# Effects of Productivity and Import on Firm-Level Export

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**Abstract**

It is well known that productive firms are more likely to become exporters. Also a common fact that the majority of trading firms are two-way traders, by importing first and then exporting later. Would firms learn from past import and make more productive firms inhibit extra motivation to engage in export? This paper investigates the interaction effects of productivity and import on firm's export participation and intensity using the firm-level data of selected Swedish manufacturing industries for 1997-2006. The main findings suggest that the interaction effects are heterogeneous across industries. For basic and high-tech industries, firms with higher productivity are more likely to export and with greater extent, following previous import activities. The results also show that past import is robust and positively determine firm's participation in and intensity of export. Lastly, the direct productivity effect is greater for basic low-skilled industries than capital-intensive high-tech industries. Several robustness tests are conducted using alternative measures, timing, and estimator. The analyses contribute to the discussion of the complex relationship of productivity and firm's trade.

**Keywords:** productivity, import, export, firm-level
**JEL Classification:** F12, F14, F41

## Introduction

An export promotion programme has been implemented by policymakers in many developed and emerging countries for several decades because of its promise on job creation and economic growth. But yet we do not fully understand what drives export, especially at the firm level. The literature on firm-level trade is only recent and empirical

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studies are still considered a rarity. However, with an increase availability of comparable micro-data from the official statistics bureaus, the field is steadily being developed.

The firm-level response to a policy change is a crucial factor in understanding the impact on the aggregate economy. This prompts a shift of emphasis from trade analysis at country or industry level to a more disaggregated firm level, which is partly a result from the contributions by Melitz (2003) and Bernard, Eaton, Jenson, and Kortum (2003). This recent literature pays much attention to firms productivity in order to explain the heterogeneity of export behaviour at the firm level. Apart from the variable transport costs, firms must incur the upfront fixed costs associated with each foreign market they wish to enter. This makes only highly productive firms to be able to afford the costs and become exporters. For a survey of empirical evidences, see Wagner (2007).

The same is true for imports: there are sunk entry costs into import. Besides, it is also argued that these associated entry costs of import are complementary for export. Kasahara and Lapham (2013) provides an extension to a model by Melitz (2003) to incorporate import in addition to productivity and export. With sunk entry costs for both trading activities, the highly productive firms that wish to engage in two-way trading have to incur the costs for both import and export entry. Using the plant-level data of Chilean manufacturing industries, Kasahara and Lapham (2013) find that there is a complementarity for the two activities. Due to this complementarity and the comparatively lower entry costs of import, the majority of trading firms are more likely to become two-way traders, by importing first and later starting to export.

So, in summary, it is expected that there are direct positive effects of past productivity and import in determining current export.

Provided firms already engaged in import in the past, would there be an extra motivation for productive firms to export in the current period? Stated differently, are there interaction effects between both productivity and import? There are supporting evidences in an emerging literature of international trade that investigates the relationship between productivity and import (Aristei, Castellani, and Franco (2013); Kasahara and Lapham (2013); Lööf and Andersson (2010); Muûls and Pisu (2009); Sjöholm (2003); Vogel and Wagner (2010) among others). On one hand, there are similar entry costs into import market that put the productivity threshold on firms. Hence, only productive firms "self-select" and become importers. On the other hand, having access to international market via import of intermediate inputs can raise firms productivity, the so-called learning by importing. Such feedback between import and productivity, regardless of direction, is captured in the interaction effect in this paper and could be one driver that determines firm's export.

This paper attempts to explain firm-level export activities, in terms of participation and intensity, with productivity and import. The emphasis is mainly on the interaction effects of firms total factor productivity (TFP) and total import value in the past. The analyses employ firm-level data for six selected industries within Swedish manufacturing sector during 1997-2006. These industries are categorised by input intensity: low (Food and Textile), medium (Chemicals and Plastics), and high capital-intensive (Electrics and Vehicles) industries. This paper contributes to the limited number of empirical work that examines the complex relationship between productivity and firms trade.

The rest of the paper is organised as follows. Theoretical framework on the relationship between productivity, import, and export is presented in section 2. Section 3 describes the empirical strategy and follows with data description. The results are presented in section 5. Several robustness checks are executed in section 6. The last section concludes the paper.

## Theoretical framework

There are certain stylised facts of firm-level exports, which are common in various cross-country studies within the past decade.

1. The majority of firms do not engage in export. For those that do, they are on average bigger and more productive than non-export counterparts.

2. Of all trading firms, the majority of them are two-way traders, which engage in both import and export.

Regarding the first fact, the literature of firm heterogeneity, sometimes called self-selection literature, provides the main argument that is robust to the findings. According to the theoretical model by Melitz (2003) and Bernard et al. (2003), the sunk costs of establishing an international network set the threshold, or trade barrier, so that only big and highly productive firms can afford and *self-select* themselves into foreign markets.

Eaton, Kortum, and Kramarz (2004) first observe this pattern in French manufacturing firms and their paper inspires a number of studies in other countries, which also find similar results. Furthermore, the *productivity premia* or a gain in productivity found in exporters are also documented and confirm the prediction from the self-selection literature. In a survey of 54 firm-level studies covering in total 34 countries by Wagner (2007), the conclusion is that "exporters are more productive than non-exporters, and the more productive firms self-select into export markets."

The second fact also involves sunk costs, in a sense that they are complementary for both import and export. Firms that already paid to enter import (export) market will be more likely to engage in export (import) later because part of the upfront costs is shared. This is well demonstrated in the co-occurrence pattern of trade activities in Table 1 for the composition of Swedish firms within manufacturing sector during 1997-2006.

From the table, we can see the co-occurrence of trade activities. Most of the non-importers also do not engage in exports. This accounts for 39.16% of all manufacturing firms. Similarly, it shows that the majority of temporary importers are also temporary exporters, and accounts for 20.46% of all firms. Lastly, the majority of persistent firms are also persistent exporters, 12.27% of all firms.

Moreover, the majority of these two-way traders usually start importing prior to export. Not surprisingly, this is because imports should incur relatively lower entry costs for importers. The cost of obtaining the information on import procedures and get into contact with the right personnel is lower due to the familiarity of the importers own country. On the other hand, exporters have to deal with unfamiliar bureaucratic system

Table 1: Composition of manufacturing firms in Sweden, 1997-2006

| | Non-Importers | Temporary Importers | Persistent Importers | Total |
|---|---|---|---|---|
| Non-Exporters | **39.16** | 6.54 | 0.21 | 45.92 |
| Temporary Exporters | 11.53 | **20.46** | 2.45 | 34.44 |
| Persistent Exporters | 1.00 | 6.38 | **12.27** | 19.65 |
| Total | 51.69 | 33.38 | 14.93 | 100.00 |

**Note:** All numbers in the table are percentage of total firms, 71,569.
Only include active firms with non-zero employees.

of the destination country. Sending a personnel to initiate, negotiate, and close the deal impose considerable expenses to the firm.

Despite the explanation above, there are only a few studies on the topic. Kasahara and Lapham (2013) investigate Chilean firms and find that in all six industries under study[1] the majority of trading firms is two-way traders and in almost all industries the probability of switching from non-trader status is highest among importers. This means that among firms that have not engaged in any trade previously, most of them are more likely to try out with the import market first. Interestingly, in all six industries, firms that import in the previous period are more likely to continue with only import, exit trading, start two-way trading, and switch entirely to only export in current period, respectively. But, the other way around, this pattern is not observed in exporters[2].

In Aristei et al. (2013), they investigate the two-way relationship between export and import of 26 transitioning economies in Eastern Europe using a bivariate probit for the decision to export(import) as explained by previous import(export) status. The findings reveal that there is no effect from past export in determining current import, whereas past import increases the probability of foreign sales. This effect, however, vanishes after controlling for productivity and other firm's characteristics. On the contrary, in a study by Muûls and Pisu (2009) Belgian firms, the two trading activities have positive and similar effects on each other.

To summarise, from the two stylised facts above, it is therefore expected that there are direct effects of productivity and import in the past on current firms export for Sweden. This constitutes the first hypothesis of the paper (hereafter H1): previous productivity, measured by TFP, and import, in terms of total value, positively affect current export, in terms of participation (whether to export or not) and intensity (how much to export).

Besides the direct effects above, there is a potential interaction effect between productivity and import themselves. Two directions to this relationship can be observed. On one hand, productivity is positively related to import because of the high entry costs and only more productive firms can become importers. On the other hand, an

[1]The six industries under their study of Chilean firms are wearing apparel, plastic products, food products, textiles, wood products, and fabricated metals.

[2]Please refer to tables 3 and 4 in Kasahara and Lapham (2013).

import of intermediate inputs can increase firms productivity through global specialisation, technology transfer, and variety effect (Acharya & Keller, 2009; Lööf & Andersson, 2010).

Global specialisation effect results in a one-time increase in productivity. This is because input costs are part of productivity. Decrease in such costs through a cheaper source thus almost instantly increases the productivity. While the result of technology transfer is a rather gradual gain in productivity through greater output efficiency over time. In another work by Amiti and Konings (2007), productivity gain can also be a variety effect from import, in which firms get access to more varieties of differentiated inputs that are not domestically produced.

Regardless of the direction of causation between productivity and import, the interaction effect of the two is captured in the analysis of this paper. Its effect is expected to enhance firms export. Stated formally, the second hypothesis (hereafter H2) follows: the interaction between productivity and import in the past positively affects current export, for both participation and intensity. More productive firms are more likely to export and with greater extent in the current period, following import in the previous period.

## Empirical strategy

### *Estimation model*

This paper investigates the exporting activities of individual firms. Specifically, I model the export as a function of past productivity measured as TFP and import, controlling for annual shocks and country fixed effects, as well as various firm- and country-specific characteristics variables, which are usually employed in a gravity equation.

To write formally,

$$Epar_{ijt} = \alpha_1 Mpar_{ij,t-1} + \alpha_2 P_{i,t-1} + \alpha_3 (Mpar_{ij,t-1} \times P_{i,t-1}) + \mathbf{x}'_{ijt}\beta_1 + \varepsilon_{1ijt} \quad (1)$$

$$Eint_{ijt} = \gamma_1 Mint_{ij,t-1} + \gamma_2 P_{i,t-1} + \gamma_3 (Mint_{ij,t-1} \times P_{i,t-1}) + \mathbf{x}'_{ijt}\beta_2 + \varepsilon_{2ijt} \quad (2)$$

The dependent variable for the participation in the equation (1), $EXPpar_{ijkt}$, is the decision whether to engage in export or not . For the intensity, equation (2), the dependent variable, $EXPint_{ijkt}$, is the extent of export in terms of total value (intensity). The controls consist of firm-specific variables ($size_{it}$, $MNE_i$, $Corporation_i$), country-specific variables ($GDP_{jt}$, $population_{jt}$, $distance_j$, $contiguity_{ij}$), and fixed effects for $year_t$ and $country_j$.

For the participation equation, I estimate with probit due to the binary dependent variable. For the intensity equation, I estimate with ordinary least square (OLS). The latter estimation does not include zero exports due to potential bias from the huge amount of zeros[3] in the constructed dataset. Alternatively, Heckman selection model

[3]The number of zeros is 95.25% for Food and Beverages, 90.78% for Textiles, 85.91% for Chemicals, 87.83% for Rubber and Plastic products, 92.49% for Electrical machinery, and 93.15% for Motor vehicles.

(Type-II Tobit) is used and reported in section 6. Besides the size of the estimated coefficients, the significance and signs do not differ between the two estimators.

*Interaction effects*

The main focus of this paper is the interaction effects, of which the estimation is not straightforward and requires an explanation into how it should be performed.

In the pioneering examples of Rajan and Zingales (1998) on the financial dependence on growth, the focus is on the interaction term between industry's dependence on external finance and country's financial development. Suppose $X_1$ is the industry's external finance dependence variable, $X_2$ is the country's financial development, and $Y$ is economic growth. We can write the model simply as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \varepsilon \tag{3}$$

where $X_1X_2$ is the interaction term of interest. One of the first problem is that $X_1X_2$ will likely correlate with $X_1$ and $X_2$ by construction. Another problem will be the interpretation. A change in $\beta_3$ cannot separately be interpreted while holding other variables constant since a change in the interaction term implies a change inherent from either $X_1$ or $X_2$ or both.

In order to estimate, the standard practice is to de-mean the main variables before interacting, that is

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 (X_1 - \bar{X}_1)(X_2 - \bar{X}_2) + \varepsilon. \tag{4}$$

The resulting model fit will be exactly the same and the estimated coefficients $\beta_1$ and $\beta_2$ will be close to the model with no interaction term.

In the case of a panel, the model involves individuals (firms, industries, or countries) and time,

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 X_{1,it} X_{2,it} + \varepsilon_{it} \tag{5}$$

where $i$ denotes the individual, and $t$ denotes time.

The mean can be one of the three possibilities: (i) centering around the individuals, i.e. mean of $i$, (ii) centering around time periods, i.e. mean of $t$, or (iii) pooled altogether, i.e. mean of $it$. Balli and Sorensen (2010) recommend centering around the mean of the individuals to avoid the interaction term to capture the individual-varying slopes spuriously.

Since there are six selected industries for the analyses, the centered mean will also be calculated separately from firms within each industry in order to allow for heterogeneity between industries.

*Total Factor Productivity calculation*

One important variable for this paper is firm's productivity. Empirically, it is estimated from the production function of the firm. This is assumed to be Cobb-Douglas function,

$$y_t = \beta_0 + \beta_1 b_t + \beta_2 w_t + \beta_3 k_t + \beta_4 m_t + \beta_5 \omega_t + \eta_t \tag{6}$$

where the lowercase letter denotes the logarithmic values, $y_t$ is the output measured by value-added, $b_t$ and $w_t$ are blue- (unskilled) and white-collared (skilled) workers, $k_t$ denotes capital, $m_t$ is intermediate inputs, and error terms are denoted by $\omega_t$ and $\eta_t$.

There are two problems in estimating the above equation. Firstly, the productivity shocks, $\omega_t$ which is a state variable, are not observed and can impact inputs. For example, firms with high productivity may choose to use more inputs based on their productivity level and vice versa. This leads to the simultaneity problem, in which a serial correlation in $\omega_t$ will be correlated with inputs at time $t$. Secondly, the endogenous exit decisions can create a self-selection problem. As pointed out by Olley and Pakes (1996), a profit function is increasing in $k_t$ allows firms to operate with the lower realised productivity threshold, thus $\underline{\omega}_t(k_t)$ is a decreasing function in $k_t$. Employing the ordinary least square (OLS) estimator for equation 6 will lead to downward biases in the estimated parameters.

The estimation methodology by Levinsohn and Petrin (2003) that extends the work by Olley and Pakes (1996) uses an intermediate input as a proxy. The two-stage estimation is explained in detail for implementation in STATA software in Petrin, Poi, and Levinsohn (2004). In this paper, I calculate input usage of each firm by subtracting total sales by its value-added[4]

To allow for heterogeneity between the industries chosen for this study, I estimate the TFP separately according to each industry. However, all variables used in the estimation of the production function (and TFP consequently) are deflated using single Producer Price Index from Statistics Sweden instead of PPI by industry due to unavailability. So, there could be some measurement error bias resulting from a punishment of low-valued industries using the same index to deflate as high-valued ones.

In section 6, two alternative TFP measures are used. The first one is TFP calculated by following Olley and Pakes (1996) methodology. The main difference is the proxy used. For Levinsohn-Petrin's approach, the intermediate inputs are the proxy variable, whereas Olley-Pakes' approach use investment variable instead. For the presentation of the main results, I choose Levinsohn-Petrin's approach because there are almost none missing values for all the variables required for the estimation of firms' production function. On the contrary, the investment variable contains zeros for around 3% of total firms, which makes the estimation incomputable for these firms. The second alternative measure is a value-added per employee, which is simply labour productivity. The three measures are highly correlated, ranging from 81%-98% for Textile and Plastics, and 71%-79% for the rest. So the results should not differ enormously.

## Data

### *Dataset construction*

From the estimation model above, one can see that the dataset involves three dimensions, namely firm, country, and time. In order to manage the computation, several considerations have to be made.

[4]Alternatively, one could subtract total sales from gross profit plus wage, I construct intermediate input with this approach as well but the two results do not differ significantly.

First of all, only active firms with 50 employees and above are included. Because there are a vast amount of very small firms that contribute to a tiny share of all trade. Including them will explode the dataset tremendously and the computation will be impossible. Active firms, in this case, refer to firms with positive turnover.

Next, I exclude non-exporters from the dataset, also due to computational constraint. This leaves me with persistent and temporary exporters. In total, there are 1,296 firms under study[5]. The next step is to construct the dataset in the following way:

1. Each individual firm is matched with all 196 countries[6], forming a set of firm-country diads. This is to simulate the choice of countries that each individual firm can choose to export to.

2. The constructed diads are then matched with the years that firms are in existent (firm-country-year triads).

3. The triads are merged with data on firm's trade (export and import), firm's characteristics (total employees, corporate affiliation, etc.), and country variables.

*Variable description*

The data for the main estimation model in equations 1 and 2 comes from various sources. The disaggregated firm-level data is a merge of three databases and all obtained from Statistics Sweden. The first database is the trade data, which contains the value of exports and imports of products at 8-digit Swedish equivalent of Harmonised System (HS) classification. This database is then aggregated to firm's total exports and imports shipped between Sweden and the rest of the world.

The second database is the firm's characteristics data, also from Statistics Sweden. It is a registry of firm information that is linked to National Tax Office and include variables such as total employees, turnover, sales, net and gross profits, and so on. Both databases are joined by the unique firm identification number. Due to confidentiality reason, such identification number is anonymously generated by Statistics Sweden to protect the identity of the actual firms.

The third source is Centre d'tudes Prospectives et d'Informations Internationales (CEPII), which provides the country-level variables. The dataset used in this paper is the Gravity dataset. For more details on the description of its variables, see the Appendix section of Head, Mayer, and Ries (2010).

Table 2 lists all variables for the analyses of this paper and the expected sign. The descriptive statistics is displayed in the Appendix. Due to space, the statistics cover the six industries altogether.

## Results

The main results are presented in Table 3 below. For export participation, the interaction term, $TFP \times IMP$, show positive and significant coefficients across six industries. This suggest that more productive firms are more likely to engage in export,

[5]The composition of firms is: 305 firms in Food, 150 in Textile, 11 in Chemicals, 254 in Plastics, 304 in Electrics, and 272 in Vehicles.

[6]There are 225 countries in total but the data on many variables are not available for 19 of them.

Table 2: Variable description

| Variable | Description | Exp. Sign |
|---|---|---|
| *Dependent variable* | | |
| $EXPpar_{ijt}$ | Export status with 1 if firm I exports any products to country j and 0 otherwise. | |
| $EXPint_{ijt}$ | Logged total export value from firm I to country j in constant SEK. | |
| *Independent variables* | | |
| $TFP_{it}$ | Logged total factor productivity estimated by firm's production function according to Levinsohn-Petrin methodology. | + |
| $IMP_{ijt}$ | Logged total import value to firm I from country j in constant SEK. | + |
| $TFP_{it} \times IMP_{ijt}$ | The interaction term of TFPit and IMPijt. | + |
| *Firm-specific controls* | | |
| $Size_{it}$ | Logged total number of employees. | + |
| $MNE_i$ | Dummy variable: 1 if a firm belongs to multinationals, 0 otherwise. | + |
| $Corporation_i$ | Dummy variable: 1 if a firm belongs to a Swedish corporate group, 0 otherwise. | + |
| $HC_{it}$ | Human capital, defined as a fraction of workers with more than three years of higher education. Only used for Heckman estimation in section 6. | +/- |
| *Country-specific controls* | | |
| $GDP_{jt}$ | Logged gross domestic product of country j in USD. | + |
| $Pop_{jt}$ | Logged total population of country j. | + |
| $Distance_j$ | Logged geographic distance from Sweden using major cities' population of country j as weight. | - |
| $Contiguity_{ij}$ | Dummy variable: 1 if country j shares a border with Sweden, 0 otherwise. | + |

provided their past import experience. It is highest in Chemicals, followed by Food, Vehicles, Textile, Electrics, and lowest in Plastics. Looking at the direct effects, past import also shows positive sign throughout all industries. The main difference between this paper and the results for Chile (Aristei et al., 2013) is the strong significance even after controlling for firm and country characteristics, whereas in Aristei et al. (2013) the coefficients gradually loses significance after adding more controls. To compare the above results with Belgium (Muûls & Pisu, 2009), on the other hand, they are similar but the model specification for the probit equation is different. In Muûls and Pisu (2009), they employ a dynamic model, which includes past export as an additional independent variable. However, when we look at TFP variable, they are positive for most industries, except Chemicals and Plastics. They are positive in the other two studies, although the analyses are for manufacturing firms in general but not as separate industries.

For export intensity, the interaction term is positive and significant in all except Chemicals. Also, the TFP and import variables are positive except for Plastics and Vehicles. The hypothesis of positive interaction effects on exports (H2) seems to apply for almost all industries, whereas the hypothesis of positive direct effects of productivity and import (H1) applies well for low capital-intensive industries, Food and Textile, fairly well for the high capital-intensive industries, Electrics and Vehicles, but not so well for medium capital-intensive ones, Chemicals and Plastics.

The following section includes several tests to check for the robustness of the results. The first consideration is on alternative measurements of TFP and import. The results using two alternative TFP measures are presented. First, the TFP that is estimated with Olley-Pakes' methodology. Second, I use value-added per employee, which is a crude measure of labour productivity.

Then, I run the regressions with alternative lag years to examine the timing response and persistency of the effects. Lastly, alternative estimator is used to estimate the export intensity in the presence of frequent zeros in the data.

## Robustness checks

*Alternative TFP measure: Olley-Pakes TFP*

As an alternative to TFP estimated by Levinsohn-Petrin's methodology, the following results use Olley-Pakes' methodology, denoted by $TFP_{OP}$ in Table 4. The results are robust for Food with all positive coefficients in all three main variables and of both equations (export participation and intensity). For other industries, the significance vanishes, either in the participation (Textile and Vehicles) or intensity equation (Textile, Chemicals and Vehicles). Interestingly, the sign of the interaction effect term is reversed for Plastics and Electrics. One explanation could be the missing values in the investment variable, which is used to estimate the production function and TFP. Past import appears positive and significant in all industries for participation equation. TFP is positive and significant for Food and Electrics in both equations but turns negative or insignificant for the rest.

Table 3: Regression results of six selected industries

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | Food | Textile | Chemicals | Plastics | Electrics | Vehicles |
| | | | *Export participation* | | | |
| *TFP* × *IMP* | 0.076*** | 0.055*** | 0.100*** | 0.009* | 0.041*** | 0.068*** |
| | (0.006) | (0.008) | (0.026) | (0.005) | (0.007) | (0.007) |
| *TFP* | 0.414*** | 0.198*** | -0.111*** | -0.040** | 0.182*** | 0.161*** |
| | (0.024) | (0.020) | (0.021) | (0.017) | (0.024) | (0.034) |
| *IMP* | 0.046*** | 0.055*** | 0.065*** | 0.038*** | 0.041*** | 0.045*** |
| | (0.003) | (0.008) | (0.004) | (0.006) | (0.005) | (0.004) |
| Observations | 211,138 | 81,136 | 150,316 | 191,611 | 208,458 | 196,114 |
| Pseudo-R2 | 0.460 | 0.536 | 0.445 | 0.475 | 0.493 | 0.488 |
| | | | *Export intensity* | | | |
| *TFP* × *IMP* | 0.126*** | 0.206*** | -0.210 | 0.082*** | 0.079*** | 0.232*** |
| | (0.028) | (0.045) | (0.141) | (0.018) | (0.021) | (0.017) |
| *TFP* | 0.503*** | 0.221** | 0.618*** | -0.119 | 0.259*** | -0.205 |
| | (0.094) | (0.107) | (0.094) | (0.072) | (0.087) | (0.135) |
| *IMP* | 0.043** | 0.052** | 0.061*** | 0.102*** | 0.022 | 0.101*** |
| | (0.021) | (0.021) | (0.017) | (0.027) | (0.020) | (0.013) |
| Observations | 10,019 | 7,434 | 21,173 | 23,309 | 15,635 | 13,386 |
| R2 | 0.263 | 0.344 | 0.325 | 0.316 | 0.306 | 0.405 |

Robust standard errors in brackets.; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
All regressions include controls, year, country dummies and constant.

In summary, the results are robust for Food, while the results are mixed for other industries.

*Alternative TFP measure: Value-added per employee*

Table 5 presents the next test results. When the value-added per employee, denoted $VA$, is used as a productivity measure, the results are as expected for Food and Vehicles with all positive and significant estimates for all main variables in both equations. While for the rest of the industries, the results are similar to those with Levinsohn-Petrin's TFP. In the export participation equation, the coefficients are positive in all except Textile and Electrics, whereas for intensity equation, they are all positive except Chemicals. Import is all positive in all industries in both equations, except Electrics. VA shows mixed sign across industries in the participation equation and positive sign for all industries in the intensity equation .

Table 4: Regressions using Olley-Pakes' TFP as an alternative measure

| VARIABLES | (1) Food | (2) Textile | (3) Chemicals | (4) Plastics | (5) Electrics | (6) Vehicles |
|---|---|---|---|---|---|---|
| | | | *Export participation* | | | |
| $TFP_{OP} \times IMP$ | 0.097*** | -0.005 | 0.599*** | -0.053*** | -0.073*** | 0.012 |
| | (0.009) | (0.016) | (0.150) | (0.006) | (0.013) | (0.008) |
| $TFP$ | 0.315*** | 0.199*** | -0.240*** | -0.082*** | 0.395*** | 0.041 |
| | (0.026) | (0.034) | (0.023) | (0.015) | (0.052) | (0.028) |
| $IMP$ | 0.132*** | 0.108*** | 0.059*** | 0.078*** | 0.092*** | 0.078*** |
| | (0.009) | (0.018) | (0.004) | (0.009) | (0.010) | (0.006) |
| Observations | 161,559 | 63,706 | 150,316 | 170,625 | 163,151 | 152,731 |
| Pseudo-R2 | 0.451 | 0.516 | 0.446 | 0.472 | 0.480 | 0.467 |
| | | | *Export intensity* | | | |
| $TFP_{OP} \times IMP$ | 0.331*** | 0.193 | -1.221 | -0.177** | 0.748*** | -0.090 |
| | (0.113) | (0.143) | (0.796) | (0.084) | (0.172) | (0.118) |
| $TFP$ | 0.192*** | 0.038 | 0.212*** | 0.231*** | 0.125*** | 0.337*** |
| | (0.041) | (0.045) | (0.076) | (0.042) | (0.030) | (0.024) |
| $IMP$ | 0.140*** | 0.205*** | 0.064*** | 0.011 | -0.113*** | -0.006 |
| | (0.034) | (0.065) | (0.016) | (0.025) | (0.039) | (0.023) |
| Observations | 9,591 | 7,113 | 21,173 | 22,906 | 14,932 | 12,553 |
| R2 | 0.266 | 0.339 | 0.319 | 0.318 | 0.302 | 0.406 |

Robust standard errors in brackets.; *** p < 0.01, ** p < 0.05, * p < 0.1.
All regressions include controls, year, country dummies and constant.

*Alternative import measure*

The origin of import is argued to play a role in the productivity gain. Importing from high-income countries, e.g. G7[7], are associated with embodied technical change and technological transfer as the composition of these imports are mainly R&D driven. Lööf and Andersson (2010) This technological transfer then adds to the firm's stock of knowledge and gradually increases its performance and productivity.

To test this line of argument, the fraction of G7 import, denoted by $IMP_{G7}$, is used as an alternative measure for past import. From Table 6, one can observe the all positive TFP in all industries for both equations.

*Alternative lagged timing*

The timing of impact response from productivity and import is not uniform across firms and industries. The lead time of production, product life cycle, and seasonal trend can alter the time to realize the gain from productivity and import. In this subsection,

[7]G7 countries consist of Canada, France, Germany, Italy, Japan, UK, and USA.

Table 5: Regressions using Value-added per employee as an alternative measure

| VARIABLES | (1) Food | (2) Textile | (3) Chemicals | (4) Plastics | (5) Electrics | (6) Vehicles |
|---|---|---|---|---|---|---|
| | | | *Export participation* | | | |
| $VA \times IMP$ | 0.070*** | -0.003 | 0.192*** | 0.016** | -0.086*** | 0.074*** |
| | (0.011) | (0.016) | (0.048) | (0.007) | (0.009) | (0.009) |
| $TFP$ | 0.323*** | 0.213*** | -0.240*** | -0.002 | 0.553*** | 0.338*** |
| | (0.026) | (0.039) | (0.023) | (0.012) | (0.039) | (0.045) |
| $IMP$ | 0.124*** | 0.096*** | 0.059*** | 0.082*** | 0.071*** | 0.063*** |
| | (0.009) | (0.017) | (0.004) | (0.009) | (0.010) | (0.006) |
| Observations | 161,559 | 63,706 | 150,316 | 170,939 | 163,321 | 153,676 |
| Pseudo-R2 | 0.452 | 0.516 | 0.446 | 0.468 | 0.486 | 0.474 |
| | | | *Export intensity* | | | |
| $VA \times IMP$ | 0.430*** | 0.319** | -0.392 | 0.307*** | 1.027*** | 0.286** |
| | (0.095) | (0.127) | (0.256) | (0.077) | (0.128) | (0.118) |
| $TFP$ | 0.168*** | 0.016 | 0.212*** | 0.217*** | 0.092*** | 0.316*** |
| | (0.043) | (0.051) | (0.076) | (0.045) | (0.033) | (0.022) |
| $IMP$ | 0.109*** | 0.204*** | 0.064*** | 0.055** | -0.116*** | 0.128*** |
| | (0.033) | (0.049) | (0.016) | (0.024) | (0.027) | (0.027) |
| Observations | 9,591 | 7,113 | 21,173 | 22,948 | 14,933 | 12,611 |
| R2 | 0.269 | 0.344 | 0.319 | 0.320 | 0.313 | 0.413 |

Robust standard errors in brackets.; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

All regressions include controls, year, country dummies and constant.

three consecutive lags (one to three years) of the main variables are used. From Table 7, there is no evident direction of change over time among the six industries. However, if we look at the magnitude of the change itself, we can see the change to be relatively stable for most of the industries, except the dramatic change in $TFP \times IMP$ and $TFP$ for Textiles and Electrics. This could be attributed to the relatively faster pace of technological change within these two industries. At the moment, it is a personal conjecture with no theoretical basis to better explain it. Further examination, possibly with longer time periods, is required to reveal some valuable insights. I leave this to future research for now.

Table 6: Regressions using import from G7 as alternative measure

| VARIABLES | (1) Food | (2) Textile | (3) Chemicals | (4) Plastics | (5) Electrics | (6) Vehicles |
|---|---|---|---|---|---|---|
| | | | *Export participation* | | | |
| $TFP \times IMP_{G7}$ | 0.225** | -0.315** | -0.221*** | -2.410* | 1.293*** | -0.648*** |
| | (0.113) | (0.126) | (0.057) | (1.254) | (0.142) | (0.072) |
| $TFP$ | 0.577*** | 0.288*** | 0.005 | 0.278*** | 0.317*** | 0.297*** |
| | (0.031) | (0.029) | (0.017) | (0.019) | (0.019) | (0.037) |
| $IMP_{G7}$ | 0.405*** | 0.955*** | -0.077** | 0.119*** | -0.312*** | 0.292*** |
| | (0.074) | (0.102) | (0.032) | (0.037) | (0.053) | (0.033) |
| Observations | 211,138 | 81,136 | 191,611 | 247,103 | 208,458 | 196,114 |
| Pseudo-R2 | 0.444 | 0.539 | 0.474 | 0.494 | 0.492 | 0.472 |
| | | | *Export intensity* | | | |
| $TFP \times IMP_{G7}$ | 0.936* | -1.902*** | -0.221 | 1.568 | 3.432*** | -0.634** |
| | (0.514) | (0.332) | (0.263) | (3.786) | (0.348) | (0.278) |
| $TFP$ | 0.790*** | 0.754*** | 0.172** | 0.501*** | 0.480*** | 0.452*** |
| | (0.083) | (0.121) | (0.069) | (0.094) | (0.045) | (0.130) |
| $IMP_{G7}$ | -0.751* | 1.856*** | -0.570*** | -0.104 | -0.500*** | 0.295** |
| | (0.420) | (0.292) | (0.144) | (0.130) | (0.124) | (0.132) |
| Observations | 10,019 | 7,434 | 23,309 | 19,643 | 15,635 | 13,386 |
| R2 | 0.257 | 0.354 | 0.313 | 0.301 | 0.315 | 0.374 |

Robust standard errors in brackets.; *** p < 0.01, ** p < 0.05, * p < 0.1.
All regressions include controls, year, country dummies and constant.

Table 7:: Regression results for alternate lag years

| | (2) | (3) | (4) | (2) | (3) | (4) |
|---|---|---|---|---|---|---|
| | Export participation | | | Export intensity | | |
| VARIABLES | 1 Year Lag | 2 Years Lag | 3 Years Lag | 1 Year Lag | 2 Years Lag | 3 Years Lag |
| | | | *Food and Beverages* | | | |
| *TFP × IMP* | 0.076*** | 0.069*** | 0.082*** | 0.126*** | 0.126*** | 0.125*** |
| | (0.006) | (0.006) | (0.008) | (0.028) | (0.028) | (0.028) |
| *TFP* | 0.414*** | 0.370*** | 0.325*** | 0.503*** | 0.520*** | 0.496*** |
| | (0.024) | (0.023) | (0.031) | (0.094) | (0.095) | (0.096) |
| *IMP* | 0.046*** | 0.050*** | 0.059*** | 0.043** | 0.044* | 0.053* |
| | (0.003) | (0.004) | (0.004) | (0.021) | (0.024) | (0.029) |
| Observations | 211,138 | 166,573 | 122,751 | 10,019 | 8,463 | 7,070 |
| R2 | 0.460 | 0.453 | 0.450 | 0.263 | 0.264 | 0.265 |

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Table 7:: (continued)

| | (2) | (3) | (4) | (2) | (3) | (4) |
|---|---|---|---|---|---|---|
| | Export participation | | | Export intensity | | |
| | 1 Year | 2 Years | 3 Years | 1 Year | 2 Years | 3 Years |
| VARIABLES | Lag | Lag | Lag | Lag | Lag | Lag |
| | | | *Textiles* | | | |
| *TFP* × *IMP* | 0.055*** | 0.044*** | 0.070*** | 0.206*** | 0.175*** | 0.225*** |
| | (0.008) | (0.008) | (0.012) | (0.045) | (0.046) | (0.052) |
| *TFP* | 0.198*** | 0.114*** | -0.133*** | 0.221** | 0.236* | -0.015 |
| | (0.020) | (0.021) | (0.029) | (0.107) | (0.126) | (0.134) |
| *IMP* | 0.055*** | 0.052*** | 0.048*** | 0.052** | 0.031 | 0.025 |
| | (0.008) | (0.008) | (0.009) | (0.021) | (0.020) | (0.022) |
| Observations | 81,136 | 63,496 | 47,252 | 7,434 | 6,397 | 5,348 |
| R2 | 0.536 | 0.535 | 0.536 | 0.344 | 0.351 | 0.362 |
| | | | *Chemicals* | | | |
| *TFP* × *IMP* | 0.100*** | 0.103*** | 0.092*** | -0.210 | -0.203 | -0.093 |
| | (0.026) | (0.025) | (0.024) | (0.141) | (0.139) | (0.106) |
| *TFP* | -0.111*** | -0.196*** | -0.163*** | 0.618*** | 0.639*** | 0.518*** |
| | (0.021) | (0.022) | (0.025) | (0.094) | (0.099) | (0.093) |
| *IMP* | 0.065*** | 0.052*** | 0.060*** | 0.061*** | 0.057*** | 0.067*** |
| | (0.004) | (0.003) | (0.004) | (0.017) | (0.016) | (0.018) |
| Observations | 150,316 | 121,726 | 98,298 | 21,173 | 18,282 | 15,496 |
| R2 | 0.445 | 0.433 | 0.424 | 0.325 | 0.329 | 0.323 |
| | | | *Rubber and Plastic products* | | | |
| *TFP* × *IMP* | 0.009* | 0.003 | -0.002 | 0.082*** | 0.070*** | 0.066*** |
| | (0.005) | (0.005) | (0.005) | (0.018) | (0.020) | (0.019) |
| *TFP* | -0.040** | -0.020 | -0.011 | -0.119 | -0.160** | -0.138* |
| | (0.017) | (0.021) | (0.024) | (0.072) | (0.075) | (0.081) |
| *IMP* | 0.038*** | 0.039*** | 0.044*** | 0.102*** | 0.116*** | 0.177*** |
| | (0.006) | (0.006) | (0.009) | (0.027) | (0.027) | (0.031) |
| Observations | 191,611 | 153,983 | 121,373 | 23,309 | 19,800 | 16,415 |
| R2 | 0.475 | 0.476 | 0.475 | 0.316 | 0.313 | 0.313 |
| | | | *Electrical machinery* | | | |
| *TFP* × *IMP* | 0.041*** | 0.024*** | 0.005 | 0.079*** | 0.070*** | 0.045** |
| | (0.007) | (0.008) | (0.009) | (0.021) | (0.023) | (0.022) |
| *TFP* | 0.182*** | 0.191*** | 0.236*** | 0.259*** | 0.169* | 0.137 |
| | (0.024) | (0.024) | (0.030) | (0.087) | (0.089) | (0.085) |
| *IMP* | 0.041*** | 0.040*** | 0.045*** | 0.022 | 0.019 | 0.014 |
| | (0.005) | (0.005) | (0.006) | (0.020) | (0.022) | (0.028) |

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Table 7:: (continued)

| VARIABLES | (2)<br>Export participation<br>1 Year Lag | (3)<br><br>2 Years Lag | (4)<br><br>3 Years Lag | (2)<br>Export intensity<br>1 Year Lag | (3)<br><br>2 Years Lag | (4)<br><br>3 Years Lag |
|---|---|---|---|---|---|---|
| Observations | 208,458 | 164,425 | 120,431 | 15,635 | 12,971 | 10,406 |
| R2 | 0.493 | 0.492 | 0.488 | 0.306 | 0.307 | 0.313 |
| | *Motor vehicles, Trailers, and Semi-trailers* | | | | | |
| *TFP* × *IMP* | 0.068*** | 0.072*** | 0.069*** | 0.232*** | 0.226*** | 0.215*** |
| | (0.007) | (0.007) | (0.007) | (0.017) | (0.020) | (0.020) |
| *TFP* | 0.161*** | 0.158*** | 0.148*** | -0.205 | -0.289** | -0.205 |
| | (0.034) | (0.037) | (0.034) | (0.135) | (0.140) | (0.125) |
| *IMP* | 0.045*** | 0.042*** | 0.044*** | 0.101*** | 0.090*** | 0.096*** |
| | (0.004) | (0.004) | (0.004) | (0.013) | (0.014) | (0.016) |
| Observations | 196,114 | 155,456 | 120,778 | 13,386 | 11,500 | 9,779 |
| R2 | 0.488 | 0.486 | 0.482 | 0.405 | 0.417 | 0.422 |

Robust standard errors in brackets.; *** p < 0.01, ** p < 0.05, * p < 0.1.

All regressions include controls, year, country dummies and constant.

*Alternative estimator*

To account for the presence of frequent zeros in the data during the estimation of the export intensity equation, the Heckman selection estimator is an alternative to OLS (Heckman, 1979). The benefit of this method is that (i) it considers both firm's decisions, whether to export or not and how much to export, at the same time, and (ii) it better deals with the dataset suffering from many zeros in the dependent (continuous) variable, which is typical in trade data, including this one. There are several alternative estimation methods that deal with data with frequent zeros, for example Zero-Inflated Poisson (ZIP), Zero-Inflated Negative Binomial (ZINB), Pseudo Poisson Maximum Likelihood (PPML) (Santos Silva & Tenreyro, 2006) but such models are mainly appropriate for count data and an evidence of superiority over Heckman is still debatable (Martínez-Zarzoso, 2013; Martin & Pham, 2008).

Both participation (or selection) and intensity (or outcome) equations can be either jointly estimated with maximum likelihood or as a two-step approach, with maximum likelihood in the first stage and normal OLS in the second. I rely on the first approach to follow Verbeek (2008) as he points out that the OLS standard errors from the two-step estimator are incorrect, whereas the maximum likelihood provides a consistent and asymptotically efficient estimator.

Normally, in order to employ a Heckman selection estimator, at least one independent variable should be excluded in the outcome equation. Here I choose to include Human Capital as an additional variable in the original participation equation since it affects more on the participation but less likely on the intensity of export.

Table 8: Regression results using Maximum Likelihood Heckman estimator

| VARIABLES | (1) Food | (2) Textile | (3) Chemicals | (4) Plastics | (5) Electrics | (6) Vehicles |
|---|---|---|---|---|---|---|
| | | | *First stage: Export participation* | | | |
| $TFP \times IMP$ | 0.072*** | 0.051*** | 0.098*** | 0.010** | 0.047*** | 0.075*** |
| | (0.007) | (0.008) | (0.027) | (0.005) | (0.006) | (0.007) |
| $TFP$ | 0.388*** | 0.177*** | -0.023 | -0.065*** | 0.141*** | 0.076*** |
| | (0.024) | (0.021) | (0.028) | (0.019) | (0.021) | (0.025) |
| $IMP$ | 0.043*** | 0.055*** | 0.055*** | 0.051*** | 0.043*** | 0.047*** |
| | (0.004) | (0.008) | (0.004) | (0.007) | (0.005) | (0.004) |
| Observations | 261,292 | 114,429 | 161,191 | 212,274 | 222,158 | 224,251 |
| | | | *Second stage: Export intensity* | | | |
| $TFP \times IMP$ | 0.154*** | 0.210*** | -0.201 | 0.077*** | 0.087*** | 0.270*** |
| | (0.031) | (0.042) | (0.142) | (0.017) | (0.019) | (0.016) |
| $TFP$ | 0.656*** | 0.250** | 0.613*** | -0.127* | 0.321*** | -0.135 |
| | (0.101) | (0.107) | (0.093) | (0.071) | (0.087) | (0.129) |
| $IMP$ | 0.064*** | 0.059*** | 0.066*** | 0.124*** | 0.037* | 0.134*** |
| | (0.022) | (0.021) | (0.016) | (0.026) | (0.020) | (0.015) |
| $\rho$ | 0.206*** | 0.095*** | 0.055 | 0.234*** | 0.194*** | 0.387*** |
| | (0.057) | (0.031) | (0.036) | (0.036) | (0.049) | (0.033) |
| $\ln \sigma$ | 1.016*** | 0.846*** | 0.923*** | 1.011*** | 0.910*** | 1.056*** |
| | (0.036) | (0.028) | (0.026) | (0.027) | (0.015) | (0.020) |
| Observations | 10,019 | 7,434 | 21.173 | 23.309 | 15.635 | 13.386 |
| Log likelihood | -45,894 | -28,277 | -83,311 | -93,288 | -64,074 | -57,443 |

Robust standard errors in brackets.; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
All regressions include controls, year, country dummies and constant.

The results are displayed in Table 8. They do not differ much with the main results in Table 1 in terms of sign and significance. In terms of magnitude, OLS is known to cause a downward bias when there are frequent zeros in the data, which is true in this case. Almost all of the coefficients from Heckman in the export intensity are greater than OLS.

## Conclusions

There are two known facts: (i) the literature of international trade provide us with an explanation for the positive relationship between productivity and export, in which several firm-level studies have found supporting evidences, and (ii) the co-occurrence of import and export is a regularity among traders, due to complementarity of sunk entry costs between the two activities. Past productivity and import are then expected to help determine firm's current export. However, an emerging literature also finds a connection between productivity and import, i.e. self-selection and learning-by-importing. Then the question is: are there interaction effects in which more productive firms are more likely to engage in export, providing their import in the past?

In this paper, the analyses of Swedish firms in six selected industries reveal that there are indeed significant interaction effects and they are heterogeneous between industries. Among other findings, the positive effect of past import is observed to be robust in explaining current export, whereas the results for TFP are mixed.

Several robustness checks are performed to employ alternative TFP and import measures, alternate time lags, and alternative estimator. There are yet issues for further studies, because the field of firm-level trade analysis is relatively new compared to the established national one. This paper contributes to the discussion of the complex relationship between productivity and firm's trade.

## Appendix

Table 9:: Descriptive statistics

| | Obs. | Mean | S.D. | Min. | Max. |
|---|---|---|---|---|---|
| $EXPpar$ | 1391404 | 0.059 | 0.235 | 0.000 | 1.000 |
| $EXPint$ | 1391404 | 0.764 | 3.153 | 0.000 | 23.642 |
| $TFP$ | 1391404 | 6.478 | 0.708 | -0.351 | 9.650 |
| $TFP_{OP}$ | 1391404 | 4.043 | 0.574 | -2.251 | 7.129 |
| $VA$ | 1391404 | 6.131 | 0.548 | 0.000 | 9.802 |
| $IMP$ | 1391404 | 12.603 | 6.759 | 0.000 | 24.055 |
| $IMP_{G7}$ | 1391404 | 0.423 | 0.286 | 0.000 | 1.000 |
| $GDP$ | 1391404 | 9.414 | 2.396 | 3.873 | 16.396 |
| $Pop$ | 1391404 | 1.608 | 2.104 | 3.927 | 7.179 |
| $Distance$ | 1391404 | 8.526 | 0.797 | 6.109 | 9.764 |
| $Contiguity$ | 1391404 | 0.010 | 0.100 | 0.000 | 1.000 |
| $Size$ | 1391404 | 3.532 | 1.825 | 0.000 | 9.891 |
| $MNE$ | 1391404 | 0.439 | 0.496 | 0.000 | 1.000 |
| $Corporation$ | 1391404 | 0.198 | 0.399 | 0.000 | 1.000 |
| $HC$ | 1391404 | 0.077 | 0.131 | 0.000 | 1.000 |

Table 10:: List of countries

| ISO | Country name | ISO | Country name |
|---|---|---|---|
| ABW | Aruba | DNK | Denmark |
| AFG | Afghanistan | DOM | Dominican Republic |
| AGO | Angola | DZA | Algeria |
| ALB | Albania | ECU | Ecuador |
| ANT | Netherlands Antilles | EGY | Egypt, Arab Rep. |
| ARE | United Arab Emirates | ERI | Eritrea |
| ARG | Argentina | ESP | Spain |
| ARM | Armenia | EST | Estonia |
| ATG | Antigua and Barbuda | ETH | Ethiopia |
| AUS | Australia | FIN | Finland |
| AUT | Austria | FJI | Fiji |
| AZE | Azerbaijan | FRA | France |
| BDI | Burundi | FRO | Faeroe Islands |
| BEL | Belgium | FSM | Micronesia, Fed. Sts. |
| BEN | Benin | GAB | Gabon |
| BFA | Burkina Faso | GBR | United Kingdom |
| BGD | Bangladesh | GEO | Georgia |
| BGR | Bulgaria | GHA | Ghana |
| BHR | Bahrain | GIN | Guinea |

Table 10:: (continued)

| ISO | Country name | ISO | Country name |
|---|---|---|---|
| BHS | Bahamas, The | GMB | Gambia, The |
| BIH | Bosnia and Herzegovina | GNB | Guinea-Bissau |
| BLR | Belarus | GNQ | Equatorial Guinea |
| BLZ | Belize | GRC | Greece |
| BMU | Bermuda | GRD | Grenada |
| BOL | Bolivia | GRL | Greenland |
| BRA | Brazil | GTM | Guatemala |
| BRB | Barbados | GUY | Guyana |
| BRN | Brunei Darussalam | HKG | Hong Kong SAR, China |
| BTN | Bhutan | HND | Honduras |
| BWA | Botswana | HRV | Croatia |
| CAF | Central African Republic | HTI | Haiti |
| CAN | Canada | HUN | Hungary |
| CHE | Switzerland | IDN | Indonesia |
| CHL | Chile | IND | India |
| CHN | China | IRL | Ireland |
| CIV | Côte d'Ivoire | IRN | Iran, Islamic Rep. |
| CMR | Cameroon | IRQ | Iraq |
| COG | Congo, Rep. | ISL | Iceland |
| COL | Colombia | ISR | Israel |
| COM | Comoros | ITA | Italy |
| CPV | Cape Verde | JAM | Jamaica |
| CRI | Costa Rica | JOR | Jordan |
| CUB | Cuba | JPN | Japan |
| CYM | Cayman Islands | KAZ | Kazakhstan |
| CYP | Cyprus | KEN | Kenya |
| CZE | Czech Republic | KGZ | Kyrgyz Republic |
| DEU | Germany | KHM | Cambodia |
| DJI | Djibouti | KIR | Kiribati |
| DMA | Dominica | KNA | St. Kitts and Nevis |
| KOR | Korea, Rep. | PRY | Paraguay |
| KWT | Kuwait | PYF | French Polynesia |
| LAO | Lao PDR | QAT | Qatar |
| LBN | Lebanon | ROM | Romania |
| LBR | Liberia | RUS | Russian Federation |
| LBY | Libya | RWA | Rwanda |
| LCA | St. Lucia | SAU | Saudi Arabia |
| LKA | Sri Lanka | SDN | Sudan |
| LSO | Lesotho | SEN | Senegal |
| LTU | Lithuania | SGP | Singapore |

Table 10:: (continued)

| ISO | Country name | ISO | Country name |
|---|---|---|---|
| LUX | Luxembourg | SLB | Solomon Islands |
| LVA | Latvia | SLE | Sierra Leone |
| MAC | Macao SAR, China | SLV | El Salvador |
| MAR | Morocco | SMR | San Marino |
| MDA | Moldova | SOM | Somalia |
| MDG | Madagascar | STP | São Tomé and Principe |
| MDV | Maldives | SUR | Suriname |
| MEX | Mexico | SVK | Slovak Republic |
| MHL | Marshall Islands | SVN | Slovenia |
| MKD | Macedonia, FYR | SWZ | Swaziland |
| MLI | Mali | SYC | Seychelles |
| MLT | Malta | SYR | Syrian Arab Republic |
| MMR | Myanmar | TCD | Chad |
| MNG | Mongolia | TGO | Togo |
| MNP | Northern Mariana Islands | THA | Thailand |
| MOZ | Mozambique | TJK | Tajikistan |
| MRT | Mauritania | TKM | Turkmenistan |
| MUS | Mauritius | TON | Tonga |
| MWI | Malawi | TTO | Trinidad and Tobago |
| MYS | Malaysia | TUN | Tunisia |
| NAM | Namibia | TUR | Turkey |
| NCL | New Caledonia | TWN | Taiwan |
| NER | Niger | TZA | Tanzania |
| NGA | Nigeria | UGA | Uganda |
| NIC | Nicaragua | UKR | Ukraine |
| NLD | Netherlands | URY | Uruguay |
| NOR | Norway | USA | United States |
| NPL | Nepal | UZB | Uzbekistan |
| NZL | New Zealand | VCT | St. Vincent and the Grenadines |
| OMN | Oman | VEN | Venezuela, RB |
| PAK | Pakistan | VNM | Vietnam |
| PAN | Panama | VUT | Vanuatu |
| PER | Peru | WSM | Samoa |
| PHL | Philippines | YEM | Yemen, Rep. |
| PLW | Palau | YUG | Yugoslavia |
| PNG | Papua New Guinea | ZAF | South Africa |
| POL | Poland | ZAR | Congo, Dem. Rep. |
| PRK | Korea, Dem. Rep. | ZMB | Zambia |
| PRT | Portugal | ZWE | Zimbabwe |

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