

Measurement of Aggregate Trade Restrictions and their Economic Effects

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Jonathan D. Ostry, and Andrew K. Rose

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A Measurement of Aggregate Trade Restrictions and their Economic Effects
Prepared by **Julia Estefania-Flores, Davide Furceri, Swarnali A. Hannan,**
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ABSTRACT: We develop a new Measure of Aggregate Trade Restrictions (MATR) using data from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. MATR is an empirical measure of how restrictive official government policy is towards the international flow of goods and services. MATR is simple, *ad hoc*, plausible, quantitative, easily updated, based solely on policy-relevant measures of trade policy, and covers an unbalanced sample of up to 157 countries annually between 1949 and 2019. MATR is strongly correlated with, but more comprehensive than, existing measures of openness and trade policy existing measures. We use MATR to show that trade restrictions are harmful for the economy and lead to significant contractions in output.

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WORKING PAPERS

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“Measurement of trade policy is perhaps one of the toughest issues faced in the evaluation of trade policy, especially in cases where non-tariff barriers are the primary trade policy instrument ... Even when trade restriction measures are available, as is the case with import tariffs, the available information comes at a highly disaggregate level. Economic analysis of these restrictions’ effects often requires the researcher to aggregate the information to a higher level (e.g., the industry, region or country) ... economic analysis of the effect of these restrictions often requires the researcher to aggregate the information to a higher level (e.g., the industry, region, bilateral trade flow, or country) to map it to the level at which economic outcomes of interest are measured.”

Goldberg and Pavcnik (2016)

I. Introduction

Measuring the restrictiveness of a country’s trade policy is important. Such measures are essential controls or determinants in empirical assessments of policy, and may be of intrinsic interest in the context of trade negotiations or economic rescue programs. But while the utility of such indicators is not in doubt, their availability is hampered by the need to aggregate across a panoply of heterogeneous restrictions. Some countries have tariff schedules with more than 5,000 individual tariff lines. Aggregating all these tariffs into a single empirical measure is challenging: tariff schedules are complicated; tariffs can be specific or *ad valorem*; tariffs for a given country differ by exporter; weighting individual goods is difficult since tariffs tend to deter and divert potential trade; and all this varies over time. Non-tariff barriers such as quotas, licenses, and regulatory requirements are perhaps even more complex and ubiquitous.

What to do? In theory, the correct way to proceed is to produce measures such as the “Trade Restriction Indices” (hereafter “TRIs”) that have been developed and studied by Anderson and Neary (2005). TRIs use as a standard metric, the uniform tariff that would produce the same overall level of trade restrictiveness as the actual pattern of policies. That is, a TRI would hypothetically, if applied to each import, generate the same effect on economic welfare as the actual set of trade restrictions. Coughlin (2010) provides a primer on TRIs, and their usefulness for general equilibrium analysis, albeit often under a set of heroic assumptions. However, in practice TRIs are not widely available. In their absence, practitioners and researchers are forced to use other, admittedly less perfect, measures of aggregate trade restrictions.

Our work is motivated by the importance of aggregate measures of trade restrictions, and their absence.

A New Measure of Aggregate Trade Restrictions (MATR)

Our objective in this paper is to present a new way to quantify policy towards international trade at the aggregate level. In constructing our measure, we are guided by principles. A good measure should, if possible, be: a) simple, b) based on plausible, relevant policy inputs, which are c) quantitative and objective, d) timely and easily updateable, e) available for a large number of countries, for f) a substantial period of time, while covering both g) tariff and non-tariff barriers. In addition, a good measure should “smell right” and look reasonable, across economies (Hong Kong should look more liberal than Venezuela), across time (most trade should become more liberal over the last half of the twentieth century), and across alternative indicators (it should be strongly correlated with tariff rates and openness).

Our Measure of Aggregate Trade Restrictions (hereafter “MATR”) is based on data from the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions* (hereafter “AREAER”). Our measure is constructed combining information in the AREAER online database (available from 1999 onwards) with the narrative accounts of how restrictive official government policy is towards the international flow of goods and services, obtainable in printed versions of the AREAER country-year specific reports (from 1949 onwards).

MATR is simple, plausible, quantitative, easily updated, based solely on policy-relevant measures of trade policy, and (currently) covers an unbalanced panel of 157 countries annually between 1949 and 2019. MATR is strongly correlated with existing measures of openness and trade policy but is both more comprehensive—with greater country and time coverage—and more granular; it is also robust to minor methodological perturbations. In the first part of the paper, we present MATR as an empirically valuable, if theoretically *ad hoc*, complement to existing measures of trade restrictions.

The Economic Effects of Trade Restrictions

In the second part of the paper, we show that MATR is useful as a new measure of trade policy by using it to investigate the aftermath of trade restrictions. We use Jordà’s (2005) local projection method to estimate the response of GDP and other economic outcomes (investment, productivity, employment, consumption, trade flows and inequality) to changes in MATR.

Consistent with much of the theoretical literature (e.g., Caliendo, Feenstra, Romalis and Taylor, 2017) and the empirical literature based on tariffs (e.g., Furceri et al. 2021), we find that trade restrictions are associated with large and persistent declines in GDP.² In particular, the results suggest that a one-standard deviation increase in the index (such as that introduced by Thailand in 2000) is associated with a reduction in the level of GDP by about 0.2 percent in the year of the change in MATR and by about 0.7 percent five years later. These effects are statistically significant and economically sizeable. The impact is almost twice the medium-term output effect of the one-standard deviation increase in tariff rates found in Furceri et al. (2021).

In line with theoretical predictions, we also find that there is complementarity between tariff and non-tariff restrictions; the effect of an increase in non-tariff restrictions is larger when tariffs are high. Further, the effect of an increase in trade restrictiveness is larger for countries that import a larger share of intermediate inputs, that is, economies that participate more in Global Value Chains (GVCs).

Our narrative source, however, does not provide enough information for us to separate trade policy actions implemented because of cyclical conditions (motivated by the objective to push output back to its normal trend) from those arising from more exogenous reasons. To address this, and in the same spirit of Romer and Romer (2010), we perform an extensive search of narrative records. We identify dates associated with major changes in MATR and look at the motivation behind such trade policy changes to identify those changes that can be deemed “exogenous”. We examine official national documents, reports from international organizations (IMF, World Bank, OECD, WTO), policy papers and academic publications. The results based exogenous measures confirm that trade restrictions are harmful for economic activity.

² See Furceri et al. (2020) for a discussion on the output-effect of tariffs from earlier literature. For example, Eichengreen (1981) show that tariffs increase output and employment in the short run but could lead to decline in production in the long run. Ostry and Rose (1992) find no theoretical presumption about the effects of tariffs on output, with the impact depending on a host of factors.

II. An Introduction to MATR

MATR aggregates the multitude of ways that countries restrict the international trade of goods and services. The underlying variables cover tariffs, non-tariff barriers, and restrictions on requiring, obtaining, and using foreign exchange for current transactions. More precisely, MATR is based on the IMF's AREAER binary variables related to: (i) exchange measures; (ii) arrangements for payments and receipts; (iii) imports and imports payments; (iv) exports and exports proceeds; and (v) payment and proceeds from invisible transfers and current transfers.³ Each of these categories is further decomposed into sub-categories. The simplest version of MATR is the unweighted sum of up to 22 possible variables.

II. Exchange measures	II.A. Restrictions and/or multiple currency practices
	II.B. Exchange measures imposed for security reasons
IV. Restrictions to payments	IV.A. Prescription of currency requirements
	IV.B. Payments arrangements
	IV.C. Administration of control
	IV.D. Payment arrears
	IV.F. Controls on exports and imports of banknotes
VII. Import Restrictions	VII.A. Foreign exchange budget
	VII.B. Financing requirements for imports
	VII.C. Documentation requirements for release of forex for imports
	VII.D. Import licenses and other nontariff measures
	VII.E. Import taxes and/or tariffs
	VII.F. State Import Monopoly
VIII. Export Restrictions	VIII.A. Repatriation requirements
	VIII.B. Financing requirements
	VIII.C. Documentation requirements
	VIII.D. Export licenses

³ The AREAER draws together information from a number of sources, including official IMF staff visits to its member. The individual country chapters include information related to restrictions on current international payments and transfers and multiple currency practices subject to the IMF's jurisdiction, in accordance with Article VIII of the IMF's Articles of Agreement, or maintained under Article XIV. The report also provides information on the structure and determination of exchange rates, monetary frameworks, arrangements for payments and receipts, procedures for resident and nonresident accounts, the operation of foreign exchange markets, controls on international trade and capital transactions, and measures implemented in the financial sector, including prudential measures. In addition, it lists exchange measures imposed by member countries for security reasons, including those reported to the IMF in compliance with IMF Executive Board decisions.

	VIII.E. Export taxes
	IX.A. Payments for Invisibles, Transfers & Current Transfers
IX. Payments and X. Proceeds for Invisibles Restrictions	X.A. Repatriation requirements on Proceeds
	X.A.1. Surrender Requirements on Proceeds
	X.B. Restrictions on use of funds

The IMF's AREAER yearly reports are freely available online from 1949. We constructed the dataset using the narrative record included in the yearly reports, complemented with information available in the AREAER online database; details are in Appendix 1.⁴ We score each sub-indicator of MATR as one if a restriction is present in a particular country for a particular year, and zero otherwise. As a result, MATR potentially varies between 0 and 22, with a higher score indicating more restrictions (in practice MATR varies between 2 and 21).

We believe that sections VII (Import Restrictions) and VIII (Export Restrictions) are likely the most important of the 22 variables, but we do not restrict ourselves solely to them, because of evidence that other instruments have been used in practice for protectionism.⁵ Below, we demonstrate the insensitivity of MATR to the exact choice of underlying fundamentals. Perhaps more importantly, we provide the underlying fundamentals in the raw data set, so that users can choose for themselves.

MATR has several desirable properties. This simple measure is based on sensible, plausible, trade policy inputs from a transparent, accessible, reliable source. Each of the underlying fundamentals is quantitative, based on clear criteria, and the fundamentals include a host of non-tariff barriers as well as tariffs. Normalization issues are avoided since the measure is an aggregate of binary components. MATR is available for a large, unbalanced panel of most economies from 1949 through 2019, and it is regularly updated.^{6,7} The coverage increases from about 30 economies in 1949 to more than 100 in 1973, and over 150 by 2000, as shown in Figure 1 (regional analogues are presented in Appendix 1, Figure A1.1).

Admittedly, MATR is an *ad hoc* measure, without a clear theoretical interpretation. It is an intrinsically aggregate measure rather than a weighted average of disaggregated microdata (as for aggregate tariffs). Moreover, it codes the *existence* of restrictions, not their intensity or efficacy. In this respect, the measure is similar to the Chinn and Ito (2008) index for capital controls. That said, and as shown in the next section, MATR is strongly correlated with existing measures that capture the intensity of trade restrictions, as well as with *de facto* measures of their consequences, such as trade openness.

⁴ Each variable is, in principle, absolute, not relative; unity merely reflects the presence of a trade barrier (and zero its absence), not how the country*year observation compares with current best practice. In this, our measure differs from, e.g., Cerdeiro and Nam (2018).

⁵ The 1997 AREAER (p 1) states that the "Import and Import Payments" section of the data base describes the nature and extend of exchange and trade restrictions on imports.

⁶ Cerdeiro and Nam (2018) deplore the fact that measures of trade policy rarely extend far back in time.

⁷ MATR is also essentially unaffected by missing granular data since the latter can be filled in using AREAER entries on annual changes to fundamentals.

MATR is just one particularly simple way to aggregate the 22 underlying fundamentals. While we find simplicity attractive, it is not particularly important. Below, we consider both broader and more narrow sets of fundamentals, and we use both factor and principal component analysis to weigh the fundamentals differently; each of these variants is provided in the MATR database which we will make available.

Whether MATR is useful or not remains to be seen; we now try to make the case that MATR is a useful complement to existing measures.

A Graphical Portrait

We now present a broad-brush picture of MATR.

Figure 2 scatters MATR against the size of the economy in 2016, as measured by the natural logarithm of real GDP (measured in USD, from the Penn World Table). The data are a cloud; there is no strong relationship between our new measure of trade restrictions and the sheer size of the economy. In the lower-right of Figure 2 are large open economies such as the United States and Germany. Large but relatively closed economies like India and China are in the top right. Small open economies like Hong Kong are towards the bottom.

Figures 3-6 examine the time-series characteristics of MATR. Figure 3 shows the development of MATR for advanced economies (AEs) and emerging market and developing economies (EMDEs). Both groups began in comparable situations, started to liberalize in the early 1970s, and have done little since the early 2000s; the liberalizations were more dramatic for AEs than EMDEs. Figure 4 presents the evolution of MATR across regions. Not surprisingly, European countries are typically characterized by the lowest restrictions, and Africans by the highest trade. MATR moves little over a typical year for most countries. Its stability is manifest in Figure 5, which scatters MATR values across four decades.⁸

Figure 6 plots the evolution of MATR for eighteen economies. The levels of MATR seem eminently sensible. For instance, in the top-left panel, MATR for the United States remains low throughout the period, while for China the opposite is true. Indonesia imposes more trade restrictions than the United Kingdom; Russia has more restrictions than Canada and Germany. India and South Africa have numerous restrictions throughout. The panels also show a few dramatic cases of MATR changes; particularly noticeable are increases in Venezuelan restrictions to trade, and the reductions for the United Kingdom and Hong Kong.

Thus far, we have only provided an intrinsic description of MATR's properties. Figure 7 broadens the exploration by providing scatterplots of MATR against four key variables, in each case using data from 1996. Richer countries tend to have fewer trade restrictions, as shown by the scatter of MATR against log real GDP per capita in the top-left panel. Reassuringly, the relationship is strongly negative. Smaller countries tend to be more open and have fewer restrictions, as reflected in the upward-sloping scatter of MATR against log population in the top-right graph.

What of traditional measures of trade restrictiveness? Tariff rates are an imperfect measure of protectionism, because of well-known measurement problems as well as NTBs. Nevertheless, tariffs remain an important measure of protectionism, in part because they are available for many countries and periods. As shown in the

⁸ Figure A1.2 presents a histogram of the net changes in MATR between 1976 and 2016 for the 106 economies with data in both years. The histogram is clustered between zero and five, since MATR usually moves little on net even over 40 years.

lower-left panel of Figure 7, MATR is strongly correlated with the World Bank's tariff rate measure.⁹ Another widely used measure is *de facto* trade openness, the ratio of exports and imports to output. There are many determinants of openness beyond protectionism; remote, landlocked, thinly populated countries with idiosyncratic languages tend to trade less. Nevertheless, MATR is negatively correlated with openness, as shown in the lower-right panel. Statistical analogues to the figures are reported in Table 1, when MATR is regressed against these variables, along with income, size, and year effects.

The image of MATR that emerges from the graphical evidence seems sensible. There is no clear relationship between economic mass and trade restrictions; trade policy restrictions move only slowly over time, and the differences between countries are more systematic than those within a country over time. Richer and smaller countries have systematically lower values of MATR, as do more open countries, and those with lower tariff rates. One does not want to over-interpret these simple scatterplots, since each is a simple bivariate cross-sectional relationship, taking no account of other factors.¹⁰ But collectively they provide reassurance.

Sensitivity Analysis

The most straightforward version of MATR is a sum of up to 22 binary dummy variables, each weighted equally. There are alternative ways to use the fundamentals from *AREAER*, and we now briefly consider some.

One tack is to aggregate the underlying *AREAER* variables in a more sophisticated way. We use standard factor analysis to extract the first principal factor from the 22 fundamentals; this allows for different weights (not necessarily all positive, let alone equal) to be applied to the underlying variables. The factor analysis works relatively well in the sense that the scatter-plot is steep (the first eigenvalue is 6.16, while the second and third are .72 and .64), and the loadings for the first factor are positive for 21 of the 22 fundamentals. We also generate a closely related variant, the first principal component, following Chinn and Ito (2008) on capital account restrictions.^{11,12} Both measures are strongly correlated with the baseline version of MATR (Figure A1.3).

⁹ That is, the mean weighted applied tariff rate for all products, available from the *World Development Indicators*.

¹⁰ Nevertheless, the visual impressions of Figure 4—and of other results elsewhere—stand up to more rigorous statistical inspection. This is clear from Table 1, which provides estimates when MATR is regressed on the variables of interest (such as the tariff rate or trade openness), controlling for year fixed effects as well as log size and income.

¹¹ Since this is a three-way panel (countries, years, and fundamentals), we cannot use dynamic factor models. Dynamic factor analysis country-by-country does not seem sensible, since we only have 21 time-series observations. Factors and principal components extracted from the cross-section, year by year, yield basically the same factors as ours.

¹² A different way to proceed is to use different sets of underlying *AREAER* fundamentals. Some of MATR's components are more distant from the underlying objective of measuring trade restrictions; this suggests using only a more restricted set of fundamentals. But *AREAER* also provides indicators that we do not use, allowing for the more liberal use of fundamentals. We try both directions. Variant 1 is a restrictive version of MATR with only the sum of the eleven trade related variables (*AREAER* variables for both import restrictions [VII.A through VII.F], and export restrictions [VIII.A through VIII.E]). This is a relatively coarse variable, ranging in principle from 0-11. But we also create more inclusive measures than MATR. Variant 4 is the least restrictive and adds in 27 more fundamentals, using all the sub indicators of the main subcomponents (if there are any). Variants 3 and 4 are intermediate between Variant 1 and variant 4. In Figure A1.3, MATR is scattered against all six of these variants; it is highly correlated with each. This also shows up in more rigorous statistical analysis; Table 2 reports results when MATR and its variants are regressed against income, size, and year effects.

III. Is MATR Useful?

Our measure is strongly correlated with existing measures of trade restrictions. To repeat, as portrayed in Figure 7, MATR is correlated with both tariff rates and openness (also apparent in Table 1). We provide more comparisons in Figure 8, which is a series of scatterplots of MATR (always on the y-axis) against alternative measures of aggregate trade restrictions. Each of the graphs is a cross-country scatterplot (most of the alternatives are not available in panel form over any substantive span of time); statistical analogues are again recorded in Table 1.¹³ We consider six alternative measures:

1. Novy's (2012) measure of *Trade Costs*, a "comprehensive all-inclusive measure ... providing an alternative measure of trade facilitation performance," used by the UN's ESCAP in conjunction with the World Bank, with export weights,¹⁴
2. The World Economic Forum's 2016 Index of *Trade Enablement*, which "assesses performance of 136 economies on domestic and foreign market access; border administration; transport and digital infrastructure; transport services; and operating environment",¹⁵
3. Quinn's measure of *Current Account Financial Openness* "... an indicator of how compliant a government is with its obligations under the IMF's Article VIII to free from government restrictions the proceeds from international trade of goods and services..."¹⁶
4. A TRI produced by the World Bank (2009), using methodology from Kee et al. (2009),¹⁷
5. A similar World Bank TRI produced using only tariffs, for 2009, and
6. A similar World Bank TRI for the service sector.¹⁸

In each case, the correlation between alternative indicators and MATR is correctly signed; Table 1 indicates that it is also significantly different from zero except for some of the TRI measures (which may be the result of the small sample size).

The closest variable to MATR that is available for a long period of time is the sub-component "Trade Freedom" of the Heritage Foundation's *Index of Economic Freedom*, discussed further in Appendix 3. Trade Freedom, "a composite measure of the absence of tariff and non-tariff barriers," is available for approximately the same countries as MATR, but with less time coverage; MATR begins in 1949, Trade Freedom in 1995. Like MATR, Trade Freedom is a measure of trade policy arising from both tariffs and NTBs. Its methodology is unclear, which may explain why it has not been used widely in the academic literature. But Trade Freedom and MATR are similarly motivated, so it is natural to compare the two measures. Reassuringly, Figure 9 shows that MATR and trade freedom are strongly (negatively) correlated at both the beginning and end of the sample, as well as two years in between. More trade restrictions are strongly correlated with less trade freedom. And since both

¹³ Novy's trade costs and Quinn's measure of current account and financial openness are available over long time spans.

¹⁴ Further details are available at <https://www.unescap.org/resources/escap-world-bank-trade-cost-database>.

¹⁵ http://reports.weforum.org/global-enabling-trade-report-2016/files/2016/11/GETR16_Global_FINAL_with-language-links.pdf; further details available at <http://reports.weforum.org/global-enabling-trade-report-2016/downloads-page/>. This measure is available for 2012, 2014, and 2016.

¹⁶ More at http://faculty.msb.edu/quinnd/data/capital%20financial_current_Master_1950_2012_public.xlsx.

¹⁷ Further details are available at <https://datacatalog.worldbank.org/dataset/overall-trade-restrictiveness-indices-and-import-demand-elasticities>.

¹⁸ Further details are available at <http://iresearch.worldbank.org/servicetrade/default.htm>.

MATR and trade freedom are likely to be imperfect measures of the underlying concept, each can serve as an instrumental variable for the other.

A final comparison of interest is with the celebrated Chinn-Ito (2008) measure of financial openness. Like MATR, the fundamentals of the Chinn-Ito “kaopen” measure stem from *AREAER*; but kaopen seeks to measure the international mobility of *capital*, where MATR’s focus is on international flows of *goods and services*. Also, where MATR simply sums the (up to 22) underlying *AREAER* fundamentals, kaopen is the first principal component of (transformations of) the underlying four variables (controls over current or capital account transactions, multiple exchange rates, and export surrender requirements). Figure 10 presents four scatter plots (for the same years as Figure 9) of MATR against kaopen. The series are substantially different, but strongly negatively related; countries more open to capital flows à la Chinn-Ito have fewer trade restrictions, as measured in MATR.

Potential Applications

Why does the world need another, admittedly imperfect, aggregate measure of trade policy? The short answer is that such measures are used, and there aren’t enough of them. Since more imperfect measures are better than fewer, we propose MATR as a helpful addition to the literature, especially given its substantial coverage over time. In this section, we provide some explicit examples of where MATR might have been useful in the past.

In a well-cited paper, Ilzetki, Mendoza and Végh (2010) compare estimated fiscal multipliers across a variety of different environments, including stage of development, exchange rate regime, public indebtedness, and openness to trade. They find that fiscal multipliers are smaller for open as opposed to closed economies, using two definitions of the latter. The first involves splitting the sample according to the trade/GDP ratio, though the authors acknowledge that low openness may be due to factors other than trade policy. The authors also split the sample by national tariff rates. MATR might have been useful in exactly such circumstances.

In an influential paper, Rodrik (1998) investigated openness as a determinant of government size, without distinguishing between natural and artificial barriers to international trade. Similarly, Alesina and Wacziarg (1998), another well-cited paper, links government size and openness through the channel of country size, but without distinguishing artificial and natural trade barriers. Both papers might have benefited from MATR.

In a completely different literature, two well-known papers Hall and Jones (1999) and Sachs and Warner (1995) use the same measure of policy-driven trade openness as a key determinant of income levels and growth respectively. This measure has been criticized by Rodriguez and Rodrik (2000), who focus on the growth impact of policy-induced trade barriers.¹⁹ Yet again, MATR might have helped.

A number of papers simultaneously employ separate measures of the international mobility of a) goods and services, and b) capital, often as control variables. For the latter, it is now common to use the policy-based

¹⁹ Rodríguez and Rodrik ask (p264) “... Do countries with lower policy-induced barriers to international trade grow faster, once other relevant country characteristics are controlled for? We take this to be the central question of policy relevance in this area... Note that this question differs from an alternative one we could have asked: Does international trade raise growth rates of income?” In his comment on the paper, Hsieh writes (p325) “Their main point is that the empirical evidence that purportedly shows a negative correlation between trade barriers and growth typically relies on measures that are either measures of macroeconomic imbalances or bad institutions and are not actually measures of trade barriers.”

measure of capital mobility estimated by Chinn and Ito (2008). However, for the former, it is almost as common to use openness, the ratio of exports and imports to aggregate output. For instance, in modelling capital flows, Fratzscher (2012) uses the Chinn-Ito (2008) measure of capital mobility, and openness to measure trade. Openness is also used as a control along with the Chinn-Ito index in a well-cited paper on growth by Eichengreen, Park and Shin (2012). In yet another well-cited paper, Milesi-Ferretti and Tille (2011) use trade openness along with the Chinn-Ito index. But while the Chinn-Ito measure relies on the presence of liberal/restrictive *policies* towards capital flows, *openness* is driven by other factors as well; more on this below. One of our objectives in this paper is to produce an analogue to the Chinn-Ito measure of capital mobility; simple to use and broad in both scope and span, if also *ad hoc*.

The problem of measuring the state of aggregate trade restrictions is similar to that of measuring the exchange rate regime. There are a number of different systems for measuring how flexibly an exchange rate moves, and there is often conflict between different schemes; Rose (2011) provides details. It is striking how many more measures of exchange rate regimes there are compared with measures of mobility of trade in goods and services.

IV. The Effect of MATR on Economic Activity

We now examine the periods after changes in MATR, to see if the dynamics of aggregate output are different following changes in trade policy. Since our contribution lies in the MATR series, we deliberately choose a well-known plain-vanilla methodology.

Empirical Methodology

To examine the short run dynamics of output following changes in trade barriers, we follow the local projection method proposed by Jordà (2005); this methodology has also been used by many others, including Auerbach and Gorodnichenko (2013), Romer and Romer (2018), and Alesina et al. (2019). This procedure does not impose the dynamic restrictions embedded in vector autoregression specifications and is particularly suited to estimating nonlinearities in the dynamic response. The first regression we estimate is:

$$y_{i,t+k} = \alpha_i^k + \gamma_t^k + \beta^k \Delta R_{i,t} + \sum_{j=0}^2 \vartheta_j^k \Delta R_{i,t-j} + \sum_{j=0}^2 \theta_j^k y_{i,t-j} + \varepsilon_t^k, \quad (1)$$

where:

- i denotes the economy and t denotes the year,
- k denotes the horizon being considered (in years after the change in trade barriers),
- y is the log of output,
- $\{\alpha\}$ are country fixed effects, included to account for differences in countries' average economic performance,
- $\{\gamma\}$ are time fixed effects, included to control for economic developments facing all countries in a given year, and
- ΔR denotes the change in MATR, increasing with restrictions,
- $\{\vartheta\}$ and $\{\theta\}$ are nuisance coefficients, and
- $\{\varepsilon\}$ are residuals that represent all other output determinants.

For the main results, we use the aggregate MATR index, denoted R . We also report separate results for sub-indices, as well as alternative aggregations as robustness checks.

The coefficient β^k denotes the “impact” of changes in trade barriers on output at a given horizon k . In the baseline we do not take a stance on the drivers of trade barriers; that is, we do not distinguish between changes in trade restrictions that can be considered exogenous to economic activity in the short-to-medium run, and endogenous changes. The latter might occur as part of broader reform, or because of a cyclical motivation to push output back to trend during recessions. Below, we also investigate the sensitivity of our results by focusing on major episodes of liberalization and tightening of trade barriers, since these can be considered more exogenous.

We estimate equation (1) for an unbalanced sample of 157 countries from 1949 to 2019, using ordinary least squares (OLS) for $k = 0, \dots, 5$. Impulse response functions are computed using the estimated coefficients β^k , and the confidence bands associated with the estimated impulse-response functions are obtained using their estimated standard errors. We also apply Driscoll and Kraay (1998) standard errors to account for cross-sectional and time dependence in the error term ε_t^k . Throughout, we consider alternative specification choices, and provide details of these, and the associated results, in Appendix 4.

Data Sources

Appendix 2 provides a summary of our other data sources. Annual series for GDP, labor productivity (defined as the ratio of GDP to employment), employment, investment, consumption are taken from the Penn World Table (PWT10.0). Exports, imports and the trade balance are taken from World Economic Outlook (April 2021). The Gini coefficient, a measure of inequality, is taken from the Standardized World Income Inequality Database (SWIID). Series on the level of regulation in product and financial markets, and job protection legislation, are taken from Alesina et al. (2019). Measures of Global Value Chains (GVC) comes from UNCTAD EORA database. Tariffs are taken from Furceri et al. (2021). The classification of countries in income groups (advanced vs. emerging and developing economies) and regions (Africa, Asia-Pacific, Europe, MENA and the Americas) follows that of the IMF World Economic Outlook.

Results

Table 3 presents the results obtained estimating equation (1) for each horizon k , from 0 to 5. The lagged output coefficients $\{\theta\}$, as expected, sum close to 1, suggesting that the level of GDP is non-stationary and that the country fixed effects *de facto* capture average national growth rates.²⁰ The country fixed effects are jointly statistically significant; so are the time fixed effects, reflecting the importance of global shocks as well as the fact that some changes in trade restrictions are determined by multi-country trade agreements.

The coefficients of interest are $\{\beta\}$; these are presented in Figure 11, the evolution of (log) output following a one-standard deviation in MATR.²¹ Time is on the x-axis; the solid line portrays the average estimated response, and its 90 percent confidence interval is included. The results suggest that such an increase in MATR (comparable to that of Thailand in 2000) is associated with an immediate reduction in output by 0.2

²⁰ Panel cointegration tests reject the null hypothesis that the estimated residual of equation (1) is non-stationary.

²¹ Equivalent to 0.82 changes in the index.

percent, and by 0.7 percent five years after. This effect is highly significant in both statistical and economic terms. To put it in perspective, it is almost twice the medium-term output effect of one-standard deviation increase in tariff rates found in Furceri et al. (2021). It is also economically plausible, close in magnitude to simulation results from a sectoral, computable, general equilibrium model with input-output linkages (Caliendo, Feenstra, Romalis and Taylor, 2017) based on the same magnitude of reduction in trade restrictions (IMF 2021 provide more details).

To check the robustness of these associations, we performed a number of sensitivity tests across alternative samples and specifications, and present the results in Appendix 4, which presents a number of analogues of Figure 11. For instance, we divided our observations into those from advanced and emerging economies; reassuringly, the results for the different groups suggest that effect of reducing trade barriers is statistically significant in both AEs and EMDEs, albeit larger in the second group.²² To get a sense of the components of MATR driving the results for AEs and EMDEs, we run the regressions on the different components of trade restrictions: invisibles, exports, imports, payments and exchange measures. The results in AEs seem to be driven mainly by export and import restrictions (latter statistically significant), while those for EMDEs seem to be driven mainly by restrictions related to invisibles, exports, imports, and payments (all statistically significant).

Potential Channels of Influence

We now explore informally some of the channels through which trade restrictions might affect output, in the hope that patterns might emerge to stimulate future research. We re-estimate (1) using as alternative dependent variables: (i) labor productivity; (ii) employment; (iii) inequality; (iv) the trade balance; (v) investment; (vi) consumption; (vii) exports and (viii) imports. The results are reported in Figure 12 in graphics constructed analogously to Figure 11.

The results suggest that one key channel is the statistically and economically significant decrease in labor productivity, which declines by about 1.5 percent after five years. This result confirms the standard view that protectionism can lead to a meaningful reduction in the efficiency with which labor is used, and thus output. An increase in trade barriers is also associated with lower investment, consistent with the idea that firms face less

²² We have also reduced the sample in a number of ways, and again, present the results in Appendix 4 (Figure A4.2). In particular, we changed the sample through dropping: (i) series with gaps and less than 20 consecutive years of data; (ii) high inflation (>100%) episodes; (iii) small countries (population < one million); (iv) outliers (those with output residuals in the bottom and top percentiles of the distribution)²²; (v) years before 1980; (vi) episodes with large changes in MATR change (corresponding to the 99th percentile of the distribution); (vii) observations from the Americas; and (viii) observations from Asia and Sub-Saharan Africa. Our results persist through all these perturbations.

We also consider three perturbations to the methodology of (1). First, we expand the set of controls by including contemporaneous changes in the trade balance and the real exchange rate; this is equivalent to considering shocks to MATR that are orthogonal to contemporaneous shocks in these variables. Second, we restrict MATR to enter (1) only with a lag; that is, we exclude a contemporaneous effect of MATR on GDP. As discussed above, an important issue in estimating the causal economic effects of MATR is the contemporaneous relation between economic activity and MATR: our baseline specification (1) does not distinguish between changes in trade barriers that can be considered exogenous to economic activity in the short run, from those endogenous that are correlated with contemporaneous shocks to economic activity or that are motivated by short-term economic objectives. Another way to address endogeneity is to include a measure of expectations on contemporaneous growth as a control (Corsetti et al. 2012; Duval and Furceri 2018). We also implement this by including the IMF WEO GDP growth forecasts made in October of the same projecting year (e.g., the growth forecast for 2018 made in October of 2018). Happily our results remain robust to these alternative specifications. While these are only imperfect ways to address endogeneity, they provide some reassurance of the main findings.

Finally, we re-estimate (1) but using the six different variants of MATR presented in Appendix 1 (Figure A1.3); the results are presented again presented in Appendix 4 (Figure A4.3). Our key result – of a persistent, economically, and statistically significant decline in output after trade is restricted – does not depend on the precise measurement of MATR.

competition from abroad and have therefore less incentive to invest. Unsurprisingly, both imports and exports fall with an increase in protectionism. Another predictable result is that increases trade barriers lower consumption, by around 1 percent after five years; this result is unsurprising, given the decline in income. While the reduced-form approach does not allow for a full-fledged analysis of the welfare effects of trade restrictions, the broad characteristics indicate that trade restrictions resemble shocks to the productivity of the tradeables sector.

Finally, the results also suggest that increases in trade restrictions are associated with a reduction in inequality. This result mirrors the view that trade liberalization does come with potentially adverse distributional consequences, as resource reallocation associated with reforms generates both winners and losers, with the already better-off well positioned to benefit more.

Components of MATR and Alternative Aggregations

Are specific trade restrictions more harmful than others? To address this question, we repeated the analysis to consider separately the five main components of MATR: (i) exchange measures; (ii) payment restrictions; (iii) import restrictions; (iv) export restrictions; and (v) payment for invisibles. The results, reported in Figure 13, suggest that increases in any component is associated with a decline in output. The effects are not statistically different across components.

Non-linearities

Theory suggests two important elements of heterogeneity in the effects of trade restrictions (Caliendo, Feenstra, Romalis and Taylor, 2017): (i) there is complementarity between tariff and non-tariff restrictions—that is, the effect of an increase in non-tariff restrictions is larger in situation when tariffs are higher; and (ii) the effect of an increase in trade restriction is larger for countries that are imports a larger share of intermediate inputs—that is, if the country participates more in Global Value Chains (GVCs).

To test these hypotheses, we modify equation (1) to allow the response to vary across according to a given country's characteristics—the level of tariff and the degree of GVC participation. The specification we estimate is:

$$y_{i,t+k} = \alpha_t^k + \gamma_t^k + F(z_{it})[\beta^{1k}\Delta R_{i,t} + \sum_{j=0}^2 \vartheta_j^{1k}\Delta R_{i,t-j} + \sum_{j=0}^2 \theta_j^{1k}y_{i,t-j}] + (1 - F(z_{it}))[\beta^{2k}\Delta R_{i,t} + \sum_{j=0}^2 \vartheta_j^{2k}\Delta R_{i,t-j} + \sum_{j=0}^2 \theta_j^{2k}y_{i,t-j}] + \varepsilon_t^k, \quad (2)$$

$$\text{with } F(z_{it}) = \frac{\exp^{-z_{it}}}{(\exp^{-z_{it}} + 1)}; \text{ and } z_{it} = \frac{(x_{it} - \bar{x})}{sd(x_i)}$$

where z is the variable measuring a given country characteristics (x , tariff rate and GVC participation), normalized to have zero mean and a unit variance. The weights assigned to each regime vary between 0 and 1 according to the weighting function $F(\cdot)$, so that $F(z_{it})$ can be interpreted as the probability of being in a given state. The coefficients β^{1k} and β^{2k} capture the output impact of trade barriers at horizon k in cases of very low z ($F(z_{it}) \approx 1$ when z goes to minus infinity) or high z ($1 - F(z_{it}) \approx 1$ when z goes to plus infinity), respectively.²³ This approach

²³ $F(z_{it})=0.5$ is the cutoff between low and high z . The approach is similar to considering a dummy variable that takes value 1 when the z is below zero, or the underlying country characteristics (x) below average (\bar{x})—that is, $F(z_{it}) \geq 0.5$, and zero otherwise. The difference is that instead of considering two discrete values (0 and 1), the smooth transition approaches allow the regimes to continuously vary between 0 and 1.

is equivalent to the smooth transition autoregressive model developed by Granger and Teräsvirta (1993), and has two advantages. First, it permits a direct test of whether the effect of reforms varies across different country characteristics. Second, compared with estimating structural vector autoregressions for each regime, it allows the effect of trade barriers to change smoothly between states by considering a continuum of states to compute the impulse response functions, thus making the response more stable and precise.

We estimate equation (2) with OLS, with standard errors clustered at the country level. The time and country sample used to estimate equation (2) is typically reduced compared to equation (1) because of limited data availability regarding the national characteristics, z , being considered (see Appendix 1). Still, the results obtained by estimating equation (2) confirm the theoretical predictions (analogues to Figure 11 are contained in Appendix 4). The decline in output following a one-standard deviation increase in MATR (excluding the tariff component) is larger when tariffs are high than when tariff rates are low (Figure A4.4), so there seem to be complementarity effects of protectionism; non-tariff barriers hurt more when tariffs are higher. Second, the effect of MATR is larger for countries with high GVC participation, as shown in Figure A4.5.²⁴

Large and Plausibly Exogenous Episodes of Trade Policy Change

As one final robustness check, we focus on both large and plausibly exogenous episodes of trade policy change. We follow the spirit of Romer and Romer (2010), and search for exogenous MATR shocks not intended to offset the output gap or return growth to trend.

The first step in identifying such episodes is to look at large changes in MATR. We follow the literature's approach to infer major episodes of stock market liberalization (Henry 2007) and capital account liberalization (Furceri and Loungani 2018; Furceri, Loungani and Ostry 2019). We identify episodes in which changes in MATR exceed their average by at least two standard deviations, using all observations (in practice, this is where MATR changes by more than 1.64). This criterion identifies a large but manageable number of 385 episodes, 123 of increased restrictions and 262 of liberalization; the majority of these occurred between 1989 and 2008. We narrow our focus to these, ignoring the many minor episodes of MATR changes that make the narrative identification difficult. This reduces measurement error associated with the timing of minor and potential gradual changes in MATR. It also reduces the possibility of reverse causality, as large changes are unlikely to be driven by normal business cycle conditions.²⁵

Of course, these major changes could be determined by significant economic shocks and crisis and therefore might still be endogenous. Therefore, as a second step, we restrict our selection to those episodes that were not preceded or succeeded by economic and financial crises in a one-year interval. This results in 162 episodes, listed in Appendix 1 (Table A1.4).

We redo our analysis by replacing the change in MATR in equation (1) with a discrete variable which takes value 1 for a major trade restriction, -1 for a major liberalization and 0 otherwise. The results, presented in Figure 14, are similar to but smaller than those of the baseline Figure 11. The analysis confirms that major

²⁴ These results are robust to alternative non-linear specifications, such as including in equation (1) either a) an interaction term between change in MATR and the level of tariff (GVC participation), or b) interactions between change in MATR and dummies that denote alternatively quartiles of distribution of the country's characteristics.

²⁵ Indeed, we run Granger causality tests between large episodes and growth, and do not find that past GDP growth helps to predict major changes in trade restrictions—the p-value for the test of the null hypothesis that GDP growth Granger cause large changes in MATR is about 0.76.

trade restrictions are associated with significant output declines, of around 0.35 percent 5 years after the restriction.

While closer to being exogenous, these major MATR changes could be driven by the desire of policy makers to bring growth to trend. To address this issue, we perform extensive search of narrative records. We searched through official national documents, international institutions reports (such as IMF, WTO or World Bank), AREAER reports, trade institutes and think-tanks (such as FREIT²⁶, TRALAC²⁷, SICE²⁸, ECIPE²⁹), policy papers, publications and other online sources, looking for the absence of any discussion of counter-acting shocks or of any desire to close an output gap. This approach produces a smaller list of 58 episodes, 7 increase in restrictions and 51 liberalizations (see Table A1.5 of Appendix 1, for the list of episodes and the associated narrative records). Looking closely, most of these “exogenous” episodes are associated with ideological and/or political changes. For instance, one occurred in Austria 1995, when the Austrian Independence Treaty was signed. Others occurred as part of major trade agreements among countries to strengthen economic and political linkages, such as those associated with the EU or WTO memberships. Still others were motivated by the desire to increase long-run growth, such as the increase in restriction associated with the import substitution strategy implemented by Costa Rica in 1966.

One final concern is that these episodes could still be part of broader reform packages aimed at improving long-term output. To address this issue, we further restrict the set of episodes to exclude those occurred during an IMF stabilization program and those associated with other major changes in product, domestic and external finance, and labor market reforms—dates for these reform indicators are taken from Alesina et al. 2020—(Table A.1.6).³⁰

The results obtained by re-estimating equation (1) with the “exogenous” changes in MATR identified with the narrative approach and excluding structural reforms are presented in Figure 15 and 16. The results confirm that trade restrictions have statistically significant negative effects on output, with output falling by almost 0.4 percent 5 years after.

V. Summary and Conclusion

In this paper, we propose a new Measure of Aggregate Trade Restrictions, MATR. This simple measure has a number of desirable properties: it is based on sensible, plausible, trade policy inputs with a transparent, accessible, reliable source. Each of the underlying fundamentals is quantitative, based on clear criteria, and include both tariffs and a host of non-tariff barriers. MATR covers an unbalanced sample of 157 countries annually between 1949 and 2019, is strongly correlated with existing measures of openness and trade policy, and is more comprehensive than existing measures. Using MATR, as well as a narrative approach to identify the motivation behind changes in MATR, we show that trade restrictions are harmful for the economy and lead to significant contractions in output.

²⁶ Forum for Research in Empirical International Trade.

²⁷ Trade Law Center.

²⁸ Foreign Trade Information Center. Organization of American States.

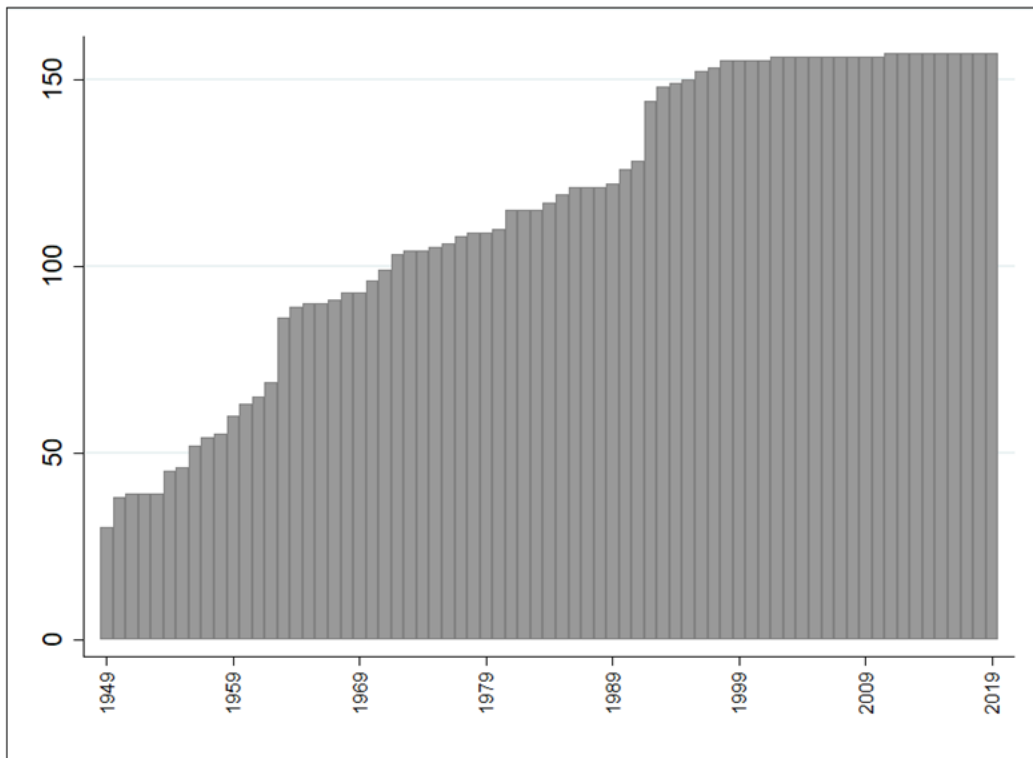
²⁹ European Center for International Political Economy.

³⁰ The episodes are listed in Appendix 1, Table A1.6.

Our work could be extended further in at least three dimensions. We have only considered impediments to the international flow of goods and services; future scholars may also want to consider FDI. Another thing for other researchers to contemplate is lagged values. In measuring capital mobility, Chinn and Ito (2008) use moving averages of current plus lagged values; we only consider contemporaneous values. Finally, we have developed MATR without a rigorous theoretical model which would be necessary to understand the general equilibrium and welfare consequences of trade restrictions more deeply.

We emphasize that MATR is not a perfect measure of artificial trade impediments. Most obviously, it is theoretically *ad hoc*. It diverges from the literature in that it is an aggregate measure of trade restrictions composed only from aggregate data, not a weighted average of disaggregated data. For all these reasons, MATR certainly does not displace any existing measures of aggregate trade restrictions; rather, we think of it as a complementary measure. There is no perfect (or even, perhaps, good) measure of aggregate trade restrictions; we think that adding another, admittedly imperfect, such measure is a worthwhile contribution, and an appropriate place to pass the torch to others.

Figure 1: MATR country coverage over time



Y axis presents the number of countries that have data for that particular year.

Figure 2: MATR against the size of the economy in 2016

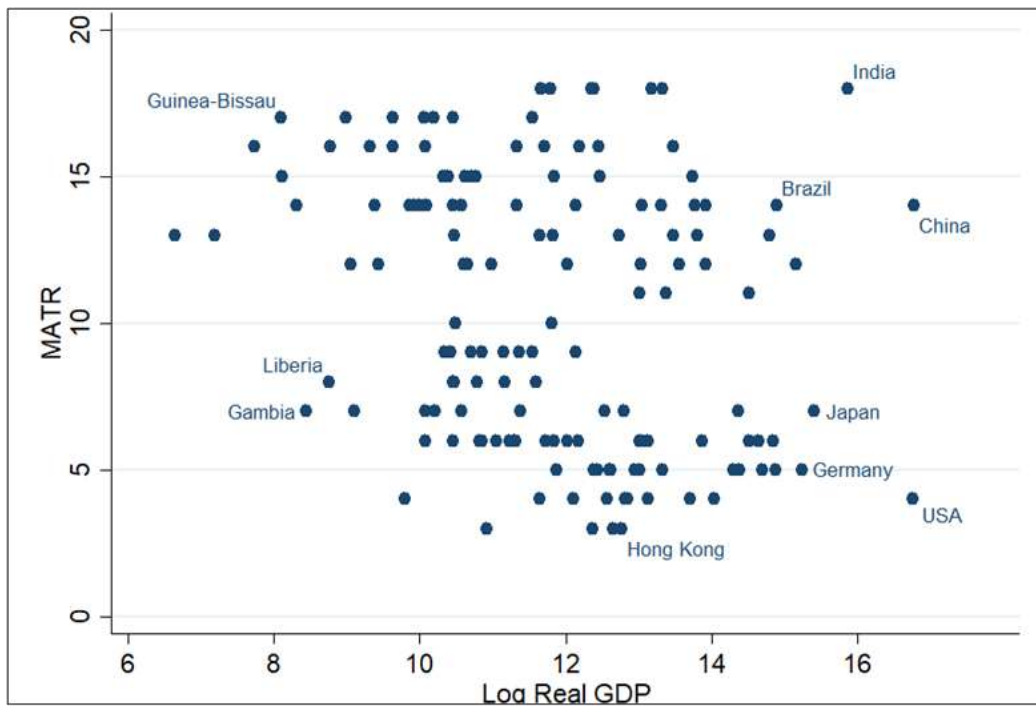


Figure 3: Evolution of MATR over time, by income groups

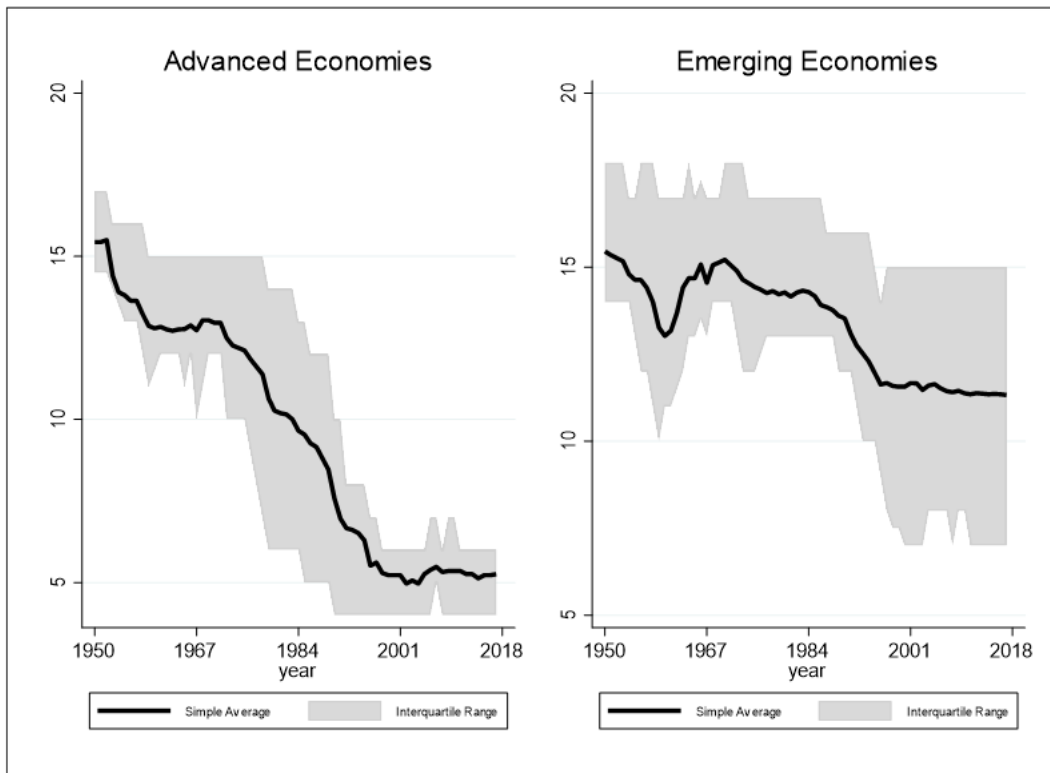


Figure plots year specific simple average and interquartile range of MATR for Advanced and Emerging Economies, classified following the IMF World Economic Outlook.

Figure 4: Evolution of MATR over time, by region

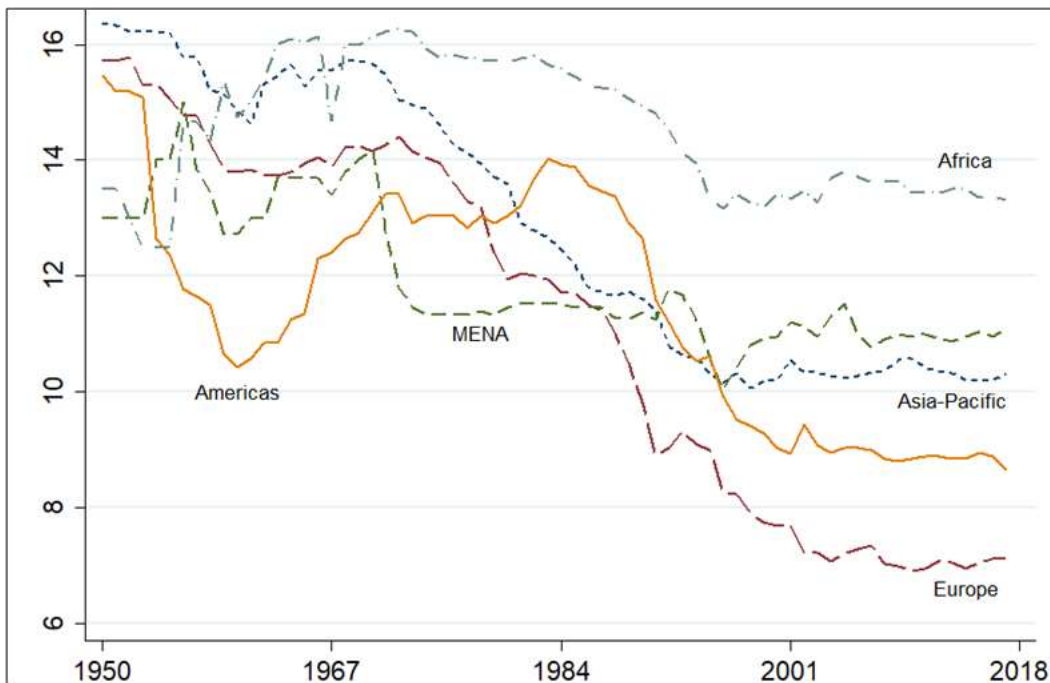


Figure plots the simple average of MATR by region. Regions are classified following the IMF World Economic Outlook.

Figure 5: Evolution of MATR over time, by decade

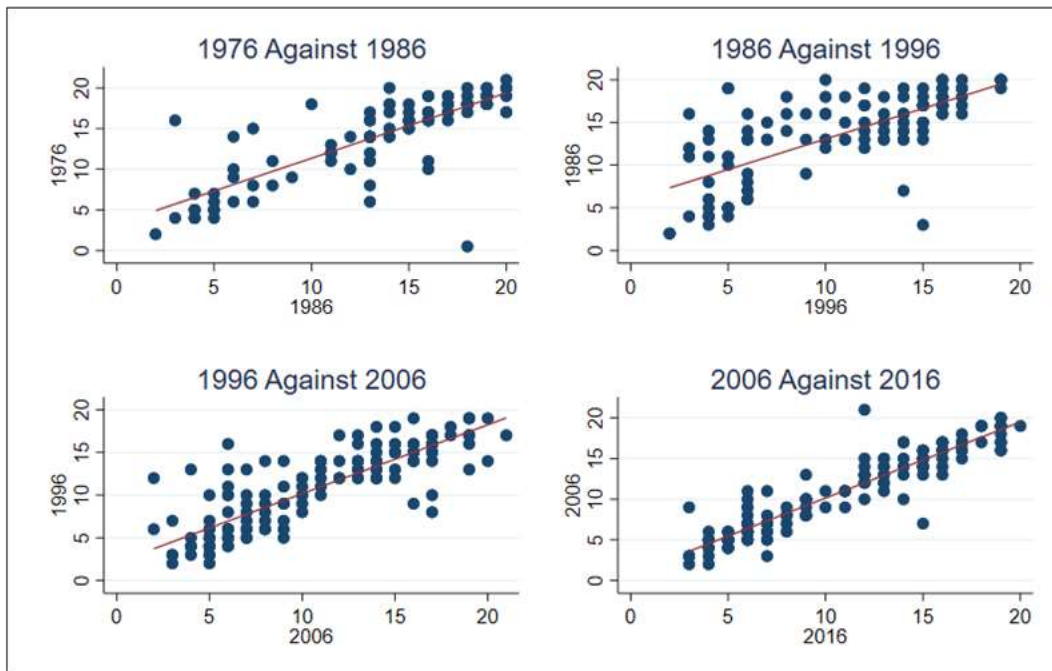


Figure compares of MATR against MATR by decades.

Figure 6: Evolution of MATR over time, for specific countries

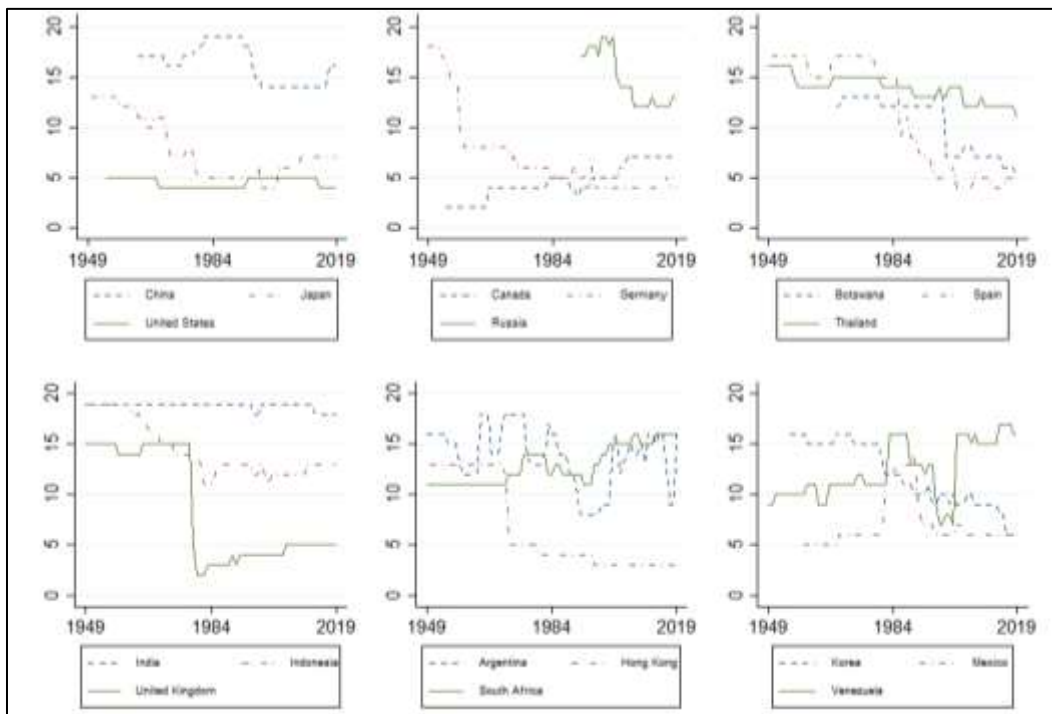


Figure shows levels of MATR trough time for a different set of countries.

Figure 7: MATR in 1996 vs. income, size, tariff and trade openness

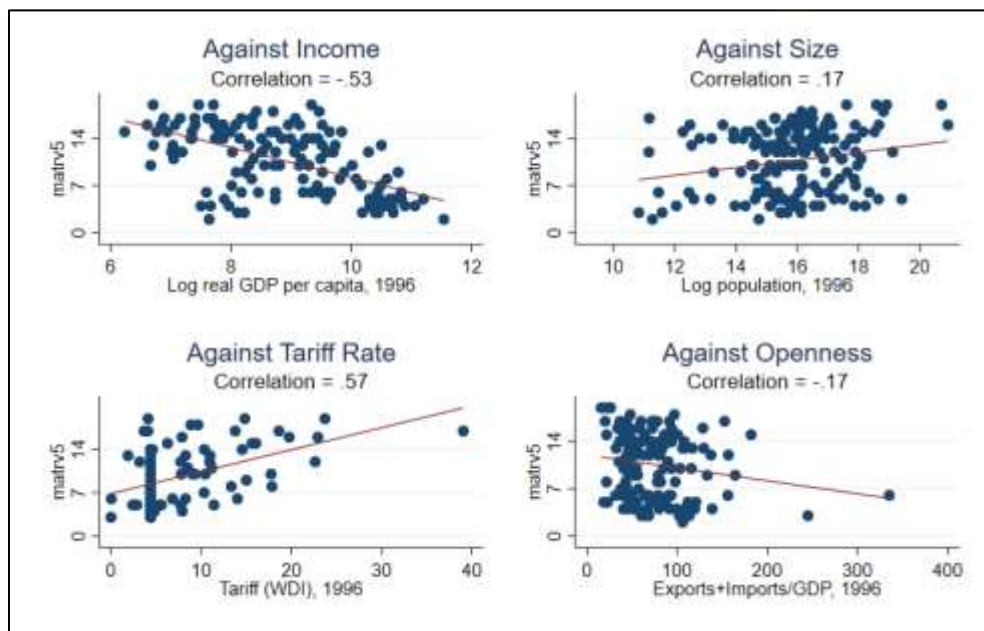
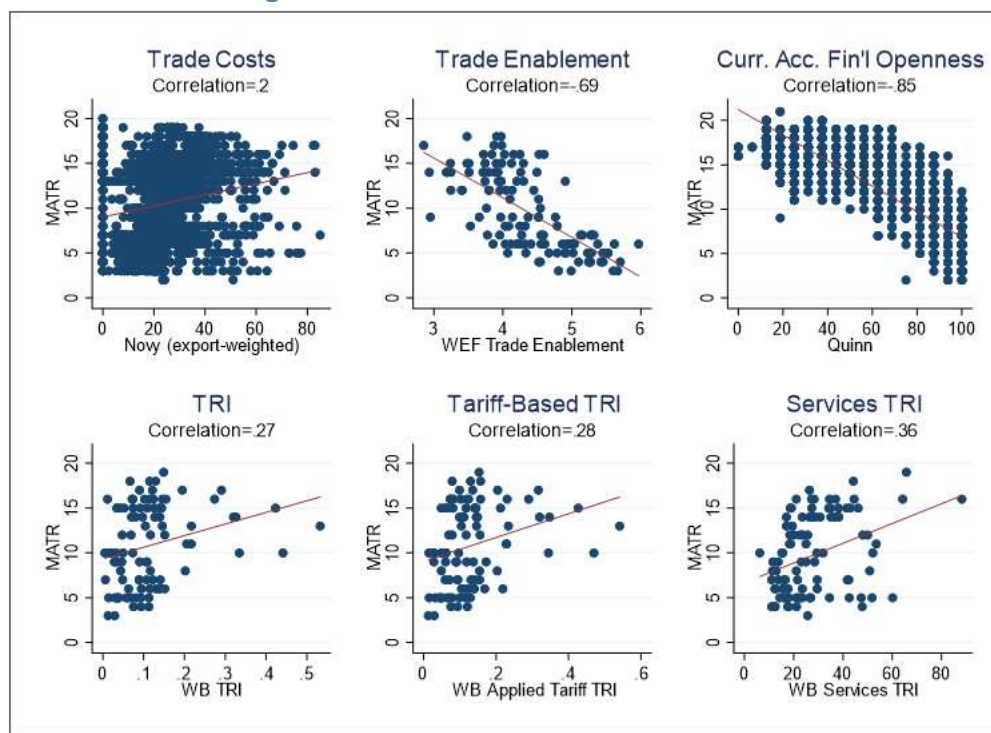


Figure shows scatterplot and correlation of MATR against four key variables for 1996 (mid-point of the sample).

Figure 8: MATR vs. alternative measures



Note: Figure shows scatterplot and correlation of MATR against six ad-hoc trade restriction existing measures: Novy's (2012) measure of trade costs; The World Economic Forum's 2016 Enabling Trade Index; Quinn's measure of current account financial openness; Trade Restriction Index (TRI) produced by the World Bank (2009), using methodology from Kee et al. (2009); World Bank TRI produced using only tariffs, for 2009; and World Bank TRI for the service sector.

Figure 9: MATR vs. Trade Freedom Indicator

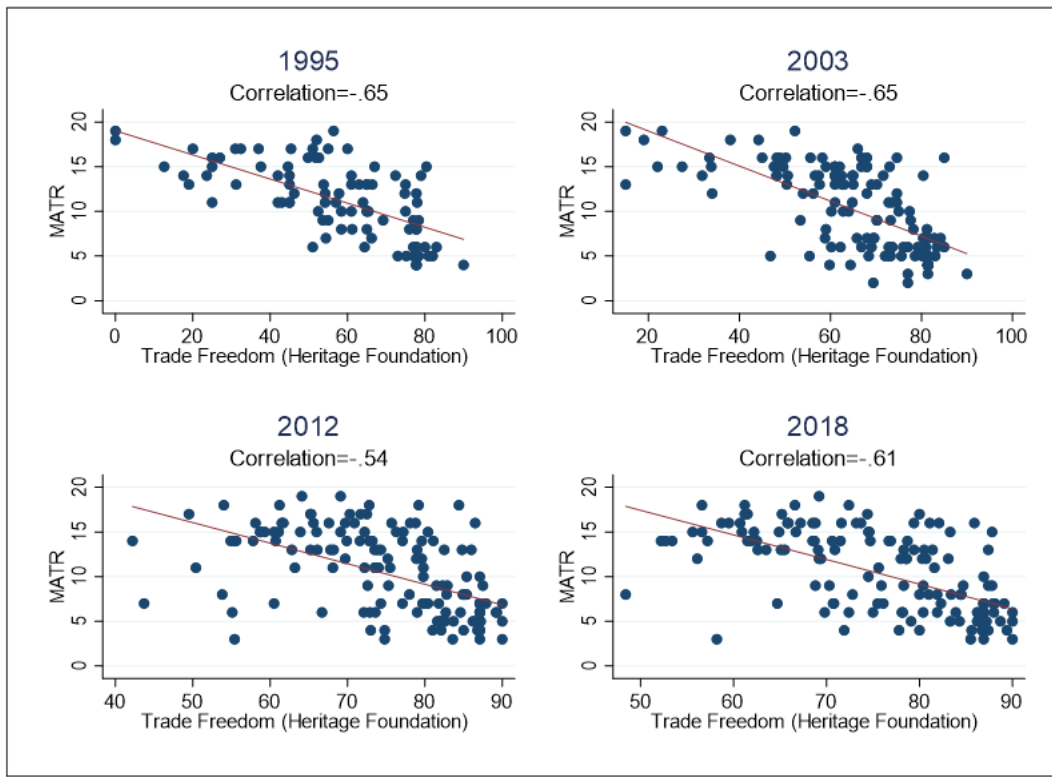


Figure 10: MATR vs. Chinn-Ito

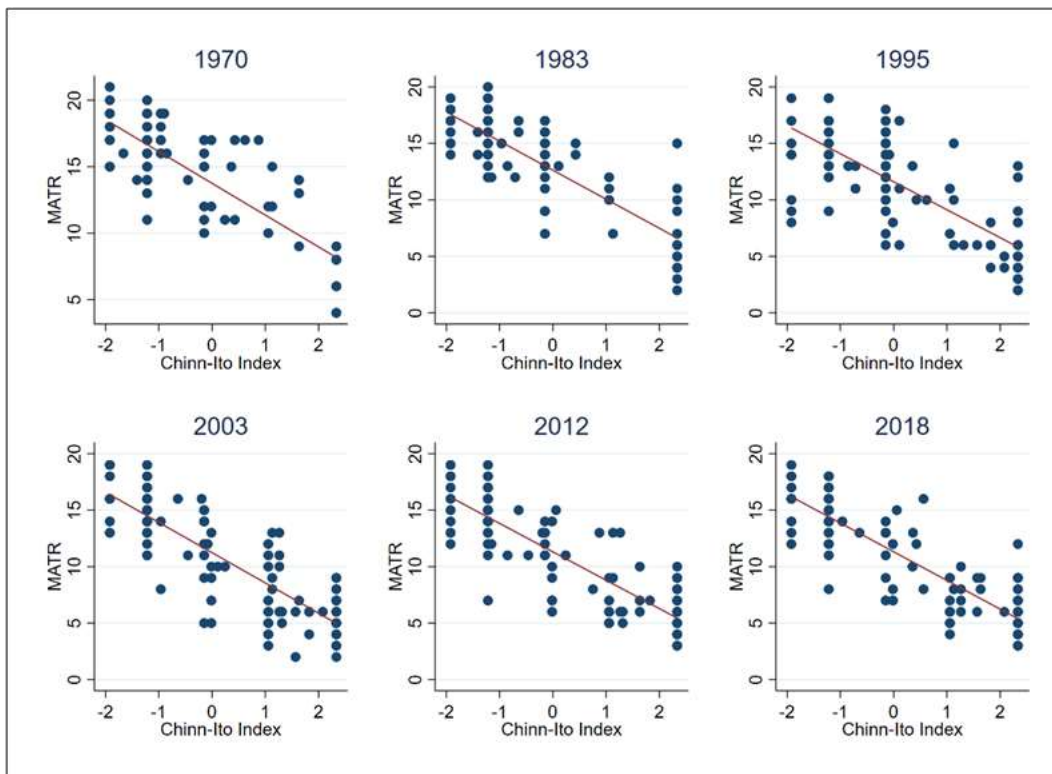
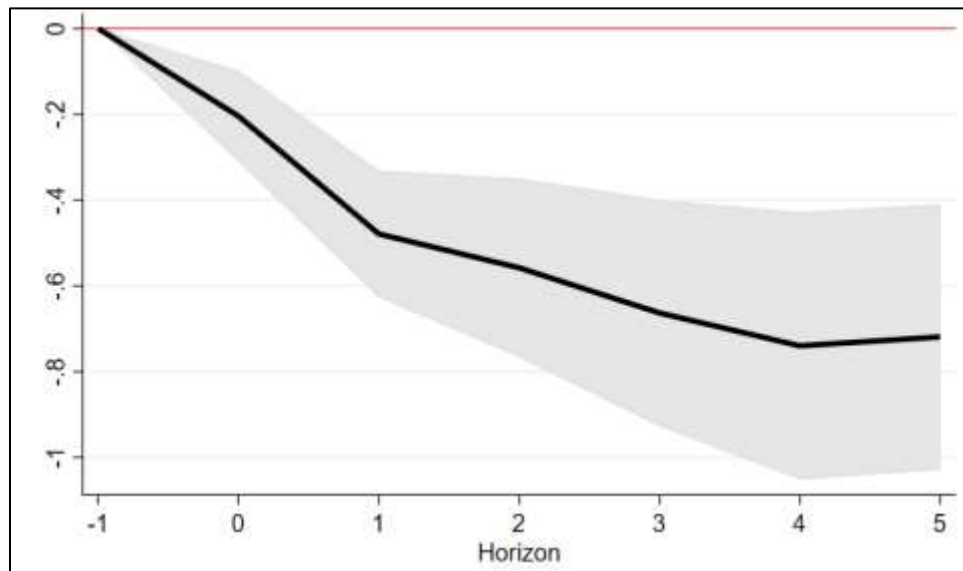
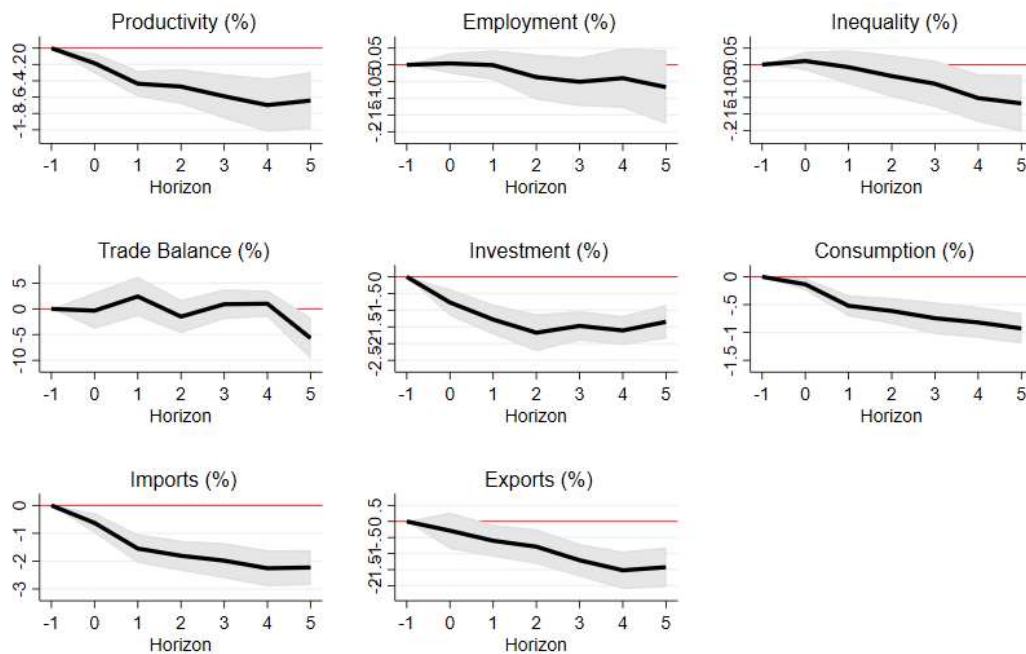


Figure 11: Response of (log) GDP to Changes in MATR (%)



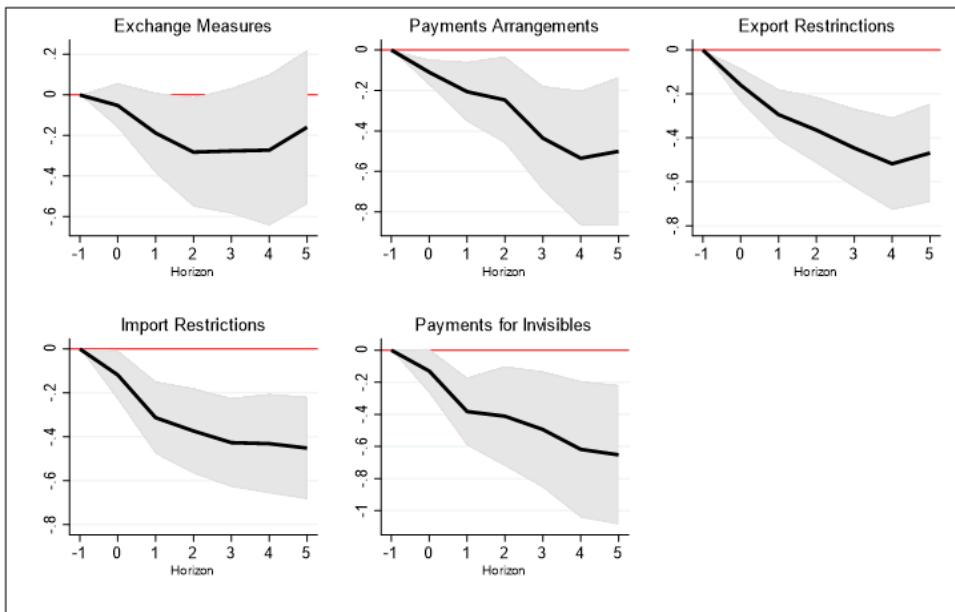
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors.

Figure 12: Response of (log) Economic Indicators to Changes in MATR



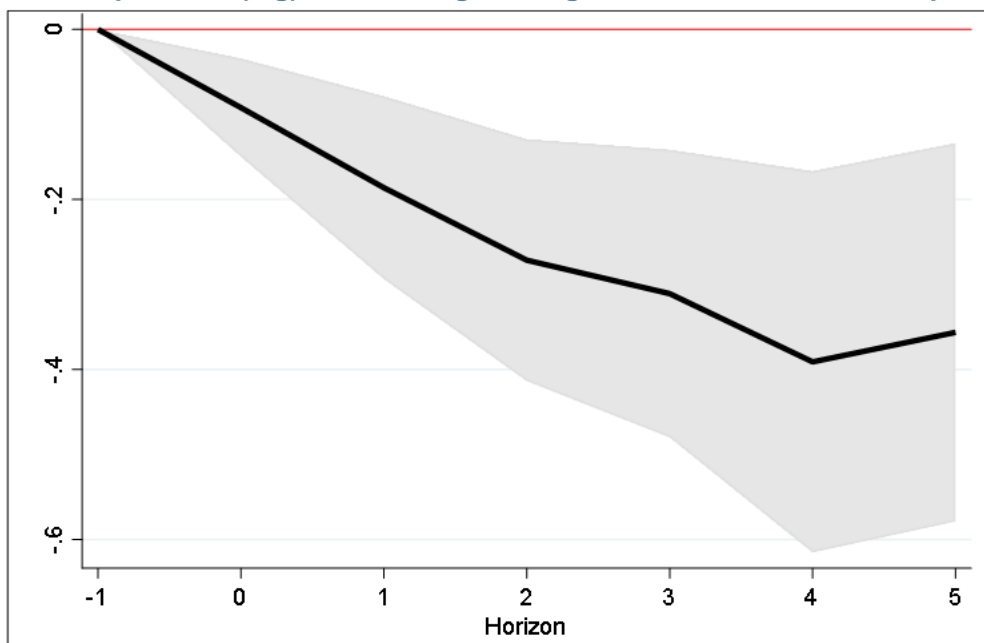
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors.

Figure 13: Response of (log) GDP to Changes in MATR components (%)



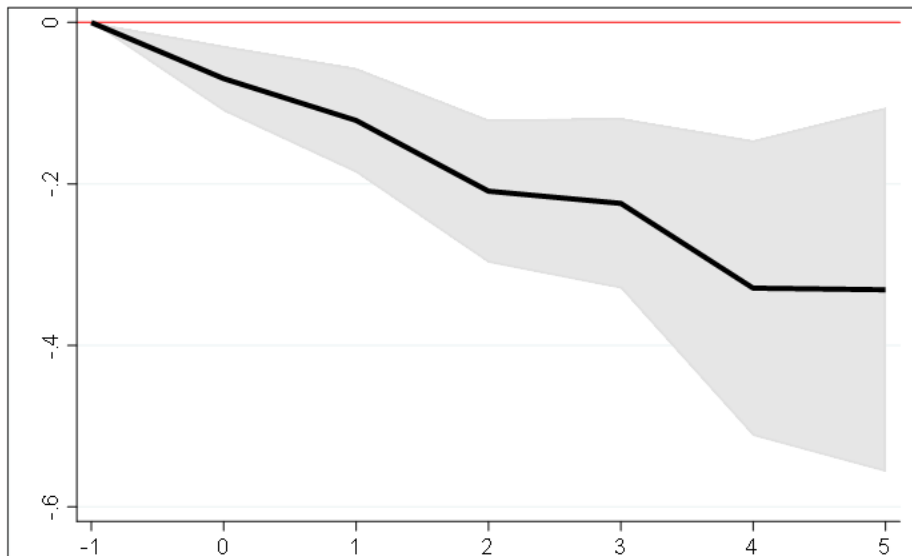
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors.

Figure 14: Response of (log) GDP to Large Changes in MATR outside crisis periods (%)



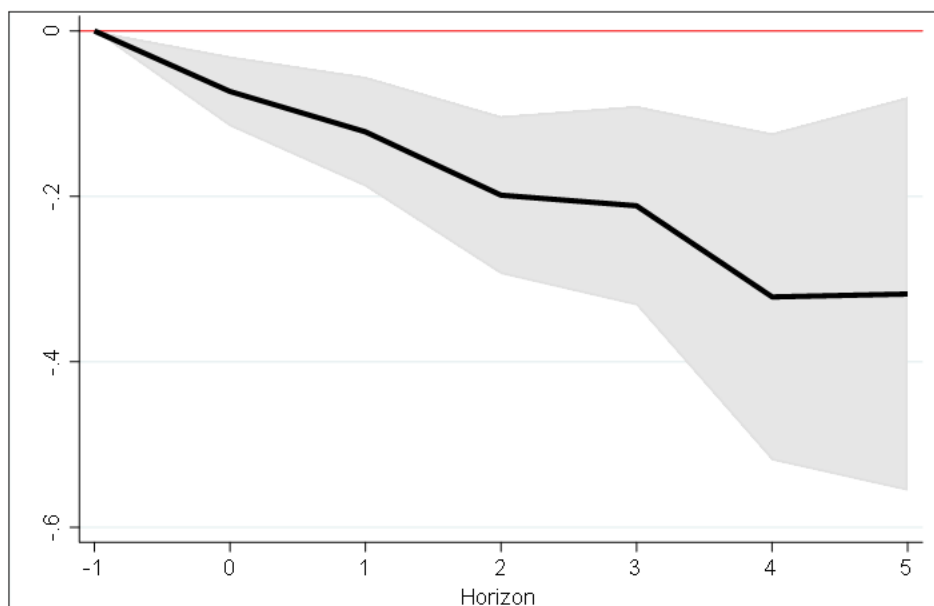
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors. Large changes in MATR defined as changes in index $> |2\sigma|$, excluding recessions within one year of change: 1 \equiv increase in restrictions; -1 \equiv liberalization; 0 ow.

Figure 15: Response of (log) GDP to Exogenous Changes in MATR (%)



Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors. Large changes in MATR defined as changes in index $> |2\sigma|$, excluding recessions and structural reforms within one year of change, using narrative approach to check: 1 \equiv increase in restrictions; -1 \equiv liberalization; 0 ow.

Figure 16: Response of (log) GDP to Exogenous Changes in MATR, also cleaned by Structural Reforms (%)



Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors. Large changes in MATR defined as changes in index $> |2\sigma|$, excluding recessions and structural reforms within one year of change, using narrative approach to check: 1 \equiv increase in restrictions; -1 \equiv liberalization; 0 ow.

Appendix I. MATR Data Construction

The IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (hereafter "AREAER") is freely available online from 1999 through 2020. We extended the relevant series back in time through 1949 by hand, examining changes to the relevant variables recorded in hard copies of *AREAER*. We have also filled in some missing *AREAER* data, using information on the relevant country-variable combination at an earlier (if possible) or later (if necessary) date for the same country-variable combination when there are no "changes" to the country-variable combination recorded in *AREAER*.

We focus on five categories of the data: II (*Exchange Measures*); VII (*Imports and Import Payments*); VIII (*Exports and Export Proceeds*); IX (*Payments for Invisible Transactions and Current Transfers*); and IX & X (*Payments and Proceed from Invisible Transactions and Current Transfers*) We are most interested in the components of the *Imports and Import Payments* category, and its immediate sub-components: (i) foreign exchange budget; (ii) financing requirement for imports; (iii) documentation requirements for release of foreign exchange for imports; (iv) import licenses and other nontariff measures; (v) import taxes and/or tariffs; and (vi) state import monopoly³¹, and *Export and Export Payments* category, and its immediate sub-components: (i) repatriation requirements; (ii) financing requirements; (iii) documentation requirements; (iv) export licenses and (v) export taxes and/or tariffs.

We restrict ourselves to the six *AREAER* categories and their immediate sub-components, though there are up to four levels of sub-components. In all cases, these variables are binary dummy variables, with unity in any sub-component meaning that all higher-level aggregates should be unity.³²

Rules of Coding

- Coding. Restriction is coded as 1, absence of restriction as 0, missing/unavailable as n/a
- Dating. Recent *AREAER* volumes includes about 180 country descriptions; these are the primary source of our text-based data analysis. Most of the country descriptions include, at the very top, a date (e.g., "data as of Dec 31, XXXX"). For any given year (e.g., 2001), most of the country descriptions are dated the preceding year (e.g., 2000). The latter year (2000) is coded as the relevant data year for all countries, so 2001 *AREAER* report data is relevant for 2000. (This is true even if a few countries in, say, the 2001 *AREAER* quote data for a date in 2001 or 1999, not 2000.)
 - Announced future changes. Sometimes a country will state in *AREAER* that it is changing policy in the future (e.g., in the 2001 *AREAER* country x states it will change policy in 2002, though it hadn't as of 2000). In that case, the announced future policy change is dated to the announced future date (2002 in the example).
 - Investigating the changes section. At the end of each country description, there is a "Changes Section" which describes changes during, e.g., 2000. Usually, any change of relevance was investigated. However, we've found changes in the text that are not reported in the "Changes Section". In these cases, we take the changes in the main text.

³¹ Publicly available, along with further details, at <https://www.elibrary-areaer.imf.org/>.

³² Thus, category colV_A_1_b_1 (restrictions on "Transactions in capital and money market instruments") is a sub-component of colV_A_1_b (restrictions on "Capital transactions") itself a sub-component of colV_A_1 (restrictions on "Controls on the use of domestic currency"), which is in turn a sub-component of colV_A (restrictions "Arrangements for Payments & Receipts, Prescription of currencies").

- Granularity. We collect data as granular as reasonably possible. Thus, for instance, we collect data on VII_D_1, an indicator of “Positive list, AREAER” as well as that for VII_D “licenses and other nontariff measures”.
- Frequency. We check for changes from year to year in all issues of *AREAER* via examining the country text descriptions.
- Summary Dummy Variable Tables. There are summary tables of indicators included in each *AREAER*, though the content of these changes in 1996. We have cross-checked to ensure that they are always coherent with the variables we code (though most of the variables we code are not in the summary tables).
- Absence of Change indicates status quo. Suppose that a given variable takes a certain value in a given year for which we have actual data, e.g., 1999 (the earliest available year for which IMF data is currently available). Then absent any information of relevance in 1998, the variable will be coded as having the same value in 1999 and 1998.

Appendix Table A1.1 List of Economies

Angola	Dominican Republic	Kuwait	Romania
Albania	Algeria	Lao PD Republic	Russian Federation
United Arab Emirates	Ecuador	Lebanon	Rwanda
Argentina	Egypt	Liberia	Saudi Arabia
Armenia	Eritrea	Sri Lanka	Sudan
Antigua and Barbuda	Spain	Lesotho	Senegal
Australia	Estonia	Lithuania	Singapore
Austria	Ethiopia	Latvia	Solomon Islands
Azerbaijan	Finland	Morocco	Sierra Leone
		Moldova, Republic of	El Salvador
Burundi	Fiji	Madagascar	Slovakia
Belgium	France		
	Micronesia, Fed. States	Maldives	Slovenia
Benin	Gabon	Mexico	Sweden
Burkina Faso	United Kingdom	Marshall Islands	Syrian Arab Republic
Bangladesh	Georgia	Mali	Chad
Bulgaria	Ghana	Myanmar	Togo
Bahrain	Guinea	Mongolia	Thailand
Bahamas	Gambia	Mozambique	Tajikistan
Bosnia and Herzegovina	Guinea-Bissau	Mauritania	Turkmenistan
Belarus	Greece	Malawi	Timor-Leste
Belize	Guatemala	Malaysia	Tonga
Bolivia	Hong Kong	Namibia	Tunisia
Brazil	Honduras	Niger	Turkey
Barbados	Croatia	Nigeria	Tuvalu
Brunei Darussalam	Haiti	Nicaragua	Tanzania, United Republic of
Bhutan	Hungary	Netherlands	Uganda
Botswana	Indonesia	Norway	Ukraine
Central African Republic	India	Nepal	Uruguay
Canada	Ireland	New Zealand	United States
Switzerland	Iraq	Oman	Uzbekistan
Chile	Israel	Pakistan	Venezuela
China	Italy	Panama	Viet Nam
Côte d'Ivoire	Jamaica	Peru	Vanuatu
Cameroon	Japan	Philippines	Yemen
Congo	Kazakhstan	Palau	South Africa
Colombia		Papua New Guinea	
	Kenya	Guinea	Zambia
Costa Rica	Kyrgyzstan	Poland	Zimbabwe
Czech Republic	Cambodia	Portugal	
Germany	Kiribati	Paraguay	
Dominica	Korea, Republic of	Qatar	
Denmark			

Appendix Table A1.2 Selected Economies and MATR Values

Country	1976	1986	1996	2006	2016
Angola			17	17	18
Argentina	18	14	8	15	13
Australia	15	7	6	5	4
Brazil	19	19	19	15	14
Canada	4	5	5	7	7
Switzerland	7	4	4	5	5
Chile	17	15	13	4	5
China	17	19	15	14	14
Germany	6	5	4	4	5
Eritrea			13	18	19
Spain	17	9	5	4	5
Finland	14	12	3	3	3
France	14	13	7	5	6
Guinea	19	18	17	18	17
Hong Kong	5	4	3	3	3
Indonesia	14	13	12	12	13
India	19	19	18	19	18
Israel	17	16	11	2	3
Italy	16	15	8	6	5
Japan	7	5	5	6	7
Korea	15	12	9	10	6
Mexico	6	13	6	6	6
Myanmar	19	20	19	19	18
Netherlands	10	6	4	5	4
Pakistan	19	19	15	16	15
Panama	6	6	6	2	4
Philippines	14	13	11	10	12
S. Arabia	4	4	4	5	5
Singapore	9	6	6	6	6
Syria				19	18
Turkey	17	15	12	11	11
Venezuela	11	16	9	15	17
S. Africa	14	13	13	15	16
Zimbabwe		18	16	19	12

Appendix Table A1.3 Examples of Narrative Records in AREAER, 2016

Measure	Sub-Component	AREAER		Country	Example/Text
		Report	Page		
II. Exchange measures	II.A. Restrictions and/or multiple currency practices	2016	22	Angola	<p>“Restrictions on the making of payments and transfers for current international transactions. ... [including]: (i) limits on the availability of foreign exchange for invisible transactions, such as travel, medical or educational allowances; and (ii) limits on unrequited transfers to foreign-based individuals and institutions. In addition, Angola maintained three exchange restrictions ... from: (i) the discriminatory application of the 0.015 percent stamp tax on foreign exchange operations; (ii) the operation of the priority list for access to US dollars at the official exchange rate; and (iii) a special tax of 10 percent on transfers to non-residents under contracts for foreign technical assistance or management services. Angola also maintains three multiple currency practices ...”</p>
	II.B. Exchange measures imposed for security reasons	2016	252	The Bahamas	<p>“Restrictions on Bahamas-licensed banks and financial institutions regarding transactions with: (i) the Democratic Republic of the Congo; (ii) the Islamic Republic of Iran; (iii) the Democratic People’s Republic of Korea; and (iv) Osama bin Laden, the Al-Qaida organization ...”</p>
IV. Restrictions to payments	IV.A. Prescription of currency requirements	2016	617-618	Cameroon	<p>“the monetary unit is the CFA franc, the sole official currency and legal tender in all CEMAC members, and all transactions among residents are required to be settled in domestic currency”</p>
	IV.B. Payments arrangements	2016	944	Denmark	<p>Denmark had payments arrangements since it was bound by regional arrangements, as</p>

					Denmark was a member of the EU.
	IV.C. Administration of control	2016	1017	Egypt	Egypt had administration of control since "Banks [were] authorized to execute foreign exchange transactions within the framework of a general authorization ..."
	IV.D. Payment arrears	2016	1312	Guinea	Guinea had payments arrears "with various financial institutions"
	IV.F. Controls on exports and imports of banknotes	2016	316	Bangladesh	"Residents and nonresidents may take out up to Tk 5,000 in domestic currency."
VII. Import Restrictions	VII.A. Foreign exchange budget	2016	1328	Guinea-Bissau	The country had a foreign exchange budget, meaning an a priori allocation of a certain amount of foreign exchange for the importation of specific types of goods..
	VII.B. Financing requirements for imports	2016	1497	India	The country had a financing requirement for imports (minimum financing and advance payment requirements) though "The RBI allows requests from exporters through their AD Category-I banks to offset export receivables against import payables of the same foreign buyer and supplier, subject to certain terms and conditions."
	VII.C. Documentation requirements for release of forex for imports	2016	1681-1682	Kazakhstan	"... importers ... [were obligated to] submit to the bank a foreign trade contract or other corroborating document."
	VII.D. Import licenses and other nontariff measures	2016	1812	Laos	The country required import licenses for 25 categories of goods, mostly for quality control, safety, or animal quarantine, but some (e.g., for cement) to limit the overall level of imports.

	VII.E. Import taxes and/or tariffs	2016	1941	Macedonia	The country had an average unweighted tariff rate for industrial products was 6.1 percent and for agricultural products 15.7 percent.
	VII.F. State Import Monopoly	2016	2359	Niger	The government of Niger, through the Société Nigérienne des Produits Pétroliers, had a monopoly on hydrocarbon imports.
VIII. Export Restrictions	VIII.A. Repatriation requirements	2016	341	Barbados	The country had repatriation requirements on export proceeds "Proceeds must be repatriated within six months."
	VIII.B. Financing requirements	2016	1163	Eritrea	"Exports may be made under LCs -Letters of Credit- on an advance-payment or consignment basis."
	VIII.C. Documentation requirements	2016	1210	Fiji	The country required a confirmation of receipt of export proceeds six months after export of goods.
	VIII.D. Export licenses	2016	931	Croatia	"Exports are free of licensing requirements, except certain products (e.g., weapons, narcotics, dual-use items) for which permits must be obtained."
	VIII.E. Export taxes	2016	1970	Liberia	"Export taxes are imposed on processed and unprocessed goods at rates of zero and 2.5 percent, respectively; on diamonds at a rate of 3 percent; and on iron ore at a rate of 4.5 percent."
IX. Payments and X. Proceeds for Invisibles Restrictions	IX.A. Payments for Invisibles, Transfers & Current Transfers	2016	3121	Sri Lanka	"Indicative limits and bona fide tests are applied to all these transactions."
	X.A. Repatriation requirements on Proceeds	2016	3198	Suriname	The country had repatriation requirements on invisible proceeds.
	X.A.1. Surrender Requirements on Proceeds	2016	3578	Ukraine	The country had a 75 percent surrender requirement
	X.B. Restrictions on use of funds	2016	767	China	The country had restriction on use of funds from invisibles

Appendix Table A1.4 Large Changes in MATR, With and Without Recessions. Recession years are shown in black italic.

Country Code (ISO3)	Year of the Episode	Sign of the Change	Country Code (ISO3)	Year of the Episode	Sign of the Change	Country Code (ISO3)	Year of the Episode	Sign of the Change
AGO	1991	-1	BEN	1987	1	CIV	1995	-1
AGO	1996	1	<i>BFA</i>	<i>2005</i>	<i>1</i>	CMR	1967	-1
AGO	2001	-1	<i>BGR</i>	<i>2006</i>	<i>-1</i>	CMR	1968	1
<i>AGO</i>	<i>2018</i>	<i>-1</i>	<i>BHR</i>	<i>1997</i>	<i>-1</i>	<i>CMR</i>	<i>2006</i>	<i>-1</i>
<i>ARE</i>	<i>2004</i>	<i>1</i>	<i>BHR</i>	<i>2004</i>	<i>1</i>	<i>COG</i>	<i>1967</i>	<i>-1</i>
ARG	1958	-1	<i>BIH</i>	<i>1997</i>	<i>-1</i>	<i>COG</i>	<i>1968</i>	<i>1</i>
ARG	1964	1	<i>BIH</i>	<i>1998</i>	<i>-1</i>	COG	2006	-1
ARG	1967	-1	<i>BIH</i>	<i>2001</i>	<i>-1</i>	COG	2008	1
ARG	1970	1	<i>BIH</i>	<i>2003</i>	<i>1</i>	<i>COL</i>	<i>1955</i>	<i>-1</i>
ARG	1977	-1	BIH	2012	1	COL	1966	1
ARG	1983	1	BLR	1998	1	COL	1991	-1
ARG	1986	-1	<i>BLR</i>	<i>1999</i>	<i>-1</i>	COL	1993	-1
ARG	1989	-1	<i>BLR</i>	<i>2006</i>	<i>-1</i>	<i>COL</i>	<i>2004</i>	<i>-1</i>
ARG	1991	-1	BOL	1956	-1	<i>COL</i>	<i>2007</i>	<i>1</i>
ARG	1992	-1	BOL	1982	1	COL	2008	-1
ARG	2001	1	BOL	1998	-1	CRI	1961	-1
ARG	2003	-1	BRA	1999	-1	<i>CRI</i>	<i>1966</i>	<i>1</i>
ARG	2010	-1	BRA	2002	-1	<i>CRI</i>	<i>1969</i>	<i>-1</i>
ARG	2011	1	BRA	2008	-1	<i>CRI</i>	<i>1971</i>	<i>1</i>
ARG	2016	-1	BRA	2015	1	CRI	1980	-1
ARG	2017	-1	BRN	2008	1	CRI	1994	-1
<i>ARG</i>	<i>2019</i>	<i>1</i>	<i>BWA</i>	<i>1999</i>	<i>-1</i>	<i>CRI</i>	<i>2011</i>	<i>-1</i>
<i>ARM</i>	<i>1998</i>	<i>-1</i>	<i>CAF</i>	<i>1967</i>	<i>-1</i>	CZE	1995	-1
<i>ARM</i>	<i>2000</i>	<i>1</i>	<i>CAF</i>	<i>1968</i>	<i>1</i>	<i>CZE</i>	<i>2001</i>	<i>-1</i>
AUS	1983	-1	CAF	1999	1	<i>CZE</i>	<i>2006</i>	<i>1</i>
AUS	1984	-1	<i>CAN</i>	<i>1966</i>	<i>1</i>	<i>DEU</i>	<i>1958</i>	<i>-1</i>
AUT	1950	1	CHE	1976	-1	<i>DEU</i>	<i>1959</i>	<i>-1</i>
<i>AUT</i>	<i>1955</i>	<i>-1</i>	<i>CHE</i>	<i>1979</i>	<i>-1</i>	DEU	1996	-1
<i>AUT</i>	<i>1989</i>	<i>-1</i>	CHL	1961	1	<i>DMA</i>	<i>2005</i>	<i>-1</i>
AZE	1994	-1	CHL	1978	-1	DNK	1973	-1
AZE	1995	-1	CHL	1999	-1	DNK	1988	-1
AZE	1996	1	<i>CHL</i>	<i>2001</i>	<i>-1</i>	DOM	1964	1
BDI	1998	1	<i>CHL</i>	<i>2006</i>	<i>-1</i>	DOM	1987	-1
BDI	2010	-1	CHN	1996	-1	DOM	2000	-1
<i>BEL</i>	<i>1990</i>	<i>-1</i>	CHN	2017	1	DOM	2001	-1
DOM	2003	-1	GRC	1953	-1	<i>IRQ</i>	<i>2006</i>	<i>-1</i>
DOM	2004	-1	GRC	1996	-1	<i>ISR</i>	<i>1996</i>	<i>-1</i>
<i>ECU</i>	<i>1961</i>	<i>1</i>	GRC	2015	1	<i>ISR</i>	<i>1998</i>	<i>-1</i>
ECU	1996	-1	<i>GRC</i>	<i>2019</i>	<i>-1</i>	<i>ISR</i>	<i>1999</i>	<i>-1</i>
ECU	2003	-1	<i>GTM</i>	<i>1962</i>	<i>1</i>	ITA	1990	-1
<i>ECU</i>	<i>2014</i>	<i>-1</i>	<i>GTM</i>	<i>1963</i>	<i>1</i>	JAM	1991	-1
EGY	1994	-1	GTM	1973	-1	JAM	2007	-1
EGY	2003	1	<i>GTM</i>	<i>1980</i>	<i>1</i>	<i>JPN</i>	<i>1972</i>	<i>-1</i>
EGY	2004	-1	GTM	1988	1	JPN	1979	-1

EGY	2014	1	GTM	1989	-1	JPN	1998	-1
ERI	1996	-1	GTM	2001	-1	JPN	2003	1
ERI	2004	1	HKG	1972	-1	KAZ	1993	-1
ESP	1967	1	HND	1969	1	KAZ	1995	-1
ESP	1986	-1	HND	1980	1	KAZ	2000	-1
ESP	1989	-1	HND	1992	-1	KEN	1995	-1
ESP	2002	-1	HND	2000	-1	KEN	1996	-1
EST	1994	-1	HND	2010	1	KGZ	1999	1
ETH	1959	1	HRV	2001	1	KHM	1971	-1
ETH	1997	1	HRV	2003	-1	KOR	1981	-1
FIN	1991	-1	HTI	1979	-1	KOR	1995	-1
FIN	1994	-1	HTI	1981	1	KOR	2016	-1
FRA	1965	-1	HTI	1984	-1	KWT	1972	-1
FRA	1967	-1	HTI	1987	-1	LAO	1958	-1
FRA	1968	1	HTI	1996	-1	LAO	1962	1
FRA	1990	-1	HUN	1998	-1	LAO	1988	-1
FRA	2001	-1	HUN	2000	-1	LAO	2003	1
GAB	1967	-1	IDN	1982	-1	LAO	2008	-1
GAB	1968	1	IRL	1965	1	LBN	2002	-1
GAB	2006	-1	IRL	1980	-1	LBN	2004	1
GBR	1979	-1	IRL	1990	-1	LBR	1986	1
GBR	1980	-1	IRL	1992	-1	LBR	1998	-1
GEO	2012	-1	IRL	1993	-1	LKA	1977	-1
GMB	1989	-1	IRQ	1994	1	LKA	1992	-1
GMB	1990	-1	IRQ	2004	-1	LKA	1993	-1
GNB	2006	1	IRQ	2005	1	MAR	1961	1
MAR	1976	1	NIC	1962	-1	PER	1997	-1
MDA	1993	-1	NIC	1978	1	PHL	1960	-1
MDA	2001	1	NIC	1986	-1	PHL	1966	1
MDG	1967	-1	NIC	1992	-1	PNG	1989	1
MDG	1968	1	NIC	2004	1	PNG	1993	1
MDG	1973	-1	NLD	1953	-1	PNG	2001	1
MDG	1997	-1	NLD	1954	-1	PNG	2005	-1
MDV	1982	-1	NLD	1977	-1	PNG	2016	1
MDV	2009	1	NLD	1992	-1	POL	2002	-1
MEX	1982	1	NOR	1973	-1	POL	2008	-1
MEX	1991	-1	NOR	1991	-1	PRT	1992	-1
MEX	1992	-1	NPL	1964	1	PRY	1950	1
MLI	1986	-1	NPL	1993	-1	PRY	1951	-1
MLI	2000	1	NPL	2017	1	PRY	1956	-1
MLI	2004	1	NZL	1984	-1	PRY	1957	-1
MMR	1991	-1	NZL	1985	-1	PRY	1971	1
MNG	2000	1	OMN	1973	-1	PRY	1973	-1
MOZ	1995	-1	PAK	1996	-1	PRY	1997	-1
MRT	1967	-1	PAK	1998	1	PRY	2002	1
MRT	1968	1	PAK	2000	-1	PRY	2003	-1
MRT	1996	-1	PAK	2007	-1	PRY	2007	-1
MRT	2001	-1	PAK	2008	1	ROU	1989	-1
MWI	1988	-1	PAN	1997	-1	ROU	1991	-1

MWI	1995	-1	PAN	2007	1	ROU	2002	-1
MWI	1997	1	PER	1959	-1	RUS	1998	1
MWI	2003	-1	PER	1960	-1	RUS	2002	-1
MWI	2005	1	PER	1966	1	RUS	2007	-1
MYS	2014	-1	PER	1967	1	RWA	1973	1
NAM	1995	-1	PER	1969	1	RWA	2009	-1
NER	1967	-1	PER	1978	-1	SAU	1959	-1
NER	1968	1	PER	1979	-1	SDN	1993	1
NER	1994	-1	PER	1987	1	SDN	1996	-1
NER	1996	-1	PER	1988	-1	SDN	1999	-1
NER	2009	1	PER	1991	-1	SDN	2007	-1
NGA	1986	-1	PER	1993	-1	SEN	1967	-1
SEN	1968	1	UGA	1998	-1			
SGP	1978	-1	UKR	1993	1			
SLE	1993	-1	UKR	1995	1			
SLE	1996	1	UKR	1996	-1			
SLE	2005	-1	UKR	1997	1			
SLV	1961	1	UKR	1998	-1			
SLV	1990	-1	UKR	2018	-1			
SLV	1992	-1	UZB	1997	1			
SLV	1996	-1	UZB	2000	1			
SVK	1961	1	UZB	2003	-1			
SVK	1990	-1	UZB	2017	1			
SVK	1992	-1	VEN	1963	-1			
SVK	1996	-1	VEN	1966	1			
SVN	1996	-1	VEN	1983	1			
SVN	2003	-1	VEN	1989	-1			
SWE	1984	-1	VEN	1996	-1			
SWE	1989	-1	VEN	1997	-1			
SWE	1996	-1	VEN	2002	1			
TCD	1967	-1	VEN	2014	1			
TCD	1968	1	VNM	1976	-1			
TCD	2006	-1	YEM	1994	-1			
TCD	2008	1	YEM	1996	-1			
THA	2004	-1	YEM	2001	1			
TJK	1995	-1	ZAF	1976	1			
TJK	2002	-1	ZAF	1983	-1			
TKM	2004	1	ZAF	1996	1			
TON	1989	-1	ZMB	1992	-1			
TUN	1994	-1	ZMB	1993	-1			
TUN	1996	-1	ZMB	1995	-1			
TUR	1989	-1	ZMB	1996	-1			
TZA	1993	-1	ZMB	1997	1			
TZA	1994	-1	ZWE	1995	-1			
TZA	2000	1	ZWE	1999	1			
UGA	1992	-1	ZWE	2008	-1			
UGA	1993	-1	ZWE	2010	-1			

Appendix Table A1.5 Exogenous Changes in MATR

Country	Year	Sign	Description of episode	Link
Angola	2018	Liberalization	The measure is created to facilitate long-term investment and not to solve short term economic issues: "On August 10, 2018, the Angolan Government enacted a private investment law aimed at facilitating investment. The law removed the previous requirement that foreign investors identify a local partner with a 35 percent stake prior to investing in priority sectors, thereby allowing foreign investors to own investments in their entirety. The law also eliminated minimum levels of foreign direct investment and established firm sunset clauses for tax incentives. In addition to changes to the investment legal framework, the government created the Agency for Private Investment and Exports Promotion, a state-run agency with the goal of facilitating investment and export processes."	https://ustr.gov/sites/default/files/files/reports/2021/2021NTE.pdf (p.16)
Austria	1955	Liberalization	Austrian Independence Treaty is signed.	https://2001-2009.state.gov/r/pa/hq/time/lw/107185.htm
Austria	1989	Liberalization	Austria applied for the EC in this year.	https://www.austria.org/austria-in-the-eu
Bahrain	2004	Increase in restrictions	Bahrain signs a Foreign Trade Agreement with the United States.	https://ustr.gov/about-us/policy-offices/press-office/press-releases/archives/2004/september/united-states-and-bahrain-sign-free-trade-agreement
Belarus	2006	Liberalization	Exchange Rate measures lifted. Previously, foreign exchange controls were in place to limit imports in the context of balance-of-payments problem.	https://hrcak.srce.hr/18634
Belgium	1990	Liberalization	Part of reforms related to The Schengen Agreement on the elimination of border checks, signed in 1985.	https://www.schengenvisainfo.com/schengen-agreement/

Bosnia and Herzegovina	1997	Liberalization	The country adopted a new law on Foreign Trade Policy (1997) focused on liberalizing laws. The laws aimed at improving existing and future economic collaboration between BIH and its entities, neighboring and other states and international organizations.	https://www.researchgate.net/publication/297550578_Non-tariff_barriers_and_their_impact_on_trade_flows_within_CEF_TA_2006_The_case_study_of_Bosnia_and_Herzegovina
Bosnia and Herzegovina	2001	Liberalization	Part of EU ascension road map.	http://pdc.ceu.hu/archive/00003190/01/economic_challenges_for_bosnia_and_herzegovina_on_the_road_to_membership_in_the_eu.pdf
Botswana	1999	Liberalization	The liberalization is part of an export-led strategy for the country that started in 1998. "Botswana has shown its commitment to promoting diversification of its economy through export-led industrialization (World Trade Organization, 1998b)."	https://www.researchgate.net/publication/287111055_The_Evolution_of_Trade_Policy_in_Botswana (p.23)
Bulgaria	2006	Liberalization	Reforms related to EU accession.	https://oxfordre.com/politics/view/10.1093/acrefore/9780190228637.001.0001/acrefore-9780190228637-e-508
Costa Rica	1966	Increase in restrictions	The country started a long-term plan to develop an Import Substitution Industrialization (ISI) to enhance growth in the country.	http://www.fao.org/3/l8308EN/i8308en.pdf
Costa Rica	2011	Liberalization	Foreign Trade Agreements with the European Union China and Singapore entered into force.	http://www.fao.org/3/l8308EN/i8308en.pdf https://www.econstor.eu/handle/10419/57577
Croatia	2003	Liberalization	Croatia signed its ascension to the Central European Union Free Trade Agreement in December 2002.	http://www.mvep.hr/en/foreign-politics/multilateral-relationsold/central-european-free-trade-agreement-(cefta/
Eritrea	1996	Liberalization	Continuity of the trade liberalization process of Eritrea over the system it inherited from Ethiopia.	https://www.imf.org/external/pubs/ft/scr/1996/cr9666.pdf

France	1967	Liberalization	The European Communities signs the final Act of the General Agreement on Tariffs and Trade (GATT) multilateral negotiations (Kennedy round).	https://europa.eu/european-union/about-eu/history/1960-1969/1967_en
Gabon	1968	Increase in restrictions	strategy of protectionism-including tariff barriers, quota restrictions on imports-to foster the development of the industrial sector after the country's independence.	https://www.europarl.europa.eu/RegData/etudes/briefing_note/join/2013/491518/EXPO-INTA_SP(2013)491518_EN.pdf
Gambia, The	1989	Liberalization	Part of the trade liberalization efforts that started in 1986 to foster long-term developments.	https://www.gafspfund.org/sites/default/files/inline-files/Attachment%2011%20The%20Gambia%20Trade%20Policy%202011.pdf
Gambia, The	1990	Liberalization	As above.	As above.
Germany	1958	Liberalization	West Germany enters the European Union Monetary Agreement. During the 50's the country started a liberalization process to integrate in western world.	https://www.econstor.eu/bitstream/10419/47235/1/255419112.pdf
Haiti	1996	Liberalization	The country joined the World Trade Organization.	https://www.wto.org/english/thewto_e/countries_e/haiti_e.htm
Hungary	1998	Liberalization	Hungary underwent major macroeconomic and structural adjustment in its transition to a market economy.	https://www.wto.org/english/tratop_e/tpr_e/tp077_e.htm
Hungary	2000	Liberalization	In 2000, Hungary and the European Union reached agreement on further liberalization of trade in agricultural products.	https://ustr.gov/archive/assets/Document_Library/Reports_Publications/2001/2001_NTE_Report/asset_upload_file569_6574.pdf https://www.elibrary.imf.org/view/books/084/03193-9781557757098-en/ch09.xml

Ireland	1992	Liberalization	In 1992, the Single European Union Act removed other barriers to trade, especially in services.	https://publications.iadb.org/publications/english/document/Trade-Agreement-and-Tax-Incentives-The-Irish-Experience.pdf
Israel	1996	Liberalization	The country signed an agreement with the US to liberalize non-tariff barriers in their agricultural and food sector. Policies related to World Trade Organization accession.	https://www.ers.usda.gov/webdocs/publications/40898/32574_aer771m_002.pdf?v=0
Israel	1998	Liberalization	Part of medium-term capital account liberalization that started in 1990.	https://www.boi.org.il/deptdata/neumim/neum190e.pdf
Japan	2003	Increase in restrictions	Japan bans beef imports after the outbreak of mad cow disease.	https://www.nytimes.com/2013/01/29/business/global/japan-to-ease-restrictions-on-us-beef.html
Country	Year	Sign	Description of episode	Link
Korea	1995	Liberalization	"In the financial sector, Korea is radically reforming the foreign exchange system by relaxing its foreign exchange controls and easing restrictions on portfolio investments and capital movement under the five-year Foreign Exchange System Reform Plan from 1995 to 1999. In December 1995, the Foreign Exchange Management Act was amended to better facilitate the liberalization measures in the future."	https://www.wto.org/english/tratop_e/tpre_e/tp040_e.htm
Korea	2016	Liberalization	The country signs a Free Trade Agreement with Vietnam.	https://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S009-DP.aspx?language=E&CatalogueIdList=236246,235687,235686,235681,234860,233827,233394,233277,232654,230836&CurrentCatalogueIdIndex=3&FullTextHasH=&HasEnglishRecord=True&HasFrenchRecord=True&HasSpanishRecord=True

Lebanon	2002	Liberalization	The country signs a Trade Agreement with the European Union.	https://research.hktdc.com/en/article/MzU3OTk3Nzcy
Liberia	1986	Increase in restrictions	Liberia signs a new constitution. Restrictions on imports of rice were imposed to avoid rice smuggling	https://pdf.usaid.gov/pdf_docs/PNABD584.pdf
Malawi	1988	Liberalization	Part of broader structural adjustment program as the country tried to change its development strategy from planned economy.	https://www.wto.org/english/tratop_e/tpf_e/tp088_e.htm https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.577.9356&rep=rep1&type=pdf https://www.cbd.int/financial/fiscalenviron/mali-structural.pdf
Malawi	1997	Increase in restrictions	Malawi accepted the obligations under Article VIII of the International Monetary Fund's Articles of Agreement. The external trading environment was significantly liberalized with a phased reduction of the temporary export levy and import duties, and a decrease of the weighted average tariff rate from 18 per cent in 1994 to about 15 per cent in 1996.	As above.
Malawi	2003	Liberalization	Malawi was set to start liberalizing against other members of the South African Development Community in 2003.	https://openknowledge.worldbank.org/bitstream/handle/10986/18645/ACS75340P1336010Box385206B00PUBLIC00.pdf?sequence=1&isAllowed=y
Malaysia	2014	Liberalization	The government implemented structural reforms on a wide front in support of Malaysia's goal of achieving high-income status by 2020.	https://www.imf.org/external/pubs/ft/scr/2015/cr1558.pdf
Mozambique	1995	Liberalization	The country joined the World Trade Organization.	https://www.wto.org/english/thewto_e/countries_e/mozambique_e.htm
Namibia	1995	Liberalization	The country joined the World Trade Organization.	Trade Policy Framework: Namibia (unctad.org)

Netherlands	1953	Liberalization	Reforms agreed related to the formation of the Organization for European Union Economic Cooperation (OEEC). In signing the Convention that gave birth to the OEEC, the contracting parties agreed, inter alia, to “develop ... the maximum possible interchange of goods and services ..., [to] continue the efforts already initiated to achieve ... a multilateral system of payments among themselves ..., [to] cooperate in relaxing restrictions on trade and payments between one another....” ² The members of the OEEC are Austria, Belgium, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and the United Kingdom.	https://www.elibrary.imf.org/view/journals/024/1955/001/article-A001-en.xml (p.181)
Netherlands	1954	Liberalization	As above.	In addition to above: https://www.un.org/en/development/desa/policy/wess/wess_archive/searchable_archive/1954_WESS_Full.pdf
Netherlands	1977	Liberalization	Deregulation to foster trade linkages with other industrialized countries.	https://www.imf.org/external/pubs/ft/wp/wp9819.pdf
Netherlands	1992	Liberalization	As above.	As above.
Niger	1996	Liberalization	The country joined the World Trade Organization.	https://www.wto.org/english/thewto_e/countries_e/niger_e.htm
Paraguay	2007	Liberalization	Memoranda of Understanding on the promotion of trade and investment have been signed by MERCOSUR countries with the Republic of Korea (2009); Singapore (2007); Russia (2006); Guyana (1999); and Trinidad and Tobago (1999).	https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=Q:WT/TPR/S245-03.pdf
Peru	1960	Liberalization	Part of the economic program to improved fiscal and monetary management and remove remaining exchange and trade restrictions.	https://www.imf.org/external/pubs/ft/wp/2012/wp12166.pdf

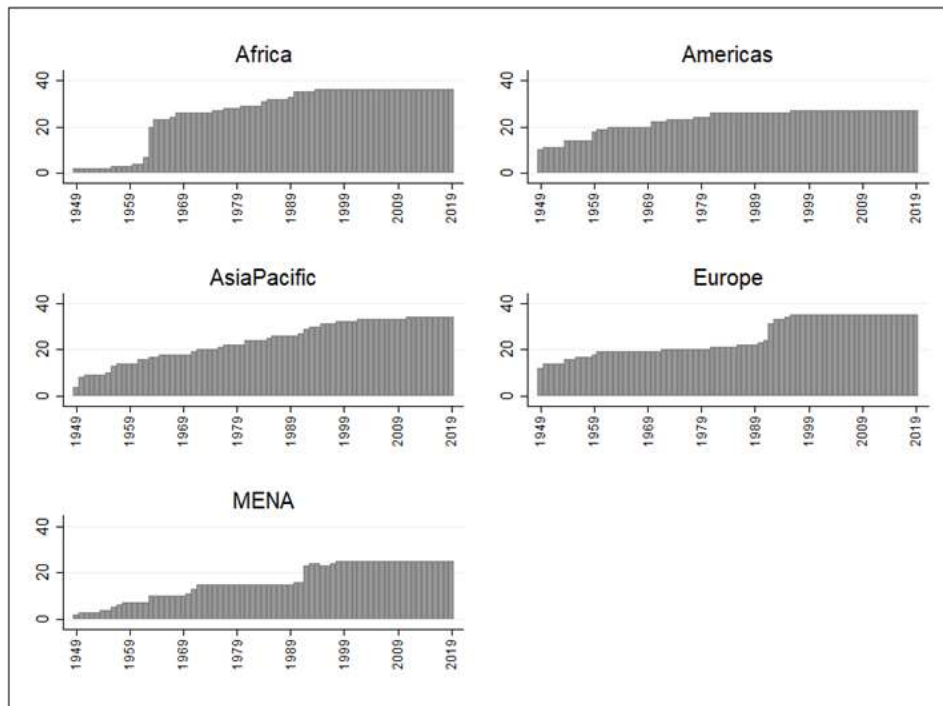
Philippines	1960	Liberalization	The start of import decontrolling.	https://www.nber.org/system/files/chapters/c9049/c9049.pdf https://www.bworldonline.com/content.php?section=Opinion&title=philippine-exports-growth-from-1960-2014&id=129148
Philippines	1966	Increase in restrictions	Unwinding of the 1960 reform and more favorable view toward economic planning and government market interventions. An outgrowth of this sentiment was the enactment of a comprehensive system of industrial incentives in 1967, as well as a financial facility for distressed firms set up at DBP in 1966. The Philippine government also intervened more actively in allocating resources among industries after the decontrol episode. The Board of Investments (BOI) that was established by the Industrial Incentives Act of 1967 had substantial discretion in administering the incentives, as well as the authority to limit investments in industries with excess capacity.	Page 9 of: https://www.nber.org/system/files/chapters/c9049/c9049.pdf
Poland	2002	Liberalization	Liberalization efforts related to accession to EU	https://www.wto.org/english/tratop_e/tpr_e/tp136_e.htm https://www.ce.uw.edu.pl/pliki/pw/y4-2000_Michalek.pdf
Slovak Republic	1990	Liberalization	Part of reforms to achieve a market-based economy. Slovakia decontrolled prices opened the economy to foreign investment and liberalized its foreign exchange regime. It has also relaxed/eliminated foreign trade restrictions and privatized many state enterprises.	https://www.wto.org/english/tratop_e/tpr_e/tp019_e.htm
Slovak Republic	1996	Liberalization	The Slovak Republic formally applied in June 1995 for European Union membership.	As above.
Slovenia	2003	Liberalization	The country joined the European Union in 2004.	https://european-union.europa.eu/principles-countries-history/country-profiles/slovenia_en

Spain	1989	Liberalization	The liberalization is part of a process that started in the 60's, in line with the accession to the European Union Community and the European Union.	http://www.realinstitutoelcano.org/wps/portal/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/dt10-2002
Sudan	1999	Liberalization	Part of Sudan application/accession to the World Trade Organization membership.	https://www.researchgate.net/publication/264440643_The_effects_of_trade_policy_reforms_on_the_agricultural_sector_of_Sudan . See Table A1-1 of the report.
Sweden	1984	Liberalization	Prior to accession to the European Union in 1995, Sweden took unilateral/bilateral efforts to further trading interests and support multilateralism	https://ecipe.org/wp-content/uploads/2014/12/sweden-2013-from-free-trade-to-protectionism.pdf . For structural reforms: https://academic.oup.com/wbro/article/34/2/274/5522304
Sweden	1989	Liberalization	As above.	As above.
Sweden	1996	Liberalization	Accession to the European Union in 1995.	As above.
Tajikistan	2002	Liberalization	Part of broader reforms plan and access to WTO.	https://www.imf.org/external/np/pfp/1999/tajik/
Uganda	1992	Liberalization	A first generation of trade policy reforms. This was related to the structural reforms to limit state intervention and impose a free market-oriented economy open to international trade.	https://freit.org/WorkingPapers/Papers/Development/FREIT437.pdf
Uganda	1998	Liberalization	Reforms aimed at simplifying the tariff structure.	As above.
Ukraine	2018	Liberalization	In 2017, Ukraine acceded to the Pan-Euro-Med Convention, which sets uniform rules of origin for trade in products manufactured in countries with which the EU has FTAs and customs unions. The Pan-Euro-Med Convention entered into force for Ukraine in February 2018.	https://uk.practicallaw.thomsonreuters.com/6-621-3097?transitionType=Default&contextData=(sc.Default)&firstPage=true

Appendix Table A1.6 Exogenous Changes in MATR, Not Part of Broader Reform Packages

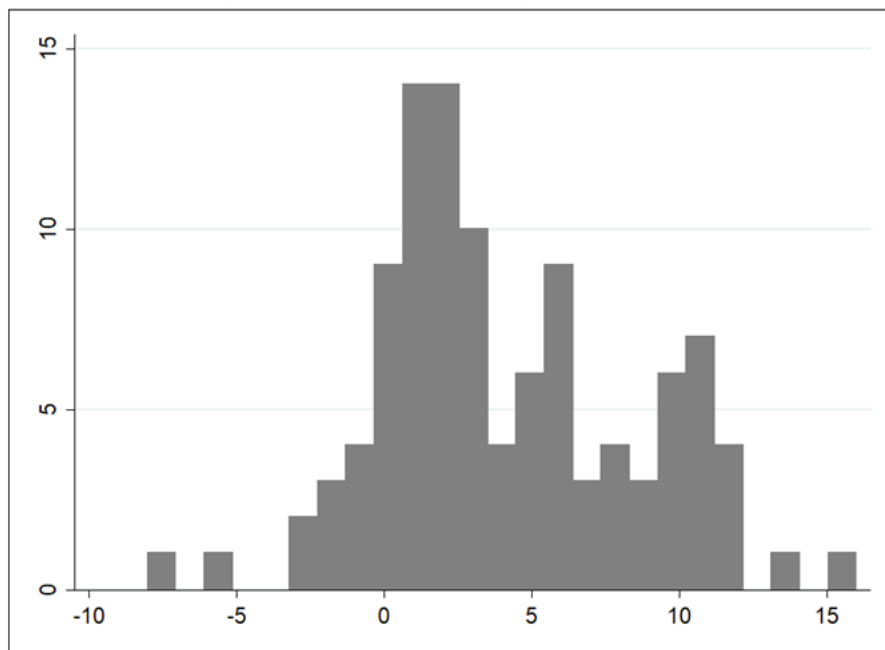
Country Code (ISO3)	Year of the Episode	Sign of the Change	Country Code (ISO3)	Year of the Episode	Sign of the Change
AGO	2018	-1	LBR	1986	1
AUT	1955	-1	MOZ	1995	-1
AUT	1989	-1	MWI	1988	-1
BGR	2006	-1	MWI	1997	1
BHR	2004	1	MWI	2003	-1
BIH	1997	-1	MYS	2014	-1
BIH	2001	-1	NAM	1995	-1
BLR	2006	-1	NER	1996	-1
BWA	1999	-1	NLD	1953	-1
CRI	1966	1	NLD	1954	-1
CRI	2011	-1	NLD	1977	-1
DEU	1958	-1	NLD	1992	-1
ERI	1996	-1	PER	1960	-1
ESP	1989	-1	PHL	1960	-1
FRA	1967	-1	PHL	1966	1
GAB	1968	1	PRY	2007	-1
GMB	1989	-1	SDN	1999	-1
GMB	1990	-1	SVK	1990	-1
HRV	2003	-1	SVK	1996	-1
HTI	1996	-1	SVN	2003	-1
HUN	1998	-1	SWE	1984	-1
HUN	2000	-1	SWE	1989	-1
ISR	1996	-1	SWE	1996	-1
JPN	2003	1	TJK	2002	-1
KOR	1995	-1	UGA	1998	-1
KOR	2016	-1	UKR	2018	-1
LBN	2002	-1			

Appendix Figure A1.1: MATR country coverage over time, by region



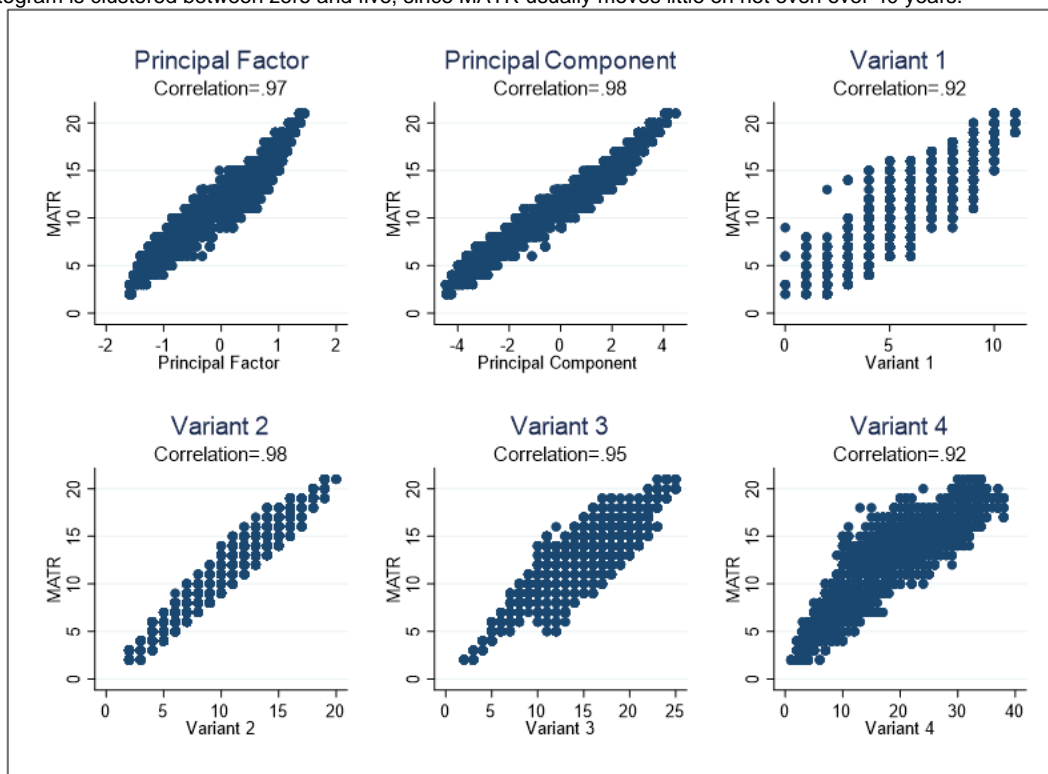
Y axis indicates the number of countries that have data for that particular year.

Appendix Figure A1.2: MATR changes over time, 1976-2016



Appendix Figure A1.3: Perturbations of MATR

Figure presents a histogram of the net changes in MATR between 1976 and 2016 for the 106 economies with data in both years. The histogram is clustered between zero and five, since MATR usually moves little on net even over 40 years.



The figure above shows scatterplots of MATR (on the Y axis) versus alternative aggregations of the Index.
 Variant 1 includes sum of: VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;VIII_A;VIII_B;VIII_C;VIII_D and VIII_E.
 Variant 2 includes sum of: IV_A;IV_B;IV_C;IV_D;IV_E;IV_F;VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;IX_A_1;VIII_A;VIII_B;VIII_C;VIII_D;VIII_E;X_A and X_B.
 Variant 3 includes sum of: II_A;II_B;IV_A;IV_B;IV_C;IV_D;IV_E;IV_F;VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;IX_A_1;IX_A_2;IX_A_3;IX_A_4;IX_A_5;IX_A_6;IX_A_7;VIII_A;VIII_B;VIII_C;VIII_D and VIII_E.
 Variant 4 includes sum of: III_F;III_G;III_A;III_B;IV_A_1;IV_A_2;IV_B_1;IV_B_2;IV_C;IV_D_1;IV_D_2;IV_E_1;IV_E_2;IV_F_1;IV_F_2;VII_B_1;VII_A;VII_B_2;VII_B_3;VII_C_1;VII_C_2;VII_C_3;VII_C_4;VII_C_5;VII_D_1;VII_D_2;VII_D_3;VII_D_4;VII_D_5;VII_E_1;VII_F;VIII_A_1;VIII_C_1;VIII_B;VIII_C_2;VIII_C_3;VIII_C_4;VIII_C_5;VIII_D_1;VIII_D_2;VIII_E_1;VIII_E_2;IX_A_1;IX_A_2;IX_A_3;IX_A_4;IX_A_5;IX_A_6;IX_A_7;X_B;X_A_1_a and X_A_1_b.

Appendix II. Other Data

Database	Coverage		Key indicators	Link to data
	Country s	Time		
MATR (Measure of Aggregated Trade Restrictions)	157	1949 – 2019	Exchange measures, payments arrangements, import restrictions, export restrictions and payments for invisibles	
World Economic Forum	135	2016	Index of trade enablement, 1-7	https://reports.weforum.org/global-enabling-trade-report-2016/
Overall Trade Restrictiveness Indices (Kee et al.)	160	2009	Market Access Trade Restrictiveness Index	https://datacatalog.worldbank.org/dataset/overall-trade-restrictiveness-indices-and-import-demand-elasticities
	103	2009	Overall Trade Restrictiveness Index	
Services Trade Restrictiveness Index	48	2014 – 2020	Services Trade Restrictiveness Index (by sector)	https://qdd.oecd.org/subject.aspx?Subject=063bee63-475f-427c-8b50-c19bffa7392d
Fraser Institute: Economic Freedom of the World	162	1970 – 2018	Freedom to Trade Internationally	https://www.fraserinstitute.org/economic-freedom/dataset?geozone=world&page=dataset&min-year=2&max-year=0&filter=0
Current Account Openness (Quinn et al.)	89	1973 – 2014	Current Account Openness	
Heritage Foundation: Trade Freedom	181	1995 – 2021	Trade Freedom Index	https://www.heritage.org/index/trade-freedom
World Bank: Services Trade Restrictions Index	104	2008 – 2011	Services Trade Restrictions Index	https://www.worldbank.org/en/research/brief/services-trade-restrictions-database

KOF: Trade Globalization Index	201	1970 – 2018	Trade Globalization Index	https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html
The Chinn-Ito Index (Kaopen)	182	1970 – 2019	Chinn-Ito index	http://web.pdx.edu/~ito/Chinn-Ito_website.htm
World Bank Trade Cost Database	124	1995 – 2018	ESCAP import/export weighted trade costs (using DoTS)	https://data.imf.org/?sk=9d6028d4-f14a-464c-a2f2-59b2cd424b85 https://www.unescap.org/resources/escap-world-bank-trade-cost-database#

Appendix Table A2.2 Other Data

Database	Coverage		Indicator
	Name	Economies	
Penn World Table (PWT 10.0)	213	1950–2019	Real GDP. Constant 2017 prices
	212	1950–2019	Employment (no. of people employed)
	211	1950–2019	Productivity (Real GDP/ Employment)
	212	1950–2019	Investment. Constant 2017 prices
	213	1950–2019	GDP Deflator Index. 2017=100
	212	1950–2019	Household Consumption. Constant 2017 prices
World Economic Outlook (April 2021)	172	1950–2019	Trade Balance (Exports (real, LCU)- Imports (real, LCU)/ Real GDP)
	178	1950–2019	Volume of total exports of goods, USD
	178	1950–2019	Volume of total imports of goods, USD
World Economic Outlook	196	1995–2020	Real GDP forecasted in that year Oct. WEO
Furceri, Hannan, Ostry and Rose (2021)	168	1960–2014	Tariffs
UNCTAD EORA Database	158	1990–2018	GVC
World Bank (WDI Indicators)	209	1960–2019	Total Population
	195	1960–2019	Trade %GDP
	195	1960–2019	Imports of G&S %GDP
	190	1990–2019	Real GDP per capita PPP
	187	1988–2018	Tariff rate applied weighted mean all products
Systemic Peace: Polity IV project	180	1950–2020	polity 2: Democracy-Autocracy Index
	180	1950–2020	Constraints on Executive (higher=more)
The Standardized World Income Inequality Database (SWIID)	194	1960–2019	Inequality in disposable (GINI net)
Alesina et al. 2020	90	1973–2014	Structural Reforms

Index of Economic Freedom

The Heritage Foundation's Index of Economic Freedom (IEF) contains a component, trade freedom (TF), which is freely available with the rest of the IEF. TF is one of three components, which together constitute "open markets" (the others being investment and financial freedoms), itself one of four broad categories of economic freedom (the others being rule of law, government size, and regulatory efficiency). Trade freedom – like the other eleven freedoms – is graded on a scale of 0 to 100. It is described on the Heritage foundation's website (<https://www.heritage.org/index/trade-freedom>) as follows:

"Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. The trade freedom score is based on two inputs:

- The trade-weighted average tariff rate and
- Non-tariff barriers (NTBs).

Different imports entering a country can, and often do, face different tariffs. The weighted average tariff uses weights for each tariff based on the share of imports for each good. Weighted average tariffs are a purely quantitative measure and account for the basic calculation of the score using the following equation:

$$\text{Trade Freedom}_i = (((\text{Tariff}_{\max} - \text{Tariff}_i) / (\text{Tariff}_{\max} - \text{Tariff}_{\min})) * 100) - \text{NTB}_i$$

where Trade Freedom_{*i*} represents the trade freedom in country *i*; Tariff_{max} and Tariff_{min} represent the upper and lower bounds for tariff rates (%); and Tariff_{*i*} represents the weighted average tariff rate (%) in country *i*. The minimum tariff is naturally zero percent, and the upper bound was set as 50 percent. An NTB penalty is then subtracted from the base score. The penalty of 5, 10, 15, or 20 points is assigned according to the following scale:

- **20**—NTBs are used extensively across many goods and services and/or act to effectively impede a significant amount of international trade.
- **15**—NTBs are widespread across many goods and services and/or act to impede a majority of potential international trade.
- **10**—NTBs are used to protect certain goods and services and impede some international trade.
- **5**—NTBs are uncommon, protecting few goods and services, and/or have very limited impact on international trade.
- **0**—NTBs are not used to limit international trade.

We determine the extent of NTBs in a country's trade policy regime using both qualitative and quantitative information. Restrictive rules that hinder trade vary widely, and their overlapping and shifting nature makes their complexity difficult to gauge. The categories of NTBs considered in our penalty include:

- **Quantity restrictions**—import quotas; export limitations; voluntary export restraints; import–export embargoes and bans; countertrade, etc.
- **Price restrictions**—antidumping duties; countervailing duties; border tax adjustments; variable levies/tariff rate quotas.
- **Regulatory restrictions**—licensing; domestic content and mixing requirements; sanitary and phytosanitary standards (SPSs); safety and industrial standards regulations; packaging, labeling, and trademark regulations; advertising and media regulations.
- **Investment restrictions**—exchange and other financial controls.
- **Customs restrictions**—advance deposit requirements; customs valuation procedures; customs classification procedures; customs clearance procedures.

- **Direct government intervention**—subsidies and other aid; government industrial policy and regional development measures; government-financed research and other technology policies; national taxes and social insurance; competition policies; immigration policies; government procurement policies; state trading, government monopolies, and exclusive franchises.

As an example, Botswana received a trade freedom score of 79.7. By itself, Botswana's weighted average tariff of 5.2 percent would have yielded a score of 89.7, but the existence of NTBs in Botswana reduced the score by 10 points.

Gathering tariff statistics to make a consistent cross-country comparison is a challenging task. Unlike data on inflation, for instance, countries do not report their weighted average tariff rate or simple average tariff rate every year; in some cases, the most recent year for which a country reported its tariff data could be as far back as 2002. To preserve consistency in grading the trade policy component, the *Index* uses the most recently reported weighted average tariff rate for a country from our primary source. If another reliable source reports more updated information on the country's tariff rate, this fact is noted, and the grading of this component may be reviewed if there is strong evidence that the most recently reported weighted average tariff rate is outdated.

The World Bank publishes the most comprehensive and consistent information on weighted average applied tariff rates. When the weighted average applied tariff rate is not available, the *Index* uses the country's average applied tariff rate; and when the country's average applied tariff rate is not available, the weighted average or the simple average of most favored nation (MFN) tariff rates is used.¹In the very few cases where data on duties and customs revenues are not available, data on international trade taxes or an estimated effective tariff rate are used instead. In all cases, an effort is made to clarify the type of data used and the different sources for those data in the corresponding write-up for the trade policy component.

Sources. Unless otherwise noted, the *Index* relies on the following sources to determine scores for trade policy, in order of priority: World Bank, *World Development Indicators 2012*; World Trade Organization, *Trade Policy Review*, 1995–2012; Office of the U.S. Trade Representative, *2012 National Trade Estimate Report on Foreign Trade Barriers*; World Bank, *Doing Business 2011 and 2012*; U.S. Department of Commerce, *Country Commercial Guide*, 2008–2012; Economist Intelligence Unit, *Country Commerce*, 2009–2012; World Bank, *Data on Trade and Import Barriers: Trends in Average Applied Tariff Rates in Developing and Industrial Countries, 1981–2010*; and official government publications of each country.”

Even ignoring the somewhat arbitrary functional form of this measure, the data sources are the issue. We have repeatedly contacted both authors specified on the IEF website for further details on the underlying NTB data sources, so far without success.

Appendix III. MATR and the Literature

There are other measures of trade policy that are related and similar. Ours is different. In this appendix we provide a brief survey of the literature, and where MATR fits in.

At the outset, we stress that summary measures of trade policy are just that; summaries. They cannot hope to provide the detail and color available in more disaggregated analyses of trade policy, such as the reviews of national trade policy provided by the WTO. Still, measures of aggregate trade restrictions are useful, especially to distracted policymakers and economists preoccupied with or focused on other matters. Indeed, often a measure of aggregate trade restrictions is not an object of intrinsic interest, merely a control or instrumental variable. A recent review of the literature is provided by Cerdeiro and Nam (2018).

From the general to the specific, a simple taxonomy of aggregate trade restrictions includes measures of: a) openness; b) trade costs; and c) artificial trade barriers.

The most general measures are based on trade outcomes, such as “openness”, the ratio of exports and imports (or just imports) to output. Since the national accounts are measured accurately for most countries, this is a natural place to start. The problem with openness is that it is strongly affected by a large number of confounding factors that above and beyond reflect trade policy, such as national tastes, technologies, institutions, and geography.³³ So while a good aggregate measure of trade restrictions should be correlated with openness, the two are different, both empirically and conceptually.

A narrower measure is trade costs, the costs associated with international trade; relevant discussions include, among others, Anderson and van Wincoop (2003, 2004) and Waugh and Ravikumar (2016). Unfortunately, trade costs are still too broad for our purposes, since they include both natural and artificial trade costs. Natural trade costs between countries are affected by proximity and transportation costs, including geographic remoteness, cultural and linguistic differences, the availability of deep-water ports, railways, roads, airports, and so forth. By way of contrast, artificial trade barriers are caused by protectionist policies, such as tariffs, quotas, regulations, bureaucratic red tape, security policies, and so forth. Novy (2012) created a measure of trade costs that has been implemented by the United Nations ESCAP in conjunction with the World Bank, from 1995 through 2016 for over 180 countries. The Novy measure is bilateral, based on microeconomic theory, and is intended to be a comprehensive all-inclusive measure of the costs of international trade, including both natural and artificial barriers to international trade.³⁴ Novy’s measure is thus, by design, larger in scope and intent than MATR, which only focuses on policy-driven trade barriers.

Two levels down from trade costs are measures based only on trade policy but not all important elements of policy. Even ignoring measurement problems, tariff rates are too narrow for our interest since they ignore non-tariff barriers (hereafter “NTBs”) such as quotas, sanitary/phytosanitary measures, technical trade barriers, customs procedures, subsidies, standards, distribution requirements, competition measures, licenses, procurement policies, health, product and environmental regulations, and so forth. By way of contrast, Ederington and Ruta (2016) consider only NTBs; many aggregate NTB measures exist such as the coverage

³³ For instance, given the desire for diversified consumption, smaller countries are systematically more open than large ones, even though they frequently have more trade barriers.

³⁴ Details are available at <https://www.unescap.org/resources/escap-world-bank-trade-cost-database>.

ratio, or the OECD's trade facilitation indices. Restricting attention to either tariffs or NTBs is too narrow for our focus; the same is true of restricting attention to services to the exclusion of goods, or vice versa.³⁵

The right way to proceed, in principle, is to construct Trade Restrictiveness Indices (TRIs), developed in the literature by Jim Anderson and Peter Neary, and carefully surveyed in their (2005) book. TRIs are well-grounded theoretically, easy to understand, and the most desirable way to judge protectionism; they are natural to use in, e.g., studies linking the level or growth of income to trade policy. As Anderson and Neary forcefully argue, TRIs represent a conceptual improvement over the average (or coefficient of variation of) trade-weighted tariff rate, NTB coverage ratio, and the like.

Unfortunately, TRIs are difficult to implement in the data, as manifestly demonstrated by the presence of their absence. Constructing a TRI requires dis-aggregated data on protectionism (associated with both tariffs and all NTBs) for many goods, countries and years, along with the associated import levels and demand elasticities. Accordingly, it is little surprise that few TRIs are available; those that do exist are only available for a limited number of countries and years. Even in their excellent (2005) book, Anderson and Neary are forced to make a number of substantive assumptions in order to proceed empirically. They measure TRIs in chapter 15, using a simple Computable General Equilibrium (CGE) model, but only: (i) for a set of 25 countries; (ii) in a single two-year cross-section (they are able to estimate TRIs over time for just five countries); (iii) assuming that all tariffs are constant ad valorem (not specific) and at their bound (rather than applied) rates while all NTBs are assumed to be binding quotas; (iv) without any other domestic distortions; with (v) inputs can be measured at the four-digit HS level; and (vi) production elasticities of substitution assumed (p 284) "with little empirical foundation".

This has not stopped scholars from trying to produce TRIs. Kee, Nicita and Olarreaga (2009) are perhaps the best known TRI producers. Kee et al. (2009) are able to provide estimates of trade restrictiveness for 78 countries; they combine tariffs and ad-valorem tariff equivalents of NTBs at the tariff line level, and aggregate these data in a number of ways. Still, their analysis is limited in scope across countries and especially by time; indeed, their estimates are derived for different years between 2000 and 2004 based on national data availability. It seems reasonable to conclude that the demands associated with their construction has precluded the comprehensive analysis of trade policy across countries and time with TRIs.³⁶ TRIs remain the Gatsby green light of aggregate commercial policy.

Perhaps the closest measure to MATR is the Trade Freedom component of the Heritage Foundation's Index of Economic Freedom, which incorporates both NTBs and tariffs and is available for a large number of countries annually back until 1995. The methodology behind this is fundamentally unclear, and is handled in a separate appendix.

To summarize: we believe that there is room for another aggregate measure of trade restrictions in the literature. Our measure is more narrowly focused than either openness or trade costs, and broader than either the average tariff rate or the NTB coverage ratio. More generally, compared to the literature, MATR has some advantages, some disadvantages, and some differences. Its advantages are many: it is a) simple, b) based on plausible, relevant policy inputs, which are c) quantitative and objective, d) timely and easily updateable, e)

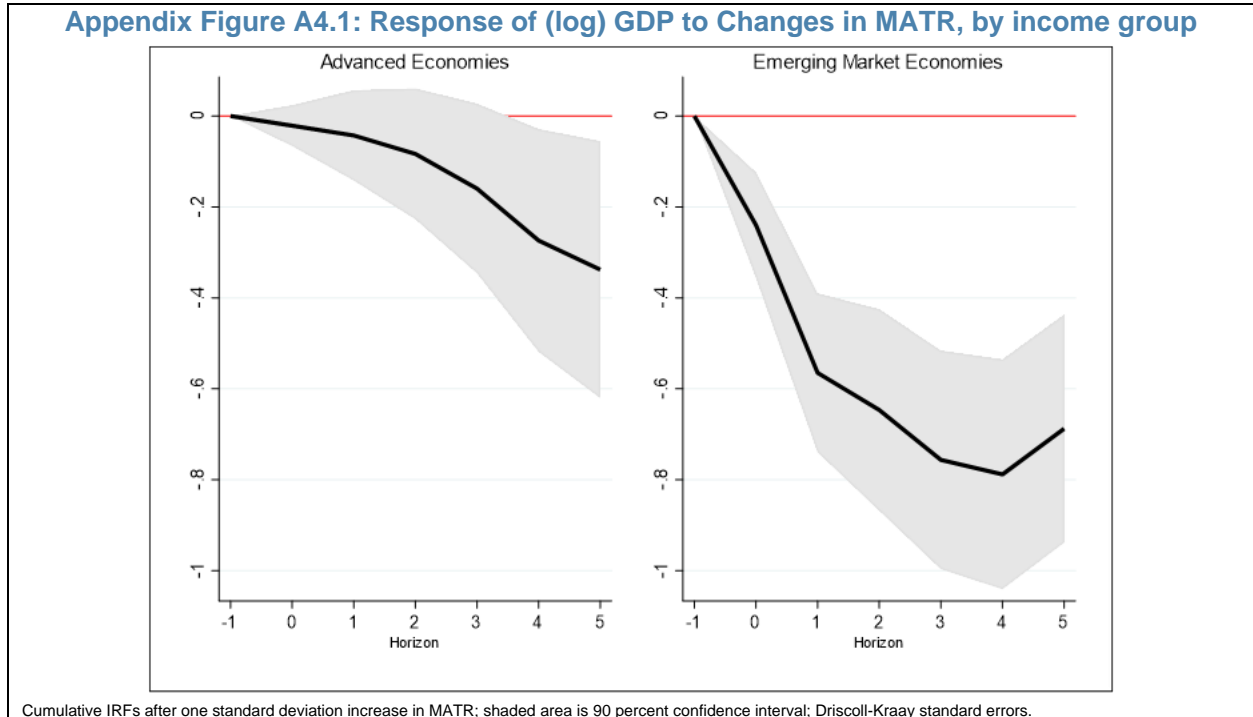
³⁵ The World Bank produces an index of service trade restrictions.

³⁶ For instance, Anderson and Neary write (2005, p 275) "The evidence presented here is not as comprehensive as we would like, because systematic detailed panel data for trade policies are not available ..."

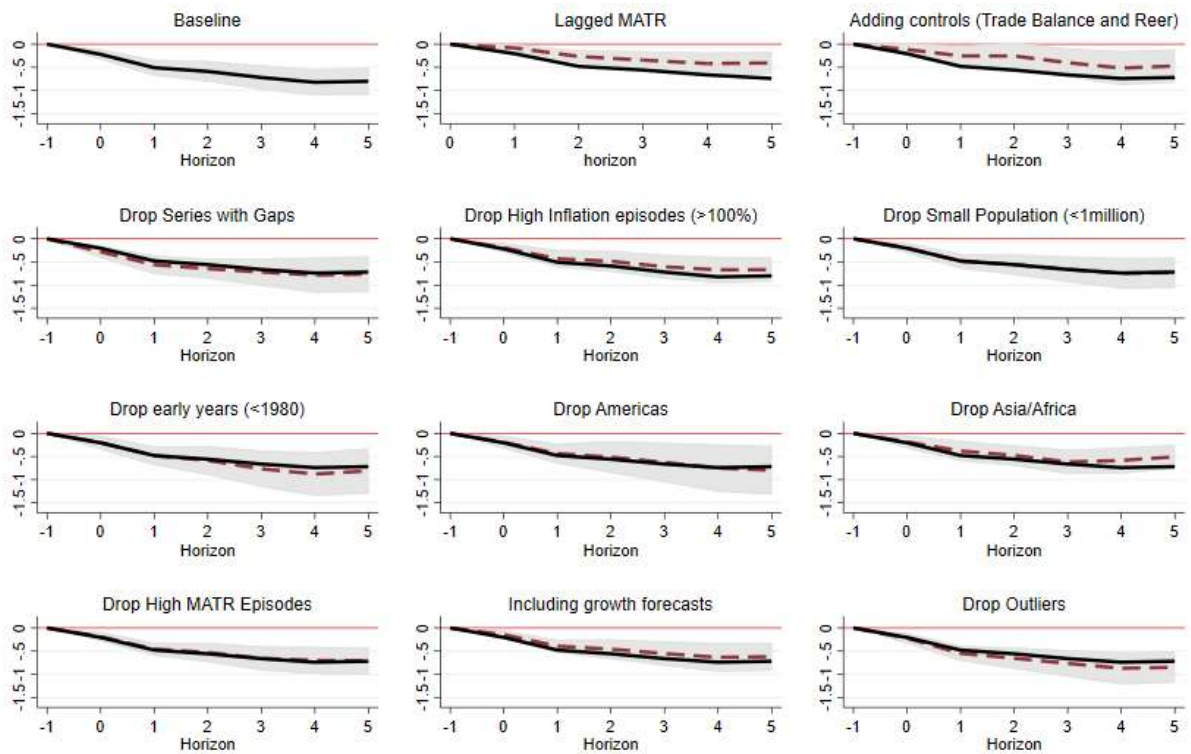
available for a large number of countries, for f) a substantial period of time, and cover both g) tariff and non-tariff barriers. It has one substantive issue: it is theoretically *ad hoc*. And it differs from the literature in not being built from the ground up; it is not an aggregation of industry- or product-level measures. Thus, we do not consider MATR to be a panacea, but rather a useful complimentary measure of aggregate trade restrictions.

Appendix IV. Robustness Checks and Extensions

Appendix Figure A4.1: Response of (log) GDP to Changes in MATR, by income group

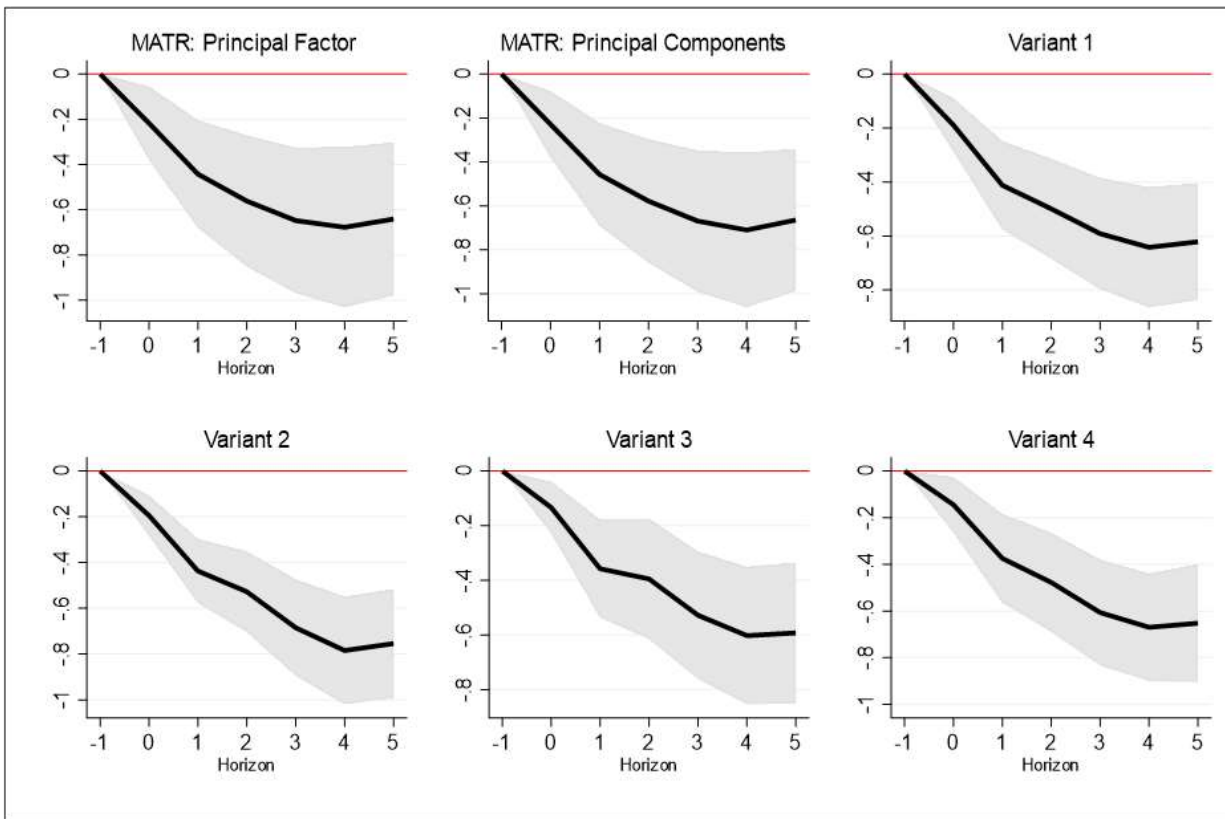


Appendix Figure A4.2: Response of (log) GDP to Changes in MATR: Robustness Checks



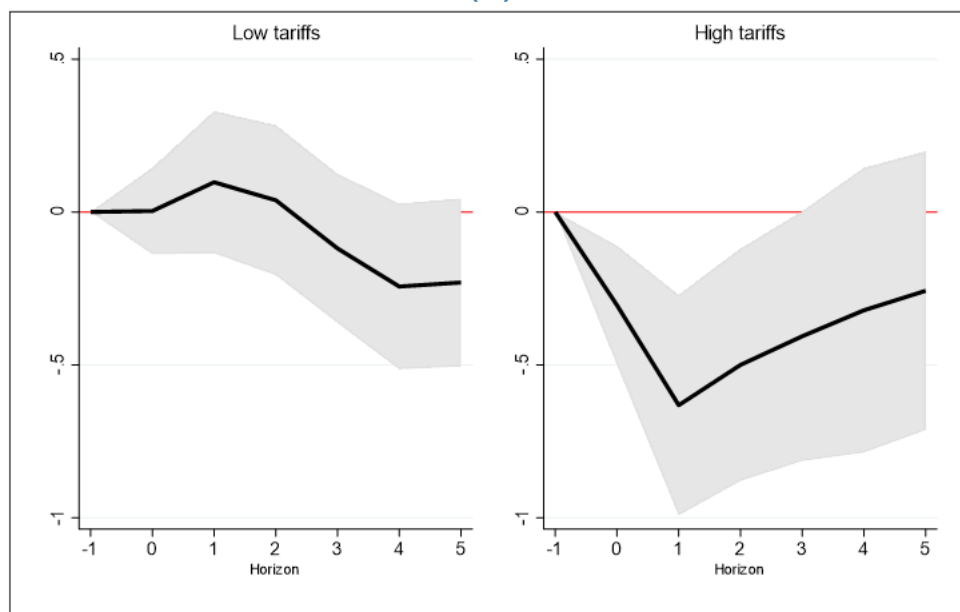
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors.

Appendix Figure A4.3: Response of (log) GDP to Changes in MATR: Alternative Measures



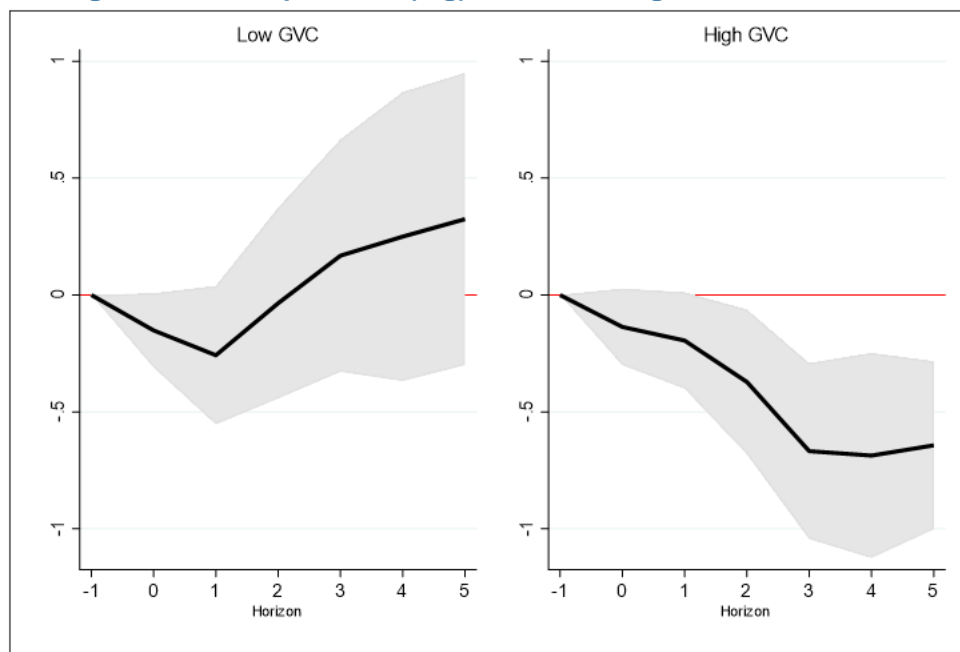
Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors.
 Variant 1 includes sum of: VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;VIII_A;VIII_B;VIII_C;VIII_D and VIII_E.
 Variant 2 includes sum of: IV_A;IV_B;IV_C;IV_D;IV_E;IV_F;VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;IX_A_1;VIII_A;VIII_B;VIII_C;VIII_D;VIII_E;X_A and X_B.
 Variant 3 includes sum of: II_A;II_B;IV_A;IV_B;IV_C;IV_D;IV_E;IV_F;VII_A;VII_B;VII_C;VII_D;VII_E;VII_F;IX_A_1;IX_A_2;IX_A_3;IX_A_4;IX_A_5;IX_A_6;IX_A_7;VIII_A;VIII_B;VIII_C;VIII_D and VIII_E.
 Variant 4 includes sum of: III_F;III_G;II_A;II_B;IV_A_1;IV_A_2;IV_B_1;IV_B_2;IV_C;IV_D_1;IV_D_2;IV_E_1;IV_E_2;IV_F_1;IV_F_2;VII_B_1;VII_A;VII_B_2;VII_B_3;VII_C_1;VII_C_2;VII_C_3;VII_C_4;VII_C_5;VII_D_1;VII_D_2;VII_D_3;VII_D_4;VII_D_5;VII_E_1;VII_F;VIII_A_1;VIII_C_1;VIII_B;VIII_C_2;VIII_C_3;VIII_C_4;VIII_C_5;VIII_D_1;VIII_D_2;VIII_E_1;VIII_E_2;IX_A_1;IX_A_2;IX_A_3;IX_A_4;IX_A_5;IX_A_6;IX_A_7;X_B;X_A_1 a and X_A_1 b.

Appendix Figure A4.4: Response of (log) GDP to Changes in MATR, tariff complementarity (%)

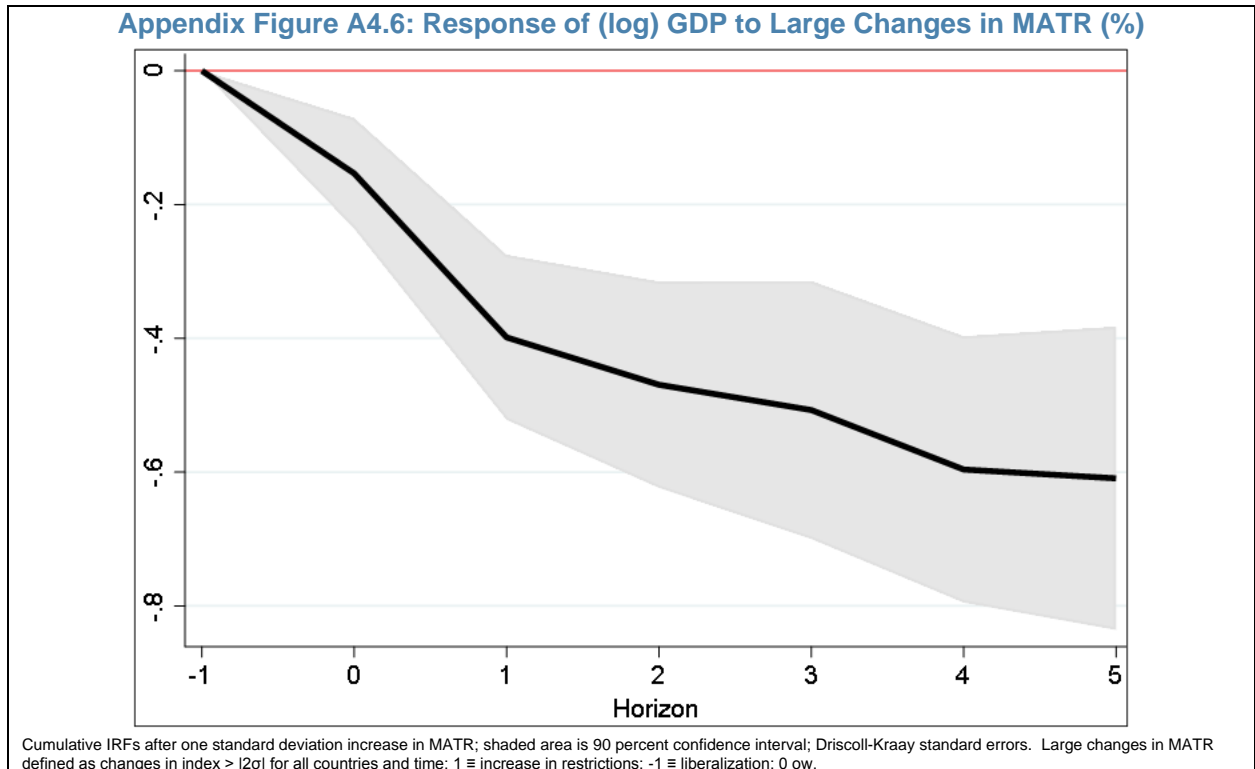


Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors. Heterogenous effects for tariffs calculated using interaction of smooth transition function of tariffs with MATR.

Appendix Figure A4.5: Response of (log) GDP to Changes in MATR, role of GVCs (%)



Cumulative IRFs after one standard deviation increase in MATR; shaded area is 90 percent confidence interval; Driscoll-Kraay standard errors. Heterogenous effects for GVC calculated using interaction of smooth transition function of GVC with MATR.



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