Exporter Dynamics and Partial-Year Effects*

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Two identical firms that start exporting in different months, one each in January and December, will report dramatically different exports for the first calendar year. This partial-year effect biases down first year export levels and biases up first year export growth rates. For Peruvian exporters, the partial-year bias is large: first-year export levels are understated by 54 percent and the first year growth rate is overstated by 112 percentage points. Correcting the partial-year effect dramatically reduces first year export growth rates, raises initial export levels and almost doubles the contribution of net firm entry and exit to overall export growth.

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1 Introduction

The past two decades have seen an explosion of research on the microeconomic determinants of exporting and the relationship between participating in foreign markets and firm performance. A growing literature, both empirical and theoretical, considers firm-level evolution and dynamics of exports over time by examining the process of entry and growth. Empirical work using annual firm-level export data by Eaton et al. (2008) and others documents a set of strong empirical regularities about the performance of exporters over time. These regularities include the fact that new market entrants, either new exporters or continuing exporters in new markets, have small levels of exports upon entry, a large fraction of entrants export for only a single year before exiting the market, and surviving entrants have extremely rapid export growth between years one and two with more modest growth rates subsequently. These facts have been taken as evidence against models of high sunk costs of entry into export markets as in Roberts and Tybout (1997) and have generated a growing literature on learning and experimentation in export markets.

At the same time, the proliferation of research on heterogeneous firms and trade has led to work documenting the magnitude of the contribution of the extensive margin to overall export growth. These papers decompose aggregate annual export growth into intensive and extensive margins and consistently conclude that the small size of new exporters leads to a minimal role for the extensive margin, see Bernard et al. (2009).

This paper focuses on one specific issue that touches on much of the existing empirical work in both these areas and suggests caution when approaching the data. Two identical firms that start exporting in different months, one each in January and December, will report dramatically different exports for the first calendar year. This partial-year effect biases down first year export levels and biases up first year export growth rates.[1]

The concept is quite simple, almost trivial, yet the implications for many of the existing stylized facts on export levels and growth rates are profound. The January entrant will record a full 12 months of sales and the growth rate from its first to second year will reflect the true underlying annual growth rate of the firm in the market. The December entrant, in contrast, will only record one month of sales for its first year so the calendar, or annual sales, of the December firm will be biased downwards relative to its actual sales during its first year in the market. Similarly the recorded first year growth rate of the December firm will be biased upwards as one month of sales will be compared to as many as 12 months of sales in the second calendar year.

Measures that flow from these averages, such as the share of new exporters in aggregate exports, will, in turn, contain the same bias.[2] This paper examines the implications of partial-year effects using transaction-level export data on Peruvian exports from 1993-2007. The partial-year bias is very large, causing the level of first-year exports of all new exporters to be understated by 54 percent on average and overstating the average growth rate between the first and second year of exporting

[1] Not every paper in this literature suffers from the problem of partial-year bias in first year export levels and growth rates. Eaton et al. (2014), Berthou and Vicard (2015), and Ruhl and Willis (forthcoming) all acknowledge the potential problem and seek to minimize its impact on their findings.

[2] There is a comparable bias in the last year of exporting when the firm totals are based on calendar years which will reduce the last year sales of exiting exporters.

by 112 percentage points.[3]

Correcting for the partial-year bias in the calendar year exports of new market entrants 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 more than double.[4] Extremely rapid growth rates in the first year of exporting, average rates well over 100 percent are typical in the calendar data, are greatly reduced for surviving entrants. Growth rates in the first year are indeed higher than those in subsequent years even after adjusting for the month of entry but the differences are substantially reduced.[5] Correcting for partial-year effects also has implications beyond the firm-level data. In the Peruvian data, the correction almost doubles the contribution of the extensive margin of entering and exiting firms to overall export growth.[6]

The empirical literature on the dynamics of firm-level exports was initiated by the work of Eaton et al. (2008) on Colombian exporters. Eaton et al. (2008) generate a new set of stylized facts on export dynamics and destination-specific flows using annual trade transaction data for Colombian firms. In the abstract to the paper, they state "that nearly half of all Colombian exporters were not exporters in the previous year. These new exporters tend to be extremely small in terms of their overall contribution to export revenues, and most do not continue exporting in the following year.... Nonetheless, out of each cohort of new exporters, a fraction of firms go on to expand their foreign sales very rapidly...." Empirical work on annual firm-level export data that confirms some or all of these findings for other countries includes Lawless (2009) [Ireland] and Buono and Fadinger (2012) [France]. Albornoz et al. (2012) confirm the small size, low survival and rapid growth of new exporters using Argentinean data. They report growth rates between the first and second years in a market that range from 104 to 190 percent.

These stylized facts in turn have been used and extended by others to motivate dynamic models of exporting and learning. Timoshenko (2015a) directly tests sunk cost versus learning models by regressing log export sales on dummies for the year of exporting and finds that first year sales are low and that the highest growth rate of exports is between years one and two in the market. Akhmetova and Mitaritonna (2012) develop a model of experimentation and learning to explain the fact that new exporters exhibit different patterns in a given market than old exporters. They emphasize the facts of Eaton et al. (2014) for Colombia and Eaton et al. (2011) for France - many new exporters ship very small quantities and surviving exporters expand rapidly. Timoshenko (2015b) examines a different dimension of exporter behavior, the margin of product switching. A model of learning by exporters in new markets is motivated by the fact that Brazilian exporters in their second year in the market have disproportionately greater shares of sales from new products and greater shares of new products in their product mix. Partial-year effects reduce the number of products sold abroad

[3]We confirm the robustness of these results using Colombian data, see the online Appendix.

[4]The fact that entrants are smaller on average than ongoing exporters is not by itself evidence against models of sunk costs of exporting, see Fajgelbaum (2013).

[5]Firm exit rates remain very high for new entrants in export markets.

[6]We focus on partial-year effects in exports but the issues also are relevant for the large literature on firm size, age and growth. Measuring firm performance using sales introduces the possibility of partial-year bias. See, for example, Coad et al. (2015) which reports very high sales growth rates for the youngest cohort of firms in Sweden. Many authors use employment at a point in time to measure firm size, i.e. a stock rather than a flow, thus avoiding the problem of partial-year bias, e.g. Haltiwanger et al. (2013).

in the first year of exporting and overstate the growth in number of exported products and their share in sales between years one and two.

Several papers in the literature on exporter dynamics are able to avoid or mitigate the partial-year bias through their choice of empirical specification. Albornoz et al. (2012) focus on the role of prior export experience and compare export growth in new markets for first-time exporters and exporters new to the market but with prior experience in other markets. They mention the possibility of partial-year effects overstating first year growth rates and include a dummy for average first year export growth. Araujo et al. (2016) study how contract enforcement and export experience shape exporter dynamics. They look at the effects of institutions by looking across destinations within firm-years. Freund and Pierola (2010) examine exporter entry and survival in products not previously exported by Peruvian firms. Their focus on the duration of export spells it is not directly affected by partial-year effects. Ruhl and Willis (forthcoming) examine exporter dynamics using the export share of total sales. They acknowledge the possibility of that partial-year bias may lower this ratio but argue that the persistence of lower export shares for several years is evidence that new exporters are growing more rapidly during their first years in the market.

Eaton et al. (2014) develop a model of search and learning to explain the dynamic pattern of entry and survival by Colombian exporters and to differentiate between the costs of finding new buyers and maintaining relationships with existing ones. Looking at exporter-importer matches, Eaton et al. (2014) show that first year exports in the match are systematically lower than exports in subsequent years for all groups of entering exporters and acknowledge the role of partial-year bias in attenuating first year sales in the market. They find little or no growth in exports within a match in subsequent years.

Alongside the literature on exporter dynamics is a related body of work exploring the underlying sources of aggregate export growth and the importance of the extensive margins of trade. These extensive margins include new exporters as well as new destinations and new products by existing exporters. Typically annual export growth is decomposed into the contribution of these extensive margins and the intensive margin, i.e. the change of sales of existing products by continuing exporters to previous destinations. Bernard et al. (2009) find that the annual variation in aggregate trade is dominated by the intensive margin and find little role for new exporters. The small role for the extensive margin is due primarily to the small initial size of new entrants relative to incumbents. Besedes and Prusa (2011) argue that new export relationships at the country-product level are too small to have an appreciable impact on export growth in the first year.

Related analyses have been conducted by Lawless (2009) [Ireland]; Amiti and Freund (2010) [China]; Van Beveren et al. (2012) [Belgium]; and Cebeci and Fernandes (2015) [Turkey]. The conclusion in all these papers is that new exporters, new export destinations and newly exported products contribute only a small fraction to overall annual export growth. However, the extensive margin contributions are subject to downward bias from partial-year effects. We implement a correction for the partial-year bias in decomposing aggregate annual export growth and find that contribution of the extensive margin of new firms, products, and markets more than triples from 14.1 to 58.4 percent.

There has been little work examining the extent of bias induced by partial-year effects. In large part this is due to the nature of the data that are available to researchers. Most trade datasets have been aggregated to the exporter-destination-product-year level before being provided to the researchers. Eaton et al. (2011) are typical when they report "All (customs record) data is aggregated first at the monthly level. In the analysis files accessible to researchers, these records are further aggregated by year ...." However even when the underlying monthly (or daily) data are available, the first step is usually to aggregate the data to the annual level, e.g. Bernard et al. (2009).[7] An exception is the recent paper by Berthou and Vicard (2015) who control for the month of entry of exporting in their study of the effect of export experience and export growth for French exporters.[8]

The rest of this paper explores the magnitude of partial-year bias in the stylized facts on export dynamics and firm size and growth using Peruvian data. The data on Peruvian exports are described in Section 2. Section 3 outlines a simple model of market entry by month and generates benchmark predictions for the bias on firm size and growth. The magnitude of the bias in entry levels and growth rates for surviving Peruvian exporters is estimated in Section 4. In Section 5 we reconsider the contribution of the extensive margins to overall export growth in Peru. The final section concludes.

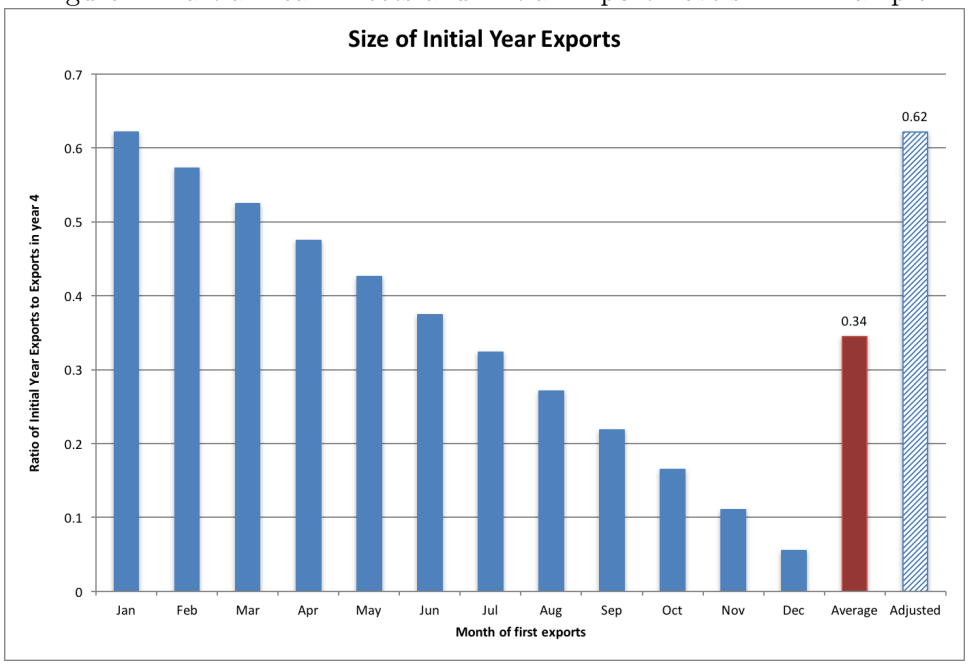
2 Data

The data employed in this paper come from Peruvian transaction-level customs data from 1993-2008. The source of the data is the Peruvian national customs office, SUNAT, and it was collected by the Trade and Integration Unit of the World Bank Research Department as part of the effort to build the Exporter Dynamics Database (see Cebeci et al. (2012)). Although we have daily information on all shipments between years 1993 and 2008, we aggregate the data to the monthly level before any of our analyses. To the extent that temporally disaggregated data is available to researchers it will typically be at the monthly level. 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 Peruvian 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.

[7] While the Exporter Dynamics Database at the World Bank has collected disaggregated firm-level export data from many countries' customs authorities, the data is typically aggregated to the calendar year before delivery. An exception is the Peruvian data we use in this paper.

[8] Although Berthou and Vicard (2015) do not focus on partial-year effects, they report that initial year exports are reduced by 32 percent.

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 17.2 percent per year, corresponding to a 1.332 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.

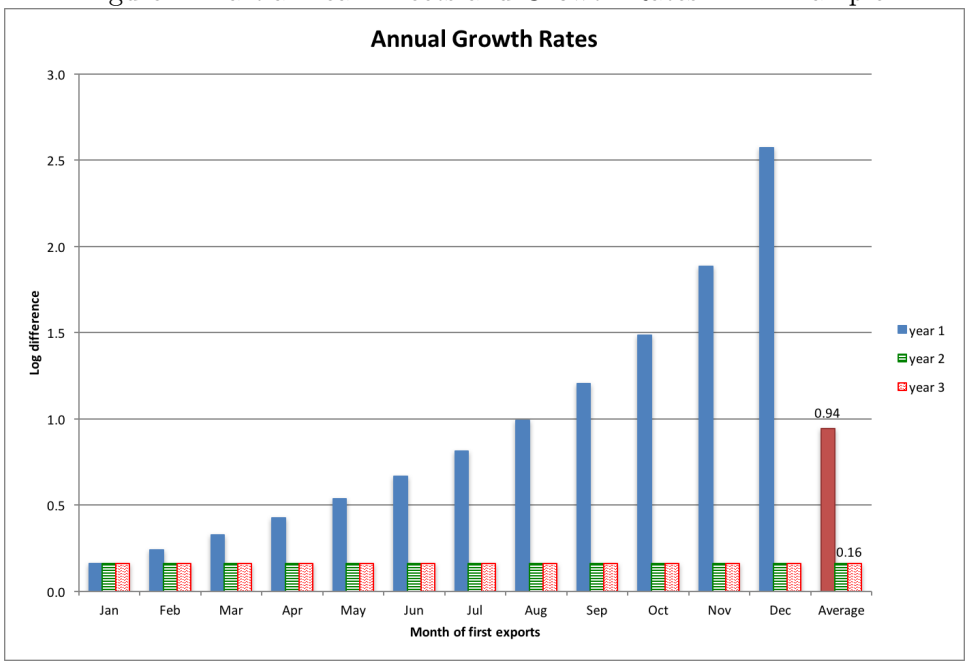
3 Partial-Year Effects - An Example

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 17.2 percent per year corresponding to a 1.332 percent 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 Peruvian exporters.[9] Table 1 shows that Peruvian exporters are slightly 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

[9]Specifically for Peruvian exporters who enter the export market for the first time from 1994-2004, export for at least 4 years, and do not exit, the average calendar growth rate after year 4 is 17.2 percent.

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 17.2 percent per year, corresponding to a 1.332 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 0.16. *Average* assumes firms enter uniformly across months, i.e 1/12th enter in each month.

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 17.2 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.

Correcting for the initial month of entry gives every firm the same level of initial exports and the same 17.2 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 62.1 percent of year 4 exports for firms that enter in January

but only 5.6 percent for firms that enter in December. The unadjusted average across all months of entry is 34.5 percent. Adjusting exports to reflect the initial month of exporting raises the ratio to 62.1 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 16 log points, or 17.2 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 1200 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 94 log points or 157 percent. In fact, all these firms are actually growing at 17.2 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.

The implications of this form of partial-year bias extend to the overall size distribution of firms and the relationship between firm size and growth. Using the assumptions of the example above, the first year size of new entrants is underestimated on average by 80 percent. This will cause the number of small firms to be overestimated and will lead to a corresponding distortion in the firm size distribution. Of course the extent of the bias in the firm size distribution depends on the share of new entrants in the overall number of firms, and the number of shipments each exporter makes during the year, but the potential magnitudes are large; in Peru more than 30 percent of firms are new to exporting each year.[10] In addition, the bias can affect attempts to understand the relationship between firm size and firm growth. Entrants are disproportionately small in the unadjusted data and thus the growth rates of the smallest firms is likely to be subject to greater overstatement.

3.1 Bias Approximation

In Table 1, we report the distribution of new Peruvian exporters across months based on their first month of exporting. There is some variation over months with later months have higher entry rates. However, the monthly averages are reasonably close to what would be expected if entry were uniform across days during the year. This finding suggests both that partial-year bias is likely to be important in the Peruvian export data and that for aggregate or market-specific measures of exporting a relatively simple adjustment might be possible.

The relationship between the firm's exports in its first full year in a market, X_s^{true}, and the observed first year exports, X_s^{obs}, is given by $X_s^{true} = \theta_s X_s^{obs}$, where s is the month of entry into exporting. The adjustment factor for the levels of exports in the first year for each month of an entering cohort is

$$\theta_s = \frac{1 - r^{12}}{1 - r^{13-s}}$$

[10]Small exporters are often single shipment exporters thus reducing the bias in the size distribution.

where r is a common constant compound monthly growth rate and average entry levels across months are assumed to be identical. We can also sign the partial-year bias in log difference growth rates, $\beta = \Delta log\left(X_0^{true}\right) - \Delta log\left(X_0^{obs}\right)$, for a cohort of firms entering the market in year 0 as

$$\beta = \sum_{s=1}^{12} \frac{N^s}{N} log\left(\frac{r^{13-s} - r^{13-s+12}}{1 - r^{13-s}}\right) - log\left(\frac{r^{12} - r^{24}}{1 - r^{12}}\right)$$

where N is the total number of entrants and N^s is the number of entrants in month s. If shares of entering firms are constant across months, the bias in log differences can be closely approximated by

$$\beta = 3.3639 - 2.546r$$

for monthly compound growth rates between 0 and 10 percent, $r \in (1.0, 1.1)$.

4 Growth and Levels of Surviving Peruvian Exporters

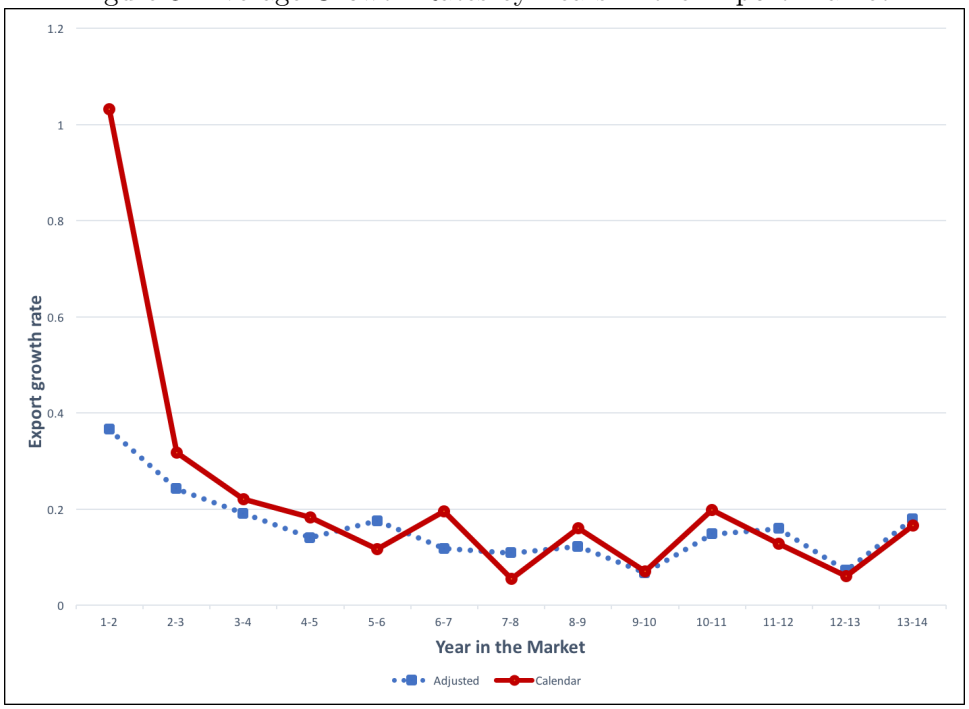
In this section, we turn our focus to two main stylized facts from the literature on firm export dynamics: the small levels of exports in the initial year of exporting and the very high average growth rate for surviving firms between years one and two. We examine the levels and growth rates of continuing Peruvian 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. Our focus on continuing exporters matches that of the empirical and theoretical literatures on exporter dynamics that explore the growth pattern of surviving exporters.

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.[11] 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 Peruvian 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 1,297 firms and 9,797 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. For both calendar and adjusted data, the growth rates settle around their long run averages by the third year in the market.

[11] 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.

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.

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,

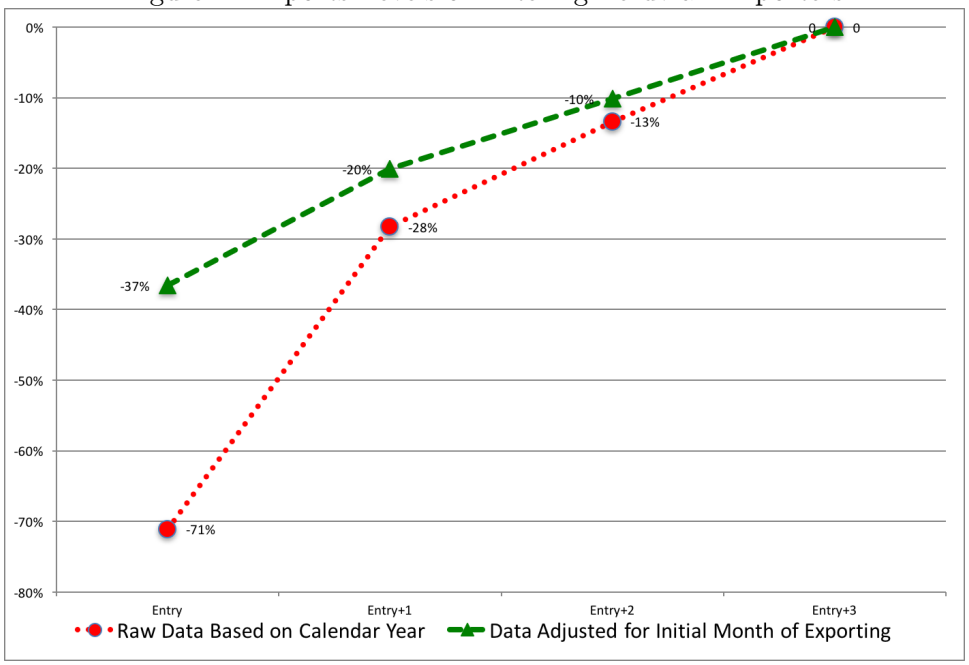
$$lnY_{it} = c_i + \sum_{n=0}^{2} \delta_{t-n}^{entry} + \delta_t + \varepsilon_{it} \tag{1}$$

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.[12]

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

[12]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 4: Exports Levels of Entering Peruvian 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.

facts about entering exporters. New exporters are small at entry, 71 percent below their average in year 4.

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 37 percent smaller than their level in year 4 of exporting compared to 71 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.[13]

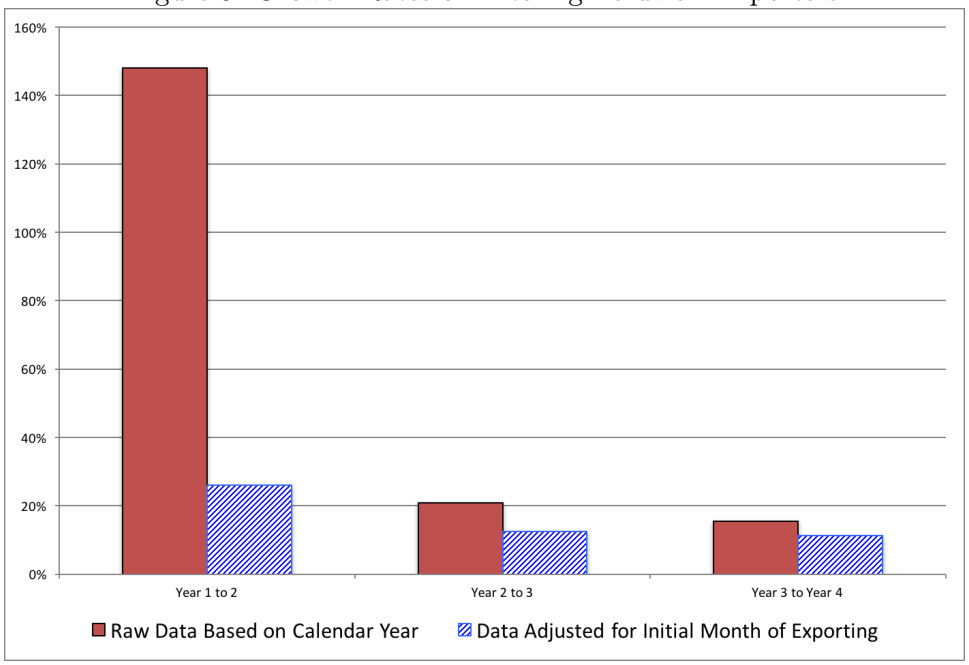
The numbers with and without partial-year corrections in Table 2 are close to those in the simple theoretical example represented in section 3.[14] In the unadjusted data, new surviving exporters are 29 percent of their size in year 4 while the average in the theoretical example is 34 percent. Adjusting for partial-year effects, the average first year export level is 63 percent of the value of year 4 exports in the data and 62 percent in the theoretical example.

Using the same regression results (Table 2), we calculate raw and adjusted growth rates for

[13]To be clear surviving exporters do not stop growing after year 4 but instead grow at the average rate for surviving exporters, 17.2 percent per year. Entrants are smaller than older firms because they have been in the market for fewer years.

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

Figure 5: Growth Rates of Entering Peruvian 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.

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, 148 percent or 91 log points, but growth slows down sharply in the next two years to 21 and 15 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 26, 12 and 11 percent respectively. The unusually large growth rate between years 1 and 2 is dramatically reduced.

Again the numbers with and without partial-year corrections are close to those in the simple example. Unadjusted first year growth rates are 91 log points in the data and 94 log points in the example. Adjusted first year growth rates are 23 and 16 log points in the data and the example respectively.

Adjusting for the month of entry dramatically reduces the first year growth rate anomaly for continuing exporters and raises initial export size.

In Table 3, we examine the growth rates for new exporters using both calendar and pseudo-year data. 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 confirm that the first year growth rate is dramatically larger when using the calendar year data. In addition we find that the export growth rate for the second year in the market is higher than the long run average growth rate, although it is only significant at the 10 percent level when using the adjusted data. These results match the findings of Ruhl and Willis (forthcoming).[15] After the first two years, however, there is no significant difference; on average, surviving exporters are growing at their long run steady state growth rate.[16]

4.1 All New Entrants

In the previous section we followed the empirical literature by examining the size and growth of entrants that survived for several years. 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 Peruvian exporters from 1994-2007. 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 (67 log points below the mean) and the highest for December entrants (95 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.[17]

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 develop a method of accounting for entry and exit that corrects for partial-year effects in firm-level exports and apply the correction to the Peruvian export data.

[15] One concern is that, within years, inflation might be exaggerating the contribution of later months relative to early months. To address this potential problem, we rerun the regressions after first removing monthly means from log exports. The results are unchanged in both magnitude and signficance and are available upon request.

[16] We check the robustness of all our results on Colombian export data from 2005-2014. The results for Colombian exporters are qualitatively and quantitatively similar and are available in the online Appendix.

[17] 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 Exporters by Month, 1994-2007

Note: This figure reports the average growth rate (log differences) of new exporters by month for the cohorts from 1994 to 2007. 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.

5.1 A Theoretical Correction for Decomposing Export Growth

As with the growth rate and level corrections above, we start by recognizing that the contributions of new exporters in a market include all the exports in the first twelve months that a firm is active in the market. For a firm that begins exporting in July of year t, the traditional method of decomposing export growth will only count the July-December exports in year t as coming from a new exporter. The correction allows this same firm to contribute to "exports of new exporters" in July through December of year t as well as the exports in January through June of year t+1. For each month of each calendar year we divide total exports into that portion contributed by new exporters and the remainder which is contributed by continuing exporters.[18]

$$EntryShare_t = \frac{\sum_{m=1}^{12} \sum_{j=new} X_{jmt}}{\sum_{m=1}^{12} \sum_{j} X_{jmt}}$$

where *new* is an indicator for any firm that started exported in the current month m of year t or in any of the previous eleven months. The traditional contribution of new exporters ignores the contribution of exporters that began exporting in any month in the previous year.

[18]Symmetrically when looking at exports from exiting firms we consider the full 12 months prior to exit.

The contribution of exiting firms is calculated in a symmetric fashion where we count exports from exiting firms for the full 12 months prior to exit.

$$ExitShare_t = \frac{\sum_{m=1}^{12}\sum_{j=die} X_{jmt}}{\sum_{m=1}^{12}\sum_{j} X_{jmt}}$$

where *die* is an indicator for any firm that stops exporting next month, *m+1* of year *t*, or in the following eleven months. The traditional contribution of exiting exporters ignores the contribution of exporters that report any exports in year *t+1*. By construction these corrections will increase the share of exports associated with entry and exit.

5.2 The Extensive Margin in Peruvian Exports

In Table 4, we report the average entry and exit shares for new exporting firms over the period 1994-2007 for Peruvian 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 3.7 percent of total exports, exiting exporters accounting for 2.8 percent of total exports and net entry contributing 6.2 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 6.2 (4.6) percent of total annual exports. The biggest effect is on the net contribution of the extensive margins which nearly doubles to 11.7 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 50 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 paper takes a step towards a deeper understanding of the performance of firms in their first years of exporting and their contribution to export growth. The motivation for the work is the rapidly growing literature on firm export dynamics. Many papers in this literature draw on the facts that exporters start small and and that exporters grow very rapidly in their early years in the foreign market, and particularly rapidly in the first year after entry. However, new exporters enter throughout the year and only part of their first year sales are recorded in the calendar year of entry. This paper shows that the small initial size and the extreme growth rates of exports between the first and second years in the market are driven largely by partial-year bias.

Aggregated to the calendar year, the Peruvian data used in this paper match the stylized facts in the literature quite closely. Adjusting for the month of entry changes the findings dramatically.

Exporters are larger upon entry, although still smaller than continuing exporters, and first year growth rates are substantially reduced. As found in prior research, new exporters do grow faster during their two years of exporting.

These findings have implications for a variety of research efforts using detailed micro-data on exports. A number of papers have examined the contributions of extensive and intensive margins to annual export growth and during specific events such as the Asian Crisis and the Great Recession. The use of calendar year data understates the contribution of the extensive margins in annual export growth. Implementing a correction for the partial-year bias raises the contributions of new and exiting exporters in Peruvian exports by more than 50 percent. The role of the extensive margin of entering and exiting firms in aggregate export growth almost doubles.

The consequences of partial-year effects may extend to work on more aggregated data such as that assembled in the Exporter Dynamics Database at the World Bank and described by Cebeci et al. (2012). Stylized Fact 1 in that paper states that more developed and larger countries have larger average exporter size and exhibit significantly lower exporter entry and exit rates. However, the findings reported here suggest that large shares of entrants and exits will by themselves be likely to induce downward bias in firm size as measured in unadjusted annual export flows. As a result, the cross-country correlation between average exporter size and GDP per capita may be driven in part by partial-year effects. The importance of entry and exit in the exporting sector and the reliance on export value data for analysis means that such comparisons based on even aggregate data must be viewed with caution.

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Table 1: The Distribution of Entry by Peruvian Exporters across Months, average 1994-2007

	Share of Entrants	% high/low
January	7.3	-1.2
February	6.9	-0.8
March	8.2	-0.3
April	7.9	-0.4
May	8.2	-0.3
June	8.6	0.4
July	8.3	-0.2
August	8.4	-0.1
September	8.9	0.7
October	9.5	1.0
November	9.5	1.3
December	8.4	-0.1

Note: The first column reports the share of new exporters that start exporting in that month averaged across 1994-2007. 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 Peruvian Firms

	Calendar	Adjusted
First year	-1.24	-0.46
	(0.07)	*(0.06)*
Second year	-0.33	-0.23
	(0.05)	*(0.05)*
Third year	-0.14	-0.11
	(0.04)	*(0.04)*
Year FEs	Yes	
Firm FEs	Yes	
N	9,797	
# of firms	1,297	

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 Peruvian Firms

	Calendar	Adjusted
Year 1-2	0.854	0.199
	(0.057)	*(0.049)*
Year 2-3	0.138	0.092
	(0.049)	*(0.047)*
Year 3-4	0.054	0.050
	(0.044)	*(0.044)*
Year FEs	Yes	
Firm FEs	Yes	
N	8,500	
# of firms	1,297	

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 Entering and Exiting Exporters, 1994-2007

	Firms		
	Entry	Exit	Growth
Calendar	3.7	2.8	6.2
Adjusted	6.2	4.6	11.7
	Firms-Products-Markets		
	Entry	Exit	Growth
Calendar	15.3	14.2	14.1
Adjusted	24.5	17.8	54.8

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