

# PRICING IN MULTIPLE CURRENCIES IN DOMESTIC MARKETS\*

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ABSTRACT. We document that a significant fraction of prices in domestic markets of emerging economies are set in dollars. More expensive goods are more likely to be priced in dollars. This fact is generalized across countries and holds within good categories. More tradable goods are also more likely to be set in dollars. We develop a search model of currency choice of prices to study how inflation and demand characteristics affect price dollarization. Sellers may set prices in dollars to avoid a rapid erosion of the real value of prices at the expense of losing willingness to pay from certain buyers.

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## 1. INTRODUCTION

In economies with a history of monetary instability, local currencies tend to coexist with a more stable currency (usually US dollars) fulfilling some of the roles of money. The most common expression of this is the use of dollars as a store of value by denominating assets and liabilities in dollars. We show that dollars also coexist with local currencies when fulfilling the role of unit of account. In particular, we document a new fact showing that in emerging economies a significant fraction of prices in domestic markets are set in dollars. We argue that the use of dollars for setting domestic prices is related to the country's inflation rate and the dynamism of the goods market. This has relevant implications for the conduct of monetary and exchange rate policy.

We present new empirical facts regarding the degree of dollarization of prices in domestic markets of various Latin American economies. The data we analyze comes from the largest e-trade platform in Latin America, and contains information on all active publications as of August 2017 for 10 Latin American economies, as well as historical information on all publications and transactions made in Argentina and Uruguay during the 2003-2012 period. Importantly, both datasets include information on the currency of denomination of prices. The data show that on average, 22% of goods available for sale are priced in dollars. This figure masks significant heterogeneity across countries and across goods. More expensive goods are more likely to be priced in dollars. Additionally, we also show that more tradable goods are more likely to be priced in dollars.

We first study the cross-sectional relationship between unit price values and the likelihood of those prices being set in dollars. We show that this relationship is increasing. While goods in the bottom quartile of the price distribution are almost exclusively priced in domestic currency, high levels of dollarization are observed for goods in the top quartile of the price distribution. This fact is generalized across countries. We then focus on the case of Argentina and Uruguay, for which we have better and more data, and show that this fact is robust to grouping the data in various dimensions. In particular, we still observe that more expensive goods are more likely to be posted in dollars when we focus on sellers of similar sizes, when we analyze data from different years and when we restrict our analysis to goods of the same type.

Second, we assess whether the degree of tradeability of goods is relevant in determining the currency choice of prices. For this we assign a tradeability index to each publication of goods by combining official sectoral trade and output data for Argentina and Uruguay. We

find that goods that are more tradeable are indeed more likely to be denominated in dollars. Finally, we explore whether the two cross-sectional observations are related to each other by conducting a variance decomposition analysis of the currency choice of prices. We find that a significant fraction of the observed variation in the currency choice of prices is correlated with the value of the unit price, even after controlling for the degree of tradeability of goods.

These new facts can have relevant implications for the conduct of exchange rate policy. The heterogeneous patterns of price dollarization, coupled with the fact that prices tend to be sticky, can give rise to differential degrees of pass-through of exchange rate shocks to prices. Additionally, our empirical findings also have implications for theory, by stressing the usefulness of incorporating prices in multiple currencies in domestic markets into existing open-economy models.

We also present two additional facts regarding the market for goods that we later use in the quantitative analysis of our theory. First, we document that in the online platform transactions do not occur immediately: the average time to sell is close to a month. Second, we also show that more expensive goods are more likely to be bought by buyers that have easier access to dollars. To show this last fact we make use of two household surveys from Uruguay that contain micro-data on households' consumption patterns and on households' balance sheet broken down by currency denomination of assets and liabilities. We first show that wealthier households tend to purchase more expensive goods. Second, we also show that wealthier households have easier access to dollars, as defined by having a higher probability of holding liquid assets (cash and bank deposits) in dollars.

Motivated by our empirical evidence, we then formulate a model of price setting in multiple currencies designed to offer one potential interpretation our cross-sectional facts. Our model focuses on how demand side characteristics and the inflation rate can affect price dollarization. We isolate from supply-side and aggregate risk considerations in affecting the currency choice of prices since these are already well-understood from previous studies (see for example, [Engel \(2006\)](#) and [Gopinath et al. \(2010\)](#)).

A key ingredient of the model is the presence of search frictions, which allows the model to speak meaningfully about markets in which goods remain unsold for a certain period of time. The model is based on the sticker-price model of [Diamond \(1993\)](#), enhanced with the possibility of setting prices in domestic or foreign currency. We also extend the model to include heterogeneous buyers that differ in the easiness with which they can acquire foreign

currency to purchase goods. This additional feature helps us addressing some of the facts documented in our empirical section.

When choosing the currency in which to set prices firms face a trade-off. If they price in local currency, the real value of that price decays faster since inflation in local currency is higher than in foreign currency (a valid assumption in all countries for which we have data). If they price in dollars, the willingness to pay of buyers is lower since some of them do not have dollars readily available and need to incur in a transaction cost associated with exchanging currency before purchasing the good. The relative importance of this trade-off differs for each seller depending on the characteristics of the market in which they sell.

Dollar pricing is more attractive for sellers that sell in markets in which there are more sellers with easy access to dollars. These buyers do not need to pay the transaction cost to acquire goods with foreign currency and hence have a similar willingness to pay for goods in dollars and domestic currency. If markets selling more valuable goods tend to be markets with a higher share of buyers with easy access to dollars, then our model predicts that this is a reason why more expensive goods are more likely to be priced in dollars. Setting prices in dollars is also more attractive for sellers that operate in markets that take more time to sell. The reason is that the relative value of preventing a fast decay rate in the real value of prices is higher for those goods that take longer to sell.

We then quantify our model by calibrating it to match the Uruguayan economy in 2012. This is the economy with the best data availability with both price and transaction data from the online platform as well as data from households' consumption patterns and access to dollars from different surveys. An important data input for the model is a significantly higher inflation rate in domestic currency than in dollars: annual inflation in Uruguay in 2012 was four times higher than in the US. The calibration strategy targets the average level of dollarization of prices and other unconditional moments of the joint distribution of prices, time to sell of goods and buyers access to dollars (measured as a data estimate of the probability of buyers holding liquid assets in dollars).

The model predicts more expensive goods are more likely to be priced in dollars. However, it underestimates the strength of this relationship. While the share of prices in dollars is around 10% in the model and 4% in the data for the cheapest quartile of prices, this share is 30% in the model and 41% in the data for the most expensive quartile of prices. Both in the model and in the data, this relationship is exponential. In the model the prediction that more expensive goods are more likely to be priced in dollars is mostly due to a calibrated

positive covariance between the valuation of the good and the share of buyers with easy access to dollars. This moment is in turn identified by the observed positive correlation between prices and the probability of buyers having a bank account in dollars.

Finally, we perform a counterfactual exercise to analyze the effects of changes in the domestic inflation rate on the share of prices denominated in foreign currency. We simulate data from a model economy that features a higher domestic inflation rate (consistent with that observed in Uruguay in 2003-04), leaving all the remaining parameters from the calibration unchanged, and analyze the patterns of currency choice of prices. Consistent with observed data for Uruguay in 2003-04, in the high-inflation economy the share of prices in foreign currency (both in the model and in the data) is higher than in the baseline low-inflation economy. The reason is that certain sellers have more incentives to set their prices in foreign currency to avoid a rapid erosion of the real value of their posted prices.

Our paper is related to the literature that studies currency choice of prices and the literature that studies price setting in markets with search frictions.

A large literature has studied the macroeconomic effects of the currency denomination of prices in international markets. [Burstein and Gopinath \(2014\)](#) provide a survey of recent advances in this literature. A bulk of the theoretical literature has focused on the determinants of firms' currency choice of international prices ([Engel \(2006\)](#)) and its implications for exchange rate policy ([Devereux and Engel \(2003\)](#), [Devereux et al. \(2004\)](#) and [Bacchetta and van Wincoop \(2005\)](#)). On the empirical side, [Goldberg and Tille \(2008\)](#) study the determinants of currency of invoicing in international trade. [Gopinath et al. \(2010\)](#) analyze new micro-data and document differential degrees of pass-through depending on the currency of invoice of prices. [Cravino \(2014\)](#) uses customs data to study differential effects of nominal exchange rate movements on output depending on the currency of prices. More recently, motivated by the predominance of the dollar as the currency associated with international trade, [Casas et al. \(2017\)](#) develop a general equilibrium theory for small open economies in which firms set their prices in the currency of a third dominant economy. All these papers focus on the currency of invoicing of internationally traded goods. We contribute to this literature by documenting that currency choice is an active margin when setting prices in domestic markets in emerging economies and studying its link with the level of inflation and other market characteristics.

Our paper also contributes to the literature that studies price setting in markets with search frictions. Following the early contributions of [Diamond \(1971\)](#), [Burdett and Judd](#)

(1983) and Benabou (1988), an important strand of the literature has developed models with search frictions on goods markets to study certain features of price setting that standard models of centralized markets have difficulties accounting for.<sup>1</sup> The two papers that are most closely related to ours in terms of the theoretical framework are Diamond (1993) and Burdett and Menzio (2017). Burdett and Menzio (2017) develop a theory of price setting with search frictions and menu costs and show that even in the presence of menu costs, search frictions are important to account for certain features of the data. Diamond (1993) studies price setting in a context in which the price is attached to individual goods. Our theory builds on Diamond (1993) and extends it to include currency choice of prices and heterogeneous buyers regarding their access to foreign currency.

Finally, our paper is also related to the literature that studies financial dollarization in emerging economies. Uribe (1997) studies hysteresis of dollarization as a means of payment. Alesina and Barro (2002) argue that adopting a common currency (full dollarization) can help eliminate currency risk and reduce currency transaction costs. Other papers argue that full dollarization can enhance monetary credibility (Barro and Gordon (1983)) and reduce default risk (Arellano and Heathcote (2010)). Gale and Vives (2002) study the effects of full dollarization on a banking sector that is prone to moral hazard and bailouts. Another strand of papers study the effects of liability dollarization in economies that have their own currency. Ize and Levy Yeyati (2003) study when can financial dollarization arise endogenously and Calvo et al. (2006) argue that dollarized liabilities can give rise to negative balance-sheet effects after large exchange rate devaluations. Alesina and Barro (2001) survey advances in this field. We contribute to this literature by studying the endogenous presence of price dollarization, which is an understudied feature of dollarization.

The remaining of the paper is organized as follows. Section 2 describes the data and documents the main stylized facts regarding the currency choice of prices. Section 3 presents and solves a model of price setting with currency choice and analyze its quantitative properties. Finally, Section 4 concludes.

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<sup>1</sup>Some examples include the study of nominal rigidities (Head et al. (2012)), price dispersion (Kaplan et al. (2016)), shopping behavior and unemployment (Kaplan and Menzio (2016)) and deviations from the law of one price in international prices (Alessandria (2004)).

## 2. EMPIRICAL FACTS ABOUT PRICE DOLLARIZATION

### 2.1. *Data Description and Representativeness*

*Data Description*—We combine data from several sources. The main dataset used in the analysis of the currency of denomination of prices comes from the largest e-trade platform in Latin America. The company started its activities in 1999, currently operates in 18 countries and has more than 190 million users. The range of goods offered for sale and transacted in this platform is very wide and tilted towards durable goods. Recently, the platform expanded its scope to allow for ads about real estate units and vehicles available for sale or rent.<sup>2</sup> In order to post goods in this platform, sellers generate a publication, which includes: a title describing the good, a picture and a more detailed description of the good, the selling price and other characteristics of the good. Buyers can find goods by either searching the good by name or by navigating a tree that categorizes goods in different groups. Once the buyer locates a good of interest, she can enter the publication and decide to make the purchase. Most of the transactions are made with electronic means of payments like credit or debit cards. Although the platform allows sellers to sell via auctions, a current search in the platform for notebooks shows that 99.5% of the goods are sold in a posted-price format. A more detailed description of the data can be found in [Drenik and Perez \(2016\)](#).

The data from this platform is divided into two sub-datasets. The first and more complete dataset contains information about all the publications and transactions of goods made in Argentina and Uruguay during the 2003-2012 period. The data regarding publications contains all the information available at the moment the seller posted the good in the platform. Some of the observed characteristics of a publication are: a description of the product, its posted price along with its currency denomination, the product category, the type of the product (new or used), the quantities available for sale, a seller identifier and the start and end date of the publication. Our analysis focuses on the currency of denomination of posted prices, which is chosen by the seller. The platform allows to set prices either in local currency or US dollars. The data regarding transactions contains information related to each transaction associated with a publication. For each transaction we have data on: the date of the purchase, buyer and seller identifiers and the transacted price and quantity. Our main analysis uses this dataset and focuses on the publications of new products (without prior

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<sup>2</sup>Unlike the case of all other goods, transactions of real estate and vehicles do not take place within the platform. Each ad includes information about the property or the vehicle and the contact information of the seller.

usage) that had transactions associated to them. The analysis is carried out using transacted prices (although the results are virtually the same when using posted prices). We also clean the data in various dimensions to make it suitable for analysis. We provide details of the cleaning procedure in Online Appendix A. Once cleaned, our entire dataset contains more than 13 million publications and around 37 million transactions in both countries during the 2003-2012 period.

The second dataset from this platform contains information of all active publications as of August 2017 for Argentina, Bolivia, Costa Rica, Dominican Republic, Guatemala, Mexico, Nicaragua, Paraguay, Peru and Uruguay.<sup>3</sup> This dataset includes information about publications of goods as well as ads of real estate units and vehicles. These data allows us to generalize our analysis in terms of coverage of countries and types of goods. This second dataset includes information on approximately 20 million publications. Due to the nature of these data, its analysis is based on posted prices.

We also make use of two household surveys from Uruguay to analyze data on buyers' consumption patterns and access to dollars. The first survey is the Uruguayan households consumption survey (*Encuesta Nacional de Gastos e Ingresos de los Hogares*), which is similar to the Consumer Expenditure Survey in the US. This survey was conducted in 2005-2006 and contains detailed information on consumption at the good level of a representative sample of households. We use this dataset to analyze demand and consumption patterns and to compare it to our main dataset to assess the representativeness of the latter. The second survey is the Uruguayan households financial survey (*Encuesta Financiera de los Hogares Uruguayos*), which is similar to the Survey of Consumer Finances in the US. This survey was conducted in 2012-2013 and contains information of households' balance sheets. One of the salient feature of this survey is that it contains information about households' holdings of assets and liabilities, both in domestic and foreign currency. From this survey we obtain measures of households' holdings of bank accounts denominated in dollars and measures of households' income. We merge the information in these two surveys through an imputation procedure based on households' income in order to jointly analyze consumption patterns and households' holdings of bank accounts denominated in dollars. We provide a detailed description of these datasets and the merging procedure in Online Appendix A.

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<sup>3</sup>We also have data for Brazil, Colombia, Chile, Ecuador, El Salvador, Panama and Venezuela. We do not include these countries in the analysis because: i. dollar pricing is not available as a choice in the platform for Brazil, Chile, Colombia and Venezuela, and ii. Ecuador, El Salvador and Panama are fully dollarized economies.



*Representativeness Analysis*—In Online Appendix B we assess how representative the goods publicized in the online platform are of the aggregate economy in Uruguay. First, we analyze the relevance of goods that are available for sale in the platform in the representative consumption basket of Uruguayan households. We do this by comparing data from the online platform with representative data from the consumption survey. We find that the online platform has a broad and relevant coverage. Goods that are traded in the platform account for 31% of the total consumption basket. However, the goods traded in the platform are heavily concentrated in certain categories of the consumption basket such as apparel, furniture and home appliances. On the other hand, other relevant consumption categories such as food and services are not offered in the platform.

Second, we use the data from the financial survey to analyze the economic and demographic characteristics of potential users of the online platform in Uruguay (as measured by those people that either use internet or use internet for shopping purposes). We find that potential users of the platform tend to be wealthier, more educated and with more liquid assets in dollars than the average population.

## 2.2. Price Dollarization in the Data

In this section we present new facts regarding the currency of denomination of prices sold in domestic markets in emerging economies. We first document that in a large number of countries there is a significant share of prices set in US dollars. For this, we compute the average levels of price dollarization using the data from the online platform that contains information about all active publications as of August 2017 for multiple countries. Table 1 shows the share of prices set in dollars by country broken down by type of publication: vehicles, real estate and goods (defined as all goods other than vehicles and real estate). The average share of prices in dollars is 22% for goods, 26% for vehicles and 49% for real estate units. There is heterogeneity in the degree of price dollarization across countries, with significant levels of dollarization in Bolivia, Nicaragua, Paraguay, Peru and Uruguay.

*Cross-sectional Aspects of Price Dollarization*—Next, we focus our analysis of the cross-sectional aspects of price dollarization. We carry out most of this analysis using the main dataset of publications and transactions from Uruguay and Argentina for the period 2003-2012. First, we analyze whether the currency of denomination of prices differs with the value

TABLE 1. Overall Price Dollarization

Country	Goods	Vehicles	Real Estate
Argentina	18%	5%	70%
Bolivia	47%	n.a.	n.a.
Costa Rica	1%	6%	36%
Dominican Rep.	2%	10%	54%
Guatemala	13%	5%	62%
Mexico	2%	3%	10%
Nicaragua	50%	n.a.	n.a.
Paraguay	28%	n.a.	n.a.
Peru	5%	73%	56%
Uruguay	25%	89%	86%
Average	19%	27%	54%

*Notes:* This table shows the fraction of prices denominated in US dollars in the online platform for each country and type of publication (goods, vehicles and real estate). Since 2013 the platform does not allow dollar pricing in Argentina. Thus, the numbers from Argentina correspond to the 2003-2012 period.

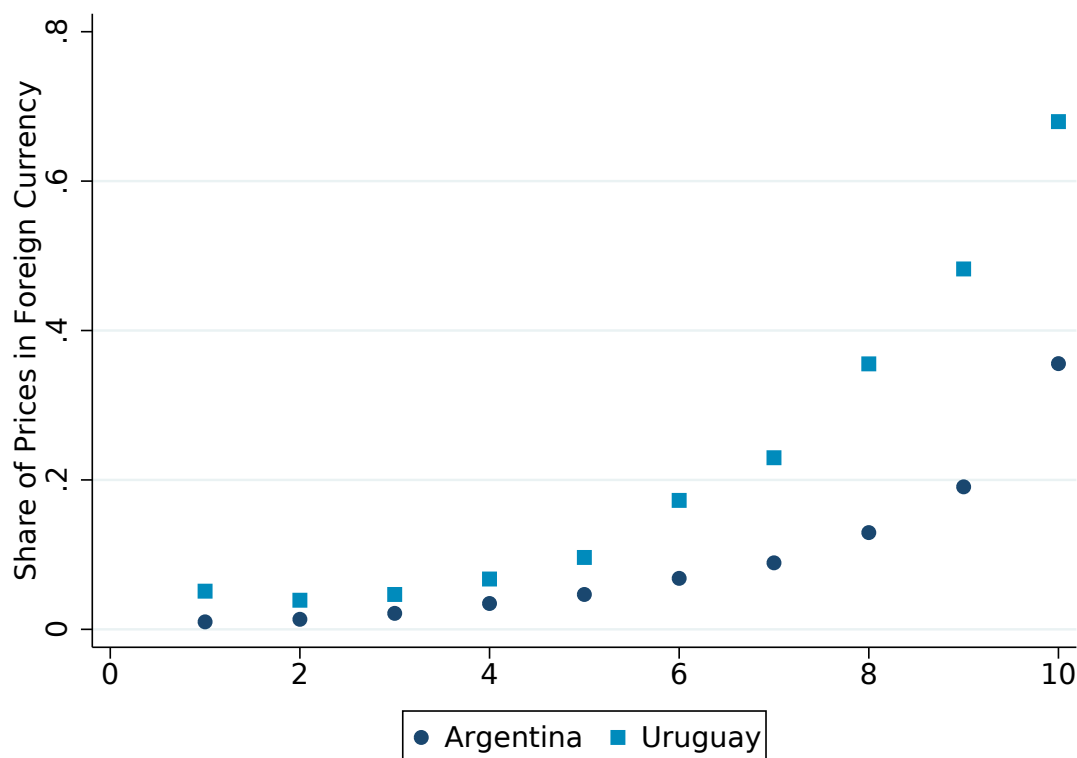
of the unit price of goods.<sup>4</sup> For this, we compute the real value of unit prices measured in a common currency, order publications from smaller to higher prices and then split them into ten bins of equal frequency. While the average price in the lowest price decile is US\$3.5, the average price among goods in the highest decile is US\$480 (see Online Appendix A for more details about the types of goods included in each price decile). Finally, we compute the fraction of goods with a price set in dollars within each price decile.

Results are presented in Figure (1), which shows the share of prices posted in dollars in the vertical axis as a function of the price decile in the horizontal axis. More expensive goods are more likely to be denominated in foreign currency than cheaper goods. In both countries, the fraction of prices set in dollars is negligible for very cheap goods. On the other side of the price distribution, the share of prices set in foreign currency is around 38% and 67% in the top two deciles in Argentina and Uruguay, respectively. We also present a regression version of Figure (1) in Online Appendix C, where we also test the null hypothesis of no difference

<sup>4</sup>In order for the unit price of a good to have a well-defined meaning we focus our analysis on those publications that have a good offered for sale that is indivisible. We describe the data cleaning procedure by which we remove publication of goods that are divisible in Online Appendix A.

across all price deciles (this type of statistical analysis is also carried out for all the figures included in this section). We repeat the previous analysis for the remaining countries with data of active posts/ads of goods in the platform as of August 2017. Results are shown in Figure (A.1). Despite the presence of significant cross-country differences in average levels of price dollarization, the same pattern emerges in all eight economies, suggesting that our main finding is generalized across countries.

FIGURE 1. Price Dollarization and Transacted Prices



*Notes:* The figure shows the share of transacted prices (measured in real terms) set in dollars in Argentina and Uruguay, by decile of the transacted price distribution. Data corresponds to publications of new goods that ended up being sold.

In Online Appendix C we argue that this fact is robust to grouping publications by broad types of goods, by year or by type of seller. First we show that the same pattern emerges if we split the sample according to different category groups and if we consider used goods.<sup>5</sup> Second, we show that the same pattern holds for both countries in every year of the sample.

<sup>5</sup>The platform offers the possibility to the seller to categorize the good being sold according to a pre-specified set of choices. Each product is placed within a category tree that has five levels, which go from

Finally, we also show that the pattern is robust to splitting the sample into publications made by big, small and one-time sellers.

Next, we attempt to understand whether supply-side and/or demand-side consideration can explain this cross-sectional pattern. Here we assess whether the degree of tradeability of goods is relevant in determining the currency choice of prices (demand-side considerations are discussed in the following subsection). One could think that internationally traded goods, which are often invoiced in dollars (Gopinath et al. (2010)), are more likely to be priced in dollars also domestically. For this we assign a tradeability index to each publication of goods included in the main dataset. We do this in multiple steps. First, we merge trade data of imports and exports with output data (at the three-digit level) for the manufacturing sector and compute a tradeability index for each sector defined as ratio of the sum of exports and imports to output.<sup>6</sup> Second, we map the tradeability indices to our data from the online platform by matching manufacturing sectors to each category available in the category-tree provided by the platform. This step requires matching manufacturing sectors to more than 30,000 categories in total. Finally, we assign to each publication the tradeability index that corresponds to the finest category of the publication. This procedure shows that there is substantial heterogeneity across types of goods: books have low tradeability while computers are highly likely to be imported. We describe the trade and output data, and the merging procedure in more detail in Online Appendix A. Figure (2) shows the relationship between the degree of tradeability of goods (grouped according to deciles of the tradeability index) and the share of prices posted in dollars. Goods that are more tradeable are indeed more likely to be denominated in dollars. The increasing relationship is more evident in Uruguay than in Argentina, and less stark than the relationship between the currency of denomination of prices and the value of unit prices previously documented.

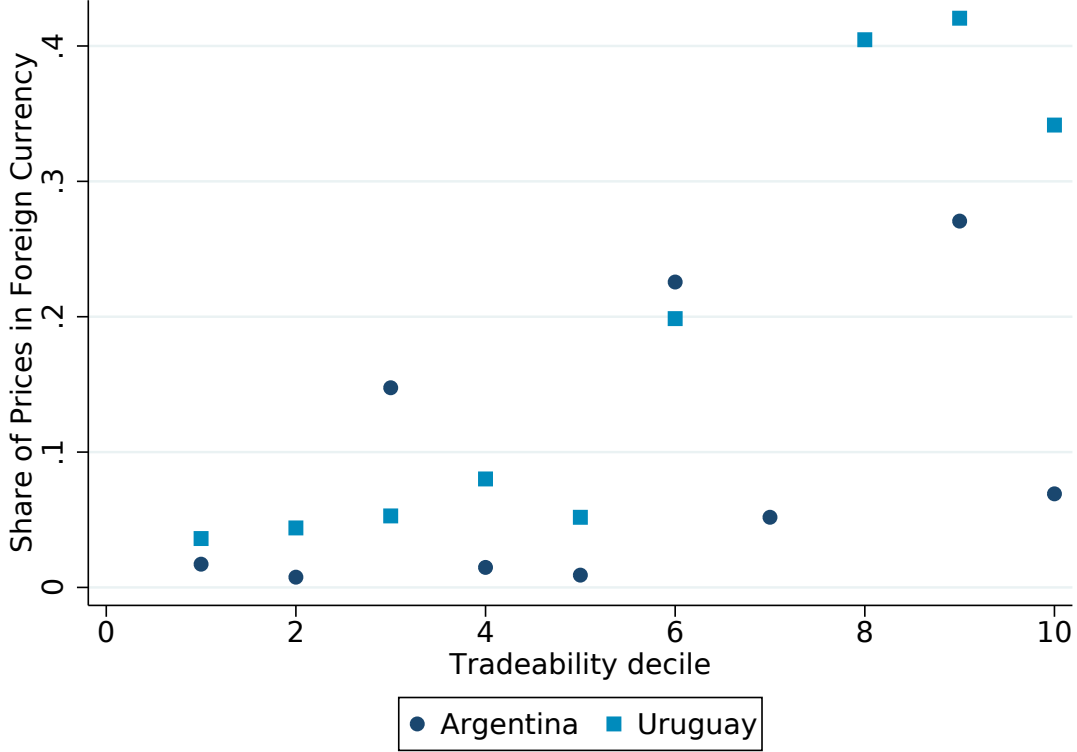
We then explore whether the two cross-sectional observations are related to each other. In particular, one could argue that the fact that more expensive goods are more likely to be sold in dollars may be due to the fact that more expensive goods tend to be imported and, as we just showed, more tradeable goods are more likely to be priced in dollars. To assess whether this is the case we conduct a variance decomposition analysis of the variation in the currency choice of prices. In particular, we estimate the following linear probability model

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a broader to a more specific classification. We repeat our analysis by grouping goods according the the broadest level which includes product types such as computers, books and health/beauty goods.

<sup>6</sup>We also compute an additional measure of tradeability as the share of external supply defined as the ratio of imports to the sum of imports and output. Results are robust to this alternative measure.

FIGURE 2. Price Dollarization and Tradeability



*Notes:* The figure shows the share of transacted prices (measured in real terms) set in dollars in Argentina and Uruguay, by decile of the tradeability index distribution. Data corresponds to publications of new goods that ended up being sold.

for Argentina and Uruguay separately

$$dollar_{p,tr}^i = \alpha_p + \beta_{tr} + \varepsilon_{p,tr}^i,$$

where  $dollar_{p,tr}^i$  is a dummy that equals one if the price of good  $i$  in price decile  $p$  and tradeability decile  $tr$  is in dollars and zero if it is in local currency,  $\alpha_p$  is a price decile fixed effect,  $\beta_{tr}$  is a tradeability decile fixed effect,  $\varepsilon_{p,tr}^i$  is an error term. We estimate the econometric model using OLS. We then compute the variance of the estimated fixed effects of the price and tradeability deciles and express them relative to the overall variance of the dependent variable. We report the results in the first two columns of Table (2). The price decile fixed effects explain 10% of the variation in the currency choice of prices in Argentina, compared to the 8% explained by the tradeability deciles fixed effects. For Uruguay, the price decile fixed effects explain 15% of the variance of currency choices of prices compared to the 10% explained by the tradeability deciles. In the last two columns of Table (2) we report

the results of an alternative model specification in which we include year fixed effects in addition to the price and tradeability deciles fixed effects. The main results remain roughly unchanged, with year fixed effects having significantly lower explanatory power than the other two variables.

TABLE 2. Currency Choice of Prices: Variance Decomposition Analysis

	Argentina	Uruguay	Argentina	Uruguay
Price Decile	10.7%	14.8%	10.3%	14.8%
Tradability Decile	8.2%	10.4%	6.9%	9.8%
Year Fixed Effects	-	-	3.9%	1.1%
N. Obs. (millions)	34.4	2.6	34.4	2.6

*Notes:* This table presents the results of a variance decomposition analysis of the currency choice of prices. Each regression is estimated with OLS using data from each country separately. Results are reported as a fraction of the overall variance of the dependent variable.

In summary, our cross-sectional analysis documents that more expensive and more tradeable goods are more likely to be priced in dollars. Additionally, a significant fraction of the observed variation in the currency of prices is correlated with the value of the unit price, even after controlling for the degree of tradeability of goods. Later, we investigate whether demand-side considerations can help explain this correlation between the currency of denomination and the value of unit prices.

*Price Stickiness by Currency*—Even though we do not directly observe changes of posted prices in our dataset, we can still infer them. We do so by comparing the transacted price with the previous reference price. The previous reference price can be one of the following: i. the original posted price in the case of the first transaction associated to the publication, or ii. the price of the previous transaction associated to the same publication, for all subsequent transactions. If the transacted price and the previous reference price differ we can infer that there was a price change somewhere in between the time of the current and previous transaction.<sup>7</sup> The degree of price stickiness in our dataset is high. The share of publications that had at least one transaction with a price that was different from the previous reference price is 5.2%. This low share can be understood if we take into account that sellers can reset

<sup>7</sup>Identifying price changes in this way serves as a lower bound of the actual number of price changes and as an upper bound of the actual elapsed time in between price changes.

their prices by posting a new publication after they sell their goods. We also compute this share for different subsamples: by currency of denomination of prices and by good categories. We find that prices in local currency are less sticky than prices in dollars. In particular, in 12 of 19 good categories the share of publications with at least one price change is higher for publications with prices in local currency than for those with prices in dollars (see Table (A1)).

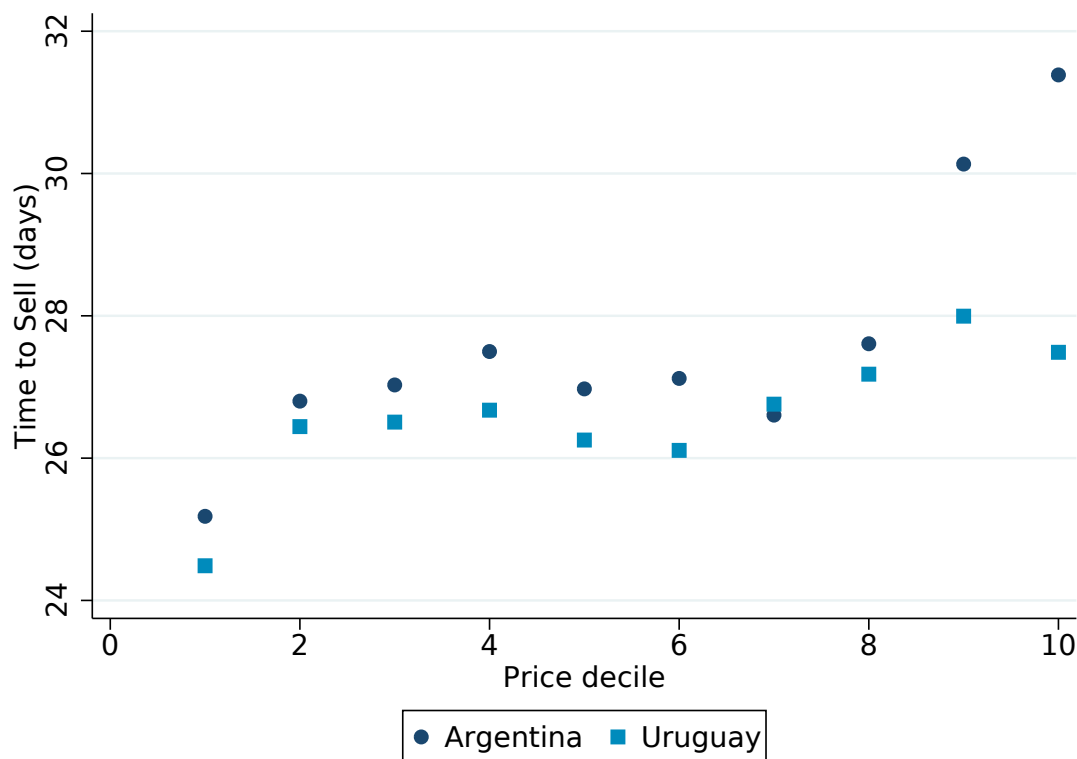
### 2.3. *Other Market Features*

In this section we analyze two additional market features that will be relevant when we develop a theory to understand the determinants of price dollarization. In particular, we study the relationship between prices of goods and the time it takes to sell them and the relationship between prices of goods and the characteristics of the buyers of these goods regarding their holdings of dollars.

From the main dataset we can compute the time it takes to sell a good in the platform. We define time to sell as the number of days elapsed between the day of the original publication and the transaction day for each unit sold. Figure (3) shows the average time to sell of goods for each price decile. The first observation is that it takes between 3 to 5 weeks on average to sell a good. Second, while we also observe an increasing pattern between time to sell and the value of unit prices, the slope is quantitatively small. For example, in Argentina in 2012 it takes 25 days on average for the goods in the cheapest decile to be sold. On the other hand, the average time to sell for prices in the most expensive decile is 31 days. Therefore, the most important take-away is that transactions do not occur immediately: the average time to sell is close to a month.

Finally, using micro-data from the two household surveys from Uruguay we estimate a relationship between prices paid for goods and the probability that buyers making those purchases had holdings of liquid assets in dollars. To do this, we construct two datasets and merge them. First, we use the consumption survey to construct a dataset at the transaction level that contains information on prices paid for goods and the monthly income of the household that bought those goods. These data show that wealthier households tend to purchase goods with higher unit prices. Second, we use the financial survey to construct another dataset that contains information on households' monthly income and on whether the household has cash in dollars and/or a bank account denominated in dollars. These data show that wealthier people are more likely to have liquid assets denominated in dollars and hence easier access to dollars when purchasing goods. For example, while the fraction of

FIGURE 3. Time to Sell and Transacted Prices



*Notes:* The figure shows the number of days it takes the average good to be sold in Argentina and Uruguay, by decile of the transacted price distribution. Data corresponds to publications of new goods that ended up being sold.

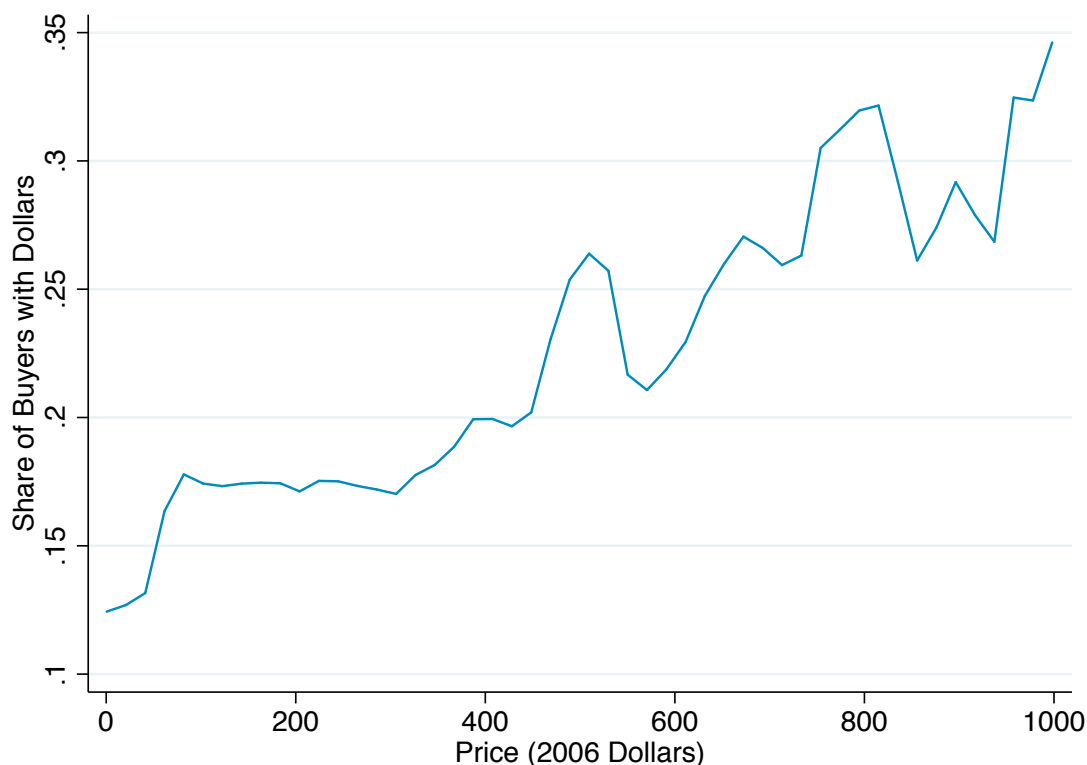
households with liquid assets in dollars is close to zero among the poorest households, more than 30% of households in the top decile of the income distribution have some type of liquid asset in dollars.

We then merge both datasets to assign to each transacted price in the consumption survey an estimate of the probability of the buyer of that good having liquid assets in dollars. The merging procedure is done through households' income, which is the variable that is common in both datasets. We document these facts and provide a detailed description of the merging procedure in Online Appendix A. We then estimate non-parametrically (with a local linear regression) the relationship between the transacted price of a good and the probability of its buyer having liquid assets in dollars. Results, shown in Figure (4), show that more expensive goods are more likely to be purchased by households that have liquid assets in dollars. The positive relationship is quantitatively important. For example, a good with a



price of 5 dollars (which corresponds to the average price in the first decile of prices in the online platform) has associated a probability of its buyer having liquid assets in dollars of 12%, whereas a good priced at 450 dollars (the average price at the top decile in the online platform) has associated a probability of its buyer having liquid assets in dollars of 20%. For the most expensive goods sold in the platform (for example, a laptop with a unit price close to US\$1,000), this probability increases up to 35%.

FIGURE 4. Transaction Prices and Households Holdings of Liquid Assets in Dollars



*Notes:* This figure shows the average probability of buyers having liquid assets denominated in dollars as a function of transaction prices. This relationship has been estimated using data from the consumption and financial survey in Uruguay. See Online Appendix A for more details on how this relationship was estimated.

Although we do not directly observe the means of payment used in each transaction made in the online platform, summary data provided by the Central Bank of Uruguay on the retail payment system show that Uruguayan households do indeed make payments in dollars. In Online Appendix C we show that 2.4% of all credit card transactions are made in US dollars. This figure increases to 4.4% for ATM extractions and to 4.8% for mobile payments. With the caveat that average transacted amounts do not correspond to the value

of unit prices of goods, the average transaction amounts tend to be larger for transactions made in dollars than for those made in pesos: US\$198 in dollars vs US\$38 in pesos for credit card transactions, US\$228 in dollars vs US\$80 in pesos for mobile payments, and US\$401 in dollars vs US\$171 in pesos for local ATM extractions. This evidence is consistent with the fact that more expensive goods are purchased by households who are more likely to have some liquid asset in dollars (and use those dollars to pay for these more expensive goods).

### 3. A SEARCH MODEL OF PRICING IN MULTIPLE CURRENCIES

In this section we formulate and quantify a search model of pricing in multiple currencies aimed at describing the trade-offs associated to the currency choice of prices. Our model focuses on demand-side features as determinants of the optimal currency choice of prices and rationalizes why more expensive goods are more likely to be priced in dollars in a context in which goods take time to sell and buyers have heterogeneous holdings of liquid assets in foreign currency, as previously documented. For tractability reasons, we isolate from supply-side considerations in affecting the currency choice of prices. For models that study this channel see [Engel \(2006\)](#) and [Gopinath et al. \(2010\)](#).

#### 3.1. *Theoretical Framework*

We model a market with search frictions and heterogeneous consumers, in which firms optimally choose the currency of their prices. Our model is based on the ‘sticker price model’ of [Diamond \(1993\)](#). We introduce search frictions since they better characterize the market we analyze in our empirical section. In the online platform, sellers post a price and transactions occur only after a consumer searches for the post and agrees to buy, thereby requiring some time to sell goods.<sup>8</sup> In addition, since we are interested in studying the link between currency choice and demand characteristics, we model heterogeneous consumers that differ in their holdings of foreign currency.

We also depart from the most common ways of modeling price stickiness (e.g. menu costs or Calvo pricing) and assume prices are attached to individual goods. Firms face no cost of setting prices when posting goods for sale. The source of price stickiness comes from the fact that it is costly for firms to change the price once the good is already available for sale.

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<sup>8</sup>Searching behavior from buyers in online markets has been documented in [De los Santos et al. \(2012\)](#). Additionally, the use of search-theoretic frameworks to study the dynamics of online markets has been widely used in the industrial organization literature (see, for example, [Ellison and Ellison \(2009\)](#) and [Dinerstein et al. \(forthcoming\)](#)).

*Buyers*—There is a continuum of buyers of endogenous mass  $B$ . The utility of buyers is linear in real wealth available to spend on goods and discounted at the real interest rate  $r$ . Real wealth grows at the rate  $r$ . Buyers receive a utility of  $u$  if they purchase and consume the good. The market features search frictions. Buyers meet sellers randomly, following a Poisson process with arrival rate  $p(\theta)$ , which we describe later. Once the buyer and the seller meet, the buyer observes the price and the currency of denomination of the price, which can be expressed in local or foreign currency. If a transaction occurs, the buyer must pay the posted price in the currency in which the price is posted.

Buyers differ in their holdings of foreign currency. An endogenous fraction  $1 - \Lambda$  has all their wealth denominated in local currency. We denote these buyers as buyers of type  $i = 1$ . When these buyers pay for the good in foreign currency they first need to acquire foreign currency. To do so, they need to pay a proportional transaction cost  $\kappa > 0$  (expressed in real terms) associated with the exchange of currency. The remaining fraction  $\Lambda$  of buyers has both local and foreign currency ready to use when purchasing the good. These buyers do not have to incur in any transaction cost when buying the good in either currency. We denote these buyers as buyers of type  $i = 2$ .

We can express the value of searching for a buyer of type  $i = \{1, 2\}$  recursively as

$$V_i^w = \mathbb{E}_\tau \left[ e^{-r\tau} \left( f \int \max \{u - s(1 + \kappa_i), V_i^w\} dG_F(s) + (1 - f) \int \max \{u - s, V_i^w\} dG_D(s) \right) \right], \quad (1)$$

where  $f$  is the fraction of goods posted in foreign currency in the market,  $\kappa_1 = \kappa > 0 = \kappa_2$ , and  $G_D(s)$  and  $G_F(s)$  denote the distributions of real prices posted in domestic and foreign currency, respectively. We use subscripts  $c \in \{F, D\}$  to denote the currency of denomination of prices, which can be foreign currency ( $F$ ) or domestic currency ( $D$ ).

Conditional on a meeting, the buyer's optimal choice of which transactions to accept involves reservation prices in foreign currency  $p_{i,F}$  and in domestic currency  $p_{i,D}$ , which are given by

$$p_{i,D} = u - V_i^w, \quad (2)$$

$$p_{i,F} = \frac{u - V_i^w}{1 + \kappa_i}, \quad (3)$$

for  $i \in \{1, 2\}$ . Thus, buyers of type  $i$  buy the good if the observed price in currency  $c$  is lower than the corresponding reservation price (i.e.,  $p \leq p_{i,D}$ ). We can compare the reservation prices of different buyers. Buyers of type 2 do not have to pay the transaction cost to buy

a good that is denominated in dollars. Hence, they are willing to pay a higher price in real terms than buyers of type 1. On the other hand, when facing a buying opportunity in domestic currency, buyers of type 1 have a higher willingness to pay since they know that if they do not buy now the next buying opportunity may be in foreign currency, for which they will have to pay the transaction cost. We formalize these results in the following proposition. All proofs can be found in Appendix B.

**PROPOSITION 1.** *In any equilibrium type 2 buyers have higher willingness to pay in foreign currency ( $p_{2,F} \geq p_{1,F}$ ) and lower willingness to pay in domestic currency ( $p_{2,D} \leq p_{1,D}$ ) than type 1 buyers.*

Given this cutoff strategy we can solve the integrals found in equation (1) using integration by parts and the definition of reservation prices:

$$\int \max \{u - s, V_i^w\} dG_D(s) = V_i^w + \int_0^{p_{i,D}} G_D(p) dp$$

and

$$\int \max \{u - s(1 + \kappa_i), V_i^w\} dG_F(s) = V_i^w + \int_0^{p_{i,F}} G_F(p) dp$$

for  $i \in \{1, 2\}$ . These equations state that the extra surplus for the buyer depends on the curvature of the distribution of prices. If prices decay quickly ( $G_c(p)$  is concave), then the buyer faces transaction opportunities with lower prices on average and hence obtains more surplus from buying that good. Replacing these expressions into equation (1) and solving for  $V_i^w$  we obtain

$$V_i^w = \frac{p(\theta)}{r} \left[ f \int_0^{p_{i,F}} G_F(p) dp + (1 - f) \int_0^{p_{i,D}} G_D(p) dp \right]. \quad (4)$$

A continuous flow of exogenous size  $b$  of new buyers enter into the market at each instant. Of these new entrants an exogenous fraction  $\lambda$  are of type 2. In a stationary equilibrium the mass of buyers of each type is constant, implying that the entry of buyers should equal the exit of buyers of each type. Inflows of buyers for types 1 and 2 are given by  $b(1 - \lambda)$  and  $b\lambda$ , respectively. Outflows of buyers of type 1 are given by  $B(1 - \Lambda)p(\theta)(fG_F(p_{1,F}) + (1 - f)G_D(p_{1,D}))$ , which is the measure of buyers that meet a good with a real price that is lower than its reservation price in the relevant currency. Similarly, outflows of buyers of type 2 are given by  $B\Lambda p(\theta)(fG_F(p_{2,F}) + (1 - f)G_D(p_{2,D}))$ . As we argue below, sellers will never set real prices above the maximum reservation price in each currency. This implies

that  $G_F(p_{2,F}) = G_D(p_{1,D}) = 1$ . Equating outflows and inflows for each type of buyers yields

$$B\Lambda p(\theta)(f + (1 - f)G_D(p_{2,D})) = b\lambda$$

and

$$B(1 - \Lambda)p(\theta)(fG_F(p_{1,F}) + (1 - f)) = b(1 - \lambda).$$

Solving for the measure of buyers and its composition we obtain

$$\Lambda = \frac{\lambda(fG_F(p_{1,F}) + (1 - f))}{\lambda(fG_F(p_{1,F}) + (1 - f)) + (1 - \lambda)(f + (1 - f)G_D(p_{2,D}))} \quad (5)$$

and

$$B = \frac{b}{p(\theta)[(1 - \Lambda)(fG_F(p_{1,F}) + (1 - f)) + \Lambda(f + (1 - f)G_D(p_{2,D}))]}. \quad (6)$$

*Sellers*—The market is also populated by a continuum of sellers of size  $S = 1$ . Sellers can produce the good at a constant marginal cost which we normalize to zero. This is without loss of generality because at the time the seller chooses the price, the good has already been produced. Sellers post a good for sale and choose its nominal price, which can be denominated either in domestic or foreign currency. We assume this price cannot be changed after it is set. The implicit assumption is that there is a sticker-cost of changing the price that is sufficiently high that dissuades sellers from revising prices.<sup>9</sup> Sellers exit the market after their good is sold and are replaced by new entrants.

Sellers discount real profits at the real interest rate  $r$  and meet buyers at an instantaneous rate  $q(\theta)$ , which is described later. We assume that the real value of nominal prices in domestic currency decreases at the rate  $\pi_D > 0$ . Similarly, the real value of nominal prices in foreign currency decreases at the rate  $\pi_F$  with  $0 < \pi_F < \pi_D$ . Our working assumption is that the inflation rate is higher for the domestic economy than for the foreign country (in this case the US).<sup>10</sup> The problem of the seller is given by

$$\max_{c \in \{D, F\}, p_c} \mathbb{E}_t [p_c e^{-i_c t}],$$

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<sup>9</sup>This assumption is motivated by the small fraction of price changes observed in our dataset. The main trade-offs would not be affected by the introduction of a low cost that allows for price changes on equilibrium.

<sup>10</sup>We take inflation rates as primitives in our model. These could be micro-founded by analyzing economies with different growth rates of money. See [Lagos and Wright \(2005\)](#) for an example of such micro-foundations based on the presence of decentralized markets.

where  $i_c = r + \pi_c$  is the nominal interest rate in currency  $c$ , and  $t$  is the time until the transaction occurs which follows a Poisson process with time-varying intensity  $\gamma_c(p, t)$  given by

$$\gamma_D(p, t) = \begin{cases} q(\theta) & \text{if } pe^{-\pi_D t} \leq p_{2,D} \\ (1 - \Lambda)q(\theta) & \text{if } p_{2,D} < pe^{-\pi_D t} \leq p_{1,D} \\ 0 & \text{if } p_{1,D} < pe^{-\pi_D t} \end{cases}, \quad \gamma_F(p, t) = \begin{cases} q(\theta) & \text{if } pe^{-\pi_F t} \leq p_{1,F} \\ \Lambda q(\theta) & \text{if } p_{1,F} < pe^{-\pi_F t} \leq p_{2,F} \\ 0 & \text{if } p_{2,F} < pe^{-\pi_F t} \end{cases}.$$

When analyzing sellers' pricing decisions we can rule out some choices. First, no seller is willing to set a price in a given currency higher than the maximum reservation price of buyers in that currency. If it does, the seller faces a zero probability of selling for some interval of time, which is costly given discounting. Similarly, no seller sets a price below the minimum reservation price of buyers. The reason is that the seller setting the lowest price can increase it without losing any transactions. Finally, given our assumption of two type of buyers, sellers will not post any price between the minimum and maximum reservation price. If a seller did set such a price, then it could increase profits either by choosing the high reservation price and without losing customers initially, or by choosing the low reservation price and attracting all customers with the initial posted price. We collect these results in the following proposition.

**PROPOSITION 2.** *The optimal posted price of sellers is one of the reservation prices of buyers,  $p_c \in \{p_{1,c}, p_{2,c}\}$ .*

This implies that the distribution of initial prices can have at most four prices corresponding to buyers' reservation prices  $(p_{1,F}, p_{2,F}, p_{1,D}, p_{2,D})$ . Once we narrow down the choices of the seller we can compute the value associated to pricing at each of the four reservation prices. If the seller chooses any of the low reservation prices  $p_{1,F}$  and  $p_{2,D}$ , the probability of a transaction occurring conditional on a meeting is equal to one. Hence, the transaction rate is equal to the meeting rate and the seller's values for posting  $p_{1,F}$  and  $p_{2,D}$ , respectively, are given by

$$W_{1,F} = p_{1,F} \frac{q(\theta)}{q(\theta) + r + \pi_F} \quad (7)$$

and

$$W_{2,D} = p_{2,D} \frac{q(\theta)}{q(\theta) + r + \pi_D}. \quad (8)$$

If the seller sets the high price, then she needs to either wait to meet a buyer with a high reservation price in that currency or wait until inflation erodes the real value of the good so much that buyers with a low reservation price are willing to purchase it.

By posting the high reservation price in foreign currency  $p_{2,F}$ , the seller initially sells only to buyers of type 2 and the arrival rate of transactions is  $q(\theta)\Lambda$ . After a period of time of length  $T_F = \log(p_{2,F}/p_{1,F})/\pi_F$ , the real value of the price is lower than the reservation price of type 1 buyers and the good will be sold to any type of buyer. Hence, the arrival rate of transactions becomes  $q(\theta)$  after  $T_F$  units of time. Thus, the value of setting the high price in foreign currency is given by

$$W_{2,F} = p_{2,F} \left( (1 - e^{-(i_F + q(\theta)\Lambda)T_F}) \frac{q(\theta)\Lambda}{q(\theta)\Lambda + r + \pi_F} + e^{-(i_F + q(\theta)\Lambda)T_F} \frac{q(\theta)}{q(\theta) + r + \pi_F} \right). \quad (9)$$

Similarly, by posting the high reservation price in domestic currency  $p_{1,D}$ , the seller initially sells only to buyers of type 1. After a period of time of length  $T_D = \log(p_{1,D}/p_{2,D})/\pi_D$ , the good will be sold to any type of buyer. The value of setting the high price in domestic currency is given by

$$W_{1,D} = p_{1,D} \left( (1 - e^{-(i_D + q(\theta)(1-\Lambda))T_D}) \frac{q(\theta)(1-\Lambda)}{q(\theta)(1-\Lambda) + r + \pi_D} + e^{-(i_D + q(\theta)(1-\Lambda))T_D} \frac{q(\theta)}{q(\theta) + r + \pi_D} \right). \quad (10)$$

Finally, the optimal choice of currency delivers the highest value to the seller:

$$W = \max\{W_{1,D}, W_{2,D}, W_{1,F}, W_{2,F}\}.$$

By setting the price in foreign currency, the seller avoids the quicker erosion of the real price due to lower foreign inflation. The cost of setting prices in foreign currency is that buyers of type 1 have a lower willingness to pay in that currency due to the transaction cost  $\kappa$ , i.e.  $p_{1,F} < p_{1,D}$ .

*Equilibrium Distribution of Prices*—Since sellers post goods at the reservation prices  $p_{1,c}$  and  $p_{2,c}$  with  $c \in \{D, F\}$ , the distribution of prices of newly posted goods in a given currency has at most two mass points at those two prices. However, the distribution of real posted prices has no mass points. The distribution of prices at any given point in time reflects the dynamics of inflation and transaction rates. We first analyze the distribution of foreign currency prices that prevail in a stationary equilibrium. In any arbitrary interval of time  $\Delta t$ , the mass of prices that enter a certain interval of prices  $(0, s)$  (for some  $s$ ) should equal the mass of prices that exit the same interval. These conditions are given by

$$G_F(se^{\pi_F \Delta t}) - G_F(s) = (1 - e^{-q(\theta)\Delta t}) G_F(s) \quad (11)$$

for all  $s \in (0, p_{1,F})$ , and

$$\begin{aligned} G_F(s e^{\pi_F \Delta t}) - G_F(s) + [(1 - e^{-q(\theta)\Lambda \Delta t}) + (1 - e^{-q(\theta)(1-\Lambda)\Delta t}) G_F(p_{1,F})] x_F \\ = (1 - e^{-q(\theta)\Lambda \Delta t}) G_F(s) + (1 - e^{-q(\theta)(1-\Lambda)\Delta t}) G_F(p_{1,F}) \end{aligned} \quad (12)$$

for all  $s \in [p_{1,F}, p_{2,F}]$ . The left hand side in equations (11) and (12) corresponds to the flow of sellers into the interval  $(0, s)$ . The inflow in (11) is given by the measure of sellers with prices between  $s$  and  $s e^{\pi_F \Delta t}$  that enter the interval  $(0, s)$  due to inflation. The inflow in (12) includes the measure of sellers that enter the interval due to inflation plus the measure of all sellers that exit due to a sale times the fraction  $x_F$  of new sellers that post the price  $p_{1,F}$  (the remaining fraction  $1 - x_F$  sets an initial price equal to  $p_{2,F}$ ). The right hand side in (11) is the flow of prices out of the interval  $(0, s)$  for  $s \in (0, p_{1,F})$ , which is given by the measure of all buyers that meet sellers with prices below  $s$  during the interval of time  $\Delta t$  and purchase the good. Finally, the right hand side in (12) is the flow out of the interval  $(0, s)$  for  $s \in [p_{1,F}, p_{2,F}]$ , which is given by the measure of sellers that meet type 1 buyers and have real price below  $s$  plus the measure of sellers that meet type 2 buyers and have real price below  $p_{1,F}$ .

Dividing both equations by  $\Delta t$  and taking the limit as  $\Delta t \rightarrow 0$  we obtain the following differential equations that characterize the distribution  $G_F(s)$ :

$$\begin{aligned} g_F(s) s \pi_F &= G_F(s) q(\theta), & \forall s \in (0, p_{1,F}) \\ g_F(s) s \pi_F + q(\theta) [\Lambda + (1 - \Lambda) G_F(p_{1,F})] x_F &= q(\theta) (1 - \Lambda) G_F(p_{1,F}) + q(\theta) \Lambda G_F(s), & \forall s \in [p_{1,F}, p_{2,F}]. \end{aligned}$$

The solutions of these differential equations are pinned down by the boundary conditions  $G_F(p_{F,2}) = 1$  (no seller sets a price above the reservation price of the buyer 2) and  $G_F(p_{1,F}^-) = G_F(p_{1,F}^+)$  (the CDF  $G_F(\cdot)$  is continuous at the price  $p_{1,F}$ ). The resulting real price distribution is

$$G_F(s) = \begin{cases} s^{\frac{q(\theta)}{\pi_F}} \phi_0^F & \text{for } 0 < s < p_{1,F} \\ q_F - \frac{(1-q_F)(1-\Lambda)}{(1-q_F(1-\Lambda))} \left( q_F + \frac{1-q_F}{(1-q_F(1-\Lambda))(p_{2,F}/p_{1,F})^{q(\theta)\Lambda/\pi_F - (1-q_F)(1-\Lambda)}} \right) + s^{\frac{q(\theta)\Lambda}{\pi_F}} \phi_1^F & \text{for } p_{1,F} \leq s \leq p_{2,F} \end{cases}, \quad (13)$$



where the constants are given by

$$\ell_1^F = \frac{(1 - q_F)}{(1 - q_F(1 - \Lambda))p_{2,F}^{q(\theta)\Lambda/\pi_F} - (1 - q_F)(1 - \Lambda)p_{1,F}^{q(\theta)\Lambda/\pi_F}}$$

and

$$\ell_0^F = \frac{\Lambda p_{1,F}^{-q(\theta)/\pi_F}}{(1 - q_F(1 - \Lambda))} \left( q_F + \frac{1 - q_F}{(1 - q_F(1 - \Lambda))(p_{2,F}/p_{1,F})^{q(\theta)\Lambda/\pi_F} - (1 - q_F)(1 - \Lambda)} \right).$$

The distribution of real prices in domestic currency is derived using the same arguments, but noting that the low and high reservation prices are  $p_{2,D}$  and  $p_{1,D}$ , respectively. The resulting distribution is given by

$$G_D(s) = \begin{cases} s^{\frac{q(\theta)}{\pi_D}} \ell_0^D & \text{for } 0 < s < p_{2,D} \\ q_D - \frac{(1 - q_D)\Lambda}{(1 - q_D\Lambda)} \left( q_D + \frac{1 - q_D}{(1 - q_D\Lambda)(p_{1,D}/p_{2,D})^{q(\theta)(1 - \Lambda)/\pi_D} - (1 - q_D)\Lambda} \right) + s^{\frac{q(\theta)(1 - \Lambda)}{\pi_D}} \ell_1^D & \text{for } p_{2,D} \leq s \leq p_{1,D} \end{cases}, \quad (14)$$

where the constants are given by

$$\ell_1^D = \frac{(1 - q_D)}{(1 - q_D\Lambda)p_{1,D}^{q(\theta)(1 - \Lambda)/\pi_D} - (1 - q_D)\Lambda p_{2,D}^{q(\theta)(1 - \Lambda)/\pi_D}}$$

and

$$\ell_0^D = \frac{(1 - \Lambda)p_{2,D}^{-q(\theta)/\pi_D}}{(1 - q_D\Lambda)} \left( q_D + \frac{1 - q_D}{(1 - q_D\Lambda)(p_{1,D}/p_{2,D})^{q(\theta)(1 - \Lambda)/\pi_D} - (1 - q_D)\Lambda} \right).$$

*Matching Technology*—There is a matching technology that determines the flow of matches as a continuously differentiable function of the stock of buyers and sellers,  $m(S, B)$ . We assume  $m$  has constant returns to scale and positive first derivatives. This allows us to characterize the meeting rates of buyers and sellers as functions of the market tightness  $\theta = S/B$ :

$$p(\theta) = \frac{m(S, B)}{B} = m(\theta, 1), \quad (15)$$

$$q(\theta) = \frac{m(S, B)}{S} = m(1, \theta^{-1}). \quad (16)$$

Having described the setup of the model, we are in a position to define a stationary equilibrium.

**DEFINITION 1.** *A stationary equilibrium is given by:*

- (1) reservation prices (2), (3) and value of searching (4),
- (2) seller's profits (7), (8), (9), and (10),

(3) cumulative distributions of prices (13) and (14),

(4) fraction of firms selling in foreign currency that post price  $p_{1,F}$ ,

$$x_F = \begin{cases} 1 & \text{if } W_{1,F} > W_{2,F} \\ \in [0, 1] & \text{if } W_{1,F} = W_{2,F} \\ 0 & \text{if } W_{1,F} < W_{2,F} \end{cases}$$

(5) fraction of firms selling in domestic currency that post price  $p_{2,D}$ ,

$$x_D = \begin{cases} 1 & \text{if } W_{2,D} > W_{1,D} \\ \in [0, 1] & \text{if } W_{2,D} = W_{1,D} \\ 0 & \text{if } W_{2,D} < W_{1,D} \end{cases}$$

(6) fraction of sellers that post price in foreign currency

$$f = \begin{cases} 1 & \text{if } W_F > W_D \\ \in [0, 1] & \text{if } W_F = W_D \\ 0 & \text{if } W_F < W_D \end{cases}$$

where  $W_c = \max\{W_{1,c}, W_{2,c}\}$ ,

(7) and measure of total buyers (6) and the share of type-2 buyers (5).

*Equilibrium Currency Choices*—In this subsection we characterize the equilibrium sellers' choices of the currency of denomination of prices for a particular case of the model with only buyers of type 1 by setting  $\lambda = 0$ . This particular case allows us to make significant advances in characterizing the equilibrium while at the same time keeping most of the relevant economic mechanisms.

When  $\lambda = 0$ , sellers will either set prices at  $p_{1,F}$  or  $p_{1,D}$ . This implies that buyers purchase the first commodity they find. While consumers can search, in equilibrium they do not do it (a phenomenon that resembles the 'Diamond Paradox', [Diamond \(1971\)](#)). The meeting rate for sellers is given by  $q(\theta) = b$ . If the flow of entry of buyers is higher, sellers will meet buyers more frequently. Using the expressions of reservation prices (2)-(3) and seller's profits (10) and (7) we obtain an expression for the optimal choice of currency for the seller,

$$f = \begin{cases} 0 & \text{if } \frac{b+r+\pi_D}{b+r+\pi_F} < 1 + \kappa \\ x \in [0, 1] & \text{if } \frac{b+r+\pi_D}{b+r+\pi_F} = 1 + \kappa \\ 1 & \text{if } \frac{b+r+\pi_D}{b+r+\pi_F} > 1 + \kappa. \end{cases} \quad (17)$$

The optimal currency choice trades-off differential resilience to inflation of prices in different currencies and differential willingness to pay by buyers. By pricing in foreign currency, sellers can prevent a rapid decay of real value of their prices but face a lower initial willingness to pay by buyers due to the presence of the transaction costs.

One advantage of the tractability of this model is that we can easily characterize the optimal currency choice. First, if transaction costs are higher then sellers are more likely to post their goods in domestic currency. A higher transaction cost reduces the initial willingness to pay of buyers and thus the average price in foreign currency that sellers can charge. Second, if inflation in domestic currency is higher then sellers are more likely to post their goods in foreign currency. A higher inflation rate erodes more rapidly the real value of prices in domestic currency. This implies that the average price that buyers face is lower. This makes pricing in foreign currency more attractive for sellers. By a symmetric argument, sellers are more likely to post their goods in domestic currency when inflation in foreign currency is higher. Third, if search frictions are more severe for sellers, sellers are more likely to set prices in foreign currency. If transaction opportunities for sellers arrive at a lower rate then there is more time between the price posting decision and the transaction. This implies that real prices are lower and sellers avoid larger losses by pricing in foreign currency. Less frequent transaction opportunities in this case come from a lower entry rate of buyers. We collect these results in the following proposition.

**PROPOSITION 3.** *If  $\lambda = 0$  and  $\pi^D > \pi^F > 0$ , optimal dollarization  $f$  is:*

- (1) *weakly decreasing in  $\kappa$ ,*
- (2) *weakly increasing in  $\pi^D$  and weakly decreasing in  $\pi^F$ ,*
- (3) *weakly increasing in  $r$ ,*
- (4) *weakly decreasing in  $b$ .*

Finally, although we cannot characterize analytically the comparative statics with respect to  $\lambda$  we can show that the equilibrium entails full price dollarization for  $\lambda = 1$  but not necessarily the case for  $\lambda = 0$ . It is expected that the degree of price dollarization is increasing in  $\lambda$ , since the expected willingness to pay for the good in dollars increases as there are more buyers with dollar holdings.

The optimal currency choice is independent of the cost structure in this simplified model. This due to the fact that in the sticker price model prices are attached to individual goods and these are already produced at the time of the pricing decision. Hence, there is no need to

forecast future costs since these will be associated to different pricing decisions. Additionally, this model isolates from any meaningful degree of optimal exchange rate pass-through, which is a relevant factor in the determination of currency denomination of international prices.<sup>11</sup> In this model there is no intensive margin (buyers can only buy one good) and therefore demand elasticity is zero everywhere except in the reservation price. These considerations are relevant for the determination of the currency of prices. Our analysis tries to shed light into relevant factors that determine the currency choice of prices in domestic markets with search frictions, above and beyond those already highlighted by previous studies.

### 3.2. Quantitative Analysis

In this section we calibrate the full model with heterogeneous buyers to match key aspects of the distribution of prices and time to sell of goods, as well certain features regarding the access to dollars of buyers for the Uruguayan economy. We then re-visit our main empirical finding using simulated data from our model to assess whether it can account for the patterns observed in the data and perform a counterfactual exercise.

#### 3.2.1. Calibration

Our model describes the equilibrium of a market of a single good with certain demand characteristics. Our dataset features various types of goods with different demand characteristics. In order to match the characteristics of our data we analyze an enhanced economy that is composed of a continuum of replicas of single markets that differ in their deep parameters. We allow markets to vary in the utility value of the good  $u$ , in the entry rate of buyers  $b$  and in the composition of buyers that enter  $\lambda$ . Hence, each market is indexed by the triplet  $(u, b, \lambda)$ . By varying these parameters our enhanced economy features significant variation in prices (by varying  $u$ ), time to sell (by varying  $b$ ) and the share of buyers with dollars (by varying  $\lambda$ ).

We assume that the underlying joint distribution for these parameters is parametric. In particular, we assume the following log-normal distribution:

$$\begin{pmatrix} \log u \\ \log b \\ \log \hat{\lambda} \end{pmatrix} \sim N \left( \begin{bmatrix} \mu_u \\ \mu_b \\ \mu_{\hat{\lambda}} \end{bmatrix}, \begin{bmatrix} \sigma_u^2 & \sigma_{u,b} & \sigma_{u,\hat{\lambda}} \\ \sigma_{u,b} & \sigma_b^2 & 0 \\ \sigma_{u,\hat{\lambda}} & 0 & \sigma_{\hat{\lambda}}^2 \end{bmatrix} \right),$$

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<sup>11</sup>The interaction of differential desired degrees of exchange rate pass-through and optimal currency choice of prices has been studied in [Gopinath et al. \(2010\)](#) and [Devereux and Engel \(2003\)](#), among others.

where  $\hat{\lambda}$  is a monotone transformation of  $\lambda$  such that  $\lambda = \hat{\lambda}/(\hat{\lambda} + 1)$ . This transformation ensures that  $\lambda \in [0, 1]$  in all markets. We allow for potential correlation between these parameters, to the extent that these correlations can be identified with our data. As discussed below, all the components of the covariance matrix are well-identified with our calibration strategy, with the exception of  $\sigma_{b,\hat{\lambda}}$ , which we set to zero.

We use a Cobb-Douglas matching function  $m(S, B) = S^\alpha B^{1-\alpha}$ , with  $\alpha \in (0, 1)$  which yields a meeting rate for sellers of  $q(\theta) = \theta^{\alpha-1}$  and a meeting rate for buyers of  $p(\theta) = \theta^\alpha$ .

We calibrate the model to match the features of the Uruguayan economy for the period 2012. We choose Uruguay since it is the country with the most comprehensive data (both data from the online platform as well as data on households' dollar holdings). We chose the year 2012 because it is the year with the largest amount of data from our online platform and close to the year in which the survey of consumer finances was carried out.

The model is calibrated to a monthly frequency. In continuous time this implies that a time interval of length one corresponds to one month. The model is parametrized by 12 parameters:  $(r, \pi_D, \pi_F, \kappa, \alpha)$  which are common across markets, and  $(\mu_u, \mu_b, \mu_{\hat{\lambda}}, \sigma_u^2, \sigma_b^2, \sigma_{\hat{\lambda}}^2, \sigma_{u,b}, \sigma_{u,\hat{\lambda}})$  which parametrize the underlying distribution of  $(u, b, \lambda)$ . The calibrated parameters are summarized in Table (3). We set the real interest rate (which is also discount rate) to  $r = 0.33\%$ , which is equivalent to an annual interest rate of 4%. The monthly inflation rates in domestic and foreign currency are set to  $\pi_D = 0.17\%$  and  $\pi_F = 0.64\%$ . These values are equivalent to annual inflation rates of 2% and 8%, respectively, which are consistent with inflation rates in the US and in Uruguay for the period studied. We set the curvature of the matching function to  $\alpha = 0.5$ , since there are no prior estimates of this parameter in the literature. We set the transaction cost  $\kappa = 0.7\%$  to match the unconditional mean of price dollarization of goods in Uruguay in 2012. Given that this value is slightly below the average observed bid-ask spread for exchanging local currency for dollars in Uruguay, we consider this a reasonable parameter value.

The parameters that shape the underlying distribution of  $(u, b, \lambda)$  are calibrated. The only exception is  $\mu_u$ , which is normalized since  $u$  only scales prices without affecting currency choices. The seven remaining parameters  $(\mu_b, \mu_{\hat{\lambda}}, \sigma_u^2, \sigma_b^2, \sigma_{\hat{\lambda}}^2, \sigma_{u,b}, \sigma_{u,\hat{\lambda}})$  are calibrated to match the following seven moments from the data: the standard deviation of log prices, the average and standard deviation of time that takes for a good to be sold, the average and standard deviation of the probability of buyers having dollar bank accounts, the correlation of log

TABLE 3. Calibrated Parameters

Parameter	Value	Comments/Targets
<i>Exogenous Parameters</i>		
$r$	0.33%	Standard value
$\pi_F$	0.14%	Average inflation in US
$\pi_D$	0.64%	Average inflation in Uruguay 2012
$\alpha$	0.50	
<i>Calibrated Parameters</i>		
$\kappa$	0.73%	Average price dollarization
$\mu_b$	0.03	Average time to sell goods
$\mu_{\hat{\lambda}}$	-2.75	Average buyers with dollar accounts
$\sigma_u^2$	2.02	Std Dev. of log prices
$\sigma_b^2$	0.23	Std Dev. of time to sell goods
$\sigma_{\hat{\lambda}}^2$	2.75	Variance of buyers with dollar accounts
$\sigma_{u,b}$	-0.23	Correlation log prices - time to sell
$\sigma_{u,\hat{\lambda}}$	0.24	Correlation log prices - dollar buyers

prices and time to sell, and the correlation of log prices and the probability of buyers having dollar bank accounts.

The data moments are obtained from our two datasets. The first and second moments of log prices and time to sell are obtained from the data from the online platform, restricting attention to Uruguay in 2012. The average and dispersion of the probability of buyers having dollar bank accounts are obtained from our merged dataset that estimates this probability for all transactions recorded in the consumption survey. Our working assumption is that buyers with bank accounts in dollars map into buyers of type  $i = 2$  since they need not pay the transaction cost to acquire goods with foreign currency.<sup>12</sup> The average and standard deviation of this probability, as well as its correlation with log prices, is computed at the transaction level. For a detailed description of this dataset and the estimates of the probability of having bank accounts in dollars see Online Appendix A.

<sup>12</sup>We also assume that buyers that have a bank account in dollars need not pay the transaction cost to acquire goods in domestic currency. This assumption is backed by the fact that in our data nearly all buyers that have a bank account in dollars also have a bank account in domestic currency.

To obtain the model moments we simulate data generated by the model. In particular, we first simulate 5,000 different markets -defined by the triplet  $(u, b, \lambda)$ - from the log-normal distribution. Then we compute the equilibrium associated to each market and then simulate 500 sellers in each of those markets for the period of a year. This implies randomizing the initial price they set and then the time evolution until they find a buyer that is willing to buy their good. Once we have our simulated data we process it the same way we process our empirical data to generate the moments and graphs.

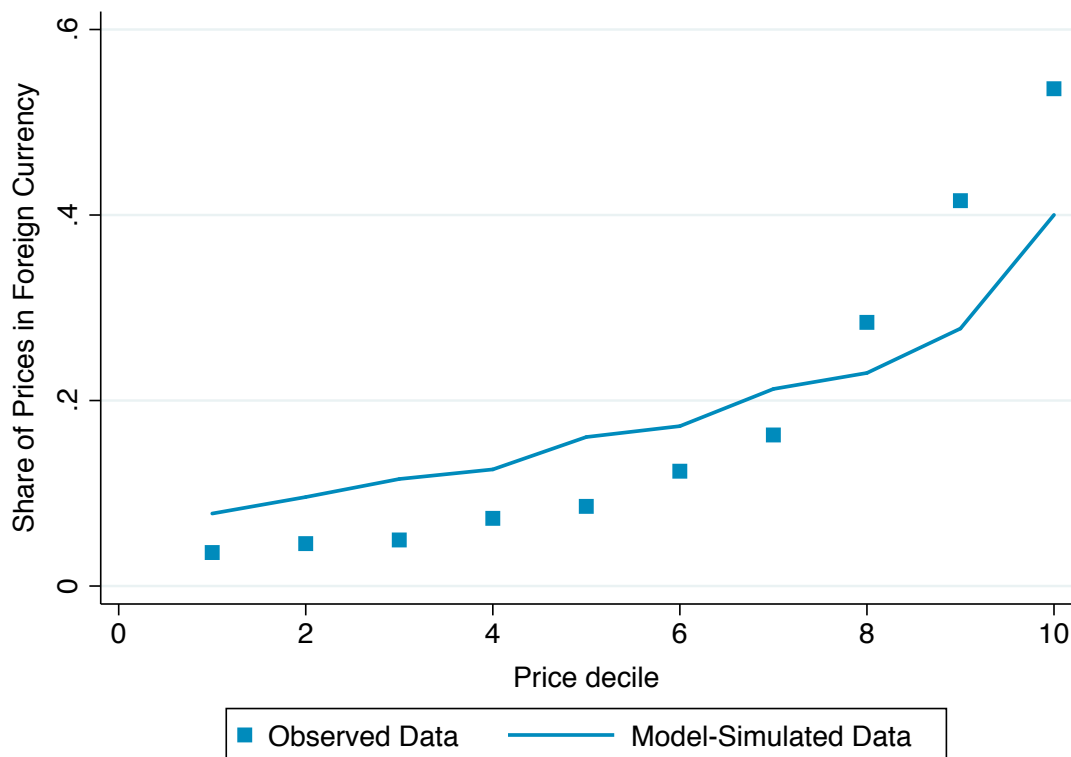
The calibrated values are  $\mu_b = 0.03$ ,  $\mu_{\hat{\lambda}} = -2.75$ ,  $\sigma_u^2 = 2.02$ ,  $\sigma_b^2 = 0.23$ ,  $\sigma_{\hat{\lambda}}^2 = 2.75$ ,  $\sigma_{u,b} = -0.23$  and  $\sigma_{u,\hat{\lambda}} = 0.24$ . While in the joint calibration each parameter can potentially affect all moments, we find that  $\sigma_u^2$  mostly affects the dispersion of prices,  $\mu_b$  and  $\sigma_b^2$  mostly determine the average and standard deviation of time to sell,  $\mu_{\hat{\lambda}}$  and  $\sigma_{\hat{\lambda}}^2$  mostly determine the average and standard deviation of the probability of buyers having dollar bank accounts, and  $\sigma_{u,b}$  and  $\sigma_{u,\hat{\lambda}}$  mostly affect the correlation of log prices with time to sell and the probability of buyers having dollar bank accounts, respectively. Table (A2) in Appendix A reports the data moments and their model counterparts used in the joint calibration. All moments are well-approximated, with the exception of the standard deviation of time to sell. In addition, our model is able to correctly reproduce the global relationship between prices and time to sell (see Figure (A.4a)), as well as prices and the probability of buyers having dollar bank accounts (see Figure (A.4b)).

### 3.2.2. Model Performance

With our calibrated model we then assess the ability of the model to replicate our empirical findings regarding currency choice of prices from section 2. The calibration strategy targets the unconditional share of price dollarization. However, it does not target the cross-sectional pattern of price dollarization. Hence, this information can be used to gauge the model's performance. Figure (5) shows the share of prices in dollars as a function of price bins for the data and model simulations. The model correctly predicts the fact that more expensive goods are more likely to be priced in dollars. However, it slightly underestimates the quantitative strength of this relationship. While the share of prices in dollars is around 9.6% in the model and 4.5% in the data for the cheapest three deciles of prices, this share is 30% in the model and 41% in the data for the three most expensive deciles of prices. Both in the model and in the data, this relationship is exponential.

In the model more expensive goods are more likely to be posted in dollars mostly because buyers that have high valuations for goods are more likely to be buyers of type 2 that don't

FIGURE 5. Price Dollarization: Model and Data



*Notes:* This figure shows the fraction of original prices set in foreign currency, within each of ten bins of equal frequency. These bins are computed by separating posted prices (in real terms) ordered from low to high into ten bins. The blue dots are computed with observed data on posted prices of new goods that ended up being sold for Uruguay in 2012. The blue solid line corresponds to data generated by simulations from the model with the calibrated parameters.

need to pay a transaction cost to pay for goods with dollars. This implies that those sellers that sell high-valuation goods also face similar expected willingness to pay for those goods in dollars and in local currency, making dollar pricing more attractive for them. What data relationship informs the correlation between buyers' valuations and composition of buyers? The observed relationship between the unit price paid for goods and the likelihood of buyers having a bank account dollars. Hence, the fact that more expensive goods are more likely to be bought by buyers with bank accounts in dollars is key in identifying the predicted relationship between price value and price dollarization in the model.

Finally, we perform a counterfactual exercise in which we analyze how the currency choice of prices changes in response to an increase in the domestic inflation rate, both in the data and the model. We leave all remaining parameters in their baseline calibrated values and



increase the level of domestic inflation to  $\pi_D = 1.1\%$  (equivalent to 14% annual inflation), which corresponds to the average observed inflation in Uruguay in 2003-04, and compare the model simulations with the observed data for those years.

Results are shown in Figure (6). In the model of a high-inflation economy the share of prices in foreign currency is 61% compared to the 36% share observed in Uruguay in 2003-04.<sup>13</sup> Yet, the positive relationship between price levels and currency denomination is present both in the data and the model. The higher share of prices in foreign currency in the high-inflation economy reflects the incentives of certain sellers to change the currency denomination of their goods from domestic currency to foreign currency to avoid a rapid erosion of the real value of their posted prices.

#### 4. CONCLUSION

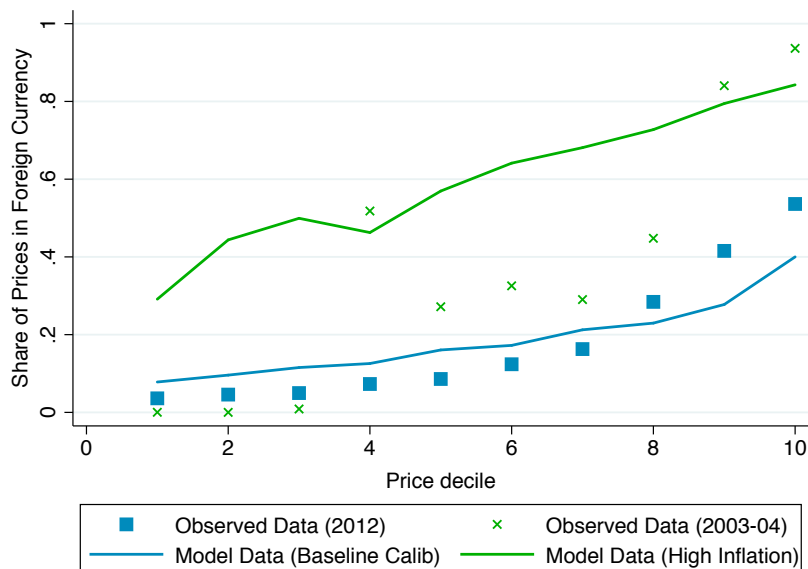
We document that a significant fraction of prices in domestic markets in emerging economies are set in dollars. Dollar pricing is more likely in those goods that are more expensive and more tradable. Most of the variation in the currency of prices correlates with the unit value of prices. We also show that goods take time to sell and that more expensive goods are more likely to be bought by buyers with bank accounts in dollars.

We then develop a search model of currency choice of prices designed to study how inflation and certain features of demand can affect the degree of price dollarization in an economy. Sellers may opt to set prices in foreign currency to avoid a rapid erosion of the real value of their prices at the expense of losing willingness to pay from certain buyers. Sellers that operate in markets in which buyers have easier access to dollars are more likely to set prices in dollars. We provide data facts that argue that these markets are characterized by higher prices. As in the data, the share of prices in foreign currency decreases when inflation decreases.

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<sup>13</sup>The fact that the model overestimates the observed the average level of price dollarization could be due to the fact that other parameters may have changed at the same time. In particular, the bid-ask spread for exchanging currency was significantly higher in 2003-04 than in 2012, which would lead to lower price dollarization in the model.

FIGURE 6. Counterfactual Exercise: Higher Inflation



*Notes:* This figure shows the fraction of original prices set in foreign currency, within each of ten bins of equal frequency. These bins are computed by separating posted prices (in real terms) ordered from low to high into ten bins. The blue dots are computed with observed data on posted prices of new goods that ended up being sold in Uruguay in 2012. The blue solid line corresponds to data generated by simulations from the model with the calibrated parameters. The green crosses are computed with observed data on posted prices of new goods for Uruguay in 2003-04. The green solid line corresponds to data generated by simulations from the a model economy in which  $\pi_D = 1.1\%$  (the observed average monthly inflation rate in Uruguay in 2003-04) and all the remaining parameters are set at their calibrated values.

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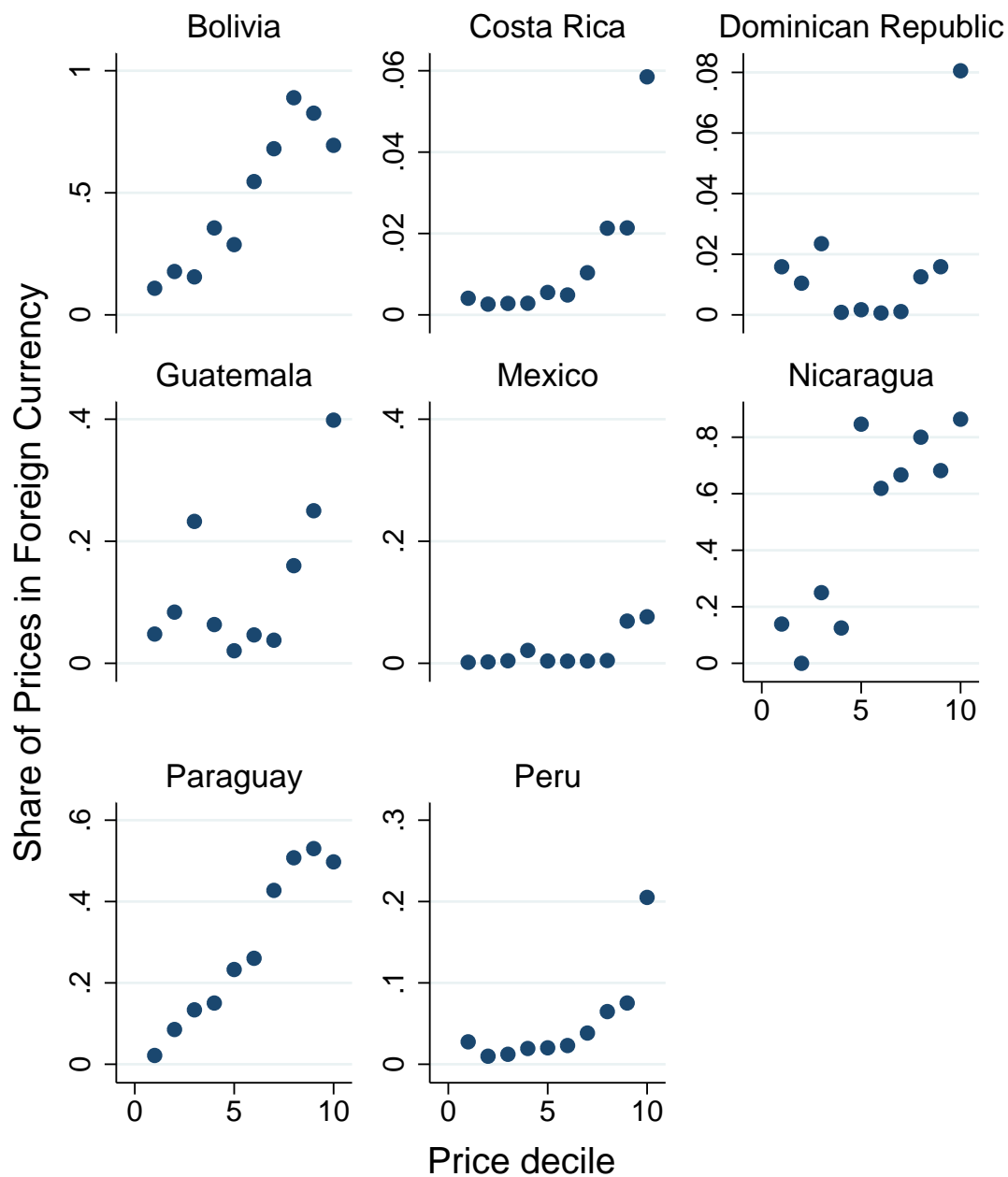
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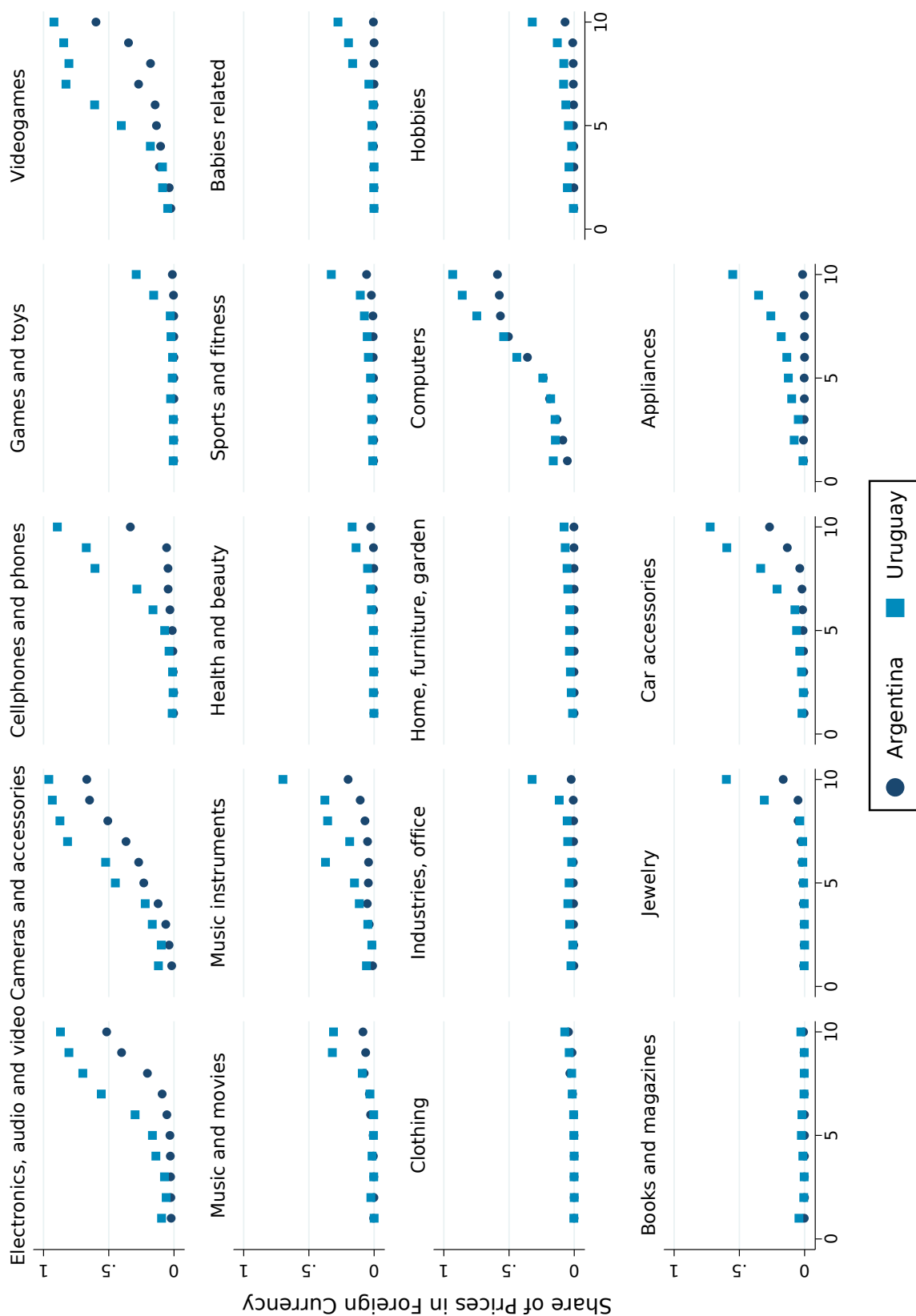
## APPENDIX A. ADDITIONAL FIGURES AND TABLES

FIGURE A.1. Dollarization vs Price percentiles: Additional Countries



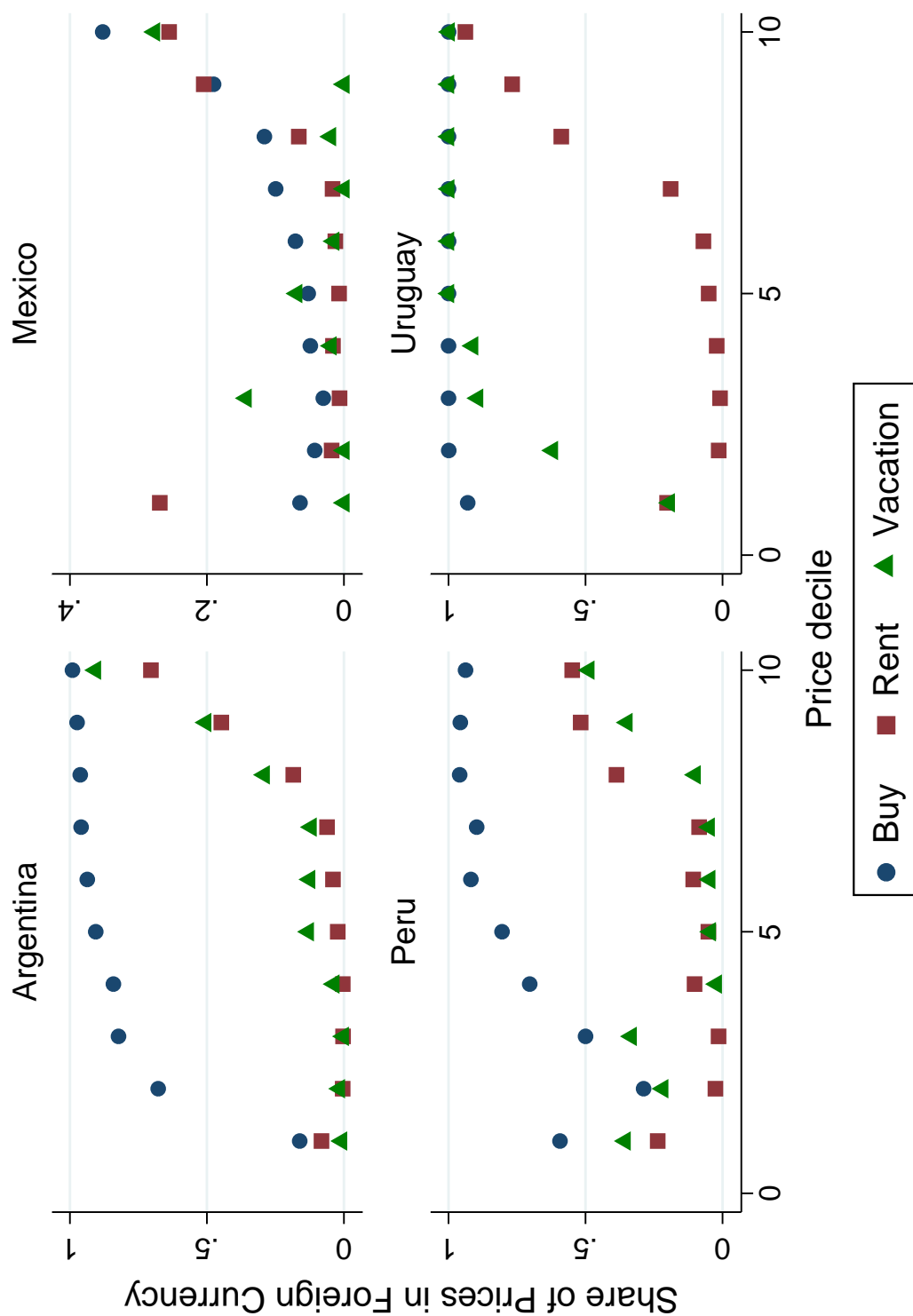
*Notes:* Each figure shows the fraction of original prices set in foreign currency dollar, by decile of the price distribution. Data corresponds to publications of all posted prices in each country as of August 2017 in the online platform.

FIGURE A.2. Share of Prices in Foreign Currency by Category of Goods



*Notes:* This figure shows the fraction of transacted prices (measured in real terms) set in dollars in Argentina and Uruguay, by decile of the transacted price distribution. Data corresponds to the publications of new goods that ended up being sold. Each panel plots the same graph for goods within different categories. These categories are taken from the broadest level of categorization provided by the online platform.

FIGURE A.3. Share of Prices in Foreign Currency in the Real Estate Market



*Notes:* This figure shows the fraction of original prices set in foreign currency (measured in domestic currency), by decile of the original price distribution. Each panel plots the same graph for different countries.

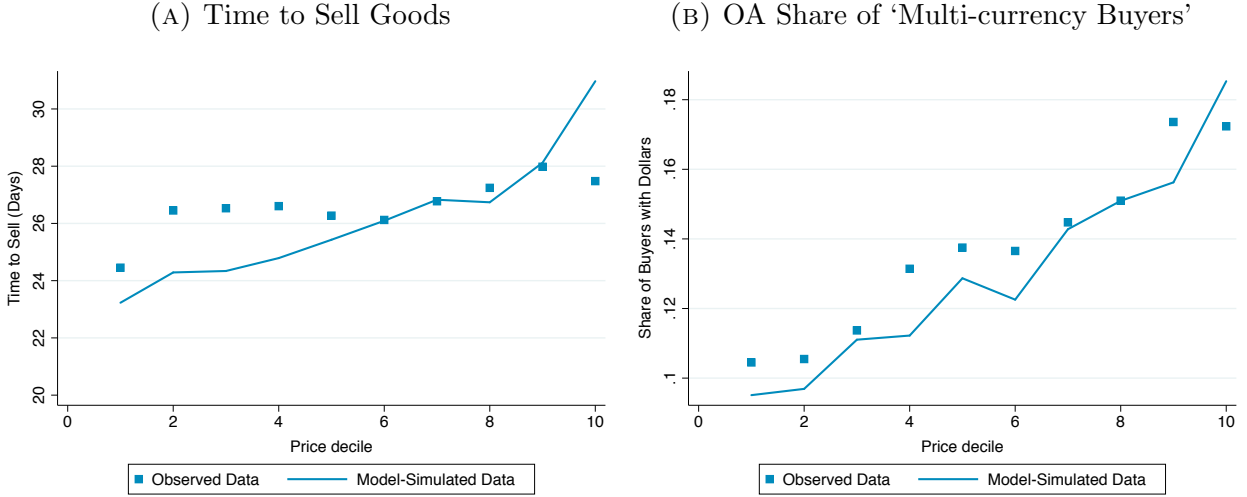
TABLE A1. Share of Publications with Price Changes by Currency

Category	Share of Price Changes		LC < FC Price Changes (p-value)
	Local Currency	Foreign Currency	
1000	7.8%	6.2%	0.000
1039	9.0%	11.3%	1.000
1051	5.6%	9.0%	1.000
1132	3.7%	2.5%	0.000
1144	6.2%	8.4%	1.000
1168	1.1%	0.7%	0.000
1182	4.9%	1.8%	0.000
1246	4.7%	2.8%	0.000
1276	4.6%	1.6%	0.000
1384	6.4%	1.5%	0.000
1430	2.7%	1.6%	0.000
1499	6.7%	4.2%	0.000
1574	6.4%	3.0%	0.000
1648	7.5%	7.7%	1.000
1798	1.0%	1.2%	0.961
3025	1.1%	1.1%	0.604
3937	2.1%	0.8%	0.000
5725	5.4%	5.5%	0.932
5726	8.1%	4.8%	0.000

*Notes:* This table shows the fraction of publications in each category that ever had a price change. Price changes are detected by comparing the transacted price with the previous reference price. The previous reference price can be one of the following: i. the original posted price in the case of the first transaction associated to the publication, or ii. the price of the previous transaction associated to the same publication, for all subsequent transactions. The second column presents the results for publications with prices set in local currency and the third column presents the results for those with prices set in foreign currency. The last column shows the p-value of a test of the null hypothesis that prices set in local currency are more sticky than prices in foreign currency.



FIGURE A.4. Time to Sell and ‘Multi-currency Buyers’: Model and Data



*Notes:* Panel (A) shows the number of days it takes the average good to be sold, by decile of the transacted price distribution. The blue dots are computed with observed data on posted prices of new goods for Uruguay in 2012. Data corresponds to transactions of new goods. The blue solid line corresponds to data generated by simulations from the model with the calibrated parameters. Panel (B) shows the share of ‘multi-currency’ buyers by decile of the transacted price distribution. The blue dots are computed with data estimates of the average probability of buyers having liquid assets in dollars, for transactions within each decile. The probability of buyers having liquid assets in dollars is estimated using data on income of the household that purchases each good. See Online Appendix A for details on this computation. The blue solid line corresponds to the data generated by simulations from the model with the calibrated parameters. It corresponds to the average value of  $\lambda$ , the share of entrant buyers of type  $i = 2$  (‘multi-currency buyers’).

TABLE A2. Model Fit

Moment	Data	Model
Average price dollarization	18.1%	18.7%
Average time to sell goods (in days)	26	26
Avg. share of multi-currency buyers	12.8%	13.0%
Std. dev. of log prices	1.40	1.38
Std. dev. of time to sell	18	31
Std. dev. of share of multi-currency buyers	0.15	0.16
Corr. log prices - time to sell	0.05	0.07
Corr. log prices - share multi-currency buyers	0.13	0.17

*Notes:* Multi-currency buyers refer to buyers of type  $i = 2$  in the model and households with liquid assets in dollars in the data.

## APPENDIX B. THEORETICAL APPENDIX

B.1. *Proof of Proposition 1.*

First we show that  $V_i^w \leq u$  for any  $i$  by contradiction (we will use this result later). Suppose instead that  $V_i^w > u$ . Then, for any distribution of non-negative prices the right hand side of equation (1) is equal to  $\mathbb{E}[\exp(-r\tau)V_i^w]$ , which is smaller than  $V_i^w$  – a contradiction.

Next we prove by contradiction both inequalities regarding reservation prices. First, suppose that  $p_{1,D} < p_{2,D}$ . Using the definition of reservation prices in domestic currency (2), it follows that  $V_1^w > V_2^w$ . Using this result and  $V_i^w \leq u$  it follows that  $p_{1,F} = \frac{u-V_1^w}{1+\kappa} < u - V_2^w = p_{2,F}$ . Using equation (4) we can express the difference between the values of both buyers as

$$V_2^w - V_1^w = \frac{p(\theta)}{r} \left[ f \int_{p_{1,F}}^{p_{2,F}} G_F(p) dp + (1-f) \int_{p_{1,D}}^{p_{2,D}} G_D(p) dp \right]. \quad (18)$$

But given that  $p_{1,D} < p_{2,D}$  and  $p_{1,F} < p_{2,F}$  this implies that  $V_2^w - V_1^w > 0$ , which contradicts our original assumption.

Now suppose that  $p_{1,F} > p_{2,F}$ . This assumption, together with the result we just showed  $p_{1,D} \geq p_{2,D}$ , implies that the right hand side of

$$V_1^w - V_2^w = \frac{p(\theta)}{r} \left[ f \int_{p_{2,F}}^{p_{1,F}} G_F(p) dp + (1-f) \int_{p_{2,D}}^{p_{1,D}} G_D(p) dp \right]. \quad (19)$$

is positive, again leading to a contradiction.

B.2. *Proof of Proposition 2.*

We show that if the seller chooses prices in foreign currency then any price different from  $p_{1,F}$  or  $p_{2,F}$  is suboptimal. A similar proof follows for prices in local currency. First, we argue that  $p > p_{2,F}$  cannot be an equilibrium since the value associated to posting this price is  $e^{-\frac{r}{\pi}p/p_{2,F}}W_{2,F} < W_{2,F}$ . This is because no buyer is willing to buy until the real price erodes to the highest reservation value. Second, we argue that  $p < p_{1,F}$  cannot be an equilibrium since the value associated to posting this price is  $p \frac{q(\theta)}{q(\theta)+r+\pi_F} < W_{1,F}$ . This is because the seller would not lose any customers by increasing its price to  $p_{1,F}$  and thus increase profits. Finally, any price  $p \in (p_{1,F}, p_{2,F})$  cannot be an equilibrium since the profit function is strictly convex in this interval, which implies that the seller can obtain higher profits by choosing the initial price at either the low or high reservation price. To show that the profit function is convex we compute its second derivative. Let  $W(p)$  be the profits associated to setting

initial price  $p \in (p_{1,F}, p_{2,F})$ , then

$$\begin{aligned} W(p) &= p \mathbb{E}_t [e^{-i_F t}] \\ &= p \left[ \int_0^{\hat{t}} e^{-i_F t} e^{-q(\theta)\Lambda t} q(\theta)\Lambda dt + \int_{\hat{t}}^{\infty} e^{-i_F t} e^{-(q(\theta)\Lambda \hat{t} + q(\theta)(t-\hat{t}))} q(\theta) dt \right] \\ &= p \left[ \left( 1 - \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}} \right) \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} + \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}} \frac{q(\theta)}{q(\theta) + i_f} \right] \end{aligned}$$

where  $\hat{t} = \log \left( \frac{p}{p_{1,F}} \right) \frac{1}{\pi}$ . Its first and second derivatives are given by

$$\begin{aligned} \frac{\partial W(p)}{\partial p} &= \left[ \left( 1 - \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}} \right) \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} + \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}} \frac{q(\theta)}{q(\theta) + i_f} \right] \\ &\quad - \left[ \frac{q(\theta)}{q(\theta) + i_f} - \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} \right] \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}}, \\ \frac{\partial^2 W(p)}{\partial^2 p} &= \left[ \frac{q(\theta)}{q(\theta) + i_f} - \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} \right] \frac{q(\theta)\Lambda}{q(\theta)\Lambda + i_f} \left( \frac{p}{p_{1,F}} \right)^{-\frac{q(\theta)\Lambda + i_F}{\pi}} \frac{1}{p} \left( 1 - \frac{q(\theta)\Lambda + i_F}{\pi} \right) < 0. \end{aligned}$$

### B.3. Proof of Proposition 3.

If  $\lambda = 0$ , we have that there is only one reservation price by currency,  $p_{1,c} = p_{2,c}$  for  $c \in \{F, D\}$ . This, together with the fact that sellers have no incentive to set prices above the reservation prices, implies that, conditional on a meeting, the probability of the transaction occurring is equal to one.

If  $u_L = u_H$  we can express the value of the seller as

$$W_c = p_c \frac{2\eta b}{2\eta b + \rho + \pi_c}. \quad (20)$$

Using the fact that  $p_D = (1 + \kappa)p_F$ , we can express the optimal currency choice of prices as

$$f = \begin{cases} 0 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} < 1 + \kappa \\ x \in [0, 1] & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} = 1 + \kappa \\ 1 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} > 1 + \kappa. \end{cases} \quad (21)$$

Note that  $f$  is weakly increasing (decreasing) in a certain parameter if and only if the function

$$J = \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} - (1 + \kappa)$$

is weakly increasing (decreasing) in the same parameter. Results (1) - (4) follow directly from taking partial derivatives of  $J$  with respect each parameter and assessing its sign.

ONLINE APPENDIX FOR  
“*PRICING IN MULTIPLE CURRENCIES*  
*IN DOMESTIC MARKETS*”

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## APPENDIX A. DATA CLEANING

A.1. *Online platform*

Before using the micro-data in the analysis, we implement a series of procedures to clean the data. The filters applied to publications about goods are the following. First, since part of our analysis is based on the price of goods, we drop all observations coming from publications of “divisible” goods. In order to implement this filter, we make use of the description of the good that sellers include in the publication and the description of the category provided by the platform to isolate two types of publications: i. those with sales in bulk, and ii. those with “divisible” goods. More specifically, we delete all publications that contained any of the following texts (in Spanish): promotion, batch, kilo (and variations), gram (and variations), liter (and variations), meter (and variations), centimeter (and variations), kilometer (and variations), pack, units, “2 for 1”. Based on this, we are able to identify the categories of goods in which these words appeared more often and dropped them completely (virgin CDs/DVDs, food, cigars/cigarettes, batteries, diapers, hobbies:bills/coins/stamps). Next, we delete goods with high prices – i.e. those with prices above US\$10,000 and above the 99% percentile of the within-category price distribution (after converting all prices into the same currency). Finally, in order to make prices comparable across time, we convert all prices in all currencies into real December 2012 US\$.

Regarding publications advertising real estate and vehicles, we apply an algorithm to delete publications with “unusual” prices (e.g., 1, 9999999, etc.). In order to isolate vacation properties, we make use of the categorization provided by the platform. Thus, vacation properties are those included in the following categories: temporary rental, vacation, seasonal, etc.

In order to provide a better idea of the types of goods included in this platform and within each price decile, Table A1 shows the average price, share of prices in foreign currency and the top 5 categories in terms of sales within each price decile in Uruguay. The platform includes goods with a wide range of prices, from an average of US\$3.4 in the lowest decile to an average of US\$475 in the highest decile. The most common types of goods sold within the cheapest deciles are apparel and phone cases/chargers/cables. Among the most expensive goods, phone accessories, computers/notebooks, video game consoles and phones are the most transacted items.

TABLE A1. Summary Statistics by Price Decile

Price decile	Avg. Price	% Foreign Curr.	Top 5 Most Common Items
1	3.5	4.3	Women apparel - Phone chargers - Ink cartridges Phone screen covers - Kitchen appliances
2	7.7	3.8	Women apparel - Phone chargers - Phone cases Phone cables - Phone screen covers
3	11.7	4.6	Women apparel - Men apparel - Phone cases Phone batteries - Phone memories
4	16.5	6.7	Women apparel - Men apparel - Phone cases Ink cartridges - Webcams
5	23.3	9.5	Women apparel - Men apparel - Fitness accessories Notebook accessories - Phone memories
6	34.9	16.8	Women apparel - Men apparel - Notebook accessories Wireless networks - Computer memory
7	54.1	22.6	Men apparel - Women apparel - Phones (other brands) Notebook accessories - Computer memory
8	87.6	35.0	Playstation 3 games - Men apparel - Phones (other brands) Computer hard drives - Women apparel
9	157.1	47.4	Phones (other brands) - Computer hard drives - Digital cameras (+11mp) Men apparel - Computer screens
10	480.2	66.5	Phone accessories - Notebooks - Video game consoles Phones (Nokia) - Couches

*Notes:* This table shows summary statistics of all goods sold in the platform by price deciles. The first column shows the average price in dollars across of all transacted prices within price decile. The second column shows the share of prices in foreign currency within price decile. The last column shows the top 5 most common transacted categories within price decile.



## A.2. *ENGIH and EFHU*

In this appendix, we explain the data used to compute Figure 4 and the moments related to households' holding of liquid assets in dollars that were used as targets of the calibration exercise. Two datasets are used for this purpose: the EFHU (*Encuesta Financiera de los Hogares Uruguayos*)<sup>14</sup>, an Uruguayan survey of household finances similar to the Survey of Consumer Finances in the US, and the ENGIH (*Encuesta Nacional de Gastos e Ingresos de los Hogares*) a consumption survey similar to the Consumer Expenditure Survey in the US.

The EFHU survey was conducted in 2013 and contains detailed financial information for a sample of 3,490 Uruguayan households, including several measures of asset holdings. Importantly, the survey distinguishes holdings of different types of assets by currency of denomination of those assets. From these data we construct a measure of dollar holdings at the household level. More specifically, we construct an indicator variable that is equal to one if the households holds cash in dollars or if it possesses a checking or savings account denominated in dollars.

The households surveyed by the EFHU were sampled from the ones that also participated in the national household survey (the *Encuesta Continua de Hogares*) in 2012, which is similar to the Current Population Survey in the US.<sup>15</sup> The household survey includes several questions that allows for the construction of a measure of household's total monthly income. Since the households surveyed in the EFHU were a subset of those in the broader ECH survey, we are able to match these two datasets and obtain for each household in the EFHU a measure of the total household monthly income, in addition to the indicator of asset holdings in dollars.<sup>16</sup> The average monthly household income in January 2006 terms is 55,159.2 Uruguayan Pesos (approximately US\$2,300). The share of households with asset holdings in dollars according to our measure is 9.4%. Figure A.1 shows the relationship between households' income and asset dollarization. While the fraction of households with liquid assets in dollars is close to zero among the poorest households, more than 20% of households in the ninth decile of the income distribution have some type of liquid asset in

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<sup>14</sup>The data are available upon request from the Economics department at the Facultad de Ciencias Sociales de la Universidad de la República.

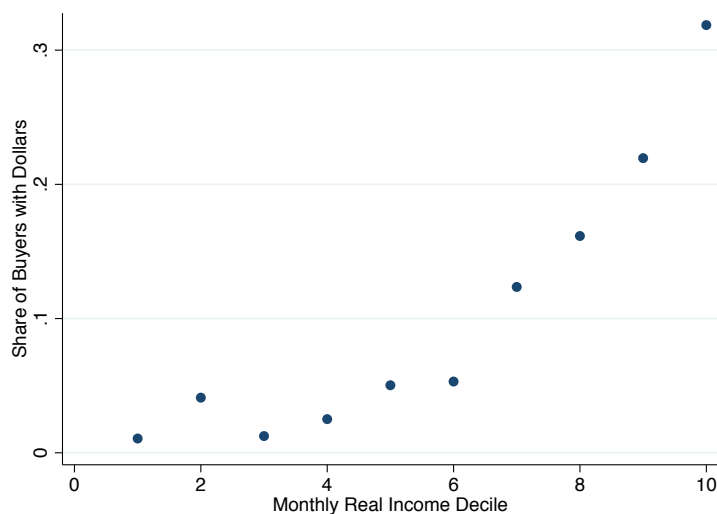
<sup>15</sup>Importantly, richer households were oversampled in the EFHU (and a proper sample weight was then assigned to them) to have a better sense of the wealth distribution in Uruguay. Throughout our analysis, we always take those household weights into consideration.

<sup>16</sup>In order to get a measure of income comparable with income measures from the consumption survey conducted in 2006, we deflated income to 2006 levels using the Uruguayan CPI.

dollars. This share is more than 30% for households in the top decile (for households earning more than US\$3,000 per month, this share is close to 60%).

Having measures of asset dollarization and total monthly income at the household level, we fit a local linear regression to estimate the conditional probability of holding assets in dollars given household monthly income. This estimate allows us to merge data from the financial survey with data coming from the consumption survey, which is described below.

FIGURE A.1. Household Income and Access to Dollars

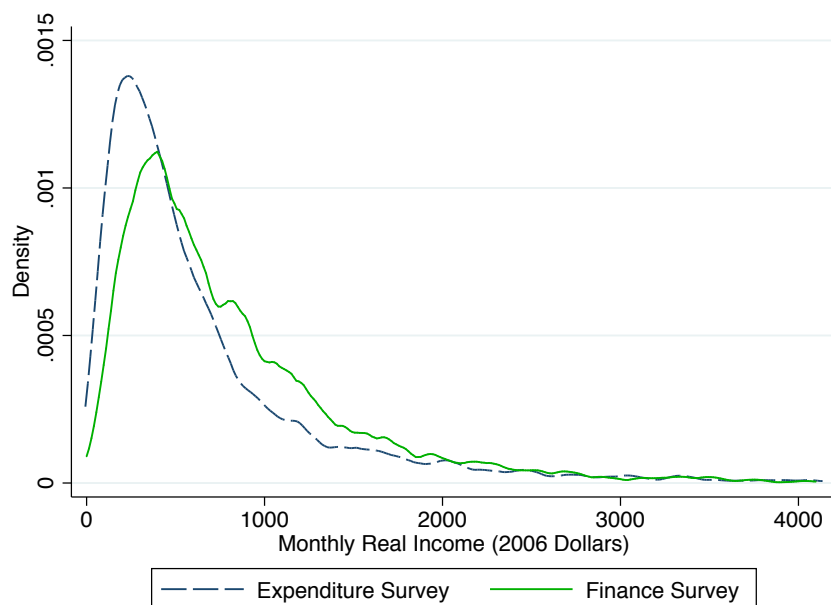


*Notes:* This figure shows the share of households with either cash holdings in dollars or at least one savings/checking account denominated in dollars by decile of the household monthly real income distribution.

The consumption survey ENGIH 2005-2006 collected expenditure and income data of all members of a total of 6,932 households. The survey covers a total of 1,088 types of goods at a very narrow level (e.g., distinguishing for example between shirts and jeans for women). Not all types of goods are relevant to our analysis, so we identify those that are available for sale in the online platform. This leaves us with 405 groups of goods. The ENGIH provides information on total expenditure in a good and quantities purchased, so we divided the former by the latter to obtain unit prices for each reported transaction. At this stage we are able to construct a dataset with individual transactions, its transacted price and the monthly income of the household purchasing the good. To be consistent with the analysis conducted with the data from the online platform, we exclude unit prices below US\$0.5 and above US\$1,000 (the range of prices found in the online platform, excluding outliers).

From the income variables included in the ENGIH, we construct a household monthly income measure that is consistent with the income measure constructed from the EFHU dataset (the questions used in the expenditure and household surveys are almost identical, so both measures of income are quite consistent between each other). Figure (A.2) shows a comparison of the distribution of household real monthly income obtained from the consumption survey and the households' finances survey. The difference between both distributions is the results of growth of household real income between 2005-2006 and 2012. However, these difference should not be of large concern because, if anything, it results in a lower imputed average asset dollarization across households (which in turn makes it harder to explain price dollarization with our theory).

FIGURE A.2. Distribution of Households' Real Income across Surveys

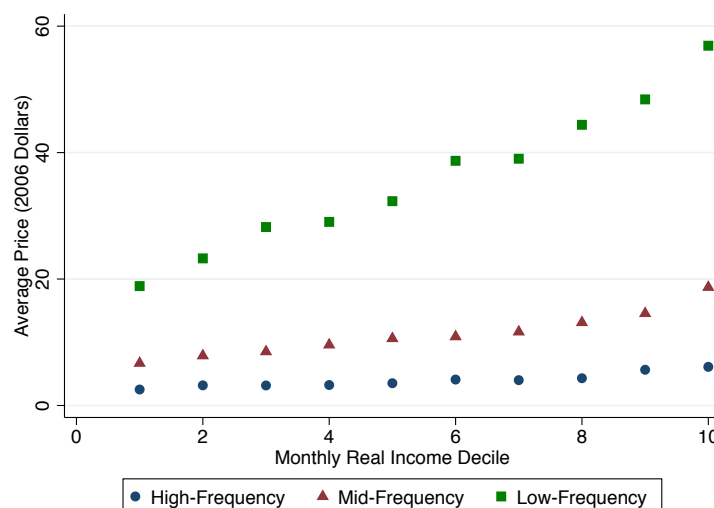


*Notes:* This figure compares the households' total monthly income distribution from the ENGIH (consumption survey), with the distribution obtained from the EFHU (financial survey). Both distributions were estimated non-parametrically. The green line approximates the income distribution from the consumption survey, whereas the blue dashed line approximates the income distribution from the financial survey.

The main purpose of the data coming from the consumption survey is to estimate a relationship between unit prices of households' purchases with the corresponding monthly households' income. Figure A.3 shows this relationships for three groups of goods: those purchased at a high frequency (less or equal than monthly), at an intermediate frequency

(bi-monthly or quarterly) and at a low frequency (semi-annually or annually).<sup>17</sup> As expected, richer households pay a larger unit price on average than poorer households, for goods purchased at any frequency. However, the slope of the relationship is small for goods purchased at a high frequency (mostly necessities) and large for goods purchased at a low frequency (the richest households buy goods that on average are three times more expensive than the goods purchased by the poorest households).

FIGURE A.3. Transaction Prices and Household Income



*Notes:* This figure shows the average transacted unit price measured in dollars within deciles of the households' monthly income distribution. Goods are split into three groups: those purchased at a high frequency (less or equal than monthly), at an intermediate frequency (bi-monthly or quarterly) and at a low frequency (semi-annually or annually).

### A.3. Merging Procedure

In order to produce Figure 4 in the paper, which shows the relationship between transacted unit prices and the share of buyers of those goods with liquid assets in dollars, we merge data from the expenditure and financial survey. For each recorded transaction in the consumption survey, we impute the expected probability that the household making that transaction had liquid assets in dollars, based on the income of the household and the estimated relationship between household income and asset dollarization obtained from the financial survey.

<sup>17</sup>The frequency of purchases is determined by the questionnaire used in the ENGIH survey and not by survey participants.

Finally, we take into account the fact that the consumption survey does not record all the transactions made within a given year, but the data coming from the online platform does. Therefore, we make use of the information provided by the consumption survey about the frequency at which households make purchases of different goods in order “convert” the frequencies of all purchases into a common annual frequency. For example, purchases of goods recorded to be made on a monthly frequency are weighted by a factor of 12. Thus, if a household purchases a certain good every month, the weighted data captured by the consumption survey would give the same relative importance to that good as the data coming from the online platform.

#### A.4. *Construction of Tradeability Indices*

We construct tradeability indices for 3-digit ISIC manufacturing industries as the ratio between the sum of exports and imports over output. We obtain trade data for Argentina and Uruguay from UN Comtrade World Integrated Solutions (WITS) and data on sectoral output from UNIDO. Due to data availability issues, we use data from 2002 for Argentina and data from 2007 for Uruguay. These data are merged using product concordance tables provided by WITS.

Next, we assign a 3-digit ISIC classification to each category of goods available in the online platform, by reading the description of each category and finding the closest match in the ISIC classification manual ([United Nations \(2008\)](#)). For those few categories with more than one possible 3-digit ISIC classification, we computed the tradeability index by first aggregating imports, exports and output of all these sectors and then computing the ratio. Aggregate statistics are reported in Table [A2](#). As expected, due to its size, Uruguay is relatively more open to trade than Argentina. Additionally, more technologically advanced products (e.g., cameras and computers) tend to be more imported in both economies, whereas local production of clothing and books tends to be more relevant than imports of those goods.

TABLE A2. Average Tradeability Indices by Category

Category	Imp./ (Imp.+Output)		(Imp.+Exp.) / Output	
	Argentina	Uruguay	Argentina	Uruguay
Electronics, audio and video	47%	96%	223%	2380%
Cameras and accessories	62%	94%	794%	2363%
Cellphones and phones	65%	85%	486%	695%
Games and toys	55%	77%	158%	341%
Videogames	56%	79%	254%	459%
Music and movies	14%	3%	32%	8%
Music instruments	50%	78%	149%	341%
Health and beauty	33%	52%	91%	160%
Sports and fitness	37%	62%	100%	249%
Babies related	25%	47%	101%	164%
Clothing	16%	38%	30%	95%
Industries, office	36%	61%	139%	684%
Home, furniture, garden	26%	45%	99%	140%
Computers	69%	87%	1469%	1978%
Hobbies	39%	48%	109%	265%
Books and magazines	7%	6%	16%	11%
Jewelry	80%	89%	162%	342%
Car accessories	43%	80%	107%	149%
Appliances	22%	75%	51%	352%

*Notes:* This table presents the average tradeability indices by broadest categories of goods in the online platform for Argentina and Uruguay. The first index is constructed as the ratio of sectoral imports to the sum of sectoral imports and output. The second index is constructed as the ratio of the sum of sectoral imports and exports to sectoral output.

## APPENDIX B. REPRESENTATIVENESS ANALYSIS

In this section we discuss the representativeness of our analysis in terms of: i) the types of goods available for sale in the online platform relative to the average household consumption bundle, and ii) the characteristics of people making online purchases relative to the overall population in Uruguay.

Table B1 compares the types of goods included in the average household consumption bundle (using data from the consumption survey) with the goods available in the online platform. In the second column, we show the share of total monthly expenditure households spend on broad categories of goods. These categories are the ones used officially when constructing the CPI. The third column presents the expenditure share in the average household consumption basket including only types of goods that are also available for sale in the online platform. The last column simply counts how many types of goods are surveyed in the household survey that are also available for sale in the online platform.

In terms of average expenditure shares, the goods included in the online platform cover almost a third of total average monthly expenditures. In particular, we have a good coverage in Apparel, Furniture and Home Appliances, Culture and Recreation, i.e. mostly durable goods. As expected, we do not have almost any coverage of services and food items. Therefore, aggregate price dollarization would be lower in the aggregate because food should be expected to be priced in local currency.

The relevance of our results also hinges on the representativeness of the population making online purchases relative to the overall population. We explore this issue by analyzing micro data from the national household survey (ECH) conducted in 2012. In that survey, all household members are asked whether they have used Internet during the last month and whether they used Internet to make online purchases. We split households into three groups: all household, households in which at least one member used Internet during the last month, households in which at least one member used Internet to make online purchases during the last month. Figure B2 shows the average demographics of the household head for each type of household: all, used internet, shopped online. First, notice that already in 2012 almost 13% of households made purchases online in a given month and more than 75% of households had access to internet. All demographic variables are monotonic in terms of tech-savviness. On average, households making online purchases have heads that tend to be more educated and younger, and more likely to be employed, male, and have liquid assets in dollars. At the household level, those making online purchases have on average a higher monthly income.

Those differences are attenuated when comparing those households with households that have recently used internet (the vast majority of households).

TABLE B1. Representativeness of the Basket of Goods Sold in the Online Platform

Category	Share of total expenditure	Expenditure share in E-platform	Share of items in E-platform
Food and Non-Alcoholic Beverages	23.0	0.00	0.00
Alcoholic Beverages and Tobacco	1.52	99.9	80.0
Apparel	4.12	95.3	93.0
Housing and Utilities	30.2	65.3	43.7
Furniture and Home Appliances	3.97	36.9	72.6
Medical Care	10.9	3.80	4.76
Transportation	8.48	5.13	9.09
Communications	4.16	10.1	12.5
Culture and Recreation	5.12	48.6	58.8
Education	1.40	0.00	0.00
Hotels and Restaurants	2.42	0.00	0.00
Other Goods and Services	4.56	22.2	32.0
Total	100.0	31.4	29.8

*Notes:* This table analyzes the representativeness of the data coming from the online platform by showing the fraction that those goods represent in the average household consumption basket. Data on households' expenditures comes from the national consumption survey from Uruguay (ENGIH) conducted in 2005-2006. The second column shows the average split of total expenditures between large categories (those used when computing the official CPI). The third column shows, for each category and overall, the average expenditure share in goods that are also available for sale in the platform. The last column shows the share of types of goods, within categories and overall, that are available for sale in the platform. Summary statistics were computed using household weights.



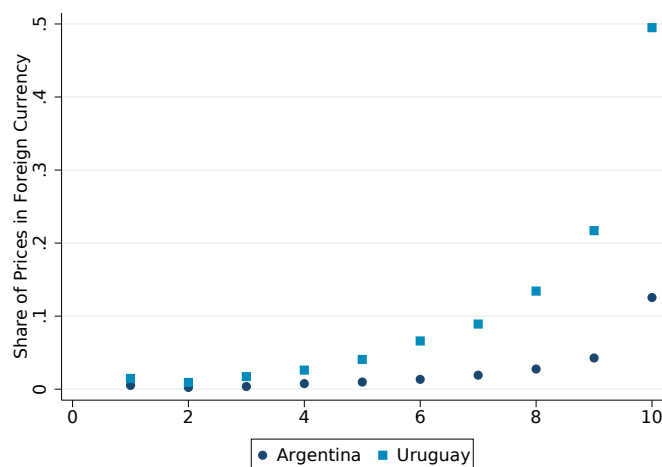
TABLE B2. Representativeness of Potential Users of the Online Platform

	All	Used Internet	Shopped Online
HH Income	817.8 (13.65)	971.3 (17.44)	1342.7 (55.24)
Yrs. of Education	9.85 (0.10)	11.0 (0.11)	12.9 (0.28)
Employed	0.65 (0.01)	0.76 (0.01)	0.82 (0.03)
Access to Dollars	0.10 (0.01)	0.13 (0.01)	0.24 (0.03)
Age	54.5 (0.39)	49.5 (0.39)	47.8 (0.95)
Male	0.57 (0.01)	0.61 (0.01)	0.71 (0.03)
N	2627	1994	339

*Notes:* This table presents a comparison across different types of households surveyed in the national household survey of Uruguay (ECH) conducted in 2012. The second column presents demographic statistics for the overall population, while the third column restricts the sample to households in which at least one member used internet during the reference month, and the last column further restricts the sample to household in which at least one member made an online purchase during the reference month. HH income corresponds to the total household monthly income from all sources of income included in the survey. Access to dollars is a dummy variable that is equal to one if the household has access to liquid assets (cash, checking/savings account) in dollars. The rest of the demographic variables pertain to the household head: age, gender, years of education, dummy variable indicating whether employed or not. Summary statistics were computed using household weights.

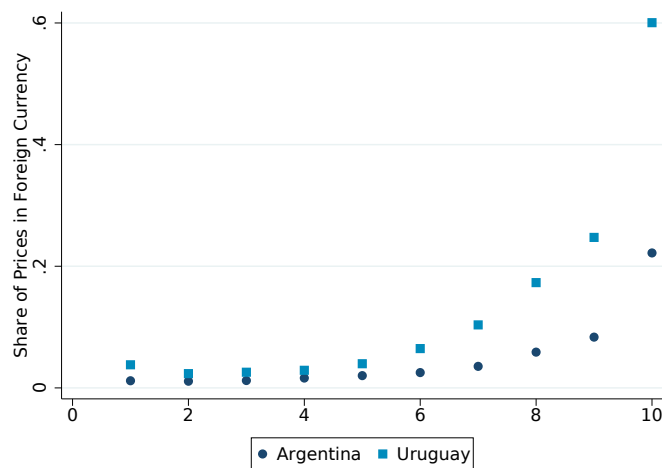
## APPENDIX C. PRICE DOLLARIZATION: FURTHER RESULTS

FIGURE C.1. Share of Prices in Foreign Currency: Used Goods



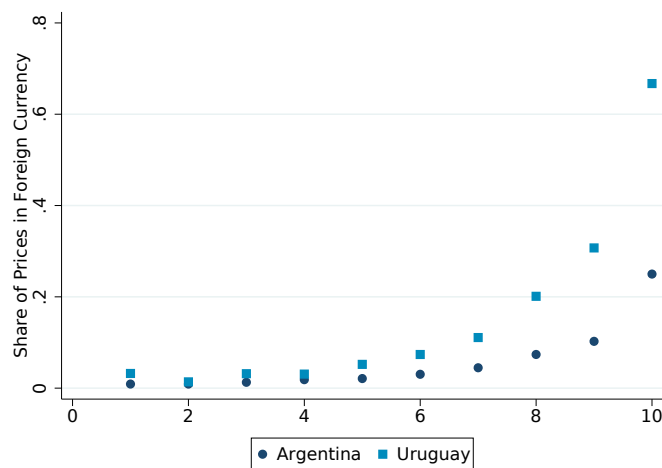
*Notes:* This figure shows the share of prices set in dollars in Argentina and Uruguay by deciles of the real posted price distribution. Data corresponds to publications of used goods that ended up being sold in the platform.

FIGURE C.2. Share of Prices in Foreign Currency: One-time Sellers



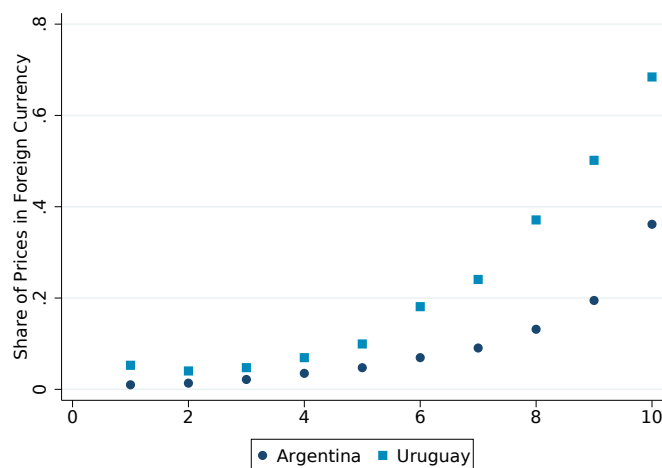
*Notes:* This figure shows the share of prices set in dollars in Argentina and Uruguay by deciles of the real posted price distribution. Data corresponds to publications of new goods that ended up being sold by sellers that only sold once in the platform.

FIGURE C.3. Share of Prices in Foreign Currency: Small Sellers



*Notes:* This figure shows the share of prices set in dollars in Argentina and Uruguay by deciles of the real posted price distribution. Data corresponds to publications of new goods that ended up being sold by sellers that sold between two and ten goods in the platform.

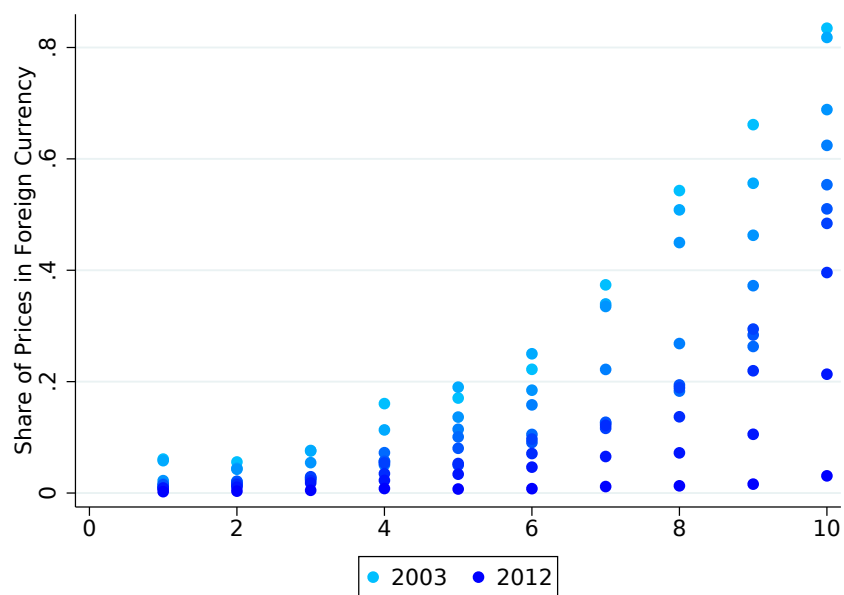
FIGURE C.4. Share of Prices in Foreign Currency: Big Sellers



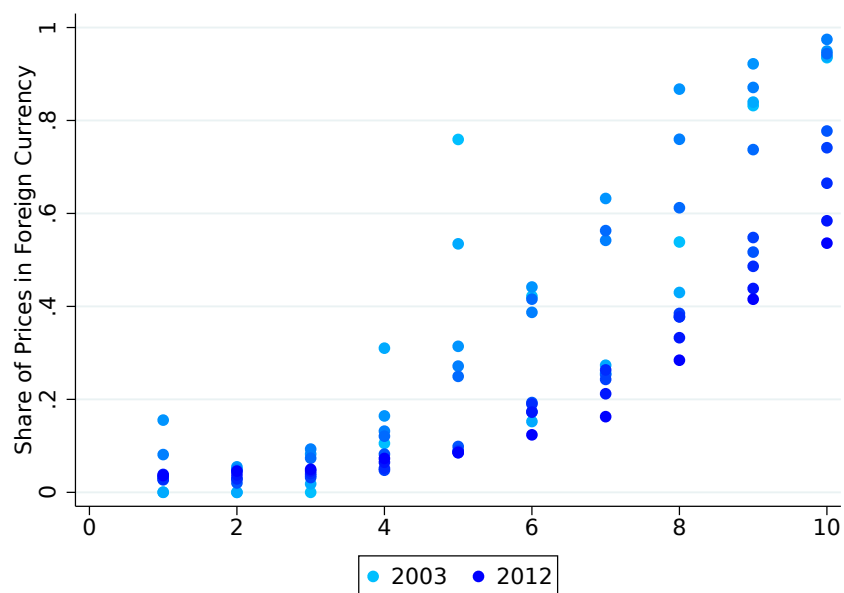
*Notes:* This figure shows the share of prices set in dollars in Argentina and Uruguay by deciles of the real posted price distribution. Data corresponds to publications of new goods that ended up being sold by sellers that sold more than ten goods in the platform.

FIGURE C.5. The Evolution of Price Dollarization

(A) Argentina



(B) Uruguay



*Notes:* This figure shows the fraction of prices set in dollars in Argentina and Uruguay for different years, by deciles of the real posted price distribution. Data corresponds to the publications of new goods that ended up being sold. The intensity of the colors of the dots vary with the year of the data. The lightest blue color corresponds to data from the year 2003 and the darkest blue color corresponds to data from the year 2012.

TABLE C1. Regression version of tables

	Price Dollarization	Price Dollarization	Price Dollarization	Time to Sell	Time to Sell	Time to Sell	Time to Sell	Asset Dollarization
Decile 2	0.003*** (0.000)	0.006*** (0.000)	-0.012*** (0.001)	1.932*** (0.014)	1.896*** (0.014)	0.074 (0.046)	1.032*** (0.043)	0.001 (0.001)
Decile 3	0.011*** (0.000)	0.019*** (0.000)	-0.004*** (0.001)	2.178*** (0.014)	2.409*** (0.014)	0.727*** (0.046)	1.241*** (0.043)	0.009*** (0.001)
Decile 4	0.025*** (0.000)	0.028*** (0.000)	0.016*** (0.001)	2.654*** (0.015)	2.612*** (0.014)	0.903*** (0.046)	1.243*** (0.043)	0.027*** (0.001)
Decile 5	0.037*** (0.000)	0.043*** (0.000)	0.045*** (0.001)	2.845*** (0.014)	2.468*** (0.014)	0.606*** (0.046)	1.301*** (0.043)	0.033*** (0.001)
Decile 6	0.058*** (0.000)	0.068*** (0.000)	0.122*** (0.001)	2.787*** (0.015)	2.363*** (0.014)	0.495*** (0.046)	1.245*** (0.043)	0.032*** (0.001)
Decile 7	0.079*** (0.000)	0.103*** (0.000)	0.179*** (0.001)	2.518*** (0.015)	2.498*** (0.014)	0.923*** (0.046)	1.323*** (0.043)	0.040*** (0.001)
Decile 8	0.120*** (0.000)	0.131*** (0.000)	0.304*** (0.001)	2.737*** (0.015)	2.987*** (0.014)	1.184*** (0.047)	1.385*** (0.044)	0.046*** (0.001)
Decile 9	0.181*** (0.000)	0.172*** (0.000)	0.431*** (0.001)	3.717*** (0.015)	2.879*** (0.014)	1.059*** (0.047)	1.416*** (0.043)	0.069*** (0.001)
Decile 10	0.346*** (0.000)	0.244*** (0.000)	0.629*** (0.001)	3.276*** (0.015)	3.169*** (0.014)	-0.885*** (0.046)	0.631*** (0.042)	0.068*** (0.002)
Constant	0.010*** (0.000)	0.173*** (0.001)	0.051*** (0.000)	21.295*** (0.010)	13.355*** (0.027)	19.518*** (0.033)	23.895*** (0.146)	0.104*** (0.001)
<i>N</i>	34387481	34387481	2596691	34387481	34387481	2596691	2596691	451369
<i>R</i> <sup>2</sup>	0.120	0.264	0.249	0.002	0.072	0.001	0.137	0.019
FE	No	Yes	No	No	Yes	No	Yes	-
Country	Argentina	Argentina	Uruguay	Argentina	Argentina	Uruguay	Uruguay	Uruguay
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*Notes:* This table presents the regression-version of the figures shown in the paper. Data corresponds to publications of new goods that ended up being sold. Price dollarization is an indicator variable equal to one if a transacted price is denominated in dollars and zero otherwise. Time to sell is defined as the number of days elapsed between the day of the original publication and the transaction day for each unit sold. Asset dollarization is an indicator variable equal to one if the household making the transaction holds any liquid asset in dollars. The independent variable labeled as Decile *i* denotes an indicator variable that is equal to one if the transacted price belongs to decile *i* in the price distribution (decile 1 is the omitted category). Regressions are estimated by OLS for each country separately. Some specifications include fixed effects at the broadest category level. The last row shows the p-value of a test of the null hypothesis that all coefficients Decile *i* are equal to zero.

TABLE C2. Means of Payment in Uruguay

Mean of payment	% of Transactions in Dollars	Avg. Amount in Dollars	Avg. Amount in Pesos
Debit Cards	1.3%	151	40
Credit Cards	2.4%	198	38
Mobile Payments	4.8%	228	80
Automatic Bank Debit	9.3%	515	220
ATM extractions	4.4%	401	171

*Notes:* For debit and credit card transactions we consider only transactions made in Uruguay with local cards. Figures expressed in US dollars. Source: [Banco Central del Uruguay \(2016\)](#).

## REFERENCES

- BANCO CENTRAL DEL URUGUAY (2016): “Sistema de Pagos Minorista,” *Reporte Informativo N 15*.
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