

# The Real Exchange Rate and Export Growth

## Are Services Different?

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## Abstract

This paper considers the determinants of exports of modern services and traditional services. It considers the growth of export volumes as well as export surges, that is, the periods of rapid sustained export growth. It asks whether the determinants of export growth rates and export surges differ between merchandise, traditional services, and modern services and whether developing countries are different. It confirms the importance of the real exchange rate for export growth. The paper finds

that the effect of the real exchange rate is even stronger for exports of services than for exports of goods and that it is especially strong for exports of modern services. The results suggest that in the course of their development, as developing countries shift from exporting commodities and merchandise to exporting traditional and modern services, appropriate policies toward the real exchange rate become even more important.

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# **The Real Exchange Rate and Export Growth: Are Services Different?**

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## 1. Introduction

There is now a broad consensus that policies encouraging exports can have a positive impact on economic growth.<sup>2</sup> The marginal product of labor tends to be higher in the production of exports than other activities. Reflecting this, export-oriented industries pay higher wages than other sectors. Exports tend to be labor intensive in developing countries, consistent with the comparative advantage implicit in factor endowments. Exports relax balance-of-payments constraints, facilitating imports of capital goods and technologies. Export industries are centers of learning by doing and sources of externalities that raise the productivity of other sectors.

These and related observations have spawned a large literature concerned with policies conducive to export growth. One strand has focused on the real exchange rate as a determinant or facilitator of export growth (Eichengreen (2008), Rodrik (2009), Haddad and Pancaro (2010), Freund and Pierola (2012)). The real exchange rate is an important constituent of the relative price of exports, and relative prices matter for allocation, including the allocation of resources to the exportable sector. Real exchange rate volatility, on the other hand, can be an important complication for planning and serve as a disincentive for investment in general and for investment in capacity in the exportable sector in particular (Servén (2003)).

These literatures developed in an age when trade was predominantly trade in merchandise. The new frontier today is trade in services. Exports of services have grown by about 10 percent annually worldwide between 2001 and 2010. Since the mid-1990s, exports of services have grown by at least 15 percent annually in several developing countries. The share of developing countries in global trade in services rose from 14 to 21 percent between 1990 and 2008 (Goswami, Mattoo and Saez (2012)). Exports of engineering, health, legal, accounting and management services, constituents of the “modern” or “non-traditional” category, have been the fastest growing component of service exports in recent years. All this points to the question of whether the same policies and circumstances conducive to the growth of merchandise exports are conducive to the growth of exports of services.<sup>3</sup>

In earlier papers, we considered the size of the service sector.<sup>4</sup> In this one we focus on service exports, distinguishing between modern and traditional services. Traditional services include trade and transport, tourism, financial services and insurance. Modern services include communications, computer, information and other related services.<sup>5</sup> We consider both the

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<sup>2</sup> See e.g. Rodrik (2009).

<sup>3</sup> A related question, which we do not consider but could be a subject of future research, is whether exports of services have the same impact on economic growth and are associated with the same spillover effects and externalities as is traditionally evidently the case of exports of merchandise.

<sup>4</sup> See Eichengreen (2008), Eichengreen and Gupta (2011), Eichengreen and Gupta (2012).

<sup>5</sup> The distinction is not straightforward. One could imagine including insurance and finance in either category, for example, since exports of such services are of long standing, but their production and sale has been revolutionized by advances in information and communication technologies. In this case, we opt for categorizing them as traditional services, given their long history and because the export of insurance and finance is correlated strongly with merchandise exports. In any case, insurance and finance account for a small share of total services exports. Travel comprises about 35 per cent of service exports across countries, communication and computer-related services together account for another 35 per cent, transport services account for a further 20 per cent, and the remainder (about 4 per cent) consists of insurance and financing. Services constituting modern services here are broadly similar to those comprising business services in Jensen (2011).

growth of export volumes and periods of unusually rapid sustained growth, which we call export surges.

The focus on export growth is straightforward, but why focus also on surges? Freund and Pierola (2012) have shown in their work on merchandise trade that surges provide additional identification. They are instances when export performance and their determinants change radically. They are when countries overcome obstacles that previously hindered export growth. Freund and Pierola find that large sustained depreciations of the real exchange rate typically precede surges of merchandise exports; and that low levels of exchange rate volatility and high levels of economic openness significantly predict export surges. They do not find other variables associated with the level of exports, such as inflation and financial crises, to be associated with surges of merchandise exports. We ask in this paper whether the results are similar for services.

The literature points to additional variables that could be important for exports of services. These include skills (human capital), English language proficiency, trade liberalization, foreign direct investment (FDI) and the existence of an overseas diaspora.<sup>6</sup> The role of human capital is self-evident, given the skilled-labor intensity of tradable services. Goswami, Mattoo and Saez (2012) observe that exports of services are more information intensive than exports of merchandise; it follows that interventions limiting information asymmetries, such as regulatory requirements and measures strengthening contract enforcement, may be especially important in this context. Other authors have pointed to the importance of a well-developed communications infrastructure: there is an obvious link between access to the internet and modern communications on the one hand and the provision of computer and back-office services on the other.<sup>7</sup> The presence of that infrastructure or significant investments in it may thus be important for the surges we consider in this paper.

The first question we ask in this paper is whether the determinants of export growth rates and surges differ between merchandise, traditional services and modern services. Building on the literature, we focus on the magnitude and significance of the response to the real exchange rate in particular.

Our second question is whether developing countries are different. Eilat and Einav (2004) argue that the exchange rate matters more for exports and growth in advanced economies. In the developing-country context, the real exchange rate is likely to matter less, while political risk is more important for competitiveness in key service sectors like tourism. In contrast, Rodrik (2009) and Freund and Pierola (2012) find the effect of exchange rate on growth and exports to be stronger for developing countries. Goswami, Gupta, Mattoo and Saez (2012) find few differences in the determinants of service exports when they estimate these separately for advanced and developing economies.

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<sup>6</sup> See for example Tharakan et al (2005).

<sup>7</sup> See Freund and Weinholt (2002) on the importance of internet for trade in services. Goswami, Mattoo and Saez (2012) express scepticism that internet penetration per se is important. As they note, Malaysia has high internet penetration but is a poor performer, while India, the exceptional performer, has low internet penetration. The same may be true of telecommunications: having adequate phone lines to a few critical call centres may be more important for the Philippines than high telephonic penetration. And to the extent that telecommunications infrastructure is characterized by natural monopoly or at least network increasing returns, there may be a role for regulation and competition policy.

Our results confirm the importance of the real exchange rate for export growth. We find that its effect is even stronger for exports of services than exports of merchandise; and that it is especially large for exports of modern services. While the evidence for differential effects between advanced and developing countries is weaker, this still suggests that as developing countries shift from exporting primarily commodities and merchandise to exporting traditional and modern services, appropriate policies toward the real exchange rate become even more important.

The rest of the paper is organised as follows. In Section 2 we describe our data and sample. In Section 3 we present the evidence from the levels of exports. In Sections 4 and 5 we define and characterize export surges in merchandise, traditional services and modern services. Section 6 presents evidence on the determinants of those surges, including the real exchange rate. The final section concludes.

## 2. Data and Sample

We use annual data for 1980-2009.<sup>8</sup> We include all countries for which significant runs of data on exports of services are available: 66 in all, of which 9 are low income, 15 are low middle income, 20 are high-middle income and 22 are high income.<sup>9</sup> We organize these data into country-year observations of the growth of exports of services in constant U.S. dollars.

Table 1 shows the bivariate correlation between exports of merchandise and exports of different categories of services. The correlation of traditional service exports and merchandise exports is higher than that between exports of merchandise and exports of modern services. This is a first indication that the determinants of exports of modern services may be different from the determinants of merchandise exports.

**Table 1: Correlation between Growth of Exports of Merchandise and Different Components of Services**

	Merchandise	All Services	Traditional Services	Modern Services
Merchandise	1			
All Services	0.39***	1		
Traditional Services	0.42***	0.77***	1	
Modern Services	0.16***	0.69***	0.18***	1

<sup>8</sup> Exports of services being unexceptional prior to the 1980s.

<sup>9</sup> We use the World Bank definition to classify countries into various income groups, based on the data sheet given by World Bank last updated in April 2012, whereby all economies with populations of more than 30,000 have been classified into various income groups according to their 2010 gross national income (GNI) per capita. The groups are: low income, \$1,005 or less; lower middle income, \$1,006-3,975; upper middle income, \$3,976-12,275; and high income, \$12,276 or more. For a few of our countries – Burkina Faso, Brazil, Comoros, Denmark, Hungary, Indonesia, Mozambique and Swaziland –we have data for only a portion of the period.

Note: Entry in each case is the correlation coefficient. \*, \*\*, \*\*\* indicate that the coefficient is significantly different from zero at 10, 5 and 1 percent level of significance, respectively. The correlations have been calculated using the data averaged over five-year periods.

We consider four real-exchange-rate measures. The first is the bilateral real exchange rate in purchasing-power-parity (PPP) terms, from Penn World Tables, vis-a-vis the United States (denoted “RER”). The second is based on the exchange rate misalignment adjusted for the Balasa-Samuelson effect. For this we regress the real exchange rate in PPP on real per-capita GDP and calendar-year fixed effects. The extent of misalignment is then calculated as the difference between the log real exchange rate and the log fitted value from the regression (as in Cheung, Chinn and Fujii (2009) and Rodrik (2009)). Third, we construct the bilateral real exchange rate with data from the International Monetary Fund’s *International Financial Statistics* (IFS) on nominal exchange rates vis-a-vis the U.S. dollar and the consumer price index for the United States and other countries. Fourth and finally, we obtain an estimate of the real effective exchange rate from IFS and the *World Development Indicators* of the World Bank. While this measure has the advantage of being multilateral rather than bilateral, country coverage is more limited.<sup>10</sup>

Tables A1 and A2 in Appendix A show correlations between different exchange rate series. The correlation coefficients between different exchange rate series in levels (Table A1) are not very large, and only some of them are statistically significant. The correlations between percentage changes in different real exchange rate measures (Table A2), by comparison, are large and also statistically significant at the 1 percent level. In particular, the correlation between the two Penn World Table-based measures is quite high (0.99). More information on the sources of the data and construction of variables is in Appendix A.

### 3. The Real Exchange Rate and Export Growth

We now analyze the determinants of the growth of exports of merchandise and services. We contrast traditional and modern services. We consider different measures of the real exchange rate. We compare advanced and developing countries. And we allow the effect of RER changes to differ for depreciations and appreciations.

Our basic specification is in equation 1, where the dependent variable  $X_{it}$  is growth rate of exports of merchandise or services for country  $i$  in five-year period  $t$ .<sup>11</sup> The independent variables include log per capita income (averaged over the previous five-year period), and the percentage change in the real exchange rate. We estimate these regressions for a panel of

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<sup>10</sup> Rodrik (2009) tests the robustness of his results to using a bilateral Real Exchange Rate (RER) based on relative wholesale price indices, which we have not included for brevity. Yet another possibility would be to use the data on bilateral exports and bilateral exchange rate to estimate the effect of real exchange rate on exports growth. Such an exercise would have two benefits: endogeneity would be less of a concern, and measurement of bilateral exchange rate would be more precise.

<sup>11</sup> We dropped outliers where export growth of merchandise, traditional or modern services exceeded 100 per cent. Some 20 observations were thus dropped.

countries and five-year averages of the data and with country and time fixed effects.<sup>12</sup> We estimate the regressions with standard errors that are robust and clustered at country level to correct for heteroskedasticity and autocorrelation.

$$X_{it} = \alpha \text{ Log Per Capita Income}_{it-1} + \beta \text{ d log RER}_{it} + \sum_i \gamma_i \text{ country fixed effects}_i + \sum_t \lambda_t \text{ period fixed effects}_t + \varepsilon_{it} \quad (1)$$

We include the level of RER in some of the basic specifications. We extend this model by including other controls, and the interaction of these other controls with change in RER.

$$X_{it} = \alpha \text{ Log Per Capita Income}_{it-1} + \beta \text{ d log RER}_{it} + \sum_i \gamma_i \text{ country fixed effects}_i + \sum_t \lambda_t \text{ period fixed effects}_t + \delta \text{ other controls}_{it} + \theta \text{ Other controls} * \text{ d log RER}_{it} + \varepsilon_{it} \quad (2)$$

In Table 2 the coefficient of the percentage change in the real exchange rate is positive and significant for merchandise exports, modern services, and traditional services alike. The coefficient for modern services is larger than that for merchandise or traditional services. The coefficient of log RER, in contrast, is insignificant. The coefficients on the RER imply that a ten percent faster depreciation accelerates the growth of exports of merchandise and traditional services by about 1.5 percentage points and that of modern services exports by about 2.3 percentage points. Given an average growth rate of exports of 6 percent for merchandise and traditional services and 8 percent for modern services, it implies a 25 percent acceleration in exports growth. Put differently, a one standard deviation increase in the rate of depreciation of RER accelerates exports growth of merchandise and traditional and modern by about 50 percent.

In order to compare the coefficients across equations, we estimate the regression equation simultaneously for exports growth of merchandise, traditional services and modern services using seemingly unrelated regressions and ask whether the coefficient of RER differs across various exports series. We find that the coefficient of RER is not different statistically for merchandise and traditional services, but it is different for modern services. This larger real exchange rate effect for modern services is one of our key findings.

Just why the real exchange rate impacts exports of services so powerfully is, at this point, a matter of conjecture. It could be that services, and especially modern services, use fewer imported imports. It could be that these sectors have lower fixed costs of entry, making for a more elastic supply response. It could be that demand for these exports is more price elastic. Or it could be a combination of the above.<sup>13</sup>

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<sup>12</sup> There are several benefits of estimating regressions with data averaged for five-year periods. Missing observations are less of a concern. Lag structure becomes less important. Outliers are less of a concern, since we are averaging out extreme values. Finally, unit roots in real exchange rate or per capita income or in other variables are less of an issue.

<sup>13</sup> Smith (2004) previously found that exports from different sectors respond differently to the exchange rate movement, in particular that exports of services are more exchange rate sensitive than the exports of agricultural goods. He finds that exports respond to exchange rate movement with a lag of 12-18 months but that the lags with which the real exchange rate affects export volumes differs by sector: exports of services volumes respond to the real exchange rate with a lag of 18 months; manufacturing exports with a lag of 12-15 months, and food exports with about a year's lag.



**Table 2: The Real Exchange Rate and Export Growth**

	I	II	III	IV	V	VI
	Merchandise		Traditional Services		Modern Services	
Log Per Capita Income, Lag	-0.03 [1.08]	-0.03 [1.02]	-0.03 [1.33]	-0.03 [1.43]	0.02 [0.41]	0.01 [0.28]
RER, Percent Change	0.15*** [4.27]	0.14*** [3.18]	0.14*** [4.95]	0.16*** [4.75]	0.23*** [3.99]	0.26*** [3.87]
RER, Log		0.01 [0.23]		-0.03 [1.14]		-0.06 [1.04]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	380	380	380	380	380
Number of Countries	66	66	66	66	66	66
R-square	0.30	0.31	0.35	0.35	0.26	0.26

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variable is growth in exports of merchandise, traditional or modern services, (in constant USD). Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects and time fixed effects, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period, per cent change in real exchange rate and log real exchange rate are the average values over the contemporaneous five year period.

In Appendix Table A3 we obtain similar results with alternative measures of the real exchange rate. The coefficient on the real exchange rate is positive and significant for all different exchange rate measures, for the exports of merchandise and different services alike. As before, it is larger for modern services.

Next we include lagged changes in RER in regressions similar to those reported in table 2. We find that the coefficient on the contemporaneous value is positive and significant while the coefficient on the lag is insignificant. Again, the coefficient on the contemporaneous value of the RER is twice as large for modern services as for merchandise and traditional services.

In Table 3 we probe for a differential effect of the RER in developing (low and middle income) and developed (high income) countries, by including the interaction of RER with a dummy for developing countries. There is little evidence to this effect. Interestingly, though the coefficient of the interaction between RER and the dummy for developing countries is largest for modern services.<sup>14</sup>

<sup>14</sup> The results do not change when we define developing countries as low and low middle income countries; and define developed countries as high middle income and high income countries. We also interact the real exchange rate with lag per capita income rather than with a simple dummy for developing countries in order to see if the effect of the RER on growth differs incrementally with per capita income of the countries. When we include the interaction of the RER and per capita income, the coefficient on the interaction term is not significant, and it also takes away the significance of lag per capita income and RER, perhaps due to multicollinearity.

**Table 3: The Real Exchange Rate and Growth of Exports across Countries (Different Income Groups)**

	<b>I</b>	<b>II</b>	<b>III</b>
	<b>Merchandise</b>	<b>Traditional Services</b>	<b>Modern Services</b>
Log Per Capita Income, Lag	-0.03 [1.14]	-0.03 [1.41]	0.02 [0.34]
RER, percent change	0.11*** [2.80]	0.09** [2.48]	0.17*** [2.90]
RER* developing country dummy	0.04 [0.73]	0.06 [1.54]	0.07 [0.97]
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Observations	380	380	380
Number of Countries	66	66	66
R-square	0.31	0.35	0.26

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variables are growth in exports of merchandise (Column I), exports of traditional services (Column II) and exports of modern services (Column III), all in constant USD. Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects, and time fixed effect, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period, per cent change in real exchange rate is average of annual values over contemporaneous five years.

Next we allow for the effect to differ for depreciation and appreciation of the RER. In Table 4 we add a dummy variable that equals 1 when the percentage change in the real exchange rate is positive, i.e. when there is depreciation, by interacting it with the real exchange rate. In the case of merchandise exports, the effect of exchange rate depreciation is somewhat larger but does not differ significantly from the effect of appreciation. Nevertheless, the coefficient on the RER for depreciation (0.07+0.12) is significantly different from 0 at the 1 percent level of significance. In the case of traditional and modern services, appreciation does not seem to affect export growth, but the effect of depreciation is positive, large and significant. As before, the effect is larger for export of modern services than for traditional services.

In sum, while real exchange rate changes affect exports of merchandise and traditional services in broadly similar ways, the effect on modern services is larger.

**Table 4: Depreciation vs. Appreciation and Export Growth**

	<b>I</b>	<b>III</b>	<b>V</b>
	<b>Merchandise</b>	<b>Traditional Services</b>	<b>Modern Services</b>
Log Per Capita Income, Lag	-0.03 [1.09]	-0.03 [1.38]	0.02 [0.35]
RER, percent change	0.07 [0.94]	0.05 [0.95]	0.05 [0.75]
RER* depreciation dummy	0.12 [1.19]	0.15** [2.02]	0.28** [2.28]
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Observations	380	380	380
Number of Countries	66	66	66
R-square	0.31	0.35	0.27

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variables are growth in exports of merchandise (Column I), exports of traditional services (Column II) and exports of modern services (Column III), all in constant USD. Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects, and time fixed effect, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period; per cent change in real exchange rate is average of annual values over contemporaneous five years.

As in other analyses of this nature, endogeneity bias cannot be entirely ruled out. Here, however, the fact that in each regression we are working with a relatively small subcomponent of the export basket attenuates the problem.<sup>15</sup> To address the issue of omitted variables, we add a vector of controls, including savings rates, net FDI as a share of GDP, an indicator for English-speaking population, a dummy for currency crises, and the years since a country joined the World Trade Organization.<sup>16</sup> We include them by themselves and, in addition, interact them with the real exchange rate. Because some of these variables are time invariant or move slowly, we estimate the specifications with random effects.

When these additional variables are included in the regressions one at a time, only some of them enter significantly. When we include interaction of these other controls with RER, the coefficients of the interaction terms are insignificant; indicating that the effect of RER on exports growth is not conditional on these factors. Details can be found in Appendix B. The important point is that the coefficient on the real exchange rate remains large and significant, as before. Again, as before, the effect of the real exchange rate is larger for modern services (Tables B1-B3).<sup>17</sup> A summary of regression results with the inclusion of other controls is in Table 5.

<sup>15</sup> To the extent that the bias may still exist, it is likely to be downward, and the coefficient of RER is likely to be underestimated.

<sup>16</sup> The explanatory variables, their sources, and summary statistics are enumerated in Appendix A4 and A5.

<sup>17</sup> In addition to the results in the Appendix, we included a financial reform index and domestic credit/GDP (as measures of financial sector development); distance from major financial centres; internet penetration; and education in the regressions. The coefficients of these variables are insignificant in all cases. The insignificant coefficient of education for modern services is surprising. We looked for outliers: India seemed to be an outlier with a low average schooling and a high growth of export of modern services. However dropping India does not make much difference.

**Table 5: Summary of Regression Results with Other Controls**<sup>18</sup>

	<b>Merchandise</b>	<b>Traditional Services</b>	<b>Modern Services</b>
One variable at a time	RER, Currency crashes: have positive and significant coefficients	RER, FDI, Currency crashes: have positive and significant coefficients	RER, English, crises, FDI: all have positive and significant coefficients
Including several variables together	RER has a positive and significant coefficient	RER, FDI, Currency crashes: have positive and significant coefficients	RER has a positive and significant coefficient

#### 4. Surges

We now use the Bai-Perron structural break technique to identify export surges.<sup>19</sup> We define a surge when a pair of breaks points to first a significant acceleration and then a significant deceleration of exports. We require the export growth rate to be at least 2 percent for three consecutive years. So defined, the surge lasts until the growth rate falls below this 2 percentage point threshold or until another structural break is identified.<sup>20</sup> To illustrate, in Appendix C, Figure C2-C4, we show the surges identified for India.

We identified 81 surges in exports of merchandise, 100 surges in traditional services, and 80 surges in exports of modern services. Table 6 shows that surges typically last four to five years, although a number of surges of traditional services last only three years.

**Table 6: Duration of Surges in Exports of Merchandise**

We tried three different education attainment variables available from the Barro and Lee data set: average years of schooling in population more than 15 years of age; percent of population with completed tertiary educations in 25-plus age group; percent of population with secondary education completed in 25-plus age group. Recognizing that education is a slow-moving variable even in five-year averages, we estimate regressions with random effects, or just Ordinary Least Squares. Again the results do not change much. We also included tariff on merchandise imports as a measure of trade restrictiveness of merchandise exports; but its coefficient was insignificant. It would have been useful to include an appropriate variable to measure the impact of trade restrictiveness or trade liberalization of services in the regression for exports of services, but the data are not available.

<sup>18</sup> Nominal exchange rate volatility has a positive and significant coefficient for traditional services; savings and tariffs are not significant in any of the regressions; the WTO dummy is positive and significant for traditional and modern services. The coefficient on currency crashes is positive and significant, consistent with Gupta, Mishra and Sahay (2007) who show that currency crises may not be detrimental to export growth in developing countries and, that if the countries in question have low external debt, they may indeed be associated with faster export growth.

<sup>19</sup> Bai and Perron (2003) derive the rate of convergence and the limiting distributions of the estimated break points. Their approach allows a subset of the parameters to not change (and includes a pure structural change model as a special case). They also address the problem of testing for multiple structural changes: a sup Wald type test for the null hypothesis of no change versus an alternative containing an arbitrary number of changes and a procedure that allows one to test the null hypothesis of, say, 1 change, versus the alternative hypothesis of 1+1 changes.

<sup>20</sup> We do consider whether the second point can be considered as a continuation of the same export surge by meeting the same criteria.

### and Traditional and Modern Services

Duration of Surge (Years)	Number of Surges: Merchandise	Number of Surges: Traditional Services	Number of Surges: Modern Services
3	3	33	0
4	34	32	38
5	19	19	17
6	9	4	6
7	8	7	11
8	6	3	5
9 or more	2	2	3
Average Duration (years)	5.1	4.4	5.2

In Table 7 we consider the growth rate of exports before, during and after the surge episodes. The growth of merchandise exports in the year the surge starts is about 15 percent per annum. In the year before the surge, in contrast, it is 0.07 percent, and it turns negative after the surge. The pattern for traditional services is similar to that of merchandise exports. Surges in exports of modern services are most pronounced, exports grow by almost 20 percent a year during the surge. Exports of modern services do not grow substantially faster in the three years following the surge than in the three years before it. Evidently, surges in exports of modern services begin suddenly, last about 5 years, and not infrequently peter out.

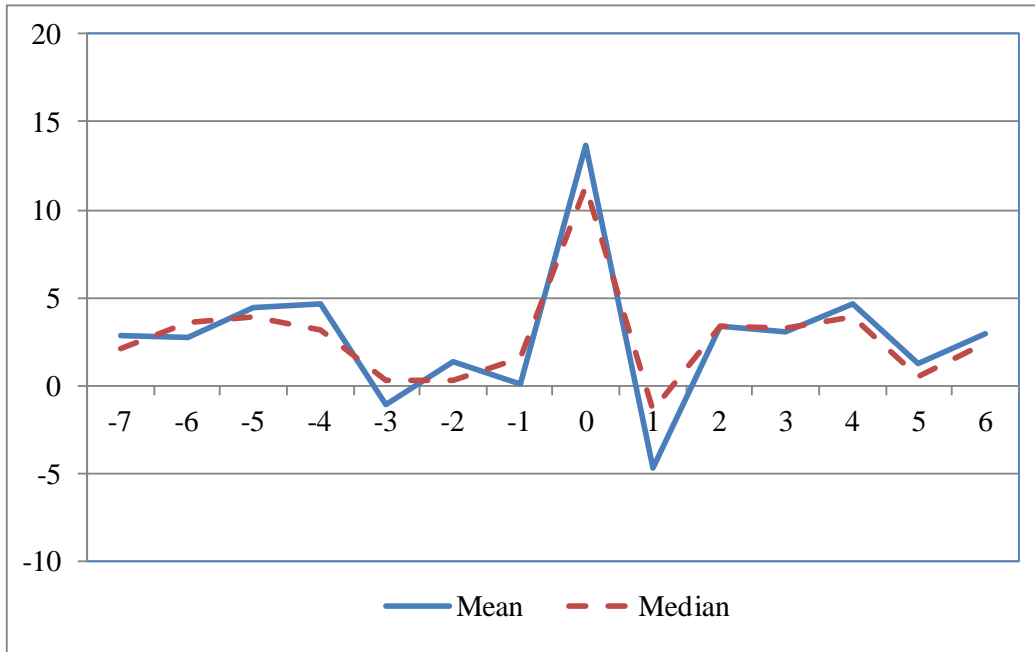
**Table 7: Export Growth during Surges**

	During the year export surge starts	During the entire duration of the surge	One year prior to surge	Three years prior to surge	One year after the surge	Three years after the surge
Surges in Exports of Merchandise						
Export Growth of Merchandise	15.0	13.4	0.07	-1.1	-4.8	3.7
Surges in Exports of Traditional Services						
Export Growth of Traditional Services	15.2	14.6	3.9	1.7	-6.5	3.3
Surges in Exports of Modern Services						
Export Growth of Modern Services	23.0	19.9	-2.1	-5.0	-9.9	2.8

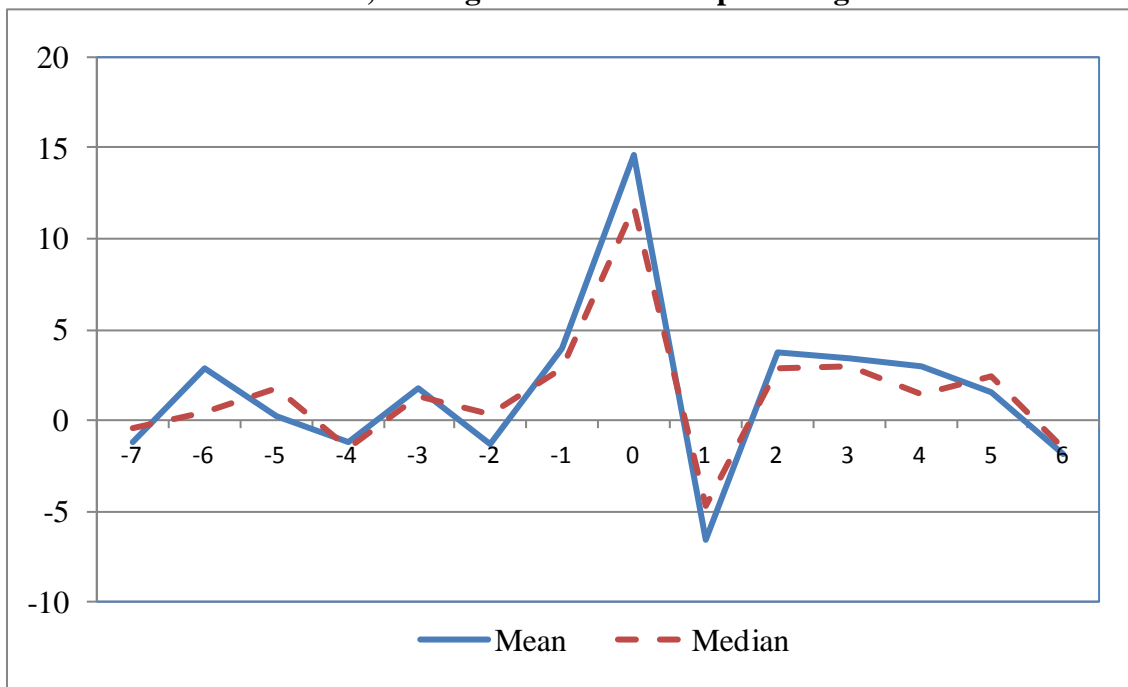
Figure 1 displays growth rates around the surge periods, where time 0 is the years of the surge, while the negative values refer to the years immediately before it and positive values to the years immediately after. The visual depiction reinforces the picture painted by Table 7.

**Figure 1a: Average Growth Rate of Exports of Merchandise Exports**

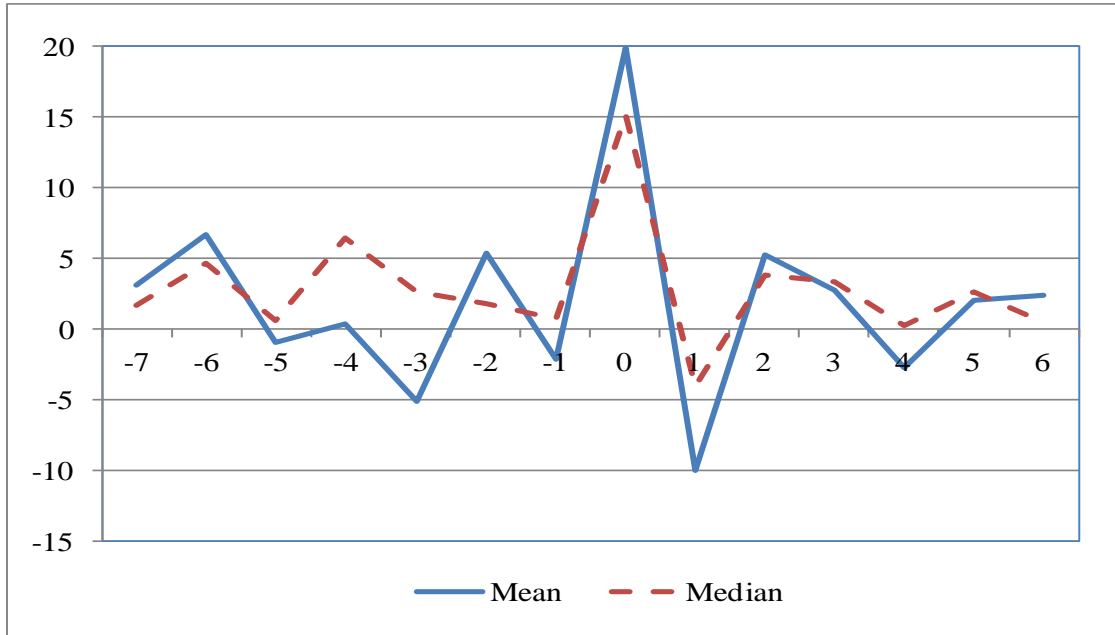
### Before, During and After the Surge



**Figure 1b: Average Growth Rate of Exports of Traditional Services Before, During and After the Export Surge**



**Figure 1c: Average Growth Rate of Exports of Modern Services Before, During and After the Export Surges**



Note: In Figures 2a-2c, 0 refers to the years of the surge, the negative values refer to the years immediately before it and positive values to the years immediately after.

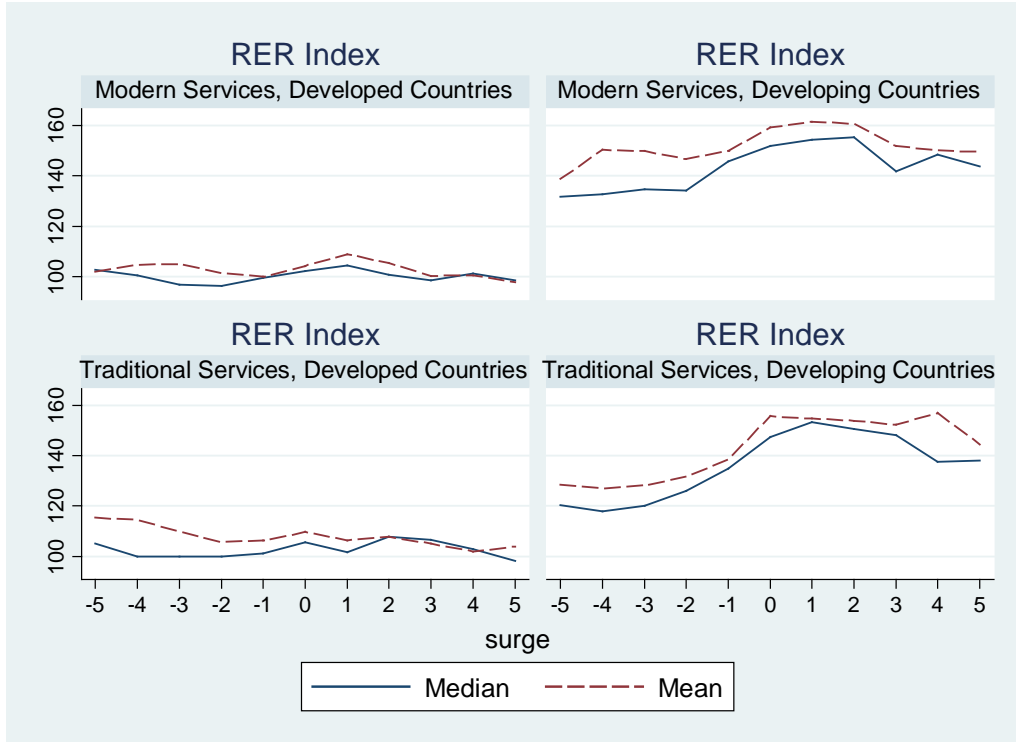
The time distribution of export surges is shown in Appendix D, Figures D1-D3. Compared to surges in exports of merchandise, surges of exports of modern services appear to be somewhat more evenly distributed. For merchandise there is a concentration of episodes in early 1990s as well as in the early 2000s, reflecting the widespread adoption of outward-oriented reforms and increases in production fragmentation and global supply chains. It might be thought that surges in exports of services reflect the diffusion of modern information and communications technology and similarly would be concentrated in this recent period. Interestingly, we do not find this to be the case. For traditional services, the clusters of surges are in 1985, 1986, 1994 and 2004. For modern services, there are clusters of surges in 1996, 1998 and 2004-2005.

### 5. Characterizing Export Surges

Following Freund and Pierola, we examine the behavior of the RER, volatility of the RER, FDI, saving rate, financial reforms and internet penetration during surge episodes. We examine them separately for traditional and modern services and for developing and developed countries. Figure 2 shows that surges in exports of services, both modern and traditional, tend to be preceded by real exchange rate depreciations, especially in developing countries. On the other hand, export surges do not seem to be preceded by declining RER volatility (see Figure 3).

Surges in service exports also seem to be preceded by increases in FDI inflows, especially in developing countries (Figure 4).<sup>21</sup>

**Figure 2: RER and Export Surges in Traditional and Modern Services**

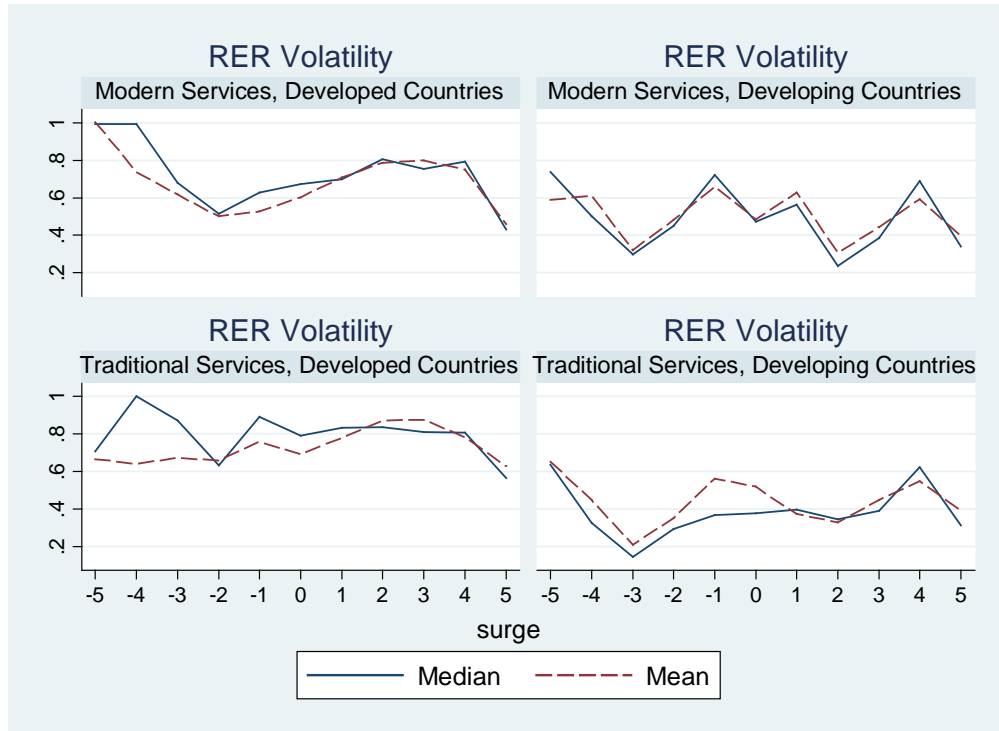


Note: 0 refers to the first three years of the surge, negative values refer to the years immediately before the surge, and positive values to the years immediately after the surge.

<sup>21</sup> We show the behavior of additional variables in Appendix E, Figures E1-E3. The financial reform index in Figure E1 shows a trend toward liberalization of the financial sector prior to the surges of exports of services, and especially fast liberalization prior to the surge in the exports of modern services by developing countries. Export surges also seem to be preceded by an increase in the saving rate, especially in developing countries (Figure E2). Surges in exports of modern services, especially in developed countries, are accompanied by and preceded by a sharp increase in the internet penetration (Figure E3).

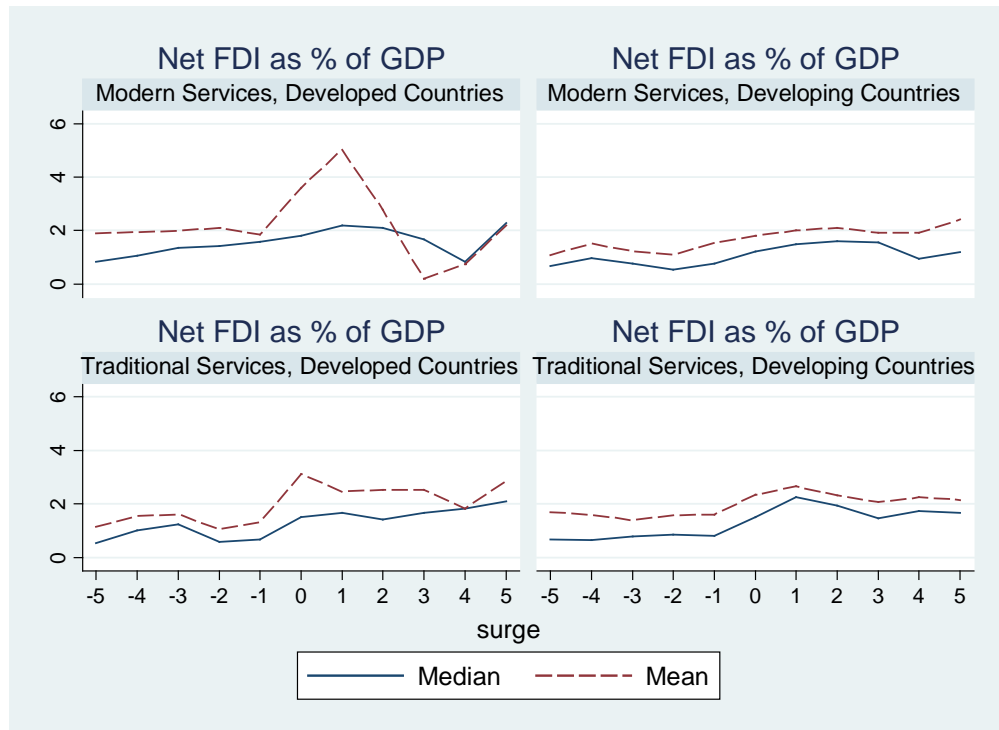


**Figure 3: RER Volatility and Surges in Exports of Traditional and Modern Services**



Note: 0 refers to the first three years of the surge, negative values refer to the years immediately before the surge, and positive values to the years immediately after the surge.

**Figure 4: FDI and Surges in Exports of Traditional and Modern Services**



Note: 0 refers to the first three years of the surge; negative values refer to the years immediately before the surge, and positive values to the years immediately after the surge.

## 6. The Real Exchange Rate and Export Surges

We estimate the determinants of the timing of a surge in the exports of merchandise, traditional and modern services, focusing again on the real exchange rate. For the dependent variable, we create a dummy which takes a value 1 for all the years of that export surge, regressing it on log per capita income and the RER (the average of previous three years to smooth out noise in the annual data).<sup>22</sup> As controls we include volatility of the real exchange rate, the savings rate, FDI, an indicator of an English-speaking population, a dummy for currency crises and the tariff rate, all again averages of three previous years.<sup>23</sup> We include year fixed effects to account for global events affecting the exports.

**Table 8: The Real Exchange Rate and Export Surges (Probit Regressions)**

	I	II	III	IV	V	VI
	Merchandise		Traditional Services		Modern Services	
RER, percent change	0.77***	1.12***	1.05***	1.12***	0.68***	0.68***
	[5.02]	[3.91]	[6.82]	[3.86]	[4.73]	[2.59]
RER percent change *Developing Countries		-0.44		-0.09		0
		[1.41]		[0.29]		[0.01]
Log Per Capita Income, Lag	0.02**	0.02***	0.01	0.01	0.03***	0.03***
	[2.57]	[2.61]	[1.64]	[1.63]	[3.82]	[3.82]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1847	1847	1867	1867	1955	1955
Pseudo R-squared	0.11	0.11	0.09	0.09	0.07	0.07

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, 1 per cent levels respectively. Standard errors are robust and clustered at countries. All regressions are estimated by Probit and marginal effects are reported. Per cent change in real exchange rate is the average of the three previous years.

Consistent with our earlier analysis, RER depreciation has a positive and significant effect on the probability of surges of merchandise and services. As shown in Table 8, the effect is slightly larger for goods and traditional services. We interact the RER with the dummy for

<sup>22</sup> The approach is similar to that of Hausmann, Pritchett, and Rodrik (2005) who seek to identify turning points in growth performance. They analyze 80 growth accelerations, estimating a probit model on the dummy for accelerations. They find that while the predictive power of the model is low, growth accelerations are correlated with RER depreciation, investment, and trade and economic reforms.

<sup>23</sup> The results on trade reforms are consistent with Freund and Pierola. The authors provide rationale for this result, namely that trade reforms are often sector specific and hence may not influence the overall exports growth. We also included years since a country joined the World Trade Organization, a financial reform index and internet penetration, but their coefficients are uniformly insignificant. There seems to be a general trend toward financial sector liberalisation in all countries, which is not noticeably stronger before the surges. The insignificant coefficients are perhaps reflecting these general trends.

developing countries to see if the RER has a different effect on the probability of an export surge. The coefficient on this interaction variable is not significantly different from zero.<sup>24</sup>

When we include other controls in the regressions, the RER continues to have a positive and significant coefficient, while RER volatility has a negative effect on the probability of an export surge (results not shown). This last result is consistent with Freund and Pierola (2012). A currency crash in the recent past does not affect the probability of an export surge in general but its effect is positive and marginally significant for surges in traditional services. This is consistent with the pattern observed by Borchert and Mattoo (2009). An English-speaking population increases the probability of a surge of modern service exports, which is intuitive. Higher FDI inflows and a higher savings rate are associated with a greater likelihood of surges of exports of traditional services and merchandise.<sup>25</sup>

To explore the robustness of these results, we estimate Tobit regressions in which the dependent variable is the growth of the exports of the corresponding series if there is a surge and zero if there is no surge. These results make fuller use of the data and as such should be more informative than those in Table 8. We estimate these regressions including the RER and per capita income, with the interaction of the RER with the dummy for developing countries, and with and without additional controls (latter not shown). Again, we include year fixed effects and cluster the standard errors by countries. As above, the impact of the real exchange rate on exports of modern services is found to be larger than that on traditional services, while the impact on exports of traditional services is larger than that on merchandise exports. As before, the coefficient on the RER is about 50 percent larger than for modern services. Among other variables with significant coefficients, RER volatility has negative coefficient while English-speaking population, FDI etc. all have coefficients similar to the ones obtained in Probit regressions. Again, there is no indication of difference between advanced and industrial countries. We also estimate these regressions only for the period since 1990, and find the coefficient of RER to be larger for all three series, but the relative values of the coefficients, across different exports series, remains similar.

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<sup>24</sup> To establish robustness we estimate a random effects Probit model, a linear probability model with country fixed effects and year fixed effects, and a random effects logit model. We calculate robust standard errors and, alternatively, cluster standard errors by country. The results do not change much. Since traditional services have many surge episodes which last only three years, we also test the robustness of the results to dropping the episodes lasting only three years.

<sup>25</sup> We estimate several other specifications, especially by including these “other controls” one at a time. The results are not shown, but are available on request. In all these specifications the RER continues to have a large positive effect on the probability of an export surge.

**Table 9: The Real Exchange Rate and Export Surges (Tobit Regressions)**

	I	II	III	IV	V	VI
	Merchandise		Traditional Services		Modern Services	
RER, percent change	0.63*** [3.68]	0.77*** [2.97]	0.83*** [4.59]	0.81** [1.97]	1.24*** [2.95]	1.42* [1.76]
RER*Dummy for Developing Countries		-0.18 [0.54]		0.03 [0.07]		-0.24 [0.23]
Log Per Capita Income, Lag	0 [0.20]	0 [0.21]	0 [0.14]	0 [0.14]	0.04 [1.13]	0.04 [1.13]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1964	1964	1925	1925	1955	1955
Pseudo R-squared	0.19	0.19	0.14	0.14	0.057	0.057

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, 1 percent levels respectively. Standard errors are robust and clustered at countries. Regressions are estimated using the Tobit model and marginal effects are reported. Regressions include data up to the first year of the surge episodes. Percent change in real exchange rate is the average of the three previous years. Per capita income is lagged by one year.

## 7. Conclusion

The role of exports in economic growth and, in turn, of the real exchange rate in export promotion is prominent in the literature on openness and development. But much of this literature dates from the era when exports were exports of merchandise, whereas today exports increasingly mean exports of services. This raises the question of whether the emphasis in the earlier literature on the importance of a competitively valued exchange rate for promoting exports carries over to this environment.

We have studied the response of exports of merchandise and both traditional and modern services to changes in the real exchange rate in this paper. We analyze both changes in average rates of export growth and sharp surges in exports. We find that the exports of services, and especially modern services, respond even more than the exports of merchandise to changes in the real exchange rate. This may reflect the fact that services, especially modern services, use fewer imported inputs, that these sectors have lower fixed costs of entry, making for a more elastic supply response, or that the demand for these exports is more price elastic. In contrast, we do not find differential effects across advanced and developing countries. Nonetheless, as less-advanced countries shift in the course of development from exporting primarily commodities and merchandise to exporting traditional and modern services, these findings suggest that appropriate policies toward the real exchange rate become, if anything, even more important.

This said, relying on an undervalued exchange rate to encourage the growth of exports of services, as of merchandise, has its limitations. Limiting the natural tendency for the real exchange rate to appreciate as an economy develops can have costs as well as benefits. Eichengreen (2008) and Haddad and Pancaro (2010) caution that depreciation and undervaluation can be used to spur growth only in the short term, because a country cannot maintain a depreciated real exchange rate indefinitely. Potential problems include tensions with

other countries, the accumulation of foreign exchange reserves on which capital losses may occur, and the fact that adjustment when it occurs may come in the form of inflation. For a competitive real exchange rate to succeed in boosting exports it will have to be accompanied by strong institutions, sound macroeconomic policies, a disciplined labor force, and high savings rates. Finally, for the benefits of the policy to exceed the costs, countries using real exchange rate depreciation to jumpstart exports and growth should have an exit strategy in mind and, ideally, in place.

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## Appendix A: Data Sources, Summary Statistics and Different Real Exchange Rate Variables

Table A1 shows that correlation coefficients between different real exchange rate series in levels are numerically not very large and that only some are statistically significant.<sup>26</sup>

**Table A1: Correlation Coefficients between Different Real Exchange Rate Series, levels**

	Log RER	RER, Residuals	Log RER, IFS	Log REER, IFS
Log RER	1			
Log RER, Residuals	0.88***	1		
Log RER, IFS	0.31***	0.43***	1	
Log REER, IFS	0.06***	0.08	0.01*	1

Note: the entry in each case is the correlation coefficient and the value in parentheses is the p value to accept the hypothesis that the correlation coefficient is equal to zero. \*, \*\*, \*\*\* indicate that the coefficient is significantly different from zero at 10, 5 and 1 per cent level of significance. The correlations have been calculated using the data averaged over five year periods.

The correlations between percent changes in different real exchange rate measures are shown in Table A2, which by comparison, are quite large and also statistically significant at the 1 percent level. The correlation between the two Penn World Table-based measures, one of which adjusts for per capita incomes, is quite high (0.99), suggesting that the adjustment will make relatively little difference to the analysis.

**Table A2: Correlation Coefficients between Log Changes in Different Real Exchange Rate Variables**

	Log difference in RER	Log difference in RER, Residuals	Log difference in RER, IFS	Log difference in REER, IFS
Log difference in RER	1			
Log difference in RER, residuals	0.99***	1		
Log difference in RER, IFS	0.82***	0.90***	1	
Log difference in REER, IFS	0.62***	0.60***	0.56***	1

Note: The entry in each case is the correlation coefficient and the value in parentheses is the p value to accept the hypothesis that the correlation coefficient is equal to zero. \*, \*\*, \*\*\* indicate that the coefficient is significantly different from zero at 10, 5 and 1 per cent level of significance. The correlations have been calculated using the data averaged over five-year periods.

We include different RER series in the regressions, in Table A3, and find the results to be robust.

<sup>26</sup> An increase in the value of the REER series indicates an appreciation, whereas for the other three series an increase in the value indicates a depreciation. In the results that we have reported here, we have flipped the sign of REER to make it consistent with those for the other real exchange rate series.



**Table A3: Different Real Exchange Rate Variables and Exports Growth**

	I	II	III	IV	V	VI
	Merchandise	Traditional Services		Modern Services		
Log Per Capita Income, Lag	-0.04 [1.36]	-0.06 [1.47]	-0.06** [2.43]	-0.06 [1.15]	0.05 [1.00]	0.01 [0.13]
Log Difference in RER, IFS	.14** * [5.92]		0.10*** [3.78]		0.19*** [3.85]	
Log Difference in REER, IFS		.15*** [5.72]		0.16*** [4.17]		0.22*** [4.02]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	317	225	317	225	317	225
Number of Countries	62	41	62	41	62	41
R-squared	0.32	0.34	0.28	0.39	0.24	0.31

Note: The dependent variable is growth in exports of merchandise, traditional and modern services, (in constant USD). Observations are averaged over five-year periods. Data are from 1980-2009. Regressions include country fixed effects and period-fixed effect, as indicated. Standard errors are robust and clustered at countries.

**Table A4: Variables and Data Sources**

Variable	Source
Merchandise Exports	Calculated using the data at constant USD from the WDI.
Modern Services Exports	Calculated using the data at constant USD from the WDI.
Traditional Services Exports	Calculated using the data at constant USD from the WDI.
Real Per Capita Income, Log	PPP Converted GDP Per Capita (Chain Series), at 2005 constant prices
RER, PPP, Log Difference	Log difference of real exchange rate in purchasing-power-parity from Penn World Tables, vis-a-vis the U.S.
RER, PPP, Residual, Log Difference	We regress the real exchange rate in PPP on real per-capita GDP and year fixed effects; and take the difference between the log real exchange rate at PPP and the log fitted value from the regression.
RER, IFS, Log difference	We construct the bilateral real exchange rate vis-a-vis the U.S. using data from the IMF's <i>International Financial Statistics</i> on nominal exchange rates vis-a-vis the U.S. dollar and the consumer price index for the US and other countries.
RER, PPP, Log difference	We obtain an estimate of the real effective exchange rate from IFS and the <i>World Development Indicators</i> of the World Bank, and take its log difference, but its country coverage is more limited.
Volatility of Real exchange rate	Monthly bilateral real exchange rate calculated using data on bilateral exchange rate and CPI of the U.S. and other countries, and calculate standard deviation using the monthly data for each country for that year.
Savings	Gross domestic savings (% of GDP), from WDI
Education	Average years of schooling in population more than 25 (or 15) years of age, percent of population with completed tertiary (or secondary) educations in 25-plus age groups. All measures are highly correlated, bivariate correlation being .65 or higher (from <a href="http://www.barrolee.com">http://www.barrolee.com</a> ).
Tariff	From the World Bank site: <a href="http://data.worldbank.org/indicator/TM.TAX.MRCH.SM.AR.ZS?page=1">http://data.worldbank.org/indicator/TM.TAX.MRCH.SM.AR.ZS?page=1</a> The simple mean applied tariff is the unweighted average of effectively applied rates for all products subject to tariffs calculated for all traded goods. We interpolated the tariff data where missing.
Foreign Direct Investment	We update the data on stock of FDI inflows in Lane and Milesi-Ferreti using the IFS data for 2008, 2009 and 2010. We have calculated the FDI inflow stock with GDP ratio, but it is available only until 2007.
English Language	We create an index which takes a value 3 if English is the first official or spoken language, 2 if English is the second spoken or official language, 1 if it is third official or most spoken language, 0 if is not one of the top three official languages or one of the three most spoken languages.
Date of Joining WTO	Dummy takes a value 0 before a country became a member and 1 thereafter. From WTO's website: <a href="http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm">http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm</a>
Income Groups	Based on the data sheet given by World Bank last updated in April 2012: low income, \$1,005 or less; lower middle income, \$1,006–3,975; upper middle income, \$3,976–12,275; high income, \$12,276 or more. Income classifications set on 1 July 2011 remain in effect until 1 July 2012.
Currency crash	Data on currency crashes is from Leaven et al for the countries that they have covered. They define a currency crash as a nominal depreciation of the currency vis-à-vis the U.S. dollar of at least 30 percent that is also at least 10

	percentage points higher than the rate of depreciation in the year before. They compute exchange rate depreciation as the percent change of the end-of-period official nominal bilateral dollar exchange rate from the World Economic Outlook (WEO) database of the IMF. For Australia, Austria, Bahrain, Denmark, France, Germany, Ireland, Mauritius, Netherlands and Switzerland we take the currency crashes dates from Reinhart and Rogoff, who define it as: an annual depreciation versus the US dollar (or another relevant anchor currency) of 15 percent or more.
Internet Penetration	Availability of internet per 100 of population

**TableA5: Summary Statistics**

<b>Variable</b>	<b>Observations</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Growth of Merchandise Exports	380	0.06	0.08	-0.24	0.70
Growth of Services Exports	380	0.06	0.07	-0.19	0.45
Growth of Modern Services Exports	380	0.08	0.12	-0.31	0.79
Growth of Traditional Services Exports	380	0.06	0.08	-0.30	0.58
Real Per Capita Income, Log	380	8.68	1.18	5.99	10.73
Real Exchange Rate Log Difference	380	-0.02	0.18	-0.57	0.99
Savings/GDP	380	18.65	9.32	-10.52	50.82
Net FDI/GDP	378	1.99	2.09	-0.19	15.53
Year of Schooling	366	6.65	3.00	0.37	13.23
Internet Penetration	258	13.98	21.77	0.00	88.03
Currency Crash	337	0.88	0.22	0	1
Volatility of Real Exchange Rate	308	0.77	0.67	-0.97	3.94
Financial Reform Index	347	0.60	0.28	0	1
English, Index	380	0.67	1.15	0	3
Tariff	257	15.5	12.8	0	96.9

Note: The summary statistics are for five-year averages that have been used in the regressions for export volumes.

## Appendix B. Sensitivity Analysis

In this appendix we provide further analysis of the covariates of merchandise and service exports analyzed in Section 3.

**Table B1: Growth of Merchandise Exports, (All Countries), Real Exchange Rate and Other Co**

	I	II	III	IV	V	VI
Log Per Capita Income, Lag	-0.03 [1.16]	-0.02 [1.00]	-0.04 [1.57]	-0.01** [1.96]	-0.06** [2.37]	-0.01* [1.70]
RER percent change	0.15*** [4.28]	0.15*** [4.28]	0.13*** [3.37]	0.15*** [4.73]	0.16*** [4.11]	0.16*** [4.23]
Savings (% of gdp)	0 [0.45]					0 [1.43]
net FDI (% of GDP)		0 [0.26]				0 [1.28]
Currency Crash			0.25*** [3.75]			0.04 [1.38]
Index for Proficiency in English				0 [1.28]		-0.01 [1.17]
Volatility of RER (log)					0.01 [1.33]	0 [0.20]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	378	337	380	308	274
Number of Countries	66	66	65	66	60	55
R-squared (within)	0.31	0.31	0.34	0.15	0.34	0.20

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variable is growth in exports of merchandise, in constant USD. Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects, and time fixed effect, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period, per cent change in real exchange rate, and all other variables are average of annual values over contemporaneous five years.

**Table B2: The Real Exchange Rate and Traditional Services Exports, Including Other Controls**

	I	II	III	IV	V	VI
Log Per Capita Income, Lag	-0.04 [1.50]	-0.02 [1.11]	-0.06** [2.23]	-0.01*** [3.25]	-0.10*** [3.95]	-0.02*** [3.33]
RER, percent change	0.14*** [4.79]	0.14*** [5.07]	0.13*** [4.22]	0.13*** [4.68]	0.12*** [4.09]	0.11*** [3.64]
Savings (% of gdp)	0 [0.82]					0 [1.42]
net FDI (% of GDP)		0.01*** [3.19]				0.01*** [3.19]
Currency Crash			0.23** [2.56]			0.07*** [3.04]
Index for Proficiency in English				0 [0.31]		0 [0.66]
Volatility of RER (log)					0.03*** [2.68]	0.01* [1.66]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	378	337	380	308	274
Number of Countries	66	66	65	66	60	55
R-squared (within)	0.18	0.19	0.21		0.23	

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variable is growth in exports of traditional services, in constant USD. Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects, and time fixed effect, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period, percent change in real exchange rate, and all other variables are average of annual values over contemporaneous five years.

**Table B3: The Real Exchange Rate and Modern Services Exports, Including Other Controls**

	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>
Log Per Capita Income, Lag	0.02 [0.29]	0.03 [0.57]	-0.01 [0.16]	0 [1.01]	0 [0.07]	-0.01 [1.14]
RER, percent change	0.23*** [3.92]	0.23*** [4.00]	0.20*** [3.40]	0.23*** [4.29]	0.23*** [3.48]	0.23*** [3.46]
Savings (% of gdp)	0 [0.32]					0 [0.75]
net FDI (% of GDP)		0.01* [1.72]				0 [1.38]
Currency Crash			0.24** [2.35]			0.06 [1.63]
Index for Proficiency in English				0.01* [1.66]		0.01 [1.58]
Volatility of RER (log)					0.02 [1.50]	0.01 [1.06]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	378	337	380	308	274
Number of Countries	66	66	65	66	60	55
R-squared (within)	0.13	0.15	0.16		0.15	

Note: \*, \*\*, \*\*\* indicate that coefficients are significant at 10, 5, and 1 per cent levels respectively. The dependent variable is growth in exports of modern services, in constant USD. Observations are averages over five-year periods. Data are from 1980-2009. Regressions include country fixed effects, and time fixed effect, as indicated. Standard errors are robust and clustered at countries. Log per capita income is lagged by one five year period, per cent change in real exchange rate, and all other variables are average of annual values over contemporaneous five years.

## Appendix C: Identifying Export Surges

**Table C1: Surges in Merchandise, Traditional Services and Modern Services Exports**

Country	Data Availability	Surge in Merchandise	Surge in Traditional Services	Surge in Modern Services
Argentina	1980-2010	1994-1997	1995-1998; 2003-2007	2000-2007
Australia	1980-2010	1993-1996; 1999-2001; 2005-2008	1986-1988; 1993-1996	1996-2000
Austria	1980-2010	1995-2000; 2004-2007	1987-1991; 2004-2008	1998-2001; 2005-2008
Bangladesh	1980-2010	1992-2000; 2003-2006	1995-1997	1989-1995; 2002-2008
Bolivia	1980-2010	2000-2006	1985-1987; 2002-2005	No surges identified
Brazil	1980-2010	1999-2004	1998-2004	1996-2002
Canada	1980-2010	1993-2000	1994-2000	1983-1988; 1996-2000
Chile	1980-2010	1985-1989; 1999-2006	1984-1986; 1989-1993; 1996-2003	2000-2003
China	1983-2010	1990-1994; 2002-2007	1986-1988; 1992-1994; 1999-2002	1984-1987; 1989-1993; 2002-2008
Colombia	1980-2010	2003-2006	1985-1988	1984-1990; 2003-2006
Comoros	1981-1995	No surges identified	1992-1995	1984-1988
Costa Rica	1980-2010	1995-1999; 2002-2007	1990-1994; 1988-1999	1987-1994; 1998-2001; 2005-2008
Cote d'Ivoire	1980-2010	1994-1997	No surges identified	1990-1994
Denmark	1982-2004	1980-1985; 1994-1997	1988-1991; 1997-2000	1998-2001
Dominican Republic	1980-2010	1997-2000	1996-1999	No surges identified
Ecuador	1980-2010	2004-2008	1985-1989; 1998-2000	1989-1992
Egypt	1980-2010	1987-1991; 1999-2006	1990-1992; 2003-2005	No surges identified
El Salvador	1980-2010	No surges identified	1984-1988; 2002-2004	1984-1987
Finland	1980-2010	1992-1998; 2004-2007	1992-1994	1992-1996; 1999-2002
France	1980-2010	1994-2000	1988-1992	No surges identified
Germany	1980-2010	1995-2001; 2004-2008	1989-1991; 1997-2002; 2005-2008	2000-2008
Greece	1980-1997	No surges identified	No surges identified	1987-1991
Guatemala	1980-2010	1997-2000	1987-1990; 1998-2001	1985-1992
Honduras	1980-2010	1993-1997	1988-1991; 1996-1999; 2002-2006	1986-1989
Hungary	1983-2010	1995-2000; 2004-2007	1985-1987; 1994-1997	2000-2007
India	1980-2010	1987-1992; 2000-2006	1986-1992; 2003-2008	1994-2000; 2003-2006
Indonesia	1982-2010	1989-1992	1985-1998	2002-2005
Ireland	1980-2010	1993-1998	1994-1998; 2001-2004	1987-1992; 1996-2001
Israel	1980-2010	1997-2000; 2003-2007	2003-2005	1996-2000; 2003-2006
Italy	1980-2010	No surges identified	1992-1995	No surges identified
Jamaica	1980-2010	1988-1992	1983-1985; 1990-1992	1991-1994

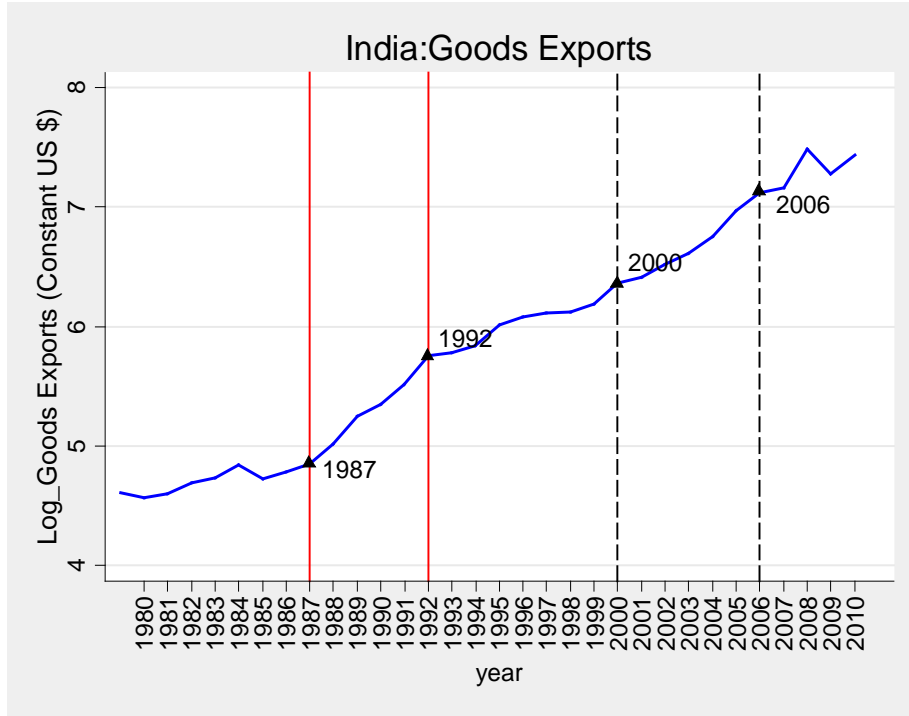
Jordan	1980-2010	2001-2004	2005-2008	1987-1991; 2004-2008
Kenya	1980-2010	No surges identified	1985-1990; 2004-2007	2004-2008
Korea, Republic of	1980-2010	1994-1998	1993-1995	1993-1998; 2004-2009
Madagascar	1980-2005	No surges identified	1986-1989; 1997-2000	1985-1991
Malaysia	1980-2010	1987-1995; 2003-2006	1985-1996; 1999-2001; 2005-2007	1989-1997
Mali	1980-2009	No surges identified	1999-2001	2004-2007
Mauritius	1980-2010	1984-1987	1986-1990; 1994-2001; 2004-2007	1986-1989; 2007-2010
Mexico	1980-2010	1994-2000	No surges identified	1984-1987
Morocco	1980-2010	2005-2008	1982-1985; 1999-2001; 2004-2007	1982-1985; 2001-2007
Mozambique	1981-2010	1999-2006	1987-1990; 2005-2010	1991-1995
Nepal	1980-2010	1997-2000	1991-1994	1994-1997
Netherlands	1980-2010	1994-1998; 2005-2008	No surges identified	1997-2000
New Zealand	1980-2009	No surges identified	1991-1995	1980-1983; 1998-2001
Norway	1980-2010	1994-1997	1989-1991	1996-2000; 2004-2007
Pakistan	1980-2010	1985-1992; 2002-2005	No surges identified	1983-1987; 1993-1996
Paraguay	1980-2010	1984-1990; 2002-2008	No surges identified	1997-2000
Peru	1980-2010	1994-1997; 2004-2008	1996-1998; 2004-2008	No surges identified
Philippines	1980-2010	1987-1991; 1993-2000	1991-1993	1994-1997; 2003-2010
Portugal	1980-2010	1982-1985; 1987-1990; 1994-1997	1984-1985; 2006-2008	2005-2008
Senegal	1980-2009	No surges identified	No surges identified	No surges identified
South Africa	1980-2010	2005-2008	1994-1998; 2001-2003	2005-2008
Spain	1980-2010	1993-1997	1981-1984; 1994-2000	1993-2001; 2005-2008
Sri Lanka	1980-2010	1992-1996	1989-1995	No surges identified
Swaziland	1980-2010	2000-2003	1986-1989	No surges identified
Sweden	1980-2010	No surges identified	1999-2001; 2004-2008	1997-2001
Switzerland	1981-2010	2004-2008	1997-2000; 2005-2007	1997-2000; 2004-2010
Thailand	1980-2010	1986-1989; 2003-2006	1984-1990; 1999-2002	1988-1993
Togo	1980-2010	No surges identified	No surges identified	No surges identified
Tunisia	1980-2010	1988-1991; 2004-2008	2004-2008	1998-2001; 2007-2010

Note: We dropped several countries either because there was no data available or because the data was available only for a few years and was not sufficient to determine structural breaks. These include Belarus, Belgium, Burundi, Cape Verde, Croatia, Czech Republic, Estonia, Iran, Laos, Latvia, Lebanon, Lithuania, Namibia, Poland, Slovenia, Tanzania and Uganda. In addition, only partial data was available for Burkina Faso, Central African Republic, Japan, Malawi, Mauritania, Rwanda and Zimbabwe. Of the countries we have included in the analysis, we have full data for five-year panels for all countries except Brazil, Comoros, Denmark, Hungary, Indonesia, Mozambique and Swaziland.

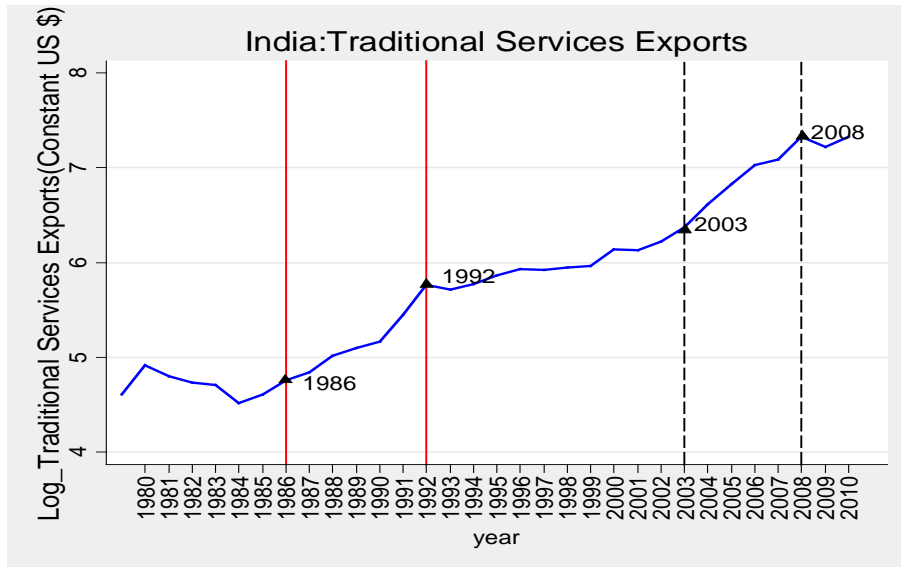


Figures C2, C3 and C4 show episodes of surges in exports of merchandise, modern services and traditional services in India.

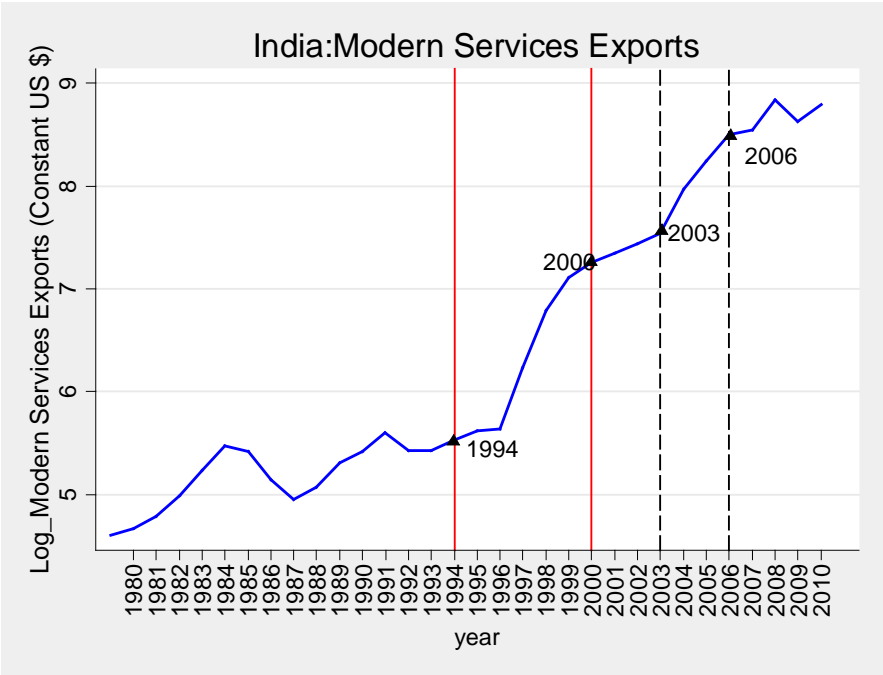
**Figure C2: India—Surge in Exports of Goods (1987-1992 and 2000-2006)**



**Figure C3: India—Surge in Exports of Traditional Services (1986-1992 and 2003-2008)**

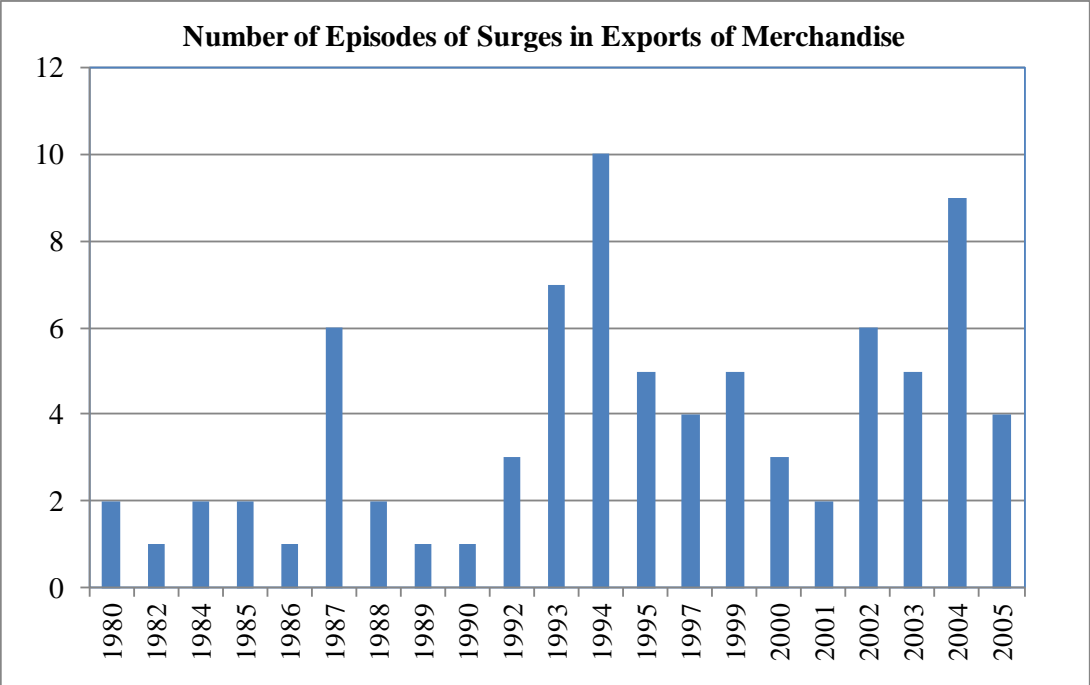


**Figure C4: India —Surge in Exports of Modern Services (1994-2000 and 2003-2006)**

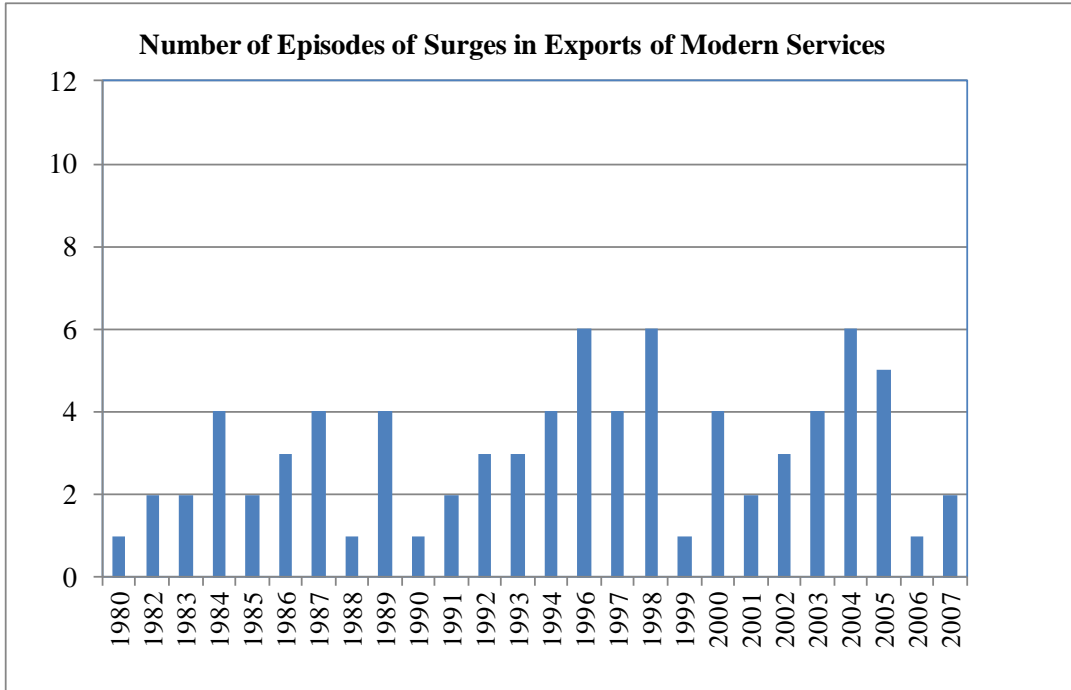


**Appendix D: Characterizing Export Surges**

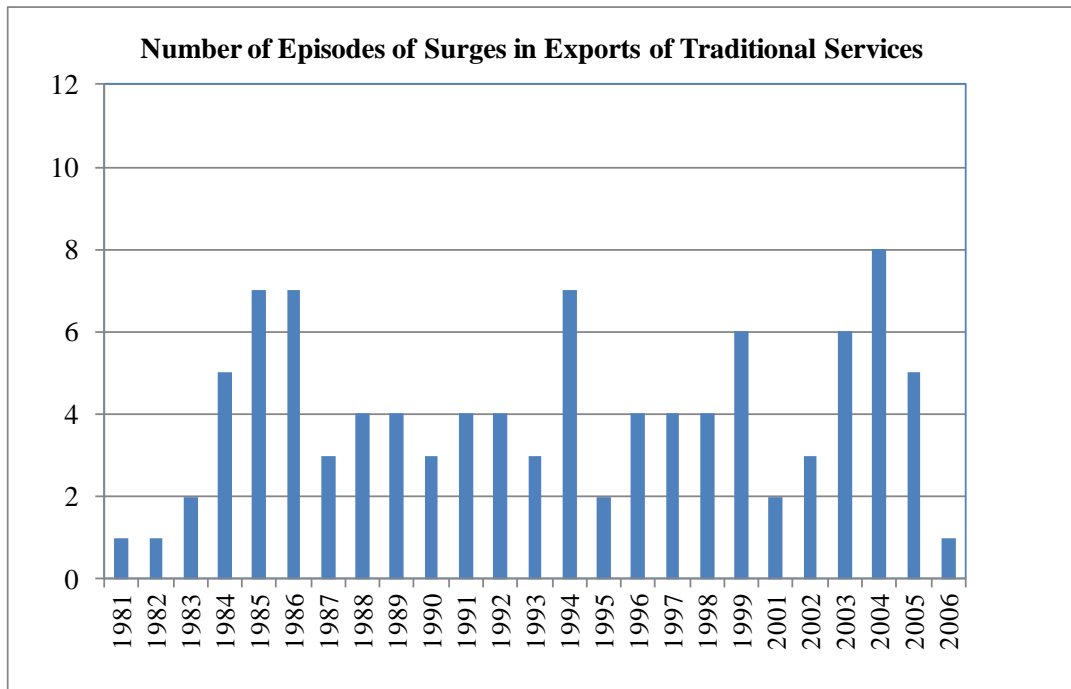
**Figure D1: Temporal Distribution of the Episode of Export Surge in Merchandise**



**Figure D2: Temporal Distribution of Export Surges in Modern Services**



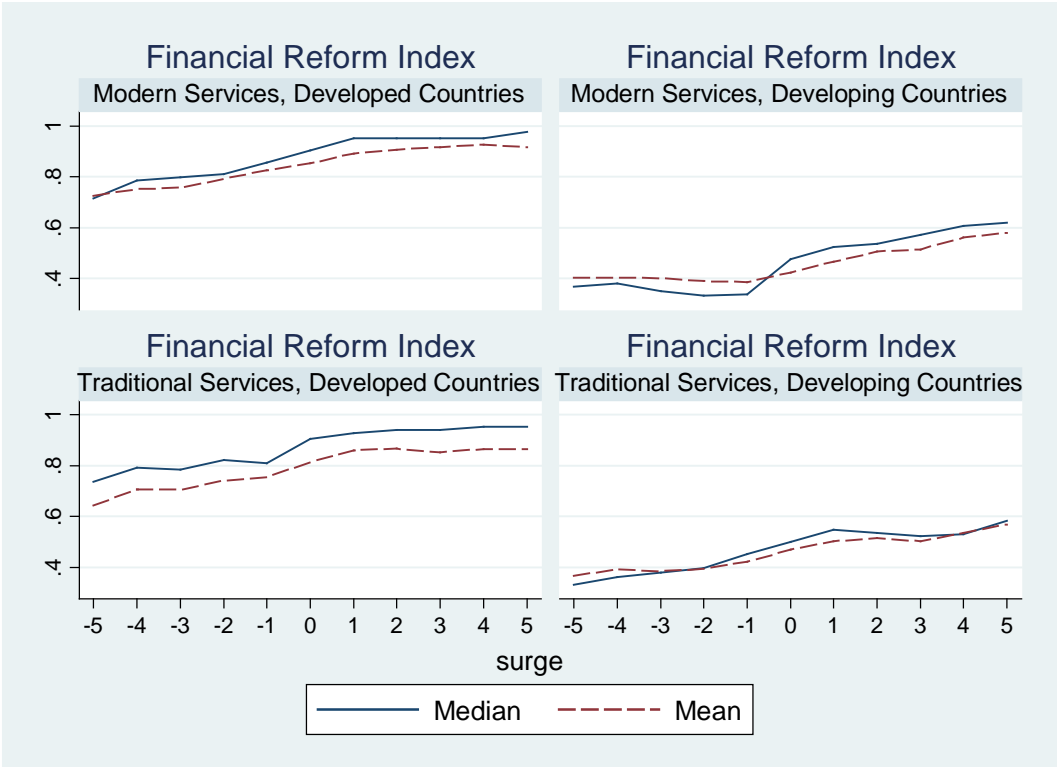
**Figure D 3: Temporal Distribution of Export Surges in Traditional Services**



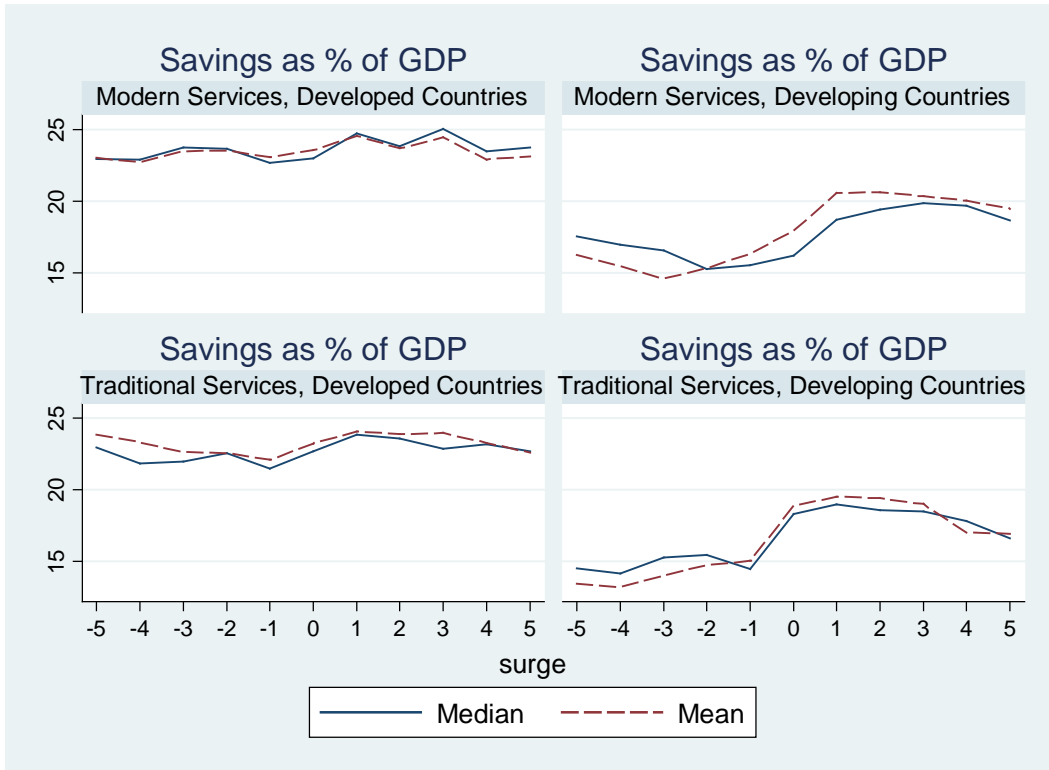
**Appendix E: Predicting Export Surges**

The financial reform index in Figure E1 shows a trend toward liberalization of the financial sector prior to surges of exports of services and especially fast liberalization prior to surges in exports of modern services by developing countries. Export surges also seem to be preceded by an increase in savings rate, especially in developing countries (Figure E2). Surges in exports of modern services, especially in developed countries, are accompanied by and preceded by a sharp increase in internet penetration (Figure E3).

**Figure E1: Financial Reforms and Export Surges in Services (Traditional and Modern)**



**Figure E2: Savings and Export Surges in Services (Traditional and Modern)**



**Figure E3: Surges in Exports of Traditional and Modern Services and Internet Penetration**

