A note on the estimation of import trade demand functions

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HIGHLIGHTS

- We compare alternative import demand models in a panel of 33 countries.
- Models with separate final demand components are best performing.
- Empirical results show that private expenditure is the main driver of imports.

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ABSTRACT

This paper compares six alternative methods of computing the import demand function. We use a sample of 33 countries from 1995:1 to 2016:3 and brand new information on import contents made available by WIOD. Preferred models take into account the separate effects of each final demand component. Contrary to some recent studies, we observe that private expenditure is the main driver of import variations.

1. Introduction

The empirical investigation of trade elasticities is still one of the most addressed topics in international economics (Marquez, 2002). The traditional model is a log-linear function of income and the relative price of imports, that can also be derived from the duality theory (Kohli, 1978). A similar specification is cast in a rational expectations permanent income setting (Clarida, 1994). Recently, Bussière et al. (2013) define economic activity as a weighted average of final demand expenditures where weights are import contents derived from Input–Output (I–O) tables.

Our contribution emphasizes the separate role each macro component of final demand exerts on imports as suggested by Giovannetti (1989), whilst most of the literature takes into account a single activity variable only (Senhadji, 1998; Marquez, 2002; Xu, 2002). However, the relative performance of these different models in a panel setting has never been assessed. We fill this gap using a sample of 33 countries from 1995:1 to 2016:3 taking also advantage of the recent release of WIOD (Timmer et al., 2015). Contrary to Bussière et al. (2013) and IMF (2016), private expenditure is the main driver of import variations, with a larger magnitude than investment and exports, whereas government spending has no effect throughout all models.

2. Methodology and data

A large part of the literature is based on a Marshallian demand function that can be derived in a standard production framework (Kohli, 1978; Marquez, 2002). In our panel setting we relate total imports to a measure of income and to the relative price of imports:

$$\ln M_{i,t} = \beta_0 + \beta_D \ln Y_{i,t} + \beta_P \ln P^M_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $M_{i,t}$ is the volume of imports in country i at time t. Similarly, $Y_{i,t}$ is the activity level, usually given by GDP or Domestic Demand (DD), $P^M_{i,t}$ is the import price divided by the GDP deflator (the relative import price, RMP), and $\varepsilon_{i,t}$ is the error term.

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Table 1
Static panel specification.

Variables	Bussière et al. (2013)		Senhadji (1998)		Giovannetti (1989)	Our model
	$Y = IAD$	$Y = GDP$	$Y = DD$	$Y = GDPX$		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔRMP_{it}	−0.258***	−0.339***	−0.261***	−0.382***	−0.277***	−0.274***
	(0.044)	(0.053)	(0.058)	(0.060)	(0.039)	(0.039)
ΔY_{it}	1.138***	1.228***	1.112***	−0.396**		
	(0.087)	(0.171)	(0.126)	(0.176)		
ΔDC_{it}					0.690***	
					(0.104)	
ΔI_{it}					0.245***	0.243***
					(0.038)	(0.037)
ΔX_{it}					0.478***	0.474***
					(0.056)	(0.055)
ΔG_{it}						0.022
						(0.060)
ΔC_{it}						0.610***
						(0.095)
SLOWDOWN2000	0.011***	0.013***	0.015***	0.018***	0.008***	0.009***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
SLOWDOWN2009	−0.023***	−0.037***	−0.039***	−0.062***	−0.019***	−0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.004***	0.007***	0.008***	0.016***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Observations	2622	2622	2622	2521	2622	2622
Adj. *R*-squared	0.474	0.285	0.313	0.178	0.510	0.512
AIC	−10676	−9870	−9976	−9094	−10859	−10869
BIC	−10652	−9846	−9952	−9071	−10824	−10828

Our elaboration from OECD and WIOD data.
Robust standard errors in parentheses.
** Significant at 5%.
*** Significant at 1%.

Using an intertemporal optimization model, Senhadji (1998) proposes to proxy income with GDP minus exports (*GDPX*). Conversely, taking into account a growing economy, Xu (2002) suggests to adopt the national cash flow given by GDP minus investment, government expenditure, and exports. Finally, Bussière et al. (2013) propose a new measure of aggregate demand, labeled *IAD* (Import intensity-Adjusted Demand), that is calculated as a weighted average of all the final demand items:

$$\ln IAD_{i,t} = \omega^{C}_{i,t} \ln C_{i,t} + \omega^{G}_{i,t} \ln G_{i,t} + \omega^{I}_{i,t} \ln I_{i,t} + \omega^{X}_{i,t} \ln X_{i,t} \tag{2}$$

where $C_{i,t}$ is private consumption, $G_{i,t}$ government expenditure, $I_{i,t}$ investment, and $X_{i,t}$ gross exports. Weights are the (relative) total import content of these components and are calculated via national I–O tables.

An additional, simpler variation decomposes GDP into three components, i.e. domestic consumption $\left(DC_{i,t} = C_{i,t} + G_{i,t}\right)$, investment, and gross exports:

$$\ln M_{i,t} = \beta_0 + \beta_C \ln DC_{i,t} + \beta_I \ln I_{i,t} + \beta_X \ln X_{i,t} + \beta_P \ln P^{M}_{i,t} + \varepsilon_{i.t}. \tag{3}$$

A more complete specification, which we will employ, separates private consumption from government consumption.

We employ a panel model with fixed effects to estimate (1)–(3) in first differences due to non-stationary time series.[1] Quarterly data on imports and exports, GDP and its components, as well as prices, come from the OECD Economic Outlook Database and refer to 33 countries. These are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxemburg, Mexico, Nederland, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Turkey, UK, USA, Brazil, India and Indonesia.[2] We employ both WIOD releases to compute yearly import contents up to 2014. For the subsequent period, we use the same weights as in 2014. We differ from Bussière et al. (2013), who utilize a scattered set of I–O tables published by OECD every five years and interpolate missing data, and from IMF (2016) that applies constant weights given by an average of EORA country specific I–O data over 1990–2011.

3. Results

Columns 1 to 3 of Table 2 refer to the model proposed by Bussière et al. (2013) but adding controls for the possible effects of recessions in the years 2000 and 2009 as suggested by Martínez-Martin (2016). All the coefficients have the expected sign and are significant at the 1% level. Column 2 and 3 refer to the traditional model where the activity level is given by GDP and domestic demand, respectively. These two models show a large drop in the explanatory power compared to the first one. Such a fall is even larger in Column 4 that reports the specification proposed by Senhadji (1998). Finally, the last two columns consider disaggregate final demand.[3] Consumption has the largest impact, but only due to its private component, whereas investment shows the smallest. This is at odds with the import content derived from I–O tables.

Table 2 presents a dynamic model with lagged variables. Results are very similar to those recorded in Table 1. We confirm the importance of taking into account the separate items of final demand. Private consumption has still a remarkable impact on imports, showing the largest coefficients amongst demand items at time t.

[1] Both Levin–Lin–Chu and Im–Pesaran–Shin tests show the panels contain a unit root. Moreover, the Mundlak approach suggests there is correlation between the time-invariant unobservables and our regressors.

[2] According to the World Bank (2016) Development Indicators these countries account for 84% world GDP in 2000 and 68% in 2015.

[3] We do not consider the model proposed by Xu (2002) as activity level is negative for some countries in our sample and estimates are unreliable for the remaining ones.

Table 2
Dynamic panel specification.

Variables	Bussière et al. (2013)		Senhadji (1998)		Giovannetti (1989)	Our model
	$Y = IAD$	$Y = GDP$	$Y = DD$	$Y = GDPX$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta M_{i(t-1)}$	−0.142***	−0.060	−0.045	0.043	−0.155***	−0.154***
	(0.043)	(0.052)	(0.044)	(0.032)	(0.040)	(0.040)
ΔRMP_{it}	−0.248***	−0.332***	−0.253***	−0.385***	−0.289***	−0.288***
	(0.043)	(0.053)	(0.054)	(0.062)	(0.036)	(0.034)
$\Delta RMP_{i(t-1)}$	−0.030	−0.011	0.020	−0.059	−0.063**	−0.061*
	(0.030)	(0.036)	(0.039)	(0.049)	(0.030)	(0.031)
ΔY_{it}	1.166***	1.190***	1.109***	−0.433**		
	(0.075)	(0.178)	(0.123)	(0.171)		
$\Delta Y_{i(t-1)}$	0.371***	0.570***	0.262***	−0.121***		
	(0.058)	(0.163)	(0.090)	(0.027)		
ΔDC_{it}					0.672***	
					(0.097)	
$\Delta DC_{i(t-1)}$					0.193**	
					(0.081)	
ΔI_{it}					0.243***	0.241***
					(0.034)	(0.033)
$\Delta I_{i(t-1)}$					0.059**	0.058**
					(0.022)	(0.022)
ΔX_{it}					0.508***	0.504***
					(0.051)	(0.050)
$\Delta X_{i(t-1)}$					0.210***	0.207***
					(0.028)	(0.028)
ΔG_{it}						0.014
						(0.084)
$\Delta G_{i(t-1)}$						0.035
						(0.097)
ΔC_{it}						0.600***
						(0.092)
$\Delta C_{i(t-1)}$						0.154*
						(0.088)
SLOWDOWN2000	0.010***	0.012***	0.015***	0.018***	0.007***	0.007***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)
SLOWDOWN2009	−0.018***	−0.029***	−0.037***	−0.060***	−0.012***	−0.011**
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)
Constant	0.002**	0.003***	0.007***	0.015***	−0.002*	−0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	2613	2613	2613	2512	2613	2613
Adj. *R*-squared	0.498	0.306	0.320	0.181	0.540	0.542
AIC	−10769	−9921	−9974	−9077	−10993	−11002
BIC	−10728	−9880	−9932	−9036	−10928	−10925

Our elaboration from OECD and WIOD data.
Robust standard errors in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

4. Conclusions

This note stresses the importance of selecting the most appropriate model to estimate the world trade demand function. Our results are based on a panel including developed and developing countries and show that private consumption exerts the largest effect in shaping imports. This is contrary to the recent literature that finds the decline in imports is almost exclusively due to a fall in investment and exports. Disentangling the compositional effects of demand shocks on imports is important especially to assess the great trade collapse and the actual trade slowdown. Our approach is relevant because it allows to accurately describe the role of each final expenditure.

Our outcomes have at least two research and policy implications. First, scholars should not only concentrate on the role of GVC in the propagation of shocks, but also on how international fragmentation impacts consumer behavior. Second, policy makers should recognize the interplay affecting domestic private consumption, investment and exports, and take appropriate measures to support families expenditures and firms investments in times of subdued demand.

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