waw.pl/en/publikacje/analyses/2013-01-09/completion-espo-oil-pipeline-connects-siberia-to-pacific-ocean. Last accessed April 22, 2014.

Uranium or Thorium Ores (HS 2612) and Uranium/Plutonium (HS 2844)

These radioactive materials used for nuclear energy are contained in two sets of HS code.

In the 2612 category (Uranium and Thorium and Concentrates) which is comprised of Uranium and Thorium. Imports of 2612.10 (Uranium and Concentrates) is zero. But for 2612.20, "Thorium and concentrates" Japan imports a small amount. Thorium is a material far cheaper than Uranium, but which cannot, alone achieve a chain reaction. There is some discussion of switching from Uranium to Thorium reactors as it argued by some to be cheaper and safer.

In 2010, a mere five units were imported at a value of 2.8 million yen. 4 units for 2.4 million were imported in 2009. 4 units were imported in 2011. 2 units were imported in July of 2011 and 2 more units in December 2011. None were imported in 2012, or 2013. Interestingly, another 2 units, worth 1.77 million yen were imported in the first half of 2014. Perhaps this signals Japan's move towards use of Thorium based nuclear fuel in the future.

There is some research in Japan (and around the world) to develop Thorium plants, and this may be one way to transform Japan nuclear industry. However, at this stage it is far too early to tell and in any case, research and development is still on a small scale. For more, read the online article posted by Mark Halper (2013).[85]

By the nature of nuclear energy, the purchase of uranium stock is lumpy. In the few years prior to the disaster a few units were imported each year. However, in 2006, 42 units were imported. In 2005, 27 units were imported.

Japan imports far more fissile material in HS 2844.

HS 2844 "Radioactive chemical elements and radioactive isotopes (including the fissile or fertile chemical elements and isotopes) and their compounds; mixtures and residues containing these products". Subcategories of this 4-digit category contain Uranium and Plutonium compounds.

Japan imported 136 billion yen of HS 2844 in 2000. In 2010, that figure was 116 billion yen. In 2011, 131 Billion yen of HS 2844 was imported. In 2012, 82 billion of HS 2844 was imported. 59 billion yen was imported in 2013. For January and February of 2014 3.6 billion yen of 2844 has been imported. So, clearly importation of these fissile materials has slowed considerably, though not stopped.

[85] http://www.the-weinberg-foundation.org/2013/03/22/a-plan-to-turn-japans-nuclear-past-into-its-future-with-molten-salt-reactors/ Dated March 22, 2013, last accessed April 15, 2014.

5.3 Machinery, Chemicals and other Industrial Imports

As mentioned in the introduction, this section will be a general overview with which to compare and contrast with the more detailed analysis in Food and Energy imports. There are two reasons for this. First, there are several detailed studies on the effects of the disaster on machinery and relatedly the effect on production networks. (See Kimura and Ando, 2012; Todo, Nakajima and Matous, 2013; Wakasugi and Tanaka, 2013.) Moreover, the many of these industries are part of larger, worldwide supply chain, which is constantly undergoing changes, not only from the disaster, but FDI activities abroad, lower wages abroad, such as in China. This has naturally brought about more outsourcing from outside of Japan. A generally stronger yen may be hastening this trend. But, and the same time, rising wages in China, and a host of other factors have caused many Japanese firms to find alternatives countries for their sourcing. This diversification of input has been exacerbated by the Japan triple disaster and the Thailand floods (hard drives, etc.). But to what extent this has occurred and to what extent it will persist are the beyond the scope of this paper, and needs more than a just a simple examination of trade data alone.

With those caveats in mind, we will proceed to summarize below, how the major non-Food and Energy categories reacted in the wake of the Disaster to get a sense of relative magnitude and for completeness. After all, while food imports are significant part of Japanese imports (about 8% in 2013), "Chemicals, Manufactures and Machinery (Principal Commodity Codes, 5,6 and 7) machinery is approximately 40% of Japan's total imports.

The general strategy will be to identify those products which has seen more than 20% rise in imports in 2011 relative to 2010 and accounted for more than 50 billion yen of imports in 2011. Next, the data for these "surge" sectors will be examined in 2012, to see if this surge seems to be persistent (generally more than 10% relative to 2010). If so, this product's recent import trends will be examined to hypothesize whether or not some disaster-related effect may be discerned.

Before discussing the results of this search, some general comments on all 8000 or so lines of data is in order.

Approximately one-fourth of the 8000 categories (HS) had both: more than 20% increase in 2011, and 10% in 2012 relative to 2010. Less than one-tenth of all cats (i.e. less than 800) had the sustained surge and more than 1,000,000,000 yen in 2011. Less than 200 lines meet the same conditions and are more than 10 billion yen. Less than 50 lines meet this and are more than 50 billion yen. As mentioned on page one of this paper, half of all Japan's imports is contained in 50 (very detailed) categories

5.3.1 Principal Commodity 1: Food and Live Animals

This category generally concords with HS code 01-23 (24 is tobacco). Despite the large amount of food Japan imports, the values for individual 9-digit items is not large, with only few with imports over 5 billion yen. These have already been examined in detail in the Food imports section. For completeness, we will note here that very few (even tiny categories) had surges in 2011 and many imports fell. None met the "over 20% surge and over 50 billion yen" criteria.

"Live animals" is a category that is far smaller than even say just "meat". Also, this has fluctuated for a variety of reasons in recent years, unrelated to the disaster (BSE, foot and mouth disease, etc.; disease has ravaged beef, pork and fowl stocks in Japan in recent years). As such, no attempt will be made to analyze imports of Live Animals.

5.3.2 Principal Commodity 2: Crude Materials, Inedible (includes wood,)

This commodity covers a broad range of goods:

05～06 , 1201～1209 , 1211 , 1212.20-2 , 13～14 , 2501～2518 , 2519.10 , 2519.90-01 , 2520.10 , 2521 , 2524～2530 , 26 , 2714 , 4001～4005 , 4101.20-111～-112 , 4101.50-111～-112 , 4101.90-110 , 4102.10 , 4102.21-01 , 4102.29-01 , 4103.20-011 , 4103.20-021 , 4103.20-031 , 4103.20-041 , 4103.20-091 , 4103.30-1 , 4103.90-011 , 4103.90-021 , 4103.90-031 , 4103.90-091 , 4115.20 , 4301 , 4401.10 , 4401.30～4407.99 , 4408.10-0 , 4408.10-2 , 4408.31-2 , 4408.39-19 , 4408.39-2 , 4408.39-59 , 4408.39-9 , 4408.90-19 , 4408.90-6 , 4409 , 4501～4502 , 47 , 5001～5003 , 5101～5105 , 5201～5203 , 5301～5305 , 5501～5507 , 6309～6310 , 7019.12 , 7019.19-09 , 7102.10～7102.29 , 7105 , 7112.30 , 7112.92～7112.99 , 7204.10～7204.49 , 7401 , 7404 , 7501 , 7503 , 7602 , 7802 , 7902 , 7903.10, 8002 , 8104.20

Many of the commodities are dealt with elsewhere (in food, for example.) We will summarize the findings of our "over 50 billion yen" search over these categories, which are not dealt with elsewhere in the paper.

HS 1205.10-0000 ("Low erucic acid rape or colza seed (often also referred to as "Canola oil" in Canada") rose from 101 bill in 2010 to 122 billion yen (more than 20%) in 2011. In 2012 this rose to 134 billion yen. Imports rose yet again to 164 billion yen in 2013.

Is this new, or an old trend continuing? In 2009 imports were 87 billion yen. In 2007 (pre-GFC) they were 112 billion. In 2006: 83 billion. 2005: 79 billion. So, this category was on a rising trend prior to the quake. This, of course, reflects Japan's lack of a comparative advantage in agriculture, which should also increase as the ageing farming population goes into retirement, and perhaps, TPP bringing more liberalization of agriculture in Japan. *As Japan exports essentially none of this single 9-digit category, this "canola" category contributes directly 1.5% of Japan's (2013) goods deficit.* 154 billion yen of 164 was from Canada. The rest is from Australia and a mere 1.6 *million* yen from Poland.

2601.11-000 -- Non-agglomerated iron ores. Japan imported a staggering 1.67 trillion yen of this category in 2011. This was 39% above 2010 (1.2 trillion) levels. Going back to 2007, pre-GFC the import values were 0.9 trillion. 1.51 trillion yen was imported in 2013. So, there was a spike in 2011, but it is not clear whether this was quake related or part of a continuing trend. *In any case, this single 9-digit category was 13% of Japanese deficit in 2013 and is in Japan's top ten imports, most of which are energy.* It also something Japan exports virtually nothing of (24 million yen of exports in 2013.) Of course, iron ores are a primary ingredient is one of Japan's top exports, steel, so increased imports reflect both a lack for this resource in Japan, but also success in Japan's exports of such goods as steel. This is true, of course, of many other imported goods in Japan.

Other categories from Principal Commodity 2 were either dealt with elsewhere, small, or had no significant increases.

5.3.3. Principal Commodity 3 "Minerals"

This most important items in this group are Energy: Gas, Coal, Oil (HS 27) which is dealt with in the Energy section of this paper and as such will not be discussed here.

3403.11～3403.19 (certain lubricants, anti-rust, etc.) is also in this Principal Commodity. None of these categories had more than 100 million yen in 2011 and so will not be explored further.

5.3.4 Principal Commodity 4 "Animal and Vegetable Oils and Fat"

This entire category's import value was 166 billion yen in 2013, so not small, but relatively tiny compared to other categories. Of this category, "Vegetable Oil" (Princ Comm "403) was 116 billion yen in 2013. The overall oil category has a remarkable stabe import quantity of 1.1 or 1.2 million MT before, during and after the disaster. So, there is not apparent change in import behavior in this group.

5.3.5 Principal Commodity 5 "Chemicals"

This is a very broad category which spans many HS codes. "Chemicals" is contained in the following HS codes.

1108～1109 , 1520 , 2207 , 2706～2707 , 2801～2850 **,** 2852.00-1 , 2852.00-21 , 2852.00-29 , 2852.00-9 , 2853.00～3215.19 , 33 , 3401～3402 , 3403.91～3403.99 , 3404～3405 , 3407 , 35～36 , 3801～3815 , 3817～3822 , 3824～3921 , 9306.21～9306.29 , 9306.30-1～-2

We will examine each of them in turn.

HS 1108-1109

All categories here amounted to less than 5 billion yen of imports and so will be ignored.

HS 1520

This category "only" amounted to 300 million yen.

HS 2207

In all of 2207 the largest single category was 2207.10-121 which had 13 billion yen of imports.

HS 2706-2707

None of the lines (at an 8 digit level) were more than 20 billion yen.

Principal Commodity "Chemicals" continued

The remainder of this large Principal Commodity ("Chemicals") has many products with large import volumes, and each subsection will now be discussed. Before delving into each category, some comments will be made as to the shifting comparative advantage in some of these chemical sectors. In short, the US's new found gas (much through "fracking") has provided many firms in the US which much cheaper energy, at least for the moment. For those energy-intensive sectors, of which many chemicals are, this has resulted in a greater competitive advantage. No doubt, some of this has fed into more exports to the world and Japan.

The quote below gives some idea of the large advantage some US firms will have in the near future.

"By 2015, the U.S. is projected to gain $7 billion to $12 billion in chemical exports from Western Europe and Japan. "The low cost of U.S.-produced natural gas, an important feedstock in chemicals, will be the big reason," explained Justin Rose, a BCG partner and coauthor. Production costs in Germany, where natural gas used in chemical manufacturing will be more than three and a half times more expensive, are projected to be 29 percent higher than in the U.S. in 2015. Costs are projected to be 16 percent higher in China, for example, and 28 percent higher in France."[86]

Of course, Chemicals are not the only sectors that can and do benefit from cheaper energy. The article goes on:

[86] Above is from http://www.bcg.com/media/pressreleasedetails.aspx?id=tcm:12-141806 Aug 13, 2013.

“Compared with other developed economies, the U.S. is particularly well positioned to increase exports in seven industrial categories, according to the report. In addition to chemicals, machinery, and transportation equipment, they are petroleum and coal products, computer and electronic products, electrical equipment and appliances, and primary metals. These seven sectors account for roughly three-quarters of total global exports. The job gains would come directly through added factory work and indirectly through supporting services, such as construction, transportation, and retail.”

So, let’s return to the data which sectors Japan has seen large import increases and then attempt to sort out whether this might be disaster-driven, cheap energy related or perhaps some other cause.

HS 2801～2850

In this HS range most commodities saw a rise I 2011 from 2010 of more than 20%. Also, many of these categories are quite large. Again, we focus on those commodities which are more 50 billion yen of imports in 2011.

Table 12. HS 2801-2850 (more than 50 billion yen in 2011 and large increase)

Commodity	2010 Value (bill yen)	2011 Value (bill yen)	2013 Value (bill yen)
2844.20-090	104	116	48
2804.61-200	84	94	78
2846.90-290	18	65	16
2805.30-000	15	57	20
2804.69-000	48	54	36

As we can see in Table 12 above, all categories level of imports are lower in 2013, most lower than even 2010 levels. As such, regardless of whether or not they are disaster-related, there is no long run impact. The last two products deserve some special attention, perhaps.

HS 2846.90-290 is “Compounds, inorganic or organic, of rare-earth metals, of yttrium or of scandium or of mixtures of these metals other than cerium compounds.” (only 6 digit description)

HS 2805.30-000 is “Rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed” (also 6 digit level).

These two rare-earth categories show large fluctuations, from year to year, which could be attributed to many factors, none of which are disaster related. In particular, controversial (in the eyes of many WTO members) export quotas of rare-earths by China (which accounts for more than 90% of the world's rare earth production) may have resulted in the restriction of rare-earth exports to Japan during this time.[87]

HS 2852.00-1, 2852.00-21 , 2852.00-29 , 2852.00-9

These categories are tiny and are thus ignored here.

HS 2853.00～3215.19

First, we will examine those HS codes up to and including HS 3001. There were six categories at a 9-digit level which had more than 50 billion yen of imports in 2011. They are: 2905.11-000, 2933.99-090, 2934.99-099, 2933.39-220, 2909.19-010 and 2933.29-000.

2905.11-000 remained very stable, a little more than 50 billion in 2010, 2011 and 2012, so will be ignored.

2909.19-010 This category was 53 billion yen in 2010 and 56 billion yen in 2012, so with no dramatic change, will not be explored further.

2933.99-090 dropped from 144 billion to 139 billion yen in 2012, so will be ignored. Also note that some categories, like this one, may have actually seen a rise in quantity of imports (in this case, from 5.5 to 5.9 million KG) despite the lower overall import bill in yen. Apparently prices fell in this category, at least in yen terms. [The HS description at a 6 digit level is; "Heterocyclic compounds with nitrogen hetero-atom(s) only"]

2934.99-099 rose from 108 billion in 2011 to 118 billion in 2012. However, in quantity terms, these imports fell. Also, there is no record for this god in 2010, perhaps because of classification change. As such, it will not be examined further.

2933.29-000. This category had 51 billion yen in 2010 and 50 billion yen in 2012, and so will be ignored.

2933.39-220 This category rose from 77 billion in 2010 to 89 billion yen in 2011 and then dropped back down to 67 billion yen in 2012 and so will not be explored further.

HS 3001 to 3215.19: *Japan's sharp increase in the imports of Medicants and Vaccines*

[87] http://www.eastasiaforum.org/2013/08/18/did-china-really-ban-rare-earth-metals-exports-to-japan/

This range also had a number of goods greater than 50 billion yen, even at the 9 digit level. Some of the products are seeing rapid and persistent increases year on year and warrant a much closer look.

Table 13: Imports of Medicants and Vaccines

HS Code	Import value in billions of yen (2011)
3004.90-029	712
3002.10-490	259
3004.90-024	160
3002.20-000	96
3004.39-000	69
3004.31-000	52
3004.32-000	50

Of the above goods in Table 13, four were not imported at all in 2010. However, there were also some category changes during this time. One category jumped 100%. All others fell, or had increases of less than 15%. Because all products are by definition and selection large, and all are medicine-related, we will discuss each of them in some detail.

HS 3004.90-029 ("Medicants, other") In 2010 633 billion yen was imported, and in 2011 712 billion yen was imported. In 2012 902 billion yen was imported. In 2013, 982 billion yen., or nearly one trillion yen. This is clearly an important sector and growing rapidly. Import values were 396 billion in 2007 and 511 billion yen in 2009. So, clearly the trend began before the quake, but is continuing. At nearly 10 billion dollars this 9-digit category is roughly 10% of Japan 2013 deficit in goods. [11.5 trillion yen goods trade deficit in 2013.] US, Germany, Spain, Singapore and the other large pharma exporting countries account for the bulk of these exports to Japan. China, for example makes up about 3% while Germany and the US account for over 10% each.

3002.10-490 "Human blood, vaccines,…antisera…other". 259 billion yen was imported in 2011, up from 242 billion in 2010. 323 billion in 2012. This category was "only" 199 billion yen in 2009, so clearly the increase is a trend prior to the quake. Nonetheless this is huge and growing sector of Japan's trade deficit. 380 billion yen in 2013, so this makes it a little less than 4% of the Japanese trade deficit in 2013.

3002.20-000 "Vaccines for Human Medicines". This was 49 billion yen in 2010 and 96 billion yen in 2011 But again, a jump (of 100%!) in vaccines is likely not due to the disaster. In 2012 this category dropped again to 62 billion yen and again dropped to 56 billion in 2013. So, again, probably not disaster related, but part of a larger trend towards imports of various medicines by Japan.

It is important to note that the items in this category changed in 2012. So, while 3002.20 was still much higher than in 2010, in 2012, some of what would have been "3002.20" in 2011, is now in 3002.10, 3002.20 and 3003.90. In 2012, the new 3002.20 had 62 bill yen of imports. How much of this decline is due to the code break up, or decline, is impossible to discern from the data. However, it can still be said that there was a surge in this product, and it seems to have been sustained. Whether this is due to the disaster also is difficult to tell. It is likely not, however, the result of the disaster, but rather a much larger change in the structure of Japanese imports of pharmaceutical products.

3004.31-000 "Medicants…containing insulin". In 2011 52 billion yen were imported, down from 58 billion in 2010. 53 billion yen was imported in 2013, so this category, the classic inelastic good, appears very stable over time.

3004.32-000 "Medicants…containing corticosteroid hormones…" 61 billion yen in 2013, up from 50 billion yen in 2011. Only 45 billion was imported in 2010, so these goods are growing somewhat as well contributing at extra (new) 1/10 of one percent or so to Japan's 2013 goods deficit.

3004.39-000 "Medicants…Containing hormones or other products of heading 29.37 but not containing antibiotics". 69 billion yen of imports in 2011 was up from 63 billion yen in 2010, so a 10% increase. There were already 60 billion yen of imports in 2007 and 74 billion yen in 2013. So, this category too, was on the rise before the quake, and continues to rise though not as dramatically and some other HS 30 sub-categories. (an extra 11 billion yen to the 11 trillion yen deficit in 2013. So, 1/10 of 1%.)

3004.90-024 ("medicants…put in measured doses or in forms…for retail sales…other"). This category is in contrast to HS 3003 which is not "in retail form" and presumably more wholesale forms of medicines or medical ingredients. 160 billion yen was imported in 2011, up from 150 billion yen in 2010. 170 billion was imported in 2009, so there is a good deal of fluctuation over years. In 2013 205 billion was imported. Clearly this is a huge sector, and in generally growing. Unless things change in the Japanese pharmaceutical industry, this will add to Japan's deficit, especially as Japan ages.

3002.90 - Other

If we look at the more aggregate 4-digit level HS 3002 total was: 416,670,562,000 or 417 bill yen in 2012. Total deficit was 6.9 trillion yen, so 400 billion of 6900 billion is: 6% of Japanese deficit is in "blood" (vaccines, etc.), 3002. For all of 2013, HS 3002 was 474 billion yen, so another 13% increase on 2012.

The bulk of the imports come from the US, Germany and other European countries which dominate the global pharmaceutical industry. In the field of vaccines alone, five large multi-

national corporations make up 80% of the global market and all of these firms are non-Japanese.[88]

However, Japanese pharmaceutical firms are trying to stay in, or perhaps get into the game. GlaxoSmithKline has recently formed joint venture with Daiichi Sankyo, so perhaps more production of these various products will occur within Japan, so imports may fall in the future.[89] This has not occurred yet. At the most 9-digit detailed level of Japanese customs data, 5 of the top ten goods are in HS 27 (Mineral fuels i.e. natural gas, crude oil, etc.), two goods are from HS 26 ("ores"), number 3 is HS 851712000 "Telephones for cellular networks or for other wireless networks", one is 000000099, and in ninth place is 300490029.

982 billion yen, or roughly 10 billion dollars of HS 3004.90-029 was imported in 2013. This accounts for almost 10% of the deficit, and more than 1% of all imports). So, this is and growing in post disaster (but was growing before too.) Does Japan export any of this product? None. Where are these imports coming from? 180 billion yen is from US and Puerto Rico (100+80 roughly). Germany and Italy each are almost as large.

In summary of this "Chemical" (Japanese Principal Commodity name) subsection of "Pharmaceutical Products" (HS code name for HS 30),

The total of all HS "30", i.e. 3001, 3002, 3003, 3004, 3005 is about 2 trillion yen in 2013. This accounts for than 2% of all imports, *almost 20% of the Japanese deficit of 11.5 trillion yen*. So, a single two-digit HS code, 30 (or nearly 100 two-digit HS codes), accounts for nearly twenty percent of the trade deficit Are there any exports in HS 30? Yes, some: Japan exported more than 300 billion yen in 2013. This leaves us with net imports of 1.7 trillion in HS 30.

In summary, aside from Japan's energy woes, the greater source of new imports is cell phones and medicine. As Japan does not seem to gaining any comparative advantage in these two products at present, Japan's goods trade deficit may continue to grow, especially if Japanese demand for medicines grows with its ageing society.

Two rare earths are also contained in this section.

2805.30-000 and 2846.90-290.

Both rare earth categories had huge spikes (more than tripling) in 2011 over 2010 and in 2012, the former was still over 100% higher than 2010. The latter also saw a spike in 2011 relative to 2010, but 2012 was "only" 30% higher than in 2010. This appears to due to volatility in the product, rather than disaster-related.

[88] See a WHO report at: http://who.int/influenza_vaccines_plan/resources/session_10_kaddar.pdf
[89] http://www.fiercevaccines.com/story/gsk-daiichi-sankyo-aim-top-japans-vaccine-market/2012-03-05

HS 33, 3401～3402 , 3403.91～3403.99 , 3404～3405 , 3407 , 35～36 , 3801～3815 , 3817～3822 , 3824～3921

A search across all HS between 3301 and 3999 found six categories at the 9-digit level that had more than 50 billion yen of imports in 2011. Of these, three had large increases in 2011, and two of these three still had approximately 20% higher levels in 2012 than in 2010. Those two products were: HS 3824.90-999 and HS 3907.60-000.

HS 3824.90-999 had 93 billion yen of imports in 2010, 164 billion yen in 2011, then 111 and 86 billion in 2012 and 2013. So, there may have been a surge, but not persistent. Also, there was only 68 billion yen imported in 2009, so the trend, if any, seems to be pre-GEJE. This product is an "other" in the broader 4-digit category of "Prepared Binders For Foundry Moulds Or Cores, Chemical Products…". In any event, there is no persistent increase which can be attributed to the quake and so this will not be explored further.

HS 3907.60-000 This is another category with a very mixed interpretation if one looks at values alone. If we look at quantities imported (million of KG) there has been a steady rise from before the GEJE (501 million kg imported) in 2007, 677 million in 2011 and 812 million kg in 2013.In value terms imports have risen from a low of 63 billion yen in 2009 to a peak of 122 billion yen in 2013. So, this category is certainly contributing to Japan's widening trade deficit as quantities are constantly on the rise. However, this cannot be attributed to the quake. The 6-digit description of this is: "Poly(ethylene terephthalate)". This is the ubiquitous "PET" (or sometimes "PETE") of "PET" plastic bottles found in Japan, and everywhere around the world these days. They may have been some temporary surge attributable to the disaster, but this is part of larger trends of deficit in Japan's import of plastics.

China and Taiwan account for over half these imports, with Thailand taking a strong third place. Japan does export this commodity as well, but Japan imports 10 times as much. Japan imported 122 billion yen of this PET plastic in 2013, or over 1 billion dollars worth of a 100 billion (11.5 trillion yen) dollar trade deficit in 2013. In short, 1% of Japan's trade deficit is material (primarily) for plastic drink bottles.

This 6 digit (which has no subsection, so the 9 digit is the same as the six digit) is also 2/3 of the entire HS 3907 category.

HS 9306.21～9306.29 , 9306.30-1～-2

The largest category here is 6 billion yen, so these will be ignored.

5.3.6. Principal Commodity 6 “Manufactured Goods” (including Plywood)

This Principal category is scattered across various HS codes. Below we will discuss larger categories that may have seen an increase or are otherwise interesting in the wake of the disaster.

HS 4412 (plywood) has many sub-categories, and given than plywood is a common housing material, I investigated the movement of this 4-digit level over time, While there is a rise in 2011 (190 billion yen) over 2010 (150 billion yen), this may be simply (or at least partly) rebound from the GFC. In 2008, imports of 4412 were also a much higher 196 billion yen. There were still higher in 2007 at 253 billion yen. Thus, it does appear that we can attribute this to much of an import surge, nor to any new trends in foreign sourcing due to the disaster.

Also in HS 40 two categories had surged, though they were not permanent

4001.22-000 48% rise in 2011 then back to (99% of) 2010 levels
4001.21-000 49% in 2011, 80% in 2012.

This is “Natural rubber, balata…natural gums, in primary forms or in plates, sheets or strip. Two types: ‘smoked’ “21” and ‘Technically specified natural rubber (TSNR)’ “22”.

So, there may have been a surge in rubber, perhaps for the rebounding auto sector, or for some other reason(s). In any case, it was not sustained.

HS 6001-6999

Seven goods in the range had significant and permanent increases of 20% or more, in 2011 and again in 2012. However, these are all clothing categories.

6109.90-021: T-shirts, singlets and other vests, knitted or crocheted. “of other man-made fibres”

6110.30-014: Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted; Of polyester

6201.93-200: Men's or boys' overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar articles, other than those of heading 62.03 of man-made fibres

6203.42-200: Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts (other than swimwear). Of cotton, other

6203.43-200: Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts (other than swimwear). Of synthetic fibre.

6205.20-000: Men's or boys' shirts, of cotton Toilet linen and kitchen linen, of terry towelling or similar terry fabrics, of cotton

6302.60-000 Toilet linen and kitchen linen, of terry towelling or similar terry fabrics, of cotton

A look at older data show that was a pre-quake trend and so probably more increasing due to "China effect" than anything earthquake-related.

HS 7001-7999

Is this range of goods, nearly 20 commodities were more than 50 billion yen of imports. Of them, five categories had more than 20% growth, and of those, three still have very high levels in 2012. The three goods are shown in Table 14 below.

Table 14. Potential Surge Categories in HS 7001-7999

HS Code	2010 Value bill yen	2011	2012	Ratio 2012/2010
7106.91-000	94.8	153.6	122.8	1.30
7112.92-000	32.7	51.7	43.4	1.33
7224.10-030	6.8	53.5	40.2	5.95

HS 7106.91: "Silver (including silver plated with gold or platinum), unwrought or in semi-manufactured forms, or in powder form, other, non-powder form."

Silver imports have risen considerable, in value terms rising from 46 billion in 2006 to 95 billion in 2010. Then in 2011, imports jump again. However, if we look at quantities (in grams), imports actually fell, say in 2012 relative to 2010. The increased value is due to huge spikes in the price of silver which occurred early 2011. The price of silver has fallen to 2010 levels again and quantities are still lower than 2010 level. So, the category cannot be attributed to the disaster.

HS 7112.92 "scrap containing precious metal or precious metal compounds, of a kind used principally for the recovery of precious metal, Of platinum, including metal clad with platinum but excluding sweepings". Here, if we look at quantities (in KG), 5.4 million KG were imported in 2013, which is up from the three previous years, but only slightly hiring than pre-GFC levels of 4.4 million. So, it may be simply a reversion to a longer, pre-GFC trend.

HS7224.10-030 "Other alloy steel in ingots or other primary forms; semi-finished products of other alloy steel, Ingots and other primary forms, other"

The last "ingots" rose from 7 bill to 40 bill yen. What's going on here? If we look back further, this category ranged from 2 to 7 billion yen from 2006 through 2010. So, why the spike?

An industry article says that the Japan's auto industry is now (allow ingots) bouncing back and demanding a lot more alloy ingots.[90] But is this just a rebound, or some new trend? Apparently, it is not persisting. Both in terms of quantity and value the imports of this category in 2013 dropped significantly, resulting in only 9 billion from 40 billion yen in 2012. So, it is perhaps just re-stocking, and not likely due to not any new sourcing from China or elsewhere. Nor is likely to add to Japan's future deficits.

In the range of HS 8001-8399 only one commodity had more than 50 billion yen of imports. This commodity's imports dropped in 2011, and in 2012 and 2013 and fairly stable. So, there appears to be no increases in imports here.

5.3.7. Principal Commodity 7 "Machinery, Transportation Equipment"

This category concords with many items in HS 84, 85, 86, 87, 88, 89 HS 90.

Again we will pick those HS codes that were more than 50 billion yen in 2011 and which saw both a 20% or more surge in 2011, and continued to remain high in 2012.

HS (84)

There were 22 goods which had over 50 billion yen in 2011. Of these 22 goods, 15 saw an increase in imports. In the short-run, of course, it is very possible for imports to drop as certain goods used as inputs, perhaps in Tohoku factories, are temporarily suspended as production in those factories are interrupted. But the focus of this paper and this section is to identify any unusual increases in imports which may have lasting impact. Of these, seven goods saw more than a 20% increase in 2011. Did these surges persist into 2012? Of the seven, all but one were still higher, much higher, than 2010 levels.

These six (HS code) commodities (see Table 15) are: 8408.20-000, 8415.10-010, 8431.49-020, 8471.41-000, 8471.49-000, and 8481.80-010. Table 16 below describes each in more detail.

[90] http://www.metal.com/newscontent/25543_china%E2%80%99s-september-exports-of-aluminum-alloy-ingot-soar-on-improved-japanese-demand (accessed sept 16, 2013)

Table 15: Potential Surges in HS 84				
HS code	2011 increase on 2010 (%)	2012 on 2010 (%)	Yen Value in 2012 (billions)	Yen Value until Sept '13
8408.20-000	20	15	58	49
8415.10-010	31	37	115	126
8431.49-020	42	59	90	74
8471.41-000	230	172	44	37
8471.49-000	49	32	86	42
8481.80-010	19	27	71	56

Table 16: HS 84 Surge goods and their descriptions

HS Code	Description (only up to HS 6 digit)
8408.20-000	Compression-ignition Internal Combustion Piston Engines for Vehicles
8415.10-010	Air Conditioning Machines, Window or Wall Types, Self-contained
8431.49-020	Parts of Derricks, Cranes, Graders, Levellers, Scrapers or Pile-drivers
8471.41-000	Other automatic data process machines: comprising in the same housing at least a central processing unit and an input and output unit, whether or not combined
8471.49-000	automatic data process machines, Other, presented in the form of systems
8481.80-010	Other Valves and Other Appliances for Pipes, Tanks, Vats or the Like

Again, because these are not economically small categories, these large, sustained increases are not the result of tiny initial numbers. Each category reflects roughly 500 million dollars or more per year of imports. Glancing at the descriptions, some products may be temporary import surges, as devastated Tohoku rebuilds. For example, wall-mounted AC units, may be for new homes in the earthquake/tsunami-hit areas. If so, this may be a one-time surge. But here, too if this expands import sources and perhaps consumer attitudes towards these foreign products, it may be part of a permanent trend. These categories should be observed in the years ahead. As for engines, and "data process" machines, there is probably a very specific industry and perhaps firm level story(ies) that needs to be investigated more.

8408.20-000 was 49 billion yen for by September of 2013. Same as 2012 levels, so perhaps a new trend was established. However, if we go back further (2006-2010) imports in this category ranged from 43 to 97 billion. So, the apparent surge is actually within historical norms, so we cannot identify any new, higher trend.

8415.10-010. By September of 2013, 129 billion yen had been imported. This category has had a steady rise (about 10 billion yen more every year) since at least 2006…2010 imports were 20% higher than that of 2009. So, the post-disaster growth is part of a previous trend and not new.

Having said that, this commodity group accounts for more than $1 billion per year and is growing over 30% year on year, so it is a product to watch. (Recall, Japan's trade deficit in 2012 was less than $70 billion in total, so this category, "AC units" takes up more than one percent.) 119 of the 129 billion yen of this good in 2013 was from China. A distance second was Thailand exporting 7 billion yen. This China shift in comparative advantage is part of a larger shift in Japan's comparative advantage and is obviously a significant explainer for Japan's newfound trade deficit. Update: for all of 2013 this category's imports totaled 149 billion yen. At 100 yen to the dollars, this is roughly $1.5 billion, or 2% of Japanese trade deficit. This is up from 115 billion for all of 2012. Hollowing out in AC units appears to continue to add to Japan's trade deficit and, presumably, to benefit consumers with cheaper AC units from China and elsewhere.

8431.49-020 This category had a large variation over the 2006-2012 period. In this context, the apparent surge in 2012 not out of line historical trends where there was a low of 28 billion yen in 2009, but peak of 105 billion yen in 2008.

8471.41-000 There is a big jump in this good. Historically, imports have been between 11 and 16 billion yen 2006-2010. Imports were 37 billion yen for Jan-Sept of 2013. 33 of 37 billion yen came from China, and the next largest exporter was Taiwan with less than 1 billion yen. So, clearly this is a continuation of shifting comparative advantage to China, and not disaster-related. Nonetheless, this is part of an overall trend in consumer electronics where Japan imports desktops, laptops, and as we will see smartphones from abroad, in huge numbers, thereby accounting for a significant part of Japan's trade deficit.

8471.49-000 This other "data processing machine" category appears flat in 2013. While not as dramatic as the previous good, is part of the overall "China effect" and not-disaster-related.

8481.80-010. There were 51 billion yen of imports in 2009, 56 billion in 2010, and 66 billion in 2011. However, if we look back to pre-GFC 2007, imports were over 70 billion. So, this is apparent a return to historical norms. Interestingly, in this category Vietnam is the number one exporter and China and the US are essentially tied for second in 2013. These three countries account for over two-thirds of this commodity's exports to Japan. Pre-GFC the US was number one exporters, then China and Vietnam. One would be tempted to attribute Vietnam's gains in this good re due to the Economic Partnership Agreement (FTA) Vietnam and Japan started in 2009, but actually tariffs for this product (as for most in HS 84) was already zero for all countries, well before 2009.

HS (85) Most commodities here are less in 2011 than in 2010, reflecting the fact that many of these products are likely imported inputs used in disrupted exports from Japan, or part of a larger disrupted global supply chain either due to the Japan disaster, Thai flooding, continued stagnation in Europe or some combination. Out of the 32 commodities of which Japan imported more than 50 billon yen of in 2011, only 15 goods, or about half, showed an increase. Of these

15 only three (3) had a greater than 20%. Seven have 15% or more increase, however, so we will examine the 2012 levels of these seven goods.

All six goods have levels of imports much higher than 2010, as Table 17 below shows. How much of this is Triple Disaster related, and how much is due to other rebound effects?

Table 17: Surge goods in HS 85

HS code	2011 increase on 2010 (%)	2012 on 2010 (%)	Yen Value in 2012 (billions)	description
8517.12-000	66	154	1,120	
8517.61-000	15	25	73	
8517.62-000	19	45	507	
8541.40-020	17	107	166	
8542.39-010	47	70	114	
8526.91-090	29	80	87	
8504.40-090	16	28	64	

Table 18. Description of Surge goods in HS 85

HS Code	Description (only up to HS 6 digit)
8517.12-000	Telephones for cellular networks or for other wireless networks
8517.61-000	Machines for the reception….base stations
8517.62-000	Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus
8541.40-020	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
8542.39-010	Electronic integrated circuits, other
8526.91-090	Radio navigational aid apparatus
8504.40-090	Static converters (subset of Electrical transformers, static converters (for example, rectifiers) and inductors.)

8517.12. This category was "only" 192 bill yen in 2006 and continued to rise rapidly even through the 2009 GFC to 442 bill in pre-quake 2010. It would be hard to attribute this to anything but the smartphone consumer revolution and the changes in both supply and demand in this unique nexus of cell phones and the continuing wireless revolution. This six-digit category alone was 1.1 trillion yen in 2012. In 2013 it was 1.6 trillion yen. Japan's entire Trade (goods only) deficit in 2012 was 6.9 trillion yen. *15% of Japan's trade deficit is imported cell phones in 2012!* Japan's Merchandise trade deficit for 2013 is currently estimated to be 11.5 trillion yen according to Japan Customs, so the 1.6 trillion yen worth of cell phones imported in that year still contributed 14% of the total merchandise deficit in 2013. (Japan only exported 2.5 billion

yen of this category in 2012. This is roughly 11 billion US dollars of a 70 billion dollar deficit in one good.)

Also, for reference, recall Japan imported 24 trillion yen of "Mineral Fuels" (Principal Commodity 3) in 2012 and 27 trillion yen in 2013. This accounted for 24% in 2012 and again 24% in 2013 of the total goods import bill. 8517.12 accounted for 1.5% of the value of all imports, and this rose to 2% in 2013. As Japan's energy imports rise, so does it overall deficit, but some other significant sector's import are growing faster.

8517.61-000, this averaged 50 billion over the 4 year 2007-2010 period, and ranging from 58 in 2007 to …So 73 in 2012 may be a significant jump upwards…But, if there is a surge, it is more likely due to the industry than to the disaster.

8517.62 roughly 350 billion yen before the quake…and more stable each year. But whether the big jump is disaster driven is hard to say, and industry and market developments more likely. This is another very large category that might be worth watching in the near future.

8541.40-020 This category was under 40 billion each year before the quake, but then in 2009 doubled in 2010, still pre-quake. As such, its rise is probably nor quake-related.

8542.39-010 This, jumped in 2011, but in 2012 was still well below 2010 and 2011 levels. In such a dynamic industry such as semiconductors, without firm specific knowledge it would be hard to attribute this to the disaster.

8526.91-090 This section was already rapidly growing well before the quake. 2010 levels were 5 times that of 2007. 2010 levels had double on the year before. Attributing to the quake would very difficult.

8504.40-090 while there were apparent surges in 2010, these are actually in line with movements since 2007. So, there was no apparent surge.

HS 86

There are only 16 commodities in this entire subsection which Japan imported in 2010. In 2011, three of these products were not imported at all in 2011. These were tiny values (only a few thousands of dollars). Lowering the search threshold considerable, we only have 3 goods that were over one (1) billion yen in 2011. How did these categories values change from 2010? Only one of the three had a surge in 2011, of 32%. This was sustained in 2012, with 2012 levels 40% higher than in 2010. The product code is (HS) 8609.00-000 and the total value was 7.1 billion yen in 2012, or about $70 million. This is also the second highest imported good in this HS 86. This category is: "Containers (including containers for the transport of fluids) specially designed

and equipped for carriage by one or more modes of transport." Again, the import value is relatively tiny and will not be explored further.

HS 87 "Vehicles other than Railway…stock…"

This is an important sector for Japan, though far more on the export side, than on imports. Again, because this is a large category (over 90 goods), we will only look at those greater than 50 billion yen per year.

Japan had seven goods which totaled over 50 billion yen in 2011. Compared to 2010, three goods rose by more than 20%. The others were between 90 and 105% of 2010 levels. The three goods' codes are: 8703.22-000, 8703.23-000 and 8703.24-000. (See Table 19 below.)

Table 19. Surge goods in HS 87 (passenger cars)

HS code	2011 increase on 2010 (%)	2012 on 2010 (%)	Yen Value in 2012 (billions)	description
8703.22-000	32	37	159	Motor veh > 1000 cc
8703.23-000	24	52	438	Greater than 15000cc
8703.24-000	25	51	209	Greater than 3000cc

These are all "motor vehicles", cars which engines larger than 1000cc, 1500cc and 3000cc, respectively. Japan does import cars with less than 1000 cc, but this "only" amounted to 4.9 billion yen in 2011 (a quantity of 9558 cars).

Because so many autos were destroyed by tsunami and because autos are fairly easy commodity to understand, we will explore this category a bit deeper.

Cars less than 1000 cc

Small cars (less than 1000 cc) autos (8703.21), more than doubled from a value of 2.1 billion yen in 2010, to 4.9 billion in 2011. The number of such cars rose from 8004 (in 2010) to 9558 (2011),

so it is clear the unit value for these cars skyrocketed, at least in the short-run. Whether this is because of tight market, or because of the types of cars imported change cannot be discerned with the trade data.

This has soared in 2012 to 28 billion yen worth of cars. The number of such cars imported in 2012 to 32,564. In 2013 just short of 30,000 cars of this smallest class were imported. So, it appears this category has leveled off. 20,000 were imported in 2007 (pre-GFC) and only 8000 were imported in 2010. With so much fluctuation and so many possible causes (recession and rebound, high gasoline prices, disaster, consumption tax hike in 2013) it is impossible to attribute this part of Japan's deficit to the disaster.

Cars more than 1000 cc

91,242 cars were imported value at 116 billion yen in 2010. This rose to 111,470 cars at 153 billion yen in 2011. A 20% increase in quantity and a 30% increase in total value. In 2012, the value was 159 billion. Was this surged sustained? Was it part of an earlier trend?

In 2013, it was 166 billion yen, so the "surge" has apparently persisted. However, the number of cars in 2013 was only 102,000, less than in 2011. All in all, this is a roughly 10% quantity increase in 2013 as compared to 2010. However, the number of cars in this class was a mere 46,000 in 2007, pre-GFC. It may be the case that consumer increasingly purchased more smaller, fuel efficient cars because of the crisis, and because of sustained higher oil prices.
Where are these new, small car imports coming from? More than half are from Thailand (35,000) and Germany (28,000).

Cars more than 1500 cc

287 billion yen of these cars were imported in 2010. 356 billion yen was imported in 2011 and 468 billion in 2012. In 2013 160,000 cars of this class were imported at a value of 526 billion yen. Only 106, 000 cars were imported in 2010. Is this disaster-related or part of a pre-existing trend? In 2007 (pre-GFC) a whopping 196,000 cars were imported. So, it is very likely that while some replacement effect occurred because of the disaster, this is simply rebound from the GFC and perhaps a slightly stronger Japanese economy.

Cars more than 3000 cc

139 billion yen of these cars were imported in 2010. This rose to 174 billion yen in 2011. 209 billion yen was imported in 2012. In 2013 33,000 cars worth 227 billion yen were imported. Again, there were 46,000 cars of this class imported in 2007, so this seems to mostly rebound effect, as well as perhaps some increase prior to the consumption hike tax in April 2013.

Japan has roughly 60 million cars on the road.[91] The total number of cars (all of 8703.2) imported by Japan in 2010 was 227,049. This is about 0.4% of the stock of all Japanese cars. In 2011, Japan imported 270,858, an increase in 20%. There were major production disruptions in autos due the Tohoku earthquake, energy conservation efforts in Japan, and the Thai flooding late 2011. And, of course, demand for cars was also disrupted by negative growth in the Japanese economy in 2011. At the same time, replacement vehicles, new or used, were in high demand following the triple disaster.

How has all of this shaken out by 2012? A total of 325,458 cars were imported in 2012. This is one-third of a million cars, or half a percent of Japanese total stock of cars on the road. Is this an important uptick? If we go back further, Japan imported 288,892 cars in 2007, 275,579 in 2006, and 281,826 in 2005. A three year average of the pre-GFC imports is: 282,099 cars. 2013 levels are 15% above this. Japan imported 150,453 cars in the first half of 2013. If we simple double this to extrapolate for the whole year, we would have 300,000 cars.[92] A bit higher than historical, but on the decline from any post-disaster surge. While this sector will be interesting to watch, it is hard to identify this as a lasting increase in auto imports, and not simple replacement, and a return to historical norms. In 2012 auto imports (all of 8703.21-24) amounted to 864 billion yen, or about 9 billion dollars. If auto imports slow down again, this would result in a small reduction in Japan current $700 billion deficit.

HS 8712 (Bicycles)

Many bicycles were swept away, with everything else. And if we compare total Bicycle imports in 2013 (80 billion yen) to 2010 (65 billion), this is an increase of 23% more. However, where there must have been some replacement purchases, imports were only slightly higher in 2011 (75 billion). Also, if we go back to pre-GFC levels, bicycles imports were already 75 billion. It is hard to attribute this to any new, higher sustained level of imports to the disaster.

HS 88

There were only 17 goods in this subcategory, and only two were greater than 50 billion yen in 2011. Both saw large *decreases* in 2011.

The category HS 8802.40-000 ("Aeroplanes and other aircraft, of an unladen weight exceeding 15,000 kg") typically accounts for over 90% of all of HS 8802. It fell from 215 billion yen in 2010 to 156 billion in 2012. It has bounced back with a vengeance, hitting 403 billion worth of

[91] Ward's automotive (www.wardsauto.com)says Japan's cars to people ratio was 1.7 in 2012, while the World Bank's database says passenger cars are 453 cars per 1000 persons, in Japan.

[92] Examining the seasonality of Japanese car imports (1994-2010, monthly) in Eviews does not reveal any marked difference between the first half and second half of the year. There are multiple "peaks" in imports throughout the year. January (new year) and March (just prior to new fiscal year) are often clear peaks, but there are often peaks in August and the end of the year as well.

imports in 2012. 8803.30-000 fell from 96 billion in 2010 to 78 billion in 2011, and back up to 105 billion in 2012.

This is largest aircraft category and includes Boeing and Airbus, but would not include smaller commuter jets, such as those made by Embraer. As no large bodied aircraft were destroyed in the triple-disaster, we can assume there were no "replacement imports" of large airplanes. Thus, such large swings are attributed to the needs of the Japanese airline industry which by its nature has very lumpy purchases over time and not to the disaster *per se*. 8803.30 is parts for airplanes and helicopters, so we cannot attribute this to the disaster either.

What about increased demand by the Japanese government for more search and rescue aircraft?

Helicopters, of course, played a vital role is rescuing those stranded and distributing relief goods to those stranded with our road access. Also, if one believes as Samuels (2013) that in the wake of the 1995 Kobe Quake and Tohoku 2011, the Japanese people (citizenry and politicians) became more comfortable with the role of the SDF, there may be more purchased of helicopters, V-22 Osprey, and the like. HS 8802 includes helicopters airplanes and even satellites, both military and non-military. Japan typically imports helicopters (HS 8802.11, 8802.12, 8802.20), smaller planes (8802.30), 8802.40 (Boeing/Airbus) and 8802.60 (satellites, etc.) each year. As mentioned above large body passenger crafts are 90% of these imports. There was no apparent trend, here with some of the helicopter subsections rising and some falling over the disaster and post-disaster period. Satellites presumably have little to do with the disaster, and in any case while the number of satellites increase in 2013 relative to 2010 (10 rather than merely 2) the value of the imports here actually fell somewhat.

While this category seems not to have been affected, we will discuss Japan's evolving stance towards the V-22 Osprey made by the US in the context of the Samuel (2013) style hypothesis, that Japan may be becoming more comfortable with Japanese and US military presence.

In-depth: The V-22 Osprey

The Bell Boeing V-22 "Osprey" can take off and land like a helicopter but can 'convert' into a turboprop aircraft, thus combining the advantages of a helicopter's (ability to land in a location without a landing strip) with the long-range advantages (fuel efficiency, for one) of a traditional fixed wing aircraft. Initially meeting resistance (safety concerns) from some in Japan, the V-22 was already deployed in parts Japan prior to the disaster. Though none were used in the joint search and rescue operation ("Tomodachi" which means "friend" in Japanese) with US military stationed in Japan and Japanese Self-Defense Forces (SDF), they will likely become a part of future rescue operations in Japan (and the world).[93]

[93] US V-22s were used after the deadly November 2013 Hurricane Haiyan/Yolanda that hit the Philippines and caused a loss of life of over 5,260 at most recent count.

According to at least one article, the disaster may have accelerated the move towards more broad adoption on the V-22 in Japan.[94] The article states, "The Defense Ministry is weighing the possibility of equipping the Ground Self-Defense Force with the U.S.-built Osprey tilt-rotor military transport aircraft as early as fiscal 2015, sources said Tuesday."

Is this, in part, disaster-related? It appears that the recent acceleration is due to both the disaster (and the useful of V-22 in future disasters) and continuing frictions in the Senkaku and other islands in the South Seas, with China. As the Japan Times articles quote officials above as saying: "…for the defense of remote islands and for disaster-relief operations." Furthermore, during the devastating Typhoon Haiyan which struck the Philippines in November 2013, the Osprey was used, with apparently great success. This surely only added to the appeal of such a craft for Japan.

Clearly, some of this could be attributed to Tohoku. But how much does an Osprey cost? About 10 billion yen, or over 170 million US dollars. If, as one report states, Japan is poised to order seventeen Osprey, this would amount to 170 billion yen.[95] While no small amount of money, this is still a small portion of any future Japanese deficit, being, for example, less than one fifth of the size of Japanese imports of cell phones, for example.

HS 89 "Ships, Boats and Floating Structures"

One might guess that the tsunami, which destroyed huge amounts of vessel may have incurring replacement purchases, some of which may have been imports. A look at the data reveals that none of the 12 goods in this HS heading are over 50 billion yen. The largest by far is 8901.90-000 with 16.9 billion yen of imports in 2011. The next largest good was 3 billion yen, so we will only examine 8901.90.

The value of imports of this category, 8901.90 (a sub-category of "Ships and Boats…" labeled "Other vessels for the transport of goods and other vessels for the transport of both persons and goods imports") fell from 26.3 billion yen of imports in 2010. In 2012, imports were back to 24.6 billon, seemingly business as usual. The entire value of HS 89 imports was 40 billion yen in 2010. This figure fell to 30 billion in 2011 and bounced back a bit higher to 46 billion yen (approximately $0.5 billion) in 2012. This is 15% above 2010 levels. However, for the first 6 months of 2013 import of HS 89 was 18.7 billion yen. A doubling of this for the year would imply a return to 2010 imports levels or a bit less.

It seems that the overall economic shock and coastal (physical and radioactive contamination in the ocean) damage in 2011 may have temporarily reduced ship/boat imports, but this has returned to normal levels. Of course, this rebound in 2012 would have only added to the massive trade deficit Japan has experienced in 2012, driven mostly by energy demands.

[94] See article http://www.japantimes.co.jp/news/2013/08/20/national/gsdf-looks-to-introduce-ospreys-in-fiscal-2015/. Article dated August 20th, 2013, last accessed January, 2014.
[95] See article by Seth Robson, "Japan to buy Ospreys, Global Hawks" online at www.stripes.com. Article dated December 16, 2013, last accessed February 28, 2014.

5.3.8 Principal Commodity Code 8: Miscellaneous Articles (Clothing, Furniture, Precision items, etc.)

This category includes Clothing and Furniture and Precision Equipment and Orthopedic devices among many other things. Was there a noticeable surge? In general, no, though in certain precision items, apparent surges may be part of a larger trend which preceded the disaster.

Imports in this category were 6.8 trillion yen in 2010, 7.2 trillion yen in 2011 and 7.7 trillion yen in 2012. The major subcategories in 8 are: 801 (Lighting), 803 (Furniture), 805 (Bags, purses, etc.), 807 (Clothing and Accessories) and 811 (Precision instruments such as Cameras, Orthopedic device, etc.). The average imports in "801" were 65 billion yen from 2005-2010. In 2011 and 2012, Japan imported 58 and 63 billion yen. As such, no surge is apparent here. One might expect Furniture to have experienced a surge as people and businesses rebuild their lives in the wake of the tsunami. Here too, however, there is no noticeable change. The 2005-2010 average was 550 billion yen, and was 505 billion yen in 2011 and 560 billion yen in 2012. For "Bags" one might even expect a negative import effect, as a small amount of survivor's guilt is said to have caused Japanese consumers to be more frugal in 2011. The 2005-2010 average was 449 billion yen, then 410 billion yen in 2011 and 458 billion yen in 2012. So, perhaps there is some truth to the survivor's guilt story here, but if so, it was brief.

This may be in part due to rebuilding and re-stocking in the wake of the disaster. In general, textiles and clothing has been on the rise in Japan. The dismantling of the worldwide Multifibre Agreement in 2005 has shaken up trade patterns in this sector. And, Japan, like other developed countries, is sourcing more and more of its clothing from China and elsewhere. However, this category's imports were actually a much higher 8.5 trillion yen in 2006, well-before the GFC and disaster. As such, this category warrants a closer look.

What about Clothing (807)? The 6 year average was 2.56 billion, then 2.60 in 2011 and 2.68 in 2012. The 2012 figure is about 5% higher than the six year average, but could easily be attributed to a strong yen, or any other host of factors aside from the disaster. The same can be said for 809, "Footware", which was also flat.

Lastly, we look at Principal Commodity Category 811, "Precision equipment". Here, there seems to be a pronounced *drop* in imports, though it is not clear why. The six year average was 1.68 Trillion yen. In 2011 it was 1.48 and 1.58 billion yen, respectively. This is a 6% decline in 2012 compared to the six year average. Over 80% of this category is "Scientific, Optimal" (81101) which has actually seen an uptick in recent years: 1.28 billion yen in 2010, then 1.28 in 2011 but 1.35 in 2012. Both "Scientific" and "Watches" has fallen over the past 8 years. Watch imports have remained flat for the past 3 years, while, as mentioned above, "Scientific" has seen a small uptick. Is the Scientific uptick a result of the disaster? As Japan imports approximately $13 billion worth of this category, it is worth exploring a bit more.

Unfortunately, Japanese online Customs data does not allow "drilling down" any further in many sub-categories of its "Principal Commodity grouping", but they do give the HS code equivalents. For "811" most commodities fall into the HS "90" headings. Still using the same Japanese Customs database, we select all sub-categories with more than $50 billion yen per year.

This provides with eight (8) highly detailed commodities. Of these eight, only *two* experienced surge of approximately 20% in 2011 relative to 2010. Both of these commodities also continued to increase in 2012.

What are these two categories? 9013.80-000 ("Other devices, appliances and instruments") and 9021.39-000 ("orthopedic appliances, artificial body parts, hearing aid, pts etc."). The first is a very broad, catch-all category. Is this the result of a one-time demand in the wake of the disaster or part of a previous upward trend? Data clearly suggests the latter. A look in previous years data shows that the "orthopedic category was already on the rise. While only 28 Billion yen of imports in 2002, it has risen steadily to 35 billion in 2005, 39 billion in 2009, and 51 billion yen in 2010. In 2011, this figure was 59 billion and in 2012 a staggering 76 billion yen.

In the first half of 2013, the "other devices" category appears to have levelled off, while "orthopedic" continues to grow and may top 90 billion yen in 2013 (the figure was already 60 billion by September 2013). 90 billion yen is roughly one billion dollars a year, so it is not a trivial amount.[96] The entire goods deficit is only 70 billion dollars or so, so this is a large portion for one single product. This increase in medical imports may be due to Japan's ageing population, or perhaps an increasing comparative advantage outside for these items, or a combination. It emphasizes, however, the "structural changes" that are a very real part of Japan's new trade deficit, and has nothing to do with more energy imports (nor, perhaps with the disaster.)

5.3.9 Principal Commodity Code 9: Commodities not classified, Re-exports (901) and Gold (903)

Re-exports in 2012 accounted for roughly $28 billion (converted at 100 yen to the dollar). Japan exports approximately $700 billion in goods per year, so this amounts to about 4% of all exports. This was only slightly higher in 2011, about $31 billion and $35 billion in 2010. "Re-imports" are even smaller and changed little over the same three period: about $1 billion per year. As such, we can rule out any significant changes in this small category for Japan. Non-monetary gold (903) imports are small, falling from $600 million in 2010, to $450 million or so in 2011 and 2012.

[96] In may be no surprise that the US provides over half (28 billion yen accumulated by September 2013) of this orthopedic category. What may be surprising is that Ireland is the number two provider (18 billion yen), and Singapore is at number three (almost 5 billion yen). Puerto Rico (a US territory) is fourth, Germany is fifth, the UK sixth and Switzerland seventh.

6. Summary of Main Findings and the Future of Japan's Trade Deficit

What has this detailed exploration into Japan's new found deficit discovered?

To be sure, the lion's share of Japan's trade deficit is energy imports, and this massive upsurge is due to the shutting down of all of its nuclear power. This increase in energy demand has put additional pressure on world energy prices. This negative terms-of-trade effect on Japan only exacerbates Japan's deficit. However, even if Japan turns back on its nuclear power, and if energy prices fall, as Japan renegotiates longer gas, coal and oil contracts, and even if more gas becomes available worldwide, Japan's new trade deficit seems likely to stay.

On Japan's 11.5 trillion yen trade deficit, roughly 7 trillion of this is energy. The largest increases were found in Heavy Fuel Oil and Natural Gas, mostly to power fossil fuel plants *in lieu* of nuclear generated electricity. Many "local" countries inadvertently benefitted from Japan's energy woes. Malaysia, South Korea, and Indonesia accounted for 90% of all Heavy Fuel Oil Imports. Other traditional suppliers of Gas (Kuwait, for example) but new suppliers like Equatorial Guinea also got huge boosts to exports, to fill Japan's enlarged appetite for energy in the world markets.

The other 4 trillion yen or so of new imports, however, are goods non-energy related. It is this shift, which occurred apparently at the time as the disaster, but almost entirely unrelated to the 3-11 disaster, that drives Japan's persistent deficit in the foreseeable future. [Iron Ore, almost always in the top ten imports, still contributes more than 10% of Japan's deficit.]

As we saw in Section 5, there were some surges in some food and water imports in the 2011. Some were clearly disaster-related, whereas for other products (such as seafood and other foodstuff) assigned the cause to 3-11 is difficult. In any case, foodstuffs, aside from seafood, are not in the top imported commodities. Also, any surged seemed to be confined to a year, or even less. Beef imports are up dramatically, and added approximately 1% to Japan's trade deficit. This will only rise. However, levels are still below the pre-BSE levels, especially for the US. It could be argued that the disaster opened up policy space between US and Canada and Japan, and sped up "normalization" in beef imports. It remains to be seen how much more beef and other food imports in Japan will be opened up as the Trans-Pacific Partnership (TPP) talks continue in 2014. Food prices are also high globally. While food imports in quantity terms have not risen dramatically, in value terms they have. This adds significantly (perhaps 10%) to Japan's new trade deficit.

Examining the broad categories of machinery and other industrial imports, we see that the "China effect" still continues. The fact that air conditioning units alone, mostly imported from China, accounted for about 1% of the Japan's deficit testifies to the fact that offshoring of production to low-cost countries continues, and continues to contribute to Japan's large and growing trade deficit. Of course, PET bottles and PET plastics also accounted for 1% of Japan's deficit.

Another new addition to the top ten imported goods is the importation of cell phones and other wireless devices. Imports have skyrocketed in recent years. Sony lost its lead in consumer

electronics ever since the Ipod (not Iphone) came to market, and perhaps before. But this shift continues. Cell phones were in the top ten imported goods at a 9 digit level, and accounted for a staggering 15% of the trade deficit. While new cell imports, a somewhat durable good, may peter out, the general trend of new consumer electronics coming from China and Korea, rather than Japan may be the norm.

Yet another surprising find was the large and sustained increases in imported medicines and vaccines. Accounting for about 20% of trade deficit and 2% of all imports, this sector's contribution to the deficit may only grow, unless a radical transformation of Japan's medicine and pharma industries occur. As Japan's society ages one can only surmise that the demand for medicines will grow. If Japan does not have a comparative advantage in this sector, much of its senior citizens' (and taxpayer subsidized health insurance funds) monthly pensions will go to firms' abroad in EU and the US.

Lastly, it remains to be seen how much of an advantage cheap energy may give to the US chemicals and other sectors due to cheaper energy through fracking. Also, how much of this will feed into Japan's trade deficit (of which Japan current has a great deal of two-way trade in) remains to be seen. Ultimately, if the US fracking industries dreams are realized and a great deal more natural gas comes online, this will enter Japan's trade deficit either directly, through the imports of more natural gas or indirectly through energy-intensive exports from the US.

The trade deficit is, of course, comprised of imports and exports. This paper has only looked at the import side in detail. We did found, however, that exports of Japanese foodstuffs did have a sharp fall in the period immediately after 3-11 and Fukushima. But this appears to have been short-lived.

Of course, a trade deficit driven by greater cost savings overseas resulting in cheaper goods for consumers in Japan should be a seen as a benefit. But it is important, especially for macro policy, to understand exactly *why* one of the largest trade surplus countries in the world has suddenly come to have a large trade deficit. The answer does not lay solely with the 'Fukushima effect' and new energy imports. Nor does this situation seem likely to change in the foreseeable future.

Acknowledgements

I would like to thank the Social Science Research Council (SSRC)/US-Japan Abe Fellowship ('12) for generous funding for travel to the US as well as in Japan and the resources to complete this work. This work was started while I was a Visiting Professor at University of Hawaii Mano'a and so I am very grateful for the support of the Chair, Professor Byron S. Gangnes, and the warm welcome and helpful insights I received from the broad and talented faculty there. Comments from participants at the Abe Fellows' retreat in Tarrytown, NY in January of 2014 also gave me invaluable advice on both this work and paths for future related work.

7. References

Asanuma, B. (1989), "Manufacturer-Supplier Relationship in Japan and the Concept of Relation-Specific Skill," *Journal of the Japanese and International Economies*, 3: 1-30.

Bachev, and Ito (2013) "Fukushima nuclear disaster - implications for Japanese agriculture and food chains," Munich Personal RePEc Archive Working Paper available online at: http://mpra.ub.uni-muenchen.de/49462/1/MPRA_paper_49462.pdf

Bergsten, C. Fred (1993), "Good and Bad of Managed Trade," *The Financial Times*, Aug. 18, p.10.

Bhagwati, Jagdish, "A New Vocabulary for Trade," August 4th, 2005, *Wall Street Journal* . available online here: http://yaleglobal.yale.edu/print/2616

Burch, Karly (2012), "Consumer perceptions and behaviors related to radionuclide contaminated food: an exploratory study from Kansai, Japan" Master's Thesis, Norwegian University of Life Sciences, available in pdf form, online here: http://brage.bibsys.no/umb/handle/URN:NBN:no-bibsys_brage_34946 Last accessed November, 18, 2013.

Campa, J.M. and Goldberg, L. S. (2002), "Exchange Rate Pass-through into Import Prices: A Macro or Micro Phenomenon," NBER WP 8934.

Food and Agricultural Organization (2011) FAO Food Outlook: Fish & Fishery Products, November 2011, available online at http://www.fao.org/docrep/014/al981e/al981e00.pdf accessed most recently September 2013.

Gassebner, M., Keck, A. & Teh, R. (2010). Shaken, not stirred: The impact of disasters on international trade. Review of International Economics, 18(2) 351-368.

Greaney, Theresa (2000) "Righting past wrongs: can import promotion policies counter hysteresis from past trade protection in the presence of switching costs?" *Japan and the World Economy* 12, 211-227.

Hayashi, Toshihiko (2012) "Japan's Post-Disaster Economic Reconstruction: From Kobe to Tohoku," *Asian Economic Journal* 26 (3), 189-210.

Horioka, Charles Yuji (1991) "Future Trends in Japan's Saving Rate and the Implications Thereof for Japan's External Imbalance." *Japan and the World Economy* 3, pp. 307-330.

Hosono, Hiromi, Kumagai, Yuko, and Tsutomo Sekizaki (2012) "How do Japanese Consumers Perceive Radiation Risks in Food?" *Japanese Journal of Risk Analysis*; ISSN:0915-5465; VOL.22; NO.4; PAGE.243-249.

Hosono, Hiromi, Kumagai, Yuko, and Tsutomo Sekizaki (2013) "Consumer Awareness and Attitude on Radiocesium Food Contamination Following Fukushima Incident" *Journal of Disaster Research*, Vol.8, No.7, 2013.

Itoh, Shoichi (2013) "Energy Security in Northeast Asia: A Pivotal Moment for the U.S.-Japan Alliance," March 2013, accessed online August 10th, 2013. Opinon (Column) at Brookings Instititue, online at: http://www.brookings.edu/research/opinions/2013/03/12-energy-security-itoh

Iwata, Mari, February 20, 2013 "Japan LNG Imports Peak on Receiving-Capacity Bottleneck" Dow Jones Newswires online accessed on October 15, 2013 here: http://www.rigzone.com/news/oil_gas/a/124476/#sthash.tegjkGHv.dpuf

Iwata, Mari, July 8, 2013, "Japanese Utilities Apply to Restart Some of their Nuclear Reactors," *Wall Street Journal*, online, available at online.wsj.com. Last accessed at October 14th, 2013.

Iwata, Mari, July 24, 2013, "Natural-Gas Demand Slips in Japan, World's No. 1 Importer"

JETRO, Japan External Trade Organization (2011), "Guidebook for Export to Japan (Food Articles, Soft Drinks) March, 2011. Pdf download August 2013, from http://www.jetro.go.jp/en/reports/market/pdf/guidebook_food_soft_drinks.pdf

Johnson, Renée (2011) "Japan's 2011 Earthquake and Tsunami: Food and Agricultural Implications", April 13, 2011 Congressional Research Service paper, available online at: http://fpc.state.gov/documents/organization/161583.pdf

Kasa, Kenneth (1997), "Get Ready for Japanese Trade Deficits," FRBSF Economic Letter 1997-28. Available here: http://www.frbsf.org/economic-research/publications/economic-letter/1997/october/get-ready-for-japanese-trade-deficits/

Kimura, Fukunari and Mitsuyo Ando (2012) "How did the Japanese Exports Respond to Two Crises in the International Production Networks? The Global Financial Crisis and the Great East Japan Earthquake," *Asian Economic Journal* 26(3) p 261-287.

Lagorce, Aude (2011) "Luxury-goods stocks slump after quake:
Analysts say material impact on profits unlikely," March 15, 2011.*The Wall Street Journal*, online MarketWatch. Available here: http://www.marketwatch.com/story/luxury-goods-stocks-drop-after-japan-quake-2011-03-15 last accessed November 18, 2013.

Ledesma, David (2013) "East Africa Gas: Potential for Export," online mimeo published by The Oxford Institute for Energy Studies, March 2013, available at http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/03/NG-74.pdf, accessed October 15, 2013.

Mayeda, Andrew and Betty Penty (2013), "Abe Says Japan, Canada Agree to Cooperate on Natural Gas" September 24, 2013 Bloomberg news online. Accessed October 15th at http://www.bloomberg.com/news/2013-09-24/abe-says-japan-canada-agree-to-cooperate-on-natural-gas.html

METI (2012) White Paper on Trade 2012 available at: http://www.meti.go.jp/english/report/downloadfiles/2012WhitePaper/

Nelson, Phillip (1970) "Information and Consumer Behavior," *Journal of Political Economy* 78, 311-329.

Otani, Akira, Shiratsuka, Shigenori, Shirota, Toyoichiro, "The Decline in the Exchange Rate Pass-Through:Evidence from Japanese Import Prices," Bank of Japan IMES Discussion Paper No. 2003-E-1 available online at www.imes.boj.go.jp.

Persily, Larry (2013) "Japan reminds LNG suppliers coal is an option" October 2, 2013, available online at: http://www.arcticgas.gov/japan-reminds-lng-suppliers-coal-is-option accessed October 15, 2013.

Samuels, Richard J. (2013) 3-11: Disaster and Change in Japan, Cornell University Press, Ithaca, NY.

Schnell, Molly K. and Weinstein, David E. (2012) "Evaluating the Economic Response to Japan's Earthquake" RIETI Policy Discussion Paper Series 12-P-003.

Spence, Michael A. (1981) "The Learning Curve and Competition," *Bell Journal of Economics*, XII, 49-70.

Tanaka, Nobuo (2011) "Securing a Future Energy Supply in a Sustainable Manner," RIETI column, July 2011. Accessed September 19, 2013 at: http://www.rieti.go.jp/en/about/Highlight_37/chap5.pdf

Todo, Yasuyuki, Nakajima, Kentaro and Petr Matous (2013) "How Do Supply Chain Networks Affect the Resilience of Firms to Natural Disasters? Evidence from the Great East Japan Earthquake," RIETI Discussion Paper Series 13-E-028.

US Energy Information Agency (EIA, 2011) Country Analysis Brief: Japan, found at: http://www.eia.gov/countries/cab.cfm?fips=JA

Wakasugi, Ryuhei and Tanaka, Ayumu (2013) "Recovery from the Mega-quake in Japan: Evidence from Manufacturing Firms," Discussion Paper #687 by Kyoto Institute of Economic Research, at http://www.kier.kyoto-u.ac.jp/DP/DP867.pdf

Westlake, Adam (2012) “Japan looking to Mozambique for fossil fuel tie-up” Japan Daily Press, online, accessed here: http://japandailypress.com/japan-looking-to-mozambique-for-fossil-fuel-tie-up-3017507/ on October 15, 2013.