Appendix for Exporter Dynamics and Partial-Year Effects

Andrew B. Bernard*

Esther Ann Bøler†

Renzo Massari‡

Jose-Daniel Reyes§

Daria Taglioni¶

This version: April 2017

This Appendix examines the role of partial year effects in exporter dynamics for Colombian exporters from 2005-2014. The results are designed to provide a robustness check of the findings for Peruvian exporters found in Bernard et al. (2017). The results for the Colombian exporters are both qualitatively and quantitively similar to those for the Peruvian exporters during an earlier time period.

Keywords: export entry, export growth, margins of trade, heterogeneous firms
JEL codes: F14, C81, D22

* *Tuck School of Business at Dartmouth, CEPR & NBER*, 100 Tuck Hall, Hanover, NH 03755, USA, *tel:* +1 603 646 0302, *email:* andrew.b.bernard@tuck.dartmouth.edu

† *Imperial College Business School, CEP and CEPR*, South Kensington Campus, London, SW7 2AZ, UK, *tel:* +44 (0)20 7594 2636 , *email:* e.boler@imperial.ac.uk

‡ *World Bank*, 1818 H Street NW, Washington, DC 20433, USA, *tel:* +1 202 473 8519 , *email:* rmassari@worldbank.org

§ *World Bank*, 1818 H Street NW, Washington, DC 20433, USA *tel:* +1 202 458 7052, *email:* jreyes2@worldbank.org

¶ *World Bank*, 1818 H Street NW, Washington, DC 20433, USA *tel:* +1 202 458 5264, *email:* dtaglioni@worldbank.org

1 Introduction

This Appendix examines the implications of partial-year effects using transaction-level export data on Colombian exports from 2005-2104.[1] The partial-year bias is large, causing the level of first-year exports of all new exporters to be understated by 56 percent on average and overstating the average growth rate between the first and second year of exporting by 112 percentage points.

Correcting for the partial-year bias in the calendar year exports of new market entrants eliminates or dramatically mitigates some of these stylized facts. Surviving new entrants still have smaller average levels of foreign sales than ongoing exporters but their adjusted first year sales are more than 80 percent larger. Extremely rapid growth rates in the first year of exporting, average rates well over 100 percent are typical, are greatly reduced for surviving entrants. Growth rates in the first year are indeed higher that those in subsequent years even after adjusting for the month of entry but the differences are greatly reduced. Colombian exporters grow more quickly than their long run average for the first two years in the market after which their growth rates are not significantly different from their long run average. Correcting for partial year effects also has implications beyond the firm-level data. In the Colombian data, the correction increases the contribution of the extensive margin of entering and exiting firms to overall export growth by more than 40 percent.

2 Data

The data employed in this paper come from Colombian transaction-level customs data from 2005-2014. Although we have information on all shipments between years 2005 and 2014, we aggregate the data to the monthly level before any of our analyses. The data have the usual features of transaction-level trade data in that it is possible to create flows of exports by product and destination for all Colombian exporters. We create two measures of annual exports for each firm in the data. The first measure is a simple aggregation to the calendar year summing across months. This results in an annual data set that is directly comparable to annual firm-level export data used by other researchers. The second data set contains annual export data adjusting for the month of entry into exporting by the firm. The first year of exports starts in the month of first entry and runs for the next 11 months. For the same firm, the second year of exporting also starts in the same month.

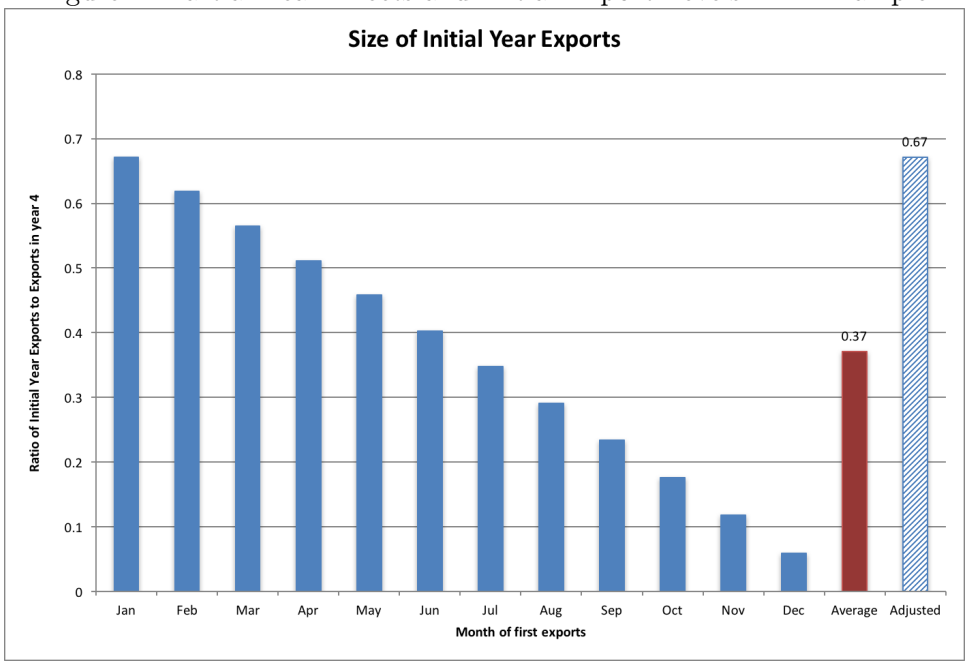
3 Partial Year Effects - An Example

In this section we work through a simple example to demonstrate the potential magnitude of the partial-year effect on first year sales and growth in a market. We refer to export sales and output interchangeably throughout this section as the partial-year effects will distort both revenue and quantity-based measures of sales. In the subsequent empirical work, we use revenue-based measures of exports.

We assume that firms enter exporting uniformly across months during the year with identical initial exports. All firms subsequently grow at 14.2 percent per year corresponding to a 1.11 percent

[1] The tables and figures in this Appendix exactly match the sequencing of those in Bernard et al. (2017).

Figure 1: Partial Year Effects and Initial Export Levels - An Example



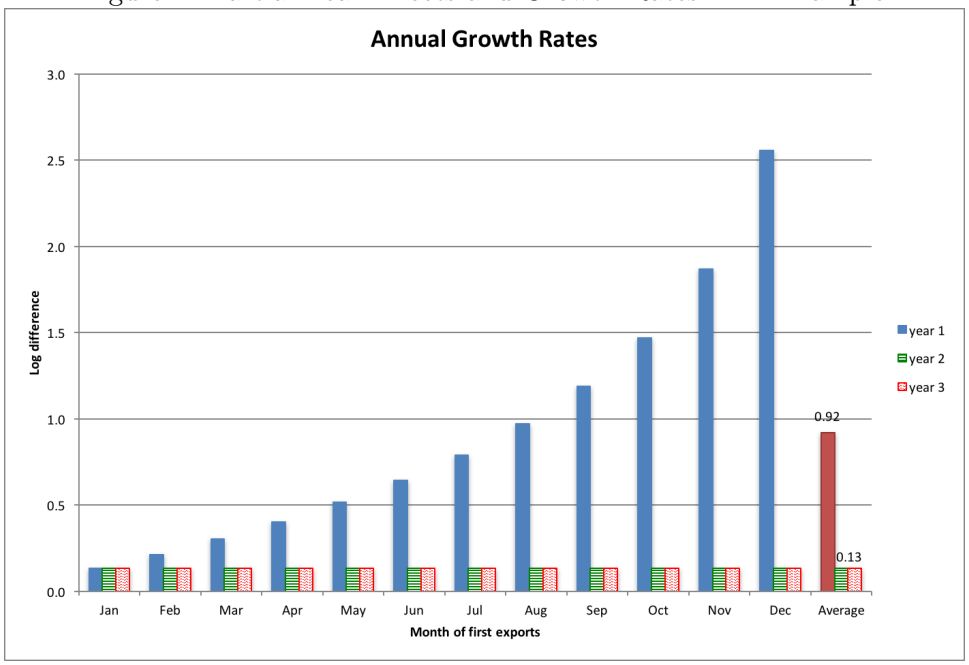
Note: Firms are assumed to be identical except for their month of entry. Firms enter uniformly across months, i.e 1/12th enter in each month. Each firm grows at 14.2 percent per year, corresponding to a 1.114 percent compound monthly growth rate. All firms survive and the displayed numbers correspond to the ratio of initial year sales to sales in year 4 for firms entering in that month, the calendar year average across all firms and the average adjusting for month of entry. *Average* assumes firms enter uniformly across months, i.e 1/12th enter in each month.

compound monthly growth rate and firms do not exit. The growth rate number is chosen to match the average growth rate of exports for surviving Colombian exporters. Specifically for Colombian exporters who enter the export market for the first time from 2005-2014, export for at least 4 years, and do not exit, the average calendar growth rate after year 4 is 14.2 percent.

Table 1 shows that Colombian exporters are more likely to enter the export market in the second half of the year, thus increasing the impact of partial year bias on aggregate exports for new exporters. We maintain an assumption of uniform entry across the months in this section. The assumption of no exits from exporting is clearly at odds with the firm-level evidence on new exporters. However, this assumption is useful to facilitate comparisons with growth rates of surviving entrants as is typically done in the empirical literature.

The firms that enter in January record a full year's initial exports and grow 14.2 percent between year 1 and year 2 with or without a correction for the initial month of exporting. For all other firms, the reduced number of months in the initial calendar year means that the exports recorded in annual, calendar year data cover only a fraction of the firm's first year of exporting. This partial-year coverage results in a downward bias in the firm's recorded first year exports and an upward bias for its first year export growth.

Figure 2: Partial Year Effects and Growth Rates - An Example



Note: Firms are assumed to be identical except for their month of entry. Each firm grows at 14.2 percent per year, corresponding to a 1.114 percent compound monthly growth rate. All firms survive and the displayed growth rates are the annual differences in log total sales, i.e log exports in year 2 minus log exports in year 1. Adjusted for the month of entry, firm sales grow at a constant rate corresponding to a log difference of 0.133. *Average* assumes firms enter uniformly across months, i.e 1/12th enter in each month.

Correcting for the initial month of entry gives every firm the same level of initial exports and the same 14.2 percent year-on-year growth for all years. We compute adjusted/corrected first year exports for a firm that enters the market in year t month m as the sum of exports from month m year t through month $m-1$ in year $t+1$. Adjusted exports for subsequent year are calculated in a similar fashion, e.g. year 2 exports for the same firm cover all months between month m in year $t+1$ through month $m-1$ in year $t+2$.

The results of the simple exercise are easily seen in Figures 1 and 2. First year levels of exports are shown in Figure 1 normalized relative to exports for the firm in year 4. The variation across months is large, first year exports are 67.1 percent of year 4 exports for firms that enter in January but only 5.9 percent for firms that enter in December. The unadjusted average across all months of entry is 37.1 percent. Adjusting exports to reflect the initial month of exporting raises the ratio to 67.1 percent for all firms. Average annual initial export size is 80 percent higher after correcting for the partial-year bias.

Figure 2 shows the results for growth rates expressed in log differences. January entrants record the expected constant growth rate of 13.3 log points, or 14.2 percent, in every year. Without adjusting for the month of entry, average export growth varies systematically according to the month of entry. The calendar year growth rate for firms entering in December is over 1100 percent.

Averaging across all months of entry, the growth of firms between their first and second year of exporting measured using calendar year data is 90 log points or 151 percent. In fact, all these firms are actually growing at 14.2 percent per year in every year. Using annual calendar exports will overstate the first year growth rate of survivors by more than a factor of 9. Variation in entry across the year will affect these results; entry concentrated in earlier months will reduce the partial-year bias while more entry later in the year will exacerbate the effect.

4 Growth and Levels of Surviving Colombian Exporters

In this section, we examine the levels and growth rates of continuing Colombian exporters using both raw, calendar years (covering twelve months from January through December) and years adjusted for the initial month of exporting (covering twelve months from the first month m of exports in year t through month *m-1* in year *t+1*). We estimate the log level of exports for new exporters during their initial years in the market. From the estimated levels, we can calculate the associated growth rates with and without adjusting for partial-year effects.

To conduct the exercise we first select a sample of firms with enough data to be able to compare the levels of exports in the initial three years after export entry to export levels in subsequent (non-exit) years. The sample includes all firms who export for at least four years and have just one change in their export status (entry) for measures of calendar year exports and exports adjusted for the initial month.[2] These criteria mean that firms with gaps in their annual exports (by either method) are excluded, as are all firms who export for brief spells, defined as fewer than 4 consecutive years. The number of firms in the sample is reduced from the overall population of Colombian exporters because many firms enter and then exit, and a smaller number of firms have multiple spells of exporting with a gap of at least one calendar year. After limiting our sample in this manner we are left with 1,024 firms and 4,853 firm export-years.

This effects of partial-year bias can be seen clearly in Figure 3 which shows the average growth rates by years in the export market for both calendar and adjusted data. The first year growth rate is dramatically reduced when the partial-year effects are removed.

To account for the possibility that the differences between the adjusted and calendar average growth rates might be driven by the year of entry or variation across firms, for the sample of continuing exporters, we estimate the following regression,

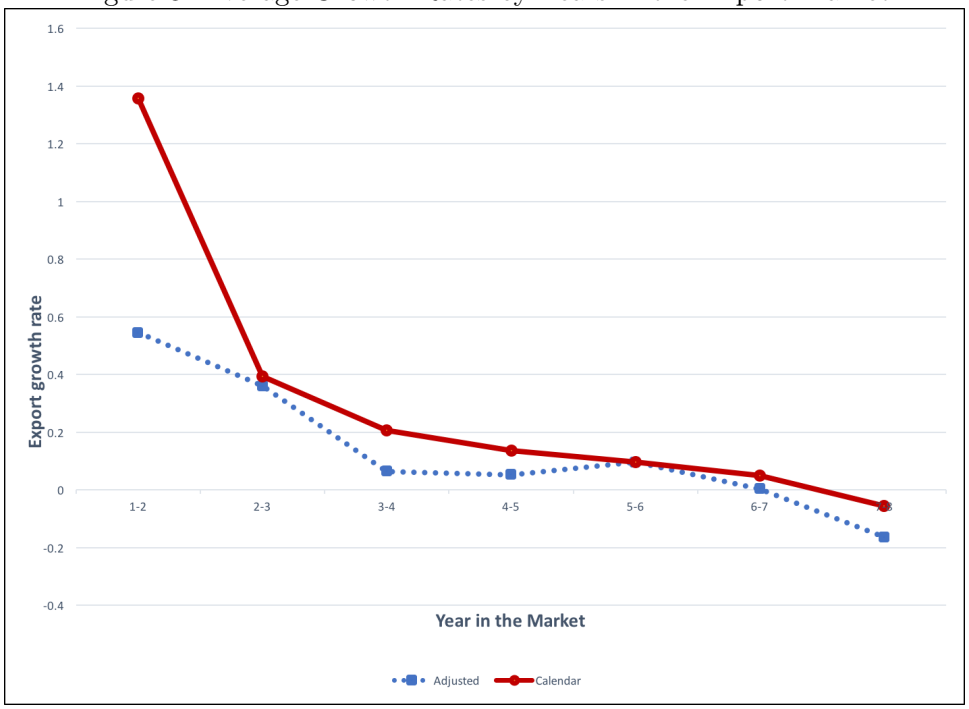
$$lnY_{it} = c_i + \sum_{n=0}^{2} \delta_{t-n}^{entry} + \delta_t + \varepsilon_{it} \tag{1}$$

where lnY_{it} is the log exports of firm i in year t, $\delta_{i,t-n}^{entry}$ is an indicator that equals one if firm i started exporting in year $t-n$, i.e. $Y_{i,t-n-1} = 0$, $Y_{i,t-n} > 0$. The regression is run on the same set of firms, once using the raw calendar year data and once using the data adjusted for the initial export month. Standard errors are clustered at the firm level.[3]

[2] It is important to make sure there are no 12 months gaps in either the annual calendar data or the data adjusted for initial months as no gaps in one series does not necessarily mean no gaps in the other.

[3] This specification means that we lose several years of data at the beginning of the sample period so that all the dummies are correctly specified for every firm.

Figure 3: Average Growth Rates by Years in the Export Market



Note: The figure displays the average growth rates of exports across firms by years in the market for both calendar and adjusted data. The average growth rate is given by the log difference. "1-2" indicates the growth rate between years 1 and year 2 in the export market.

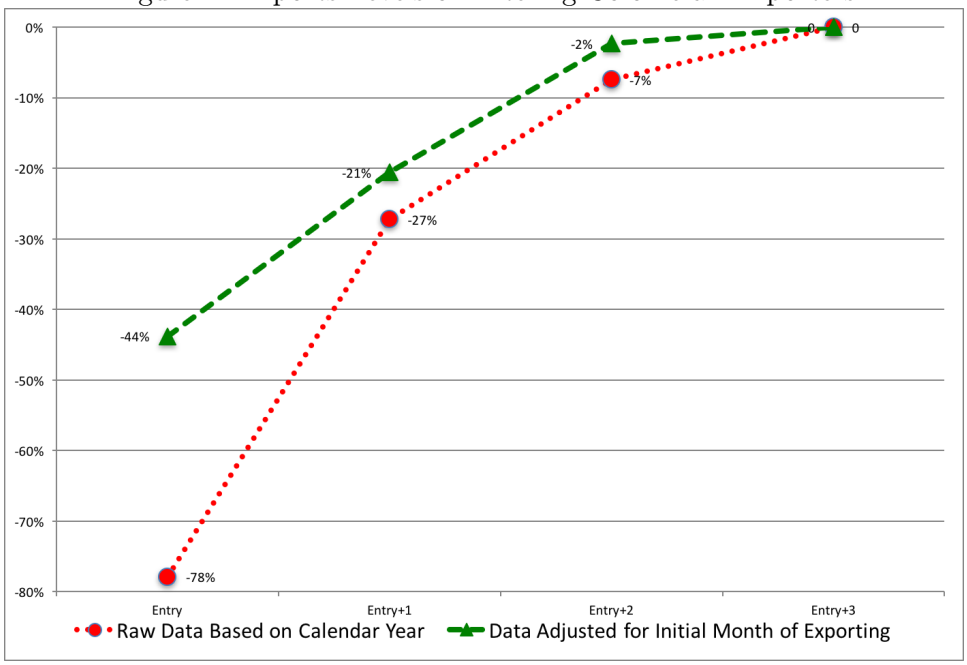
Table 2 reports coefficients on dummy variables for the first, second and third year of exporting. Firm and year fixed effects are included in the specification so all coefficients give log levels relative to average firm exports in year 4 and beyond. Figure 4 shows the average within-firm deviations in percentages for new exporters in their first three years. The series of circles is calculated from the raw data without any partial-year corrections. These numbers correspond to the often-reported facts about entering exporters. New exporters are small at entry, 78 percent below their average in year 4 and beyond.

The triangles give comparable size measures for the same sample of firms adjusting for the month of entry. The differences from the unadjusted numbers are remarkable. Entrants are still smaller but the magnitudes are greatly reduced. Entering exporters are 44 percent smaller than their level in year 4 of exporting compared to 78 percent smaller in the raw data. Adjusting for the month of entry and allowing first year exports to represent 12 months for each firm raises the size of entrants substantially.

The numbers with and without partial-year corrections in Table 2 are close to those in the simple theoretical example represented in section 3.[4] In the unadjusted data, new surviving exporters are 22 percent of their size in year 4 while the average in the theoretical example is 37 percent. Adjusting

[4]In the example, the only number designed to match the Colombian data was the average growth rate of surviving exporters from year 4 onwards.

Figure 4: Exports Levels of Entering Colombian Exporters



Note: The figure displays the regression coefficients from equation 1 reported in Table 2. The sample of firms includes those who exported continuously for at least 4 years and had at most one transition (entry) in their export status. Coefficients are estimated in a firm fixed effects specification and report the log levels relative to those for the firm 4 years after entry.

for partial year effects, the average first year export level is 56 percent of the value of year 4 exports in the data and 67 percent in the theoretical example.

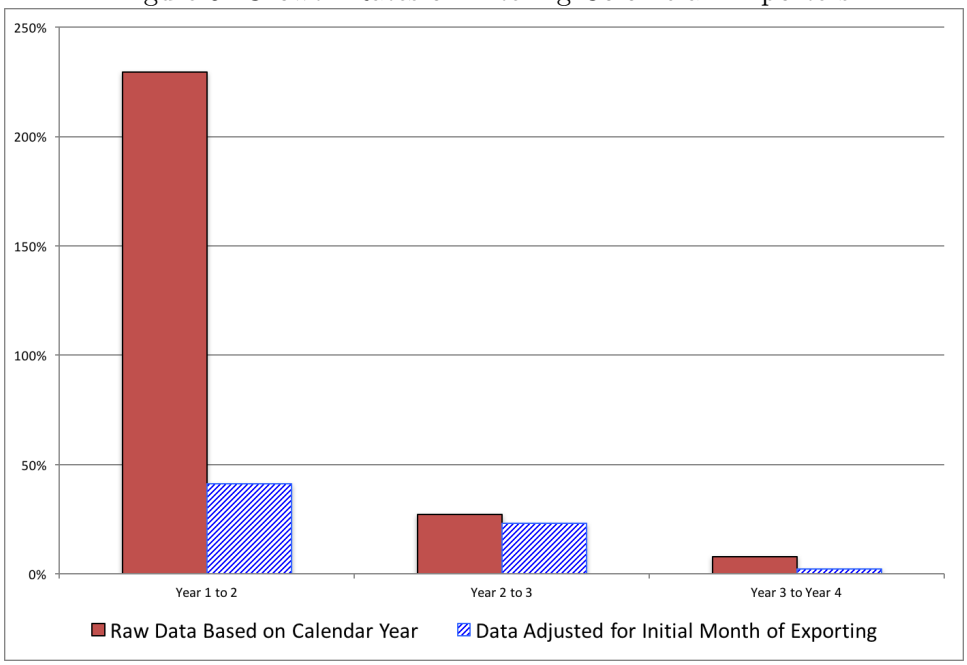
Using the same regression results (Table 2), we calculate raw and adjusted growth rates for entering exporters in Figure 5. The growth rates from the raw data are calculated as percentage changes and displayed in the solid columns. These unadjusted growth rates closely resemble those found in the existing literature across a wide range of data sets. Surviving exporters grow extremely quickly in the first year, 229 percent or 150 log points, but growth slows down sharply in the next two years to 27 and 8 percent respectively. However, adjusting for the starting month of exporting produces dramatic changes as seen in the striped columns. These same firms now show average annual growth rates in the first three years of exporting of 41, 23 and 2 percent respectively.[5]

[5]We estimate the following regression,

$$\Delta lnY_{it} = c_i + \sum_{n=1}^{3} \delta_{t-n}^{entry} + \delta_t + \varepsilon_{it} \tag{2}$$

where ΔlnY_{it} is the difference log exports of firm i between year t and $t-1$, $\delta_{i,t-n}^{entry}$ is an indicator that equals one if firm i started exporting in year $t-n$. The results in Table 3 confirm that the first year growth rate is dramatically larger when using the calendar year data but that growth rates in subsequent years are not significantly different from the long-run average.

Figure 5: Growth Rates of Entering Colombian Exporters



Note: The figure displays growth rates (log differences) calculated from the regression coefficients in Table 2 (equation 1). The sample of firms includes those who exported continuously for at least 4 years and had at most one transition in their export status, i.e. entry.

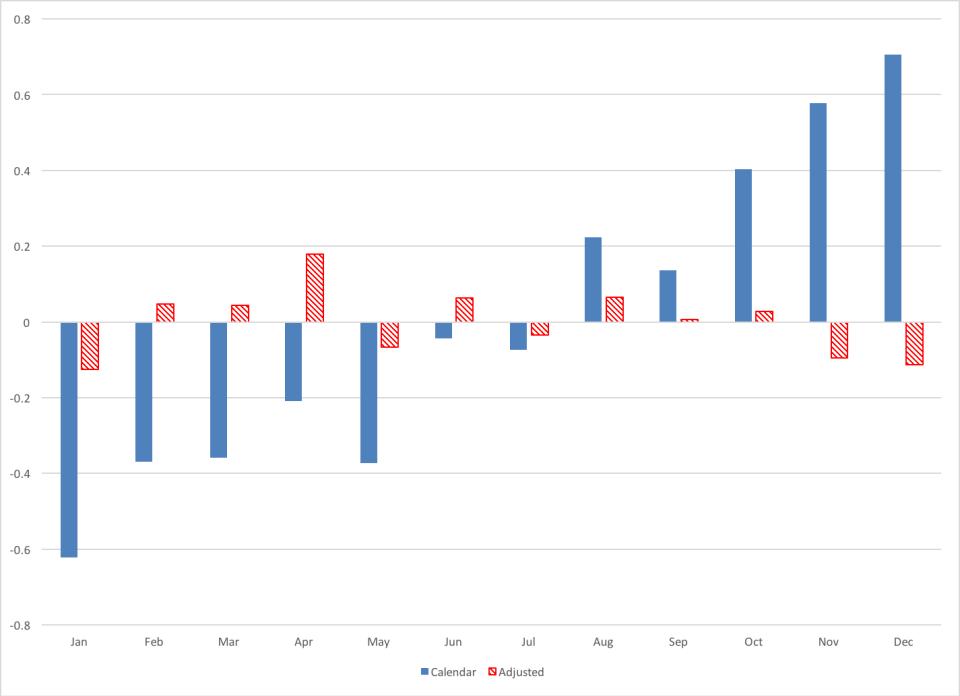
4.1 All New Entrants

Here we extend our sample to include all firms in the export market and examine how partial-year effects might affect reported first year export sales and the growth rates between years one and two.

Figure 6 shows the relationship between firm export growth and the month of entry for new Colombian exporters from 2005-2014. The sample of firms is all entrants into exporting in a year t who report some exports in the following calendar year t+1. The solid columns are the average first year growth rates by month of entry for all firms using the raw calendar data. The growth rates are given as the deviation from the average across all months and years. As expected, partial-year effects cause the growth rates based on the calendar year data to rise systematically across the months with the lowest for January entrants (62 log points below the mean) and the highest for December entrants (70 log points above the mean). The striped columns show the same growth rates relative to the mean for first year export growth adjusting for the month of entry. The systemic relationship between entry month and export growth is eliminated and the pattern partly reverses.[6] The average growth rates of all new exporters is 75 percent higher using calendar year data instead of the adjusted data.

[6]The lower growth rates for entrants in later months comes from a truncation of the sample. Firms are included if they report exports in years t and t+1 whether or not they continue to export past December, t+1. The later months include a greater fraction of firms that no longer export in year t+2 and thus have small exports in their second year due to exit.

Figure 6: Annual Growth Rates of New Colombian Exporters by Month, 2005-2014



Note: This figure reports the average growth rate (log differences) of new exporters by month for the cohorts from 2005 to 2014. The monthly averages are reported as deviations from the average across all months and years. The solid color columns are calculated from the unadjusted calendar year exports while the striped columns are calculated from exports adjusting for the initial month of entering exporters.

5 Decomposing Export Growth

With the growth of research on firm heterogeneity and exporting, a number of papers have examined the contribution of the extensive margin of new exporters and concluded that firm entry and exit are small relative to overall export growth. In this section we decompose Colombian export data into the contributions of extensive and intensive margins with and without corrections for partial year effects. The methods for correcting the aggregate growth contributions can be found in Bernard et al. (2017).

5.1 The Extensive Margin in Colombian Exports

In Table 4, we report the average entry and exit shares for new exporting firms over the period 2005-2014 for Colombian exports. The first row of the upper panel uses calendar year data and contains the average shares of exports for entering firms and exiting firms as well as the average net contribution of entrants/exits to overall export growth. As is typically found in the literature, the role of extensive margin is small with new exporters accounting for 2.4 percent of total exports, exiting exporters accounting for 2.0 percent of total exports and net entry contributing 4.0 percent of export growth.

The second row present comparable statistics corrected for the partial year bias. While the large majority of exports are at continuing or surviving firms, the role of new exporting (exiting) firms is more than 60 percent larger when adjusting for partial year effects. New exporters contribute on average 3.8 (3.3) percent of total annual exports. The net contribution of the extensive margins increases to 6.0 percent of annual aggregate export growth.

The bottom half of the table expands the definition of the extensive margin to include new products and new markets from continuing firms as well as firms new to exporting as in Besedes and Prusa (2011). This broader definition of the extensive margin of trade now accounts more more than 40 percent of aggregate export growth. These findings suggest that the systematically small role for new firms and products in annual export growth is driven in part by partial-year bias.

6 Conclusion

This Appendix reestimates the effects of partial year bias on exporter dynamics for a different country, Colombia, and for a different time period than the original work on Peru. The findings across the board are both qualitatively and quantitively similar to those from the orginal Peruvian data. Exporter growth rates from year 1 to year 2 are substantially reduced when controlling for partial year effects and export levels are comparably larger. The contribution of extensive margins to aggregate export growth increases by 40-53 percent and more than 40 percent of aggregate export growth in Colombia comes from the combined extensive margins of new products, new markets and new firms.

References

Bernard, Andrew B., Esther Ann Bøler, Renzo Massari, Jose-Daniel Reyes, and Daria Taglioni, "Exporter Dynamics and Partial Year Effects," Technical Report, Tuck School of Business 2017. (document), 1, 5

Besedes, Tibor and Thomas J. Prusa, "The role of intensive and extensive margins and export growth," *Journal of Development Economics*, November 2011, *96* (2), 371–379. 5.1

Table 1: The Distribution of Entry by Colombian Exporters across Months, average 2005-2013

	Share of Entrants	% high/low
January	7.2	-1.3
February	8.0	0.3
March	8.8	0.3
April	7.4	-0.8
May	8.4	-0.1
June	8.1	-0.2
July	9.3	0.8
August	9.2	0.7
September	8.9	0.6
October	8.5	0.0
November	8.0	-0.2
December	8.3	-0.2

Note: The first column reports the share of new exporters that start exporting in that month averaged across 2005-2014. The second column shows the percentage point difference of the monthly average from the benchmark of new entrants arriving uniformly across the days of the year.

Table 2: Export Levels after Entry for Continuing Colombian Firms

	Calendar	Adjusted
First year	-1.509***	-0.576***
	(0.155)	*(0.137)*
Second year	-0.318***	-0.231***
	(0.093)	*(0.088)*
Third year	-0.077	-0.024
	(0.059)	*(0.055)*
Year FEs	Yes	
Firm FEs	Yes	
N	4,853	
# of firms	1,024	

Note: This table reports coefficients on dummy variables for first, second and third year of exporting. Firm and year fixed effects are included so all coefficients give log levels relative to average firm exports in years outside the first three. The sample includes all firms who export for at least four years and have just one change in their export status (entry) for measures of calendar year exports and exports adjusted for the initial month. These criteria means that firms that both enter and exit are excluded, as are those with gaps in their annual exports (by either method) and those that export for brief spells, fewer than 4 years. Standard errors are clustered by firm.

Table 3: Log Differences of Exports after Entry for Continuing Colombian Firms

	Calendar	Adjusted
Year 1-2	1.072***	0.436***
	(0.220)	*(0.188)*
Year 2-3	0.122	0.271*
	(0.155)	*(0.135)*
Year 3-4	-0.075	0.017
	(0.109)	*(0.102)*
Year FEs	Yes	
Firm FEs	Yes	
N	3,829	
# of firms	1,024	

Note: This table reports coefficients of the log difference of firm exports on dummy variables for year pairs (1-2, 2-3, 3-4) of exporting. Firm and year fixed effects are included so all coefficients give log differences relative to average firm growth rates (log differences). The sample includes all firms who export for at least four years and have just one change in their export status (entry) for measures of calendar year exports and exports adjusted for the initial month. These criteria means that firms that both enter and exit are excluded, as are those with gaps in their annual exports (by either method) and those that export for brief spells. Standard errors are clustered by firm.

Table 4: Shares for Colombian Entering and Exiting Exporters, 2005-2014

	Firms		
	Entry	Exit	Growth
Calendar	2.4	2.0	4.0
Adjusted	3.8	3.3	5.5

	Firms-Products-Markets		
	Entry	Exit	Growth
Calendar	14.7	12.8	27.4
Adjusted	20.0	16.6	41.9

Note: The top panel reports the average share of exports at (i) entering firms (new exporters) and (ii) exiting firms (firms that stop exporting) as well as the percent contribution of net entry and exit to export growth. In the first row, firms are entrants (exits) if they start (stop) exporting in the same (next) calendar year. In the second row firms are entrants (exits) if they start (stop) exporting in the current (next) month or any of the prior (subsequent) eleven months. In the bottom panel, entry refers to the average share of exports from (i) new exporting firms, (ii) new products at continuing exporters and (iii) new destinations of continuing products at continuing exporters; exit refers to the average share of exports from (i) exiting export firms, (ii) to-be-dropped products at continuing exporters in continuing markets and (iii) dropped destinations at continuing exporters