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Yen's Trade Spillover*

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While some exporters to the world markets for goods may be hurt by a cheaper yen, others will benefit from lower input costs, to the extent that they source parts and components from Japan for processing, assembly and reexport. This paper formalizes these intuitions and tests them against data covering more than 90% of world trade at the product level, between 2000 and 2011. For countries and products facing Japan's strongest competition, a 10% appreciation of the yen lowers exports by more than 3%, a sizeable pass through. Elsewhere, the impact is negligible, particularly when vertical trade is accounted for.

JEL Classification: F12, F13, F14
Keywords: export competition, exchange rate spillover, Abenomics, Japan, Korea

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1. INTRODUCTION

The Japanese yen depreciated sharply in late 2012 and the first half of 2013, as markets reckoned with the country's new policy stance promoted by Prime Minister Shinzo Abe. In an all-out effort pulling the economy out of its long slump, 'Abenomics' entails a combination of government fiscal stimulus and Bank of Japan (BOJ) expansionary monetary policy, combined with labor market and other structural reforms that would seek to further Japan's economic performance in the long run.

The real economic outcome of Japan's ambitious reform plan has yet to crystalize. So far, its effects have been felt mostly in the stock and money markets, which reacted sharply to BOJ's policy turnaround and newly found vigour. Currency markets followed suit: between July 2012 and April 2013, the yen lost about a quarter of its value against currencies such as the U.S. dollar, the euro, and the Korean won (figure 1).

These sudden adjustments have dismayed several of Japan's competitors in the foreign goods markets, fearing an Abenomics spillover in terms of stiffer competition or foregone market shares. Making matters worse is that this threat comes at a time of sluggish and uncertain global demand. Korea's[1)] finance minister has given such sentiments expression at the margins of the April 2013 meeting of the G20, pointing out that "[...]a sliding yen is having considerable impact on the real economy of South Korea[.]" [2)]

In the face of persistent deflation, Japanese authorities view their monetary stance as legitimate intervention in support of an ailing economy. Moreover, it may be argued that the yen's recent depreciation reverses a sustained period of appreciation that started in 2007 and lasted until 2012 (figure 1) and that, in any case, recent trade data fail to portray a drop in exports that could be ascribed to the yen depreciation without a counterfactual at hand. Actually, Korean exports have been roughly at level since mid 2012, the

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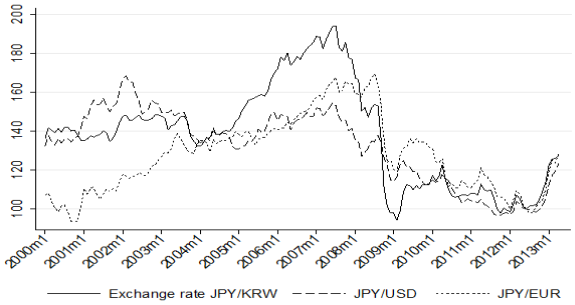
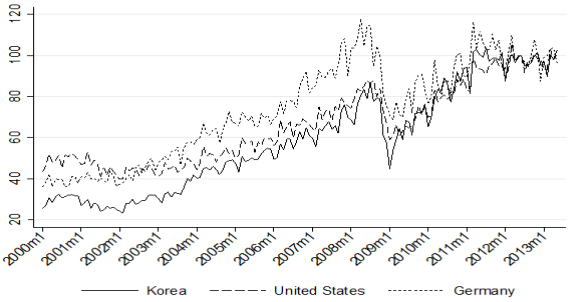
1) The ADB official designation of the country is 'Republic of Korea'.
2) (www.bloomberg.com/news/2013-04-18/south-korea-says-yen-bigger-issue-than-north-Korea.html), accessed 19 April 2013.

Figure 1 Exchange Rates Index



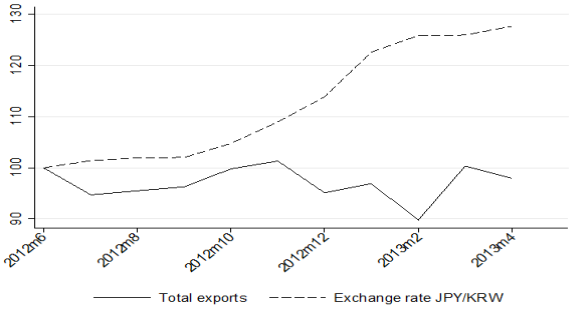
Source: Author's calculations, based on IMF International Financial Statistics (2012m6=100).

Figure 2 Total Exports Index



Source: Author's calculations, based on IMF International Financial Statistics (2012m6=100).

Figure 3 Korea's Exports and Exchange Rate



Source: Author's calculations, based on IMF International Financial Statistics (2012m6=100).

usual ups and downs of monthly data notwithstanding (figures 2 and 3).

Be that as it may, there is no denying that Korean and other exporters must have been experiencing sharper competition and a squeeze of margins from yen's sharp depreciation, and some even a loss of market shares to Japanese exporters. Anecdotal evidence in that regard has been fueling stakeholder's concern during the past few months. For an assessment of the matter on grounds less elusive and selective than the anecdotal, a systematic empirical analysis of Japan's competition in the international goods markets and of the yen's impact on global trade appears both timely and relevant.

Because of the time lag with which detailed, product-level international trade data become available in the public domain, a direct assessment of Abenomics' trade impact is not a feasible option for empirical investigation at this time of writing. Instead, the trade data available allows for an assessment of the impact of the Japanese yen on competing countries' exports over a period predating Abenomics. This sheds light on these countries' sensitivity to sharp shifts in their exchange rates to the yen and provides an indirect measure of exporters' vulnerability to increased competitive pressure from Japanese firms contesting the same markets overseas.

This paper uses a finely detailed global trade matrix and a suitably defined index to identify and rank the key products, destinations and exporters facing Japan's competition in global merchandise trade. For example, competition is assessed in terms of Korea's contention of Japan's exports share in the Chinese market for imported photographic paper and related chemicals. Similarly assessed are each of the 1,215 product categories, 117 exporters and 53 importing countries included in the analysis, covering more than 90% of world trade.

The competitiveness index by exporter-importer country pairs and products is then merged with data on yearly average exchange rates of the yen against the currencies of the economies Japan and its competitors export to. The ensuing data set spans over nearly 10 million observations. It is suitable to the application of a fixed-effect panel estimation technique involving more than one million indicator variables, in an attempt to circumvent the bias from the likely presence of endogeneity, or

indeterminacy as regards the causal relationship between exports and exchange rates.

Regression analysis yields robust evidence of the yen exchange rates impacting global trade flows. This finding is consistent and statistically significant across various model specifications. However, the estimated magnitude of the yen's impact on trade suggests that while this matters for countries and market segments facing Japan's strongest competition, it does less so for the bulk of world trade. That is, for the top 5% competing products and destinations serviced by both Japanese and other exporters, a 10% depreciation (appreciation) of the yen against the local currency at destination lowers (raises) competing export flows by about 3.2% on average. For the remaining 95% of observations in the data set, the relationship is statistically irrefutable but practically irrelevant.

The regressions also suggest that, in the presence of vertical trade between Japan and its competitors, a depreciation of the yen may constitute an advantage rather than an adversity, by reducing the import price of Japanese parts and components for processing, assembly and reexport. Indeed, when vertical trade is accounted for in the regressions, the net effect of change in the value of the yen turns out to be negligible, because competition in the final goods markets and complementarity through trade in intermediates roughly cancel each other out.

The remainder of this paper is structured to sketch out, in section 2, the empirical framework underlying the analysis. Section 3 discusses the data, and section 4 illustrates Japan's position as an exporter competing in the world markets. Section 5 evaluates the regression results, and section 6 concludes.

2. EMPIRICAL FRAMEWORK

The empirical framework rests on Mattoo *et al*. (2012).[3] This simple

[3] In turn, Mattoo *et al*. (2012) rest their model on Feenstra *et al*. (2012). For a more

framework defines the spillover effect of the Japanese exchange rate E^{Jj} on exports of product h from exporter *i* to importer *j*, X_h^{ij}, as an interaction of a competition index C_h^{ij} with a parameter ϕ_h^j that embodies elasticities of consumption and the degree of pass-through of prices in Japan to the importing country *j*:

$$\frac{\partial \ln X_h^{ij}}{\partial \ln E^{Jj}} = C_h^{ij} \phi_h^{ij}. \tag{1}$$

C_h^{ij} is an index of competition in product market *h* between country *i* and Japan's exports to *j*. It is computed across all the Harmonized System (HS) 6-digit products exported by both Japan and *i* to *j*, as the share of Japan in *j*'s total imports of good *h*, $M_h^{Jj} / \sum_i^H M_h^{ij}$, weighted by the share of good *h* out of the HS 4-digit aggregate $(h \in H)$ it pertains to, $X_h^{ij} / \sum_h^H X_h^{ij}$:

$$C_h^{ij} = \sum_h \left[\frac{X_h^{ij}}{\sum_h^H \sum_h^{ij}} \frac{M_h^{Jj}}{\sum_i^H M_h^{ij}} \right]. \tag{2}$$

For example, if there are two types of video recording or reproducing apparatus (HS code 8521) — the magnetic tape-type (852110) and 'others' (852190) — then competition in this sector is defined as Japan's share in country *j*'s imports of each of the two types of video equipment, weighted by the importance of magnetic tape-type vs. other equipment in country *i*'s total video equipment exports to country *j*.

Consumption elasticities and pass-through are denoted by the parameter ϕ_h^j, which is a composite of the elasticity of substitution (σ_h) among the import varieties of good *h*, the elasticity of substitution (ω_h) between domestic and imported varieties of *h*, and of the product-specific exchange

comprehensive discussion of the underlying model, the reader is referred to Mattoo *et al.* (2012). Here, the focus is on its empirical implementation with application to Japan and its expansion to also reflect the vertical dimension of trade, involving the cross-border movement of parts and components.

rate pass-through (μ_j^h) from prices in Japan to the importing country *j*:

$$\phi_h^j = \mu_j^h(\omega_h - \sigma_h). \tag{3}$$

The estimation strategy rests on the assumption that the elasticities of substitution and pass-through are constant within HS 4-digit categories, thus requires no prior knowledge about the parameters in ϕ_h^j. A testable proposition accrues from equation 1, which postulates that the magnitude of the exchange-rate spillover is directly proportional to the degree of competition between Japan and the other exporters. That is, if we rank countries by descending degree of competition with Japan within any particular product category and destination, we would expect a depreciation of the yen to cause top-listed countries' exports to drop most strongly. We test this proposition with the following estimating equation:

$$\ln X_{ht}^{ij} = \beta C_h^{ij} \ln E_t^{Jj} + d_{ht}^{ij} + \varepsilon_{pt}^{ij}, \tag{4}$$

where the left-hand side variable X_{ht}^{ij} now carries the time subscript *t*, reflecting the longitudinal time series dimension of exports aggregated at the level of 4 digits of the HS goods classification. The product-level competition index C_h^{ij} is interacted with E_t^{Jj}, which is defined as the exchange rate of the Japanese yen to the importing countries' currency, for example ¥/$. To minimize endogeneity issues, the index is computed at the start of the assessment period (*t*=1).

The coefficient β estimates the spillover effect, that is the elasticity of exports to changes in the exchange rate of the yen against importing countries' currencies. We expect this coefficient to take on a negative sign, because a depreciating yen is postulated lowering competing exporters' sales in the contested market. The adopted exchange rate notation implies that a depreciation of the yen, say against the U.S. dollar, raises the ratio *E*=¥/$, while the competition index is always positive, its size determining the intensity of the exchange rate effect.

d_{ht}^{ij} is a vector of exporter, importer, product and time fixed effects, which enter the regressions in the form of a full set of dichotomous variables for each to the four dimensions (i, j, h, t) taken individually and also combined as three-way permutations, to control for a nearly exhaustive spectrum of endogeneity. It should be noted that this specification of fixed effects encompasses an effective control of income and business cycle effects, as well as of any ideosynchratic shocks affecting the export capacity of any one supplying or buying nation, or of any particular industry at any given time. Examples of possible sources of bias this technique controls for range from idiosyncratic growth and income effects; to floods hampering Thailand's export capacity; to subsidies to Japanese rice farmers; to the global financial crisis triggering a temporary slump in world trade. One important limitation of this approach is its incapacity to control for variations that would involve all four the dimensions simultaneously, such as for example changes over t across j's market access provisions that vary across both i and h.

Finally, we extend the empirical framework to reflect international production sharing and vertical trade among competing exporters. Such extension appears particularly relevant in view of Japan's role as a key supplier of parts and components to the Asian and global production networks (Cheng and Kierzkowski, 2001; Ando and Kimura, 2003; Elms and Low, 2013). To the extent that competing exporters in our sample rely on Japanese parts and components for their exports, a depreciation of the yen against their currencies is expected to increase their exports if lower input costs translate into lower prices of the processed or final goods they supply to the world markets.[4] For example, a drop in the value of the yen will lower the price of Japanese micro circuits used in the production of U.S. consumer electronics, as well as the price of Japanese auto parts, thereby increasing U.S. exporters' ability to price their products competitively.

Trading partners' dependence on Japan's parts and components is best gauged by the network trade index or NTI (N_h^{iJ}) introduced in Ferrarini (2013). For the purpose of the analysis here, N_h^{iJ} is best defined as the share

[4] The opposite will hold true for an appreciation of the yen.

of Japan's components (o_h^J) in country i's total imports of parts and components ($\sum_i o_h^i$) weighted by the share of (2-digit) sector h in i's total final goods exports, ($f_h^i / \sum_i f_h^i$)[5] Sector-specific N_h^J measures are the weighted sum across countries i, and the country-specific N^{ij} is derived as the weighted sum across sectors h:

$$N_h^{ij} = \sum_h \sum_{j \neq i} \frac{c_h^J}{\sum_i c_h^i} \frac{p_h^i}{\sum_i p_h^i}. \quad (5)$$

The index augments the estimating regression in equation (4) through the addition of the term $\gamma N^{ij} \ln E_t^{iJ}$ which interacts the network trade index with the exchange rate of the yen vis-a-vis the currency of the importer of parts and components. The ensuing expression is:

$$\ln X_{ht}^{ij} = \beta C_h^{ij} \ln E_t^{Jj} + \gamma N^{ij} \ln E_t^{iJ} + d_{ht}^{ij} + \varepsilon_{pt}^{ij}. \quad (6)$$

Contrary to β, which we expect to be negative, the γ coefficient should be estimated positive, reflecting opposite impacts in relation to horizontal and vertical trade relationships between competing exporters.

3. DATA

Equations (4) and (6) are estimated against yearly panels that combine bilateral trade with exchange rate data. For a matrix of bilateral trade data disaggregated at six digits of the HS-1996 product classification, we draw on the latest *Banque analytique de commerce internationale* (BACI) data set. BACI itself is based on the COMTRADE database maintained by the United

[5] To the NTI, the larger the share of parts imports from a given partner country within a given industry, the greater is that partner's importance to the importing country's network of industrial relations. By the same token, the larger the share of that industry in the country's total exports of final goods, the more relevant a network partner is deemed as a supplier of inputs to that industry.

Nations Statistics Division (UNSD).[6] Product disaggregation at six digits of HS distinguishes more than 5,000 different products traded by more than 200 countries, with yearly data spanning from 1998 to 2011.

Observations for 1998 and 1999 are dropped, to avoid the trade distortions from the Asian Financial Crisis and its aftermath. Trade in fuels (HS category 27) is excluded, for a sharper competitiveness index in view of Japan's lack of significant exports in this category.

To avoid clutter, we drop exports by the smallest countries, except Asian and Pacific countries.[7] We also drop imports by all but the largest countries. This leaves us with data on 117 exporters and 53 importers, trading in 5,111 categories at HS six digits and 1,215 categories at four digits, and which combined account for more than 90% of average global trade flows during the 2000-2011 period of analysis (Annex table A1) Taipei,China is not part of the analysis because it is not explicitly coded in the United Nations database underlying BACI.

The trade data is deflated by the U.S. consumer price index and merged with (period-average) yearly bilateral exchange rate data of importing countries' currencies vis-a-vis the yen. To reflect the transmission of Japanese domestic prices, bilateral exchange rates are deflated by Japan's consumer price index.

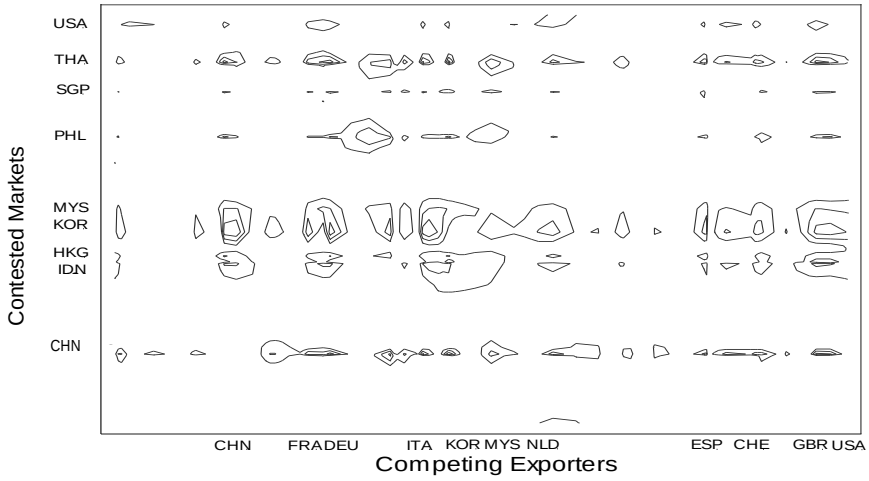
4. COMPETING WITH JAPAN IN THE GLOBAL GOODS MARKETS

Figure 4 is a contour plot profiling Japan's competition in the world markets,

[6] The BACI data set is compiled by the French Centre d'Êtudes Prospectives et d'Informations Internationales (CEPII). Compared to the underlying UNSD data, BACI offers the advantage of reconciled importer and exporter records, for a more consistent and balanced world trade matrix of bilateral flows. For a description of the data set, see Gaulier and Zignago (2010).

[7] Asian and Pacific countries are kept in the data set for a comprehensive account of developing Asia, although smaller countries' narrow trade baskets are not expected to display a great deal of competition with Japan.

Figure 4 Japan's Exports Competition Profile



Note: International Standards Organization (ISO) 3-digit alphabetic codes, listed in Appendix table A1.
Source: Author's calculations.

measured by the index C_h^{ij} in equation 2.[8] The markets contested are lined up on the vertical axis. Competing exporters are placed along the horizontal axis. Ordering along both the axes is alphabetical. The main competing exporters and destinations are marked with corresponding country ISO codes, which are spelled out in table A1.

Relevant are the contours of the C_h^{ij} index at the top quartile of its distribution. That is, figure 4 highlights but the strongest instances of competition associated with the exporter-importer-product combinations in the sample. Among the export destinations, the contours are most prominent in relation to East and Southeast Asian markets, as well as the U.S. Among the top exporters competing with Japan, figure 4 highlights PRC (China)[9] and Korea, as well as the U.S. and a number of European countries.

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[8] Figure 4 offers a synthetic view at the data. Essentially, a contour plot allows for the representation of the space dimensions, that is width, depth and height. The contours represent slices through the height dimension.

[9] The ADB official designation of the country is 'People's Republic of China'.

Figure 5 Top Exporters Competing with Japan

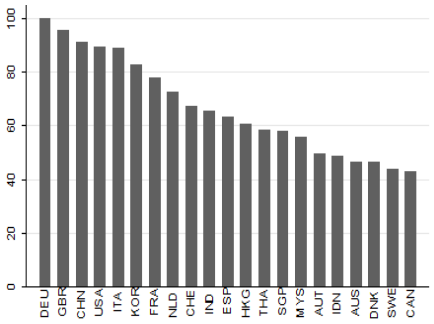
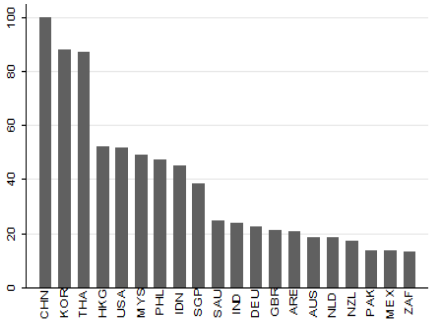


Figure 6 Top Destinations Japan Competes In



Notes: 1) Includes countries with a competitiveness index above the median. 2) International Standards Organization (ISO) 3-digit alphabetic codes, listed in Appendix table A1.
Source: Author's calculations based on CEPII-UN COMTRADE data.

The relative intensity of competition across product categories emerges further from figures 5 and 6, ranking exporters and destinations above the median of the C_h^{ij} distribution. Greater detail is provided in Annex tables A2 to A4, which break down the index by exporters, importers and products. Besides the U.S. and several countries in Europe, PRC (China), Korea and Thailand stand out as the most hotly contested markets by Japan and the other exporters. They themselves compete with Japan in markets such as Malaysia, Philippines, Indonesia (table A3).

Germany ranks as the single strongest competitor with Japan across product markets and importers, and is associated with a cumulative competitiveness index equal to 100, its normalized maximum. The top row in table A2 also shows that, among all the destinations of German and Japanese exports, competition is strongest in the Korean product markets (94.6). Korea is also the top destination of Chinese, U.S. and Italian exports competing with Japan.

In the full set of exporter-importer combinations, competition is fiercest between Korea and Japan for exports to the Chinese product markets (table A3). The two countries compete in a broad range of markets, such as textiles, chemicals, metal foils and tubes, musical instruments, sewing and

weaving machines (table A5).

Motor vehicles and related parts and accessories are products with the strongest competition between Japan and the other exporters, followed by instruments, machinery, electrical and electronic components (table A4). Japan's main competitors are thus countries with a strong foothold in the automotive or electronic industries, such as Germany, the United States, and Korea.

In sum, all evidence points to Korea as a country that it is indeed heavily exposed to Japanese exports, be it as a competing exporter or as an importer of goods from countries that are in competition with imports from Japan. The net effect of Korea's exposure to a depreciating yen will be either positive or negative, depending on the intensity of competition in each consumer market, the corresponding price elasticities of Korea's exports and imports, and the degree of vertical integration the countries production and trade. Whatever the net effect, which is difficult to gauge, the degree of exposure of Korean exporters to Japan's competition arguably justifies the Korean government's sensitivity toward sharp movements in the won exchange rate to the yen.

5. ESTIMATES OF YEN′S TRADE SPILLOVER

Table 1 lists the regression results from the estimation of equations 4 and 6. Shown are the core specification (equation 4), in column 1; robustness tests involving different combinations of fixed effects or a differently defined competition index, in columns 2 to 5; and the specification controlling for vertical trade (equation 6), in column 6.

The top coefficient in column 1 corresponds to β in equation 4. As expected, the sign of the coefficient is negative (–0.113). A very small cluster-robust standard error attests a high statistical significance. The R^2 statistic is relatively large, at 0.31, mainly on account of the broad set of fixed-effects indicators included in the regression.

Table 1 Panel Regression

Regressor: $\ln X_{ijht}$	(1)	(2)	(3)	(4)	(5)	(6)
$C_h^{ij} \cdot \ln E_t^j$	–0.113*** (0.00630)	–0.0840*** (0.00640)	–0.0753*** (0.00664)	–0.0758*** (0.00666)		–0.0676*** (0.00644)
$S_h^{ij} \cdot \ln E_t^{Jj}$					–0.0756*** (0.000318)	
$N^{ij} \cdot \ln E_t^{Jj}$						0.0461*** (0.00396)
Constant	0.567*** (0.003)	2.056*** (0.193)	1.488*** (0.114)	5.104*** (0.115)	1.774*** (0.180)	1.431*** (0.01501)
Fixed Effects Excluded	None	*ijh*	*ijh, ijt*	*ijh, ijt iht, jht*	None	None
Observations	9,671,927	9,671,927	9,671,927	9,671,927	9,671,927	9,099,610
Clusters	1,115,735	1,115,735	1,115,735	1,115,735	1,115,735	1,013,465
R-squared	0.309	0.152	0.169	0.147	0.363	0.359

Notes: 1) Robust standard errors in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). 2) Fixed effects include all combinations of *ijh*, *ijt*, *iht*, *jht*.
Source: Author's estimates.

Table 2 Impact of a 10% Appreciation of the Japanese Yen

Percentile	C_h^{ij}	Impact (%)
5th	0.000	–0.001
25th	0.002	–0.017
50th	0.011	–0.123
75th	0.055	–0.624
95th	0.288	–3.243

Note: Based on table 1, column 1.

Table 2 shows that the magnitude of the spillover is small for all combinations of exporters, importers and products, except for those associated with the highest competition index, that is where Japan's

competition is strongest. At the upper fifth percentile of the distribution of C_h^{ij}, a 10% appreciation of the yen lowers average exports by more than 3.2%, which is a sizeable pass through. But at the median of the competition index, or below, the impact is negligible.

This finding suggests that the bulk of international trade is largely unaffected by the yen, simply because competition with Japanese exports facing most of the exporters in most of the product categories is insufficiently strong to cause a substantial shift in importers' demand. Of course, weak transmission on average does not imply an equally mild impact at the level of specific products, many of which rank within the upper percentiles of the competition index. For example, in the sector 'Mounted lenses, prisms, mirrors and optical elements (HS 9002)', the Korea competes with Japan in 30 markets that are associated with a competition index within the top five percentiles (table A6.)

To test the robustness of these findings, alternative specifications in columns 2 to 4 of table 1 progressively exclude from the regression certain fixed-effects combinations. As a result, the estimates of β as well as the coefficient of determination are somewhat lower compared to the core regression, but the sign and level of significance appear highly robust.

Robustness is further tested in the fifth column of table 1, through the adoption of the Finger and Kreinin (1979) indicator of export similarity instead of the Mattoo *et al.* (2012) competitiveness index used in the other regressions. Denoting Japan's exports of good h to country j by X_{ht}^{Jj}, we compute the similarity index as the difference of product market shares in Japan and those in other countries, summed across the entire set of products:

$$S_h^{ij} = 1 - 0.5 \sum_h \left| \frac{X_{ht}^{ij}}{\sum_h X_{ht}^{ij}} - \frac{X_{ht}^{Jj}}{\sum_h X_{ht}^{Jj}} \right|. \qquad (7)$$

The similarity index takes value one for the case of perfect similarity of any country's export pattern with that of Japan, and value zero when there is no overlap at all. Like the competition measure, it enters the regression as an

interaction with the exchange rates vis-a-vis the yen. Column 5 shows that the estimated β coefficient on the similarity index closely matches that in column 1, in terms of magnitude, sign and statistical significance.[10)]

As an additional robustness test and model extension, described in Section 2, the sixth column of table 1 adds to the regression the Network Trade Index, N^{ij} as a control variable capturing the intensity of vertical trade between the ij country pairs N^{ij}. The additional regressand enters the analysis as a multiplicative term, interacted with exporters' exchange rates as compared with the yen.[11)]

As expected, the estimate of coefficient γ is positive: on average, countries' dependence on Japan as a supplier of parts and components translates into higher (lower) exports as the yen depreciates (appreciates) against their currencies. At –0.0676 and 0.0461, β and γ are roughly of the same order of magnitude, operating in different directions. As a result, the yen's impact on competing countries' exports is very limited when vertical trade is accounted for. Exceptions are countries that export to destinations Japan is highly competitive in (high C_h^{ij} and which at the same time do not benefit from vertical integration with Japan (low N^{ij}).

In this regard, Annex table A7 suggests that Asian countries, including the Korea, tend to rely heavily on Japan as a supplier of parts and components. As C_h^{ij} and N^{ij} are both high for these countries, the yen's depreciation is likely to cut both ways, toughening competition in some product lines, but improving their own competitiveness in the vertically integrated industries benefiting from lower input prices.[12)] The same is true for the U.S. and Europe, and for the key emerging markets, such as Mexico and Brazil. All these countries' reliance on Japanese inputs cushions the competitive impact from changes to the value of the yen.

[10)] Both the competition and similarity indices range from zero to one, which allows for a rough comparison between the estimated coefficients.

[11)] Note that this differs from the case of horizontal competition, where interaction is between N^{ij} and S^{ij} and importers' exchange rates.

[12)] The opposite applies when the yen appreciates.

6. CONCLUSION

There is no escaping Japan's competition in the world markets for goods, particularly in the automotive and electronics industries. Countries exporting to these markets are bound to feel the competitive pressure from a marked fall in the value of the yen. However, while some exporters may be hurt by a cheaper yen, others will benefit from lower input costs to the extent that they source parts and components from Japan for processing, assembly and reexport.

This paper has formalized these intuitions and put them to test in a rigorous empirical framework. Based on a data set covering more than 90% of world trade at the product level between 2000 and 2011, panel regression analysis confirms the hypotheses of the yen's impact via competition and vertical integration. These findings are both robust and highly statistically significant.

However, the estimated magnitude of the yen spillover is relatively small, which suggests that it only matters for those countries and products facing Japan's competition at its toughest. There, at the upper fifth percentile of the distribution of C_h^{ij} a 10% appreciation of the yen lowers average exports by more than 3%, which is a sizeable pass through. Elsewhere, the impact is negligible, particularly when vertical trade is accounted for.

Competition analysis has revealed that several countries in Asia face Japan's competition in the world markets, particularly Korea, PRC (China) and Thailand. While it is inevitable that their exporters' competitiveness will feel the impact from sharp movements in the yen, their strong vertical integration with Japan is likely to cushion the effects.

All in all, the findings in this paper suggest that the recent depreciation of the yen should not be of particular concern to the economies in the region. Of greater importance for the rest of Asia will be Japan's success or failure to revitalize its economy, in the context of which the yen's depreciation ought to be considered a temporary symptom, not a cure.

APPENDIX

Table A1 List of Countries Included in the Regression Analysis

ISO	Exporter/Importer	ISO	Exporter/Importer	ISO	Exporter/Importer
AFG	Afghanistan	GHA	Ghana	PAK	Pakistan*
ARE	United Arab Emirates*	GRC	Greece*	PER	Peru*
ARG	Argentina*	GTM	Guatemala	PHL	Philippines*
ARM	Armenia	HKG	Hong Kong, China *	PNG	Papua New Guinea
AUS	Australia*	HRV	Croatia	POL	Poland*
AUT	Austria*	HUN	Hungary*	PRT	Portugal*
AZE	Azerbaijan	IDN	Indonesia*	PRY	Paraguay
BGD	Bangladesh*	IND	India*	QAT	Qatar
BGR	Bulgaria	IRL	Ireland*	ROM	Romania*
BHR	Bahrain	ISL	Iceland	RUS	Russian Federation*
BLR	Belarus	ISR	Israel*	SAU	Saudi Arabia*
BOL	Bolivia	ITA	Italy*	SGP	Singapore*
BRA	Brazil*	JAM	Jamaica	SLB	Solomon Islands
BRN	Brunei Darussalam	JOR	Jordan	SLV	El Salvador
BTN	Bhutan	KAZ	Kazakhstan	SVK	Slovakia*
CAN	Canada*	KEN	Kenya	SVN	Slovenia
CHE	Switzerland*	KGZ	Kyrgyz Republic	SWE	Sweden*
CHL	Chile*	KHM	Cambodia	SYR	Syria
CHN	PRC (China)*	KIR	Kiribati	THA	Thailand*
CIV	Cote d'Ivoire	KOR	Korea, Republic of *	TJK	Tajikistan
CMR	Cameroon	KWT	Kuwait	TKM	Turkmenistan
COL	Colombia*	LAO	Lao People's Democratic Republic	TMP	Timor-Leste
CRI	Costa Rica	LBN	Lebanon	TON	Tonga
CYP	Cyprus	LBY	Libya	TUN	Tunisia
CZE	Czech Republic*	LKA	Sri Lanka	TUR	Turkey*
DEU	Germany*	LTU	Lithuania	TUV	Tuvalu
DNK	Denmark*	LVA	Latvia	TZA	Tanzania
DOM	Dominican Republic	MAR	Morocco*	UGA	Uganda
DZA	Algeria*	MDV	Maldives	UKR	Ukraine*
ECU	Ecuador	MEX	Mexico*	URY	Uruguay
EGY	Egypt*	MHL	Marshall Islands	USA	United States*
ESP	Spain*	MMR	Myanmar	UZB	Uzbekistan
ETH	Ethiopia	MNG	Mongolia	VEN	Venezuela*
FIN	Finland*	MYS	Malaysia*	VNM	Viet Nam
FJI	Fiji	NGA	Nigeria*	VUT	Vanuatu
FRA	France*	NLD	Netherlands *	WSM	Samoa
FSM	Micronesia, Federated States of	NOR	Norway*	YEM	Yemen
GBR	United Kingdom*	NZL	New Zealand*	ZAF	South Africa*
GEO	Georgia	OMN	Oman	ZWE	Zimbabwe

Note: Exports by all the 117 countries are included, as well as imports by the 53 starred countries.

Source: Author's listing.

Table A2 Top 50% of Exports Competing with Japan

Exporter	Top Importer/Market	$\sum_j \sum_h C_h^{ij}$	$\sum_h C_h^{ij}$
Germany	Korea, Republic of	100.0	94.6
United Kingdom	Thailand	95.2	86.7
PRC (China)	Korea, Republic of	91.2	91.7
United States	Korea, Republic of	89.2	93.2
Italy	Korea, Republic of	88.6	87.5
Korea, Republic of	PRC (China)	82.8	100.0
France	PRC (China)	77.6	75.9
Netherlands	PRC (China)	72.7	68.6
Switzerland	PRC (China)	67.2	64.7
India	Thailand	65.5	68.7
Spain	PRC (China)	63.0	63.9
Hong Kong, China	PRC (China)	60.4	82.6
Thailand	PRC (China)	58.4	66.5
Singapore	Thailand	57.7	65.9
Malaysia	Thailand	55.9	70.9
Austria	PRC (China)	49.4	53.8
Indonesia	Thailand	48.6	64.4
Australia	PRC (China)	46.4	52.7
Denmark	PRC (China)	46.3	52.4
Sweden	PRC (China)	43.9	47.7
Canada	PRC (China)	43.0	49.7

Source: Author's calculations, based on CEPII-UN COMTRADE data.

Table A3 Top 50% Destinations Contested by Japan its Competitors

Importer/Market	Top Competing Exporter	$\sum_i \sum_h C_h^{ij}$	$\sum_h C_h^{ij}$
PRC (China)	Korea, Republic of	100.0	100.0
Korea, Republic of	Germany	88.1	94.6
Thailand	Germany	87.1	89.4
Hong Kong, China	United Kingdom	51.9	58.5
United States	United Kingdom	51.7	40.4
Malaysia	PRC (China)	48.9	52.6
Philippines	Korea, Republic of	47.4	66.2
Indonesia	PRC (China)	45.2	55.9
Singapore	United Kingdom	38.5	41.6
Saudi Arabia	Germany	24.7	23.1
India	United Kingdom	23.9	24.4
Germany	United Kingdom	22.2	16.7
United Kingdom	Germany	21.0	16.1
United Arab Emirates	Germany	20.7	20.4
Australia	United Kingdom	18.4	23.0
Netherlands	Germany	18.4	16.8
New Zealand	PRC (China)	17.1	22.9
Pakistan	PRC (China)	13.7	18.9
Mexico	Germany	13.7	15.3
South Africa	Germany	13.3	16.3

Source: Author's calculations, based on CEPII-UN COMTRADE data.

Table A4 Top 5% Products by Competition across Exporters and Importers

HS Code	HS Description	$\sum_{ij} C_h^{ij}$
8708	Parts and accessories for motor vehicles	100.0
8703	Motor vehicles for transport of persons (except buses)	87.0
8511	Ignition/starter equipment, internal combustion engine	68.2
8711	Motorcycles, bicycles, etc with auxiliary motor	66.7
8482	Ball or roller bearings	61.1
8483	Shafts, cranks, gears, clutches, flywheel, pulleys, etc.	56.4
7318	Screws, bolts, nuts, rivets, washers, etc., iron, steel	55.4
8413	Pumps for liquids	54.6
8429	Self-propelled earth moving, road making, etc. machines	54.6
8479	Machines nes having individual functions	53.9
9018	Instruments, etc. for medical, surgical, dental, etc. use	52.7
8536	Electrical switches, connectors, etc.	52.3
3702	Photograph film, rolls, unexposed, not paper	50.8
8532	Electrical capacitors, fixed, variable or adjustable	48.7
8407	Spark-ignition internal combustion engines	48.2
4011	New pneumatic tyres of rubber	47.8
7304	Tube or hollow profile, seamless iron/steel not cast	47.2
8414	Air, vacuum pumps, compressors, ventilating fans, etc.	46.2
8541	Diodes, transistors, semi-conductors, etc.	45.8
8443	Printing and ancillary machinery	45.3
9010	Equipment for photographic laboratories nes	44.7
3920	Plastic plate, sheet, film not cellular, reinforced	44.5

Note: nes=not elsewhere specified.
Source: Author's calculations, based on CEPII-UN COMTRADE data.

Table A5 Top 30 Chinese Product Markets Korean and Japanese Exporters Compete In

Rank	HS Code	HS Description	
1	5513	Woven fabric, synthetic and cotton[...]	0.86
2	8103	Tantalum and articles thereof, including waste, scrap	0.82
3	2822	Cobalt oxides and hydroxides	0.82
4	2809	Diphosphorus pentaoxide, phosphoric acids	0.79
5	2846	Compounds, mixes of rare-earths, yttrium, scandium nes	0.79
6	8904	Tugs and pusher craft	0.78
7	5803	Gauze	0.76
8	3703	Photographic paper, board, etc sensitised, unexposed	0.76
9	9201	Pianos, harpsichords, keyboard string instruments nes	0.74
10	5408	Woven fabric of artificial filament, monofilament yarn	0.73
11	2808	Nitric acid, sulphonitric acids	0.71
12	8452	Sewing machines (not book sewing), related furniture	0.71
13	3707	Chemical preparations for photographic use	0.71
14	7607	Aluminium foil of a thickness<0.2 mm	0.70
15	8005	Tin foil (thickness<0.2 mm), tin powder, flakes	0.69
16	9607	Slide fasteners and parts thereof	0.69
17	9612	Typewriter and similar ribbons, ink pads, etc	0.69
18	8446	Weaving machines (looms)	0.66
19	5308	Yarn of other vegetable textile fibers, paper yarn	0.66
20	7804	Lead plates, sheets, strip, foil, powders and flakes	0.65
21	2928	Organic derivatives of hydrazine or of hydroxylamine	0.64
22	7004	Drawn or blown glass, in sheets	0.63
23	7014	Signalling glassware, unworked optical elements	0.62
24	7411	Copper pipes, tubes	0.62
25	5606	Chenille, loop whale, gimped (except metallised) yarn	0.62
26	5208	Woven cotton fabric, >85% cotton, <200g/m2	0.61
27	7109	Base metals, silver, clad with gold, semi-manufactured	0.61
28	0713	Vegetables, leguminous dried, shelled	0.61
29	5403	Artificial filament yarn (except sewing), not retail	0.61
30	7115	Articles of, or clad with, precious metal nes	0.61

Note: nes=not elsewhere specified.
Source: Author's calculations, based on CEPII-UN COMTRADE data.

Table A6 Korean Exports of Mounted Lenses, Prisms, Mirrors, Optical Elements (HS 9002)

Importer	C_h^{ij}
Pakistan	0.98
Thailand	0.85
Norway	0.72
Australia	0.72
Colombia	0.72
Algeria	0.62
New Zealand	0.59
Canada	0.58
United Kingdom	0.58
Philippines	0.58
PRC (China)	0.54
Turkey	0.51
Singapore	0.49
United States	0.48
Chile	0.47
Austria	0.45
Spain	0.45
United Arab Emirates	0.43
Czech Republic	0.41
South Africa	0.39
Finland	0.39
Israel	0.38
Germany	0.37
Peru	0.36
Saudi Arabia	0.36
Hong Kong, China	0.34
France	0.31
Morocco	0.31
Malaysia	0.31
Denmark	0.31

Source: Author's calculations, based on CEPII-UN COMTRADE data.

Table A7 Network Trade Index — Top and Bottom 30 P&C Importers from Japan

Top 30	2000	2007	Bottom 30	2000	2007
Thailand	0.357	0.636	Ecuador	0.007	0.018
PRC (China)	0.366	0.537	Saudi Arabia	0.006	0.017
Korea, Republic of	0.414	0.526	Egypt	0.006	0.016
Philippines	0.261	0.324	Morocco	0.003	0.016
United States	0.255	0.275	Greece	0.012	0.015
Malaysia	0.261	0.233	Uruguay	0.008	0.013
Viet Nam	0.267	0.225	Denmark	0.017	0.012
Hong Kong, China	0.178	0.198	Belarus	0.009	0.012
Indonesia	0.195	0.191	Norway	0.007	0.008
Mexico	0.055	0.187	Romania	0.004	0.007
Sri Lanka	0.137	0.178	Ukraine	0.001	0.006
Singapore	0.163	0.134	Kuwait	0.005	0.006
Hungary	0.071	0.094	Peru	0.022	0.006
Brazil	0.054	0.092	Tunisia	0.003	0.005
Germany	0.079	0.090	Paraguay	0.001	0.005
United Kingdom	0.085	0.085	Russia	0.003	0.005
New Zealand	0.068	0.082	Slovenia	0.020	0.005
Czech Republic	0.018	0.076	Mongolia	0.003	0.004
Turkey	0.029	0.069	Chile	0.006	0.004
Netherlands	0.055	0.062	Bulgaria	0.005	0.004
France	0.043	0.061	Macedonia	0.002	0.003
Canada	0.043	0.058	Bolivia	0.006	0.002
Spain	0.044	0.058	Latvia	0.001	0.002
India	0.056	0.053	Venezuela	0.002	0.001
Israel	0.021	0.053	Nigeria	0.000	0.001
Italy	0.040	0.047	Azerbaijan	0.000	0.001
Slovak Republic	0.016	0.046	Kazakhstan	0.001	0.000
Ireland	0.019	0.045	Turkmenistan	0.000	0.000
Belgium	0.039	0.045	Algeria	0.000	0.000
Portugal	0.039	0.043	Libya	0.000	0.000

Note: P&C=parts and components.
Source: Ferrarini (2013).

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