PRICING IN MULTIPLE CURRENCIES IN DOMESTIC MARKETS*

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Abstract. We document that in emerging economies a significant fraction of prices in domestic markets are set in dollars. The currency of prices is not homogeneous across goods. More expensive goods are more likely to be set in dollars and also take longer time to sell. We rationalize these facts using a model of price setting in multiple currencies with search frictions. Pricing in dollars prevents erosion of real prices caused by inflation at the expense of a lower willingness to pay from buyers. When goods take longer to sell the relative value of preventing price erosion is higher. Consistent with empirical evidence, our model predicts that the share of prices in foreign currency increases when domestic inflation is high.

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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 as a unit of account. In particular, this is the first paper that shows 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. 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. In order to do this, we use a novel dataset from the largest e-trade platform in Latin America, which includes data on original publications made by sellers and transactional data from Argentina and Uruguay during the 2003-2012 period. Importantly, the dataset includes information on the currency of denomination of prices. The data show that more expensive goods (measured in real terms) are more likely to be priced in foreign currency. In particular, high levels of dollarization are observed for those goods that are in the top quartile of the price distribution. We also show that more expensive goods take longer to sell. We document that these patterns hold in both countries and if we restrict our analysis to goods of the same type, broadly defined. Additionally, using graphical and regression analysis, we show that the share of prices denominated in dollars is higher in those periods in which the domestic inflation is higher. This result holds in both countries and is robust to the inclusion of a broad control set of macro variables.

Motivated by our empirical evidence, we then formulate a general equilibrium model of price setting in multiple currencies designed to understand our documented facts. 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 extend the model to include goods that are horizontally differentiated in terms of their attributes, and vertically differentiated in terms of their durability. These additional features help 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. If they price in dollars, the willingness to pay of buyers is lower since they need to incur in a transaction cost associated to exchanging currency before purchasing the good. The relative importance of this trade-off differs for each seller depending on the type of good that they sell.

Setting prices in dollars is more attractive for those goods 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. Goods can take longer to sell if meetings with buyers arrive less frequently or because conditional on a meeting, buyers are less likely to buy those goods. We show that both features are more severe for more durable goods. More durable goods are traded in an less tight market, and hence transaction opportunities arrive less frequently for sellers, and buyers wait more to find the good that matches better their tastes. Buyers wait more because they know they will likely keep this good for a longer period of time and only resume searching after the good becomes obsolete. Additionally, more durable goods are sold at a higher price since they have a larger expected life and a more valued by buyers. This way our model delivers the prediction that more expensive goods are more likely to be priced in foreign currency and take longer to sell.

We then quantify our model by calibrating it to match the Argentinean economy for the period of 2003-12. The calibration strategy targets the average level of price dollarization, as well as unconditional moments of the distributions of prices and time to sell goods. We then assess the ability of the model to replicate our empirical findings. In the model, like in the data, more expensive goods are more likely to be priced in foreign currency. The goods that are posted in foreign currency are those in the top quartile of the price distribution. The model can also account qualitatively for the fact that more expensive goods take longer to sell. However, it does not match quantitatively well this pattern in the data, a feature that suggests that higher prices are associated with additional attributes of goods that are not captured by durability.

Finally, we use our model 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 low-inflation economy and a high-inflation economy, leaving all the remaining parameters from the calibration unchanged, and analyze the patterns of currency choice of prices. Consistent with our empirical finding, in the high-inflation economy the share of prices in foreign currency is higher than in the 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. The model also predicts that if an economy experiences a process of disinflation, the accompanying process of dedollarization occurs gradually at the top percentiles of the price distribution and then gradually expands to middle price percentiles. We denominate this pattern a process of *dedollarization from the top*.

Our paper is related to the literature that studies currency choice of prices and the literature on dollarization of emerging economies. Additionally, our theoretical framework builds on 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. Engel (2006) and Gopinath et al. (2010) show that firms may optimally choose different currencies to set their prices depending on their desired level of exchange rate pass-through. Devereux and Engel (2003) stress that the optimal exchange rate policy depends on the currency on which prices are denominated. Devereux et al. (2004) and Bacchetta and van Wincoop (2005) develop general equilibrium frameworks to study the interaction of optimal currency choice of prices and stability of monetary policy and differential degrees of competition. Burstein and Gopinath (2014) survey recent advances in the literature. 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 economies set their prices in the currency of a third dominant economy. With the exception of Casas et al. (2017), all papers focus on currency invoicing of internationally traded goods. We contribute to this literature by documenting that different currency denomination of prices exist also in domestic markets in emerging economies and studying its link with the level of inflation in the economy.

Motivated by the wide use of the dollar currency in some emerging economies, various scholars have studied the macroeconomic effects of renouncing the use of individual currencies and of having high levels of financial dollarization. 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.

Finally, our paper also builds on 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.[1] Diamond (1993) studies price setting in a context in which the price is attached to individual goods. Burdett and Menzio (2016) 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. Our theory builds on Diamond (1993) and extends it to include currency choice of prices, horizontal differentiation of goods and goods with different duraibilities, all features that are relevant in explaining our micro facts.

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 a general equilibrium model of price setting with currency choice and search frictions and characterizes its equilibrium. A quantitative analysis of the model implications for currency choice and inflation is carried out in Section 4. Finally, Section 5 concludes.

2. Dollarization and Search in the Data

2.1. *Data Description*

The data used for the analysis of price dispersion comes from the largest e-trade platform in Latin America that started its activities in 1999 and currently operates in 19 countries with 69.5 million users. 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, he can enter the publication and decide to make the purchase. 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.

[1] Some examples include the study of nominal rigidities (Head et al. (2012)), price dispersion (Kaplan et al. (2016)), and shopping behavior and unemployment Kaplan and Menzio (2016).

We obtained data for all the publications made in Argentina and Uruguay during the 2003-12 period. A more detailed description of the data and an assessment of its representativeness of the aggregate economy can be found in Drenik and Perez (2016).

Our data is divided into two datasets. The first dataset 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. The second dataset includes data on all the transactions made in the platform for same sample period. For each transaction we have data on: the date of the purchase, buyer and seller identifiers and the transacted price and quantity. The entire dataset includes more than 140 million publications made and around 111 millions of goods sold in both countries during the 2003-2012 period.

An important variable included in the data is the currency of denomination of the posted price. A significant fraction of prices are posted in foreign currency (US dollars) in both countries. This fraction has decreased over time (see Figure 6). The share of prices in dollars in the early years of our sample was around 20% and 50% for Argentina and Uruguay, respectively. In the last years the share is lower in both countries (around 5% and 15% for Argentina and Uruguay, respectively).

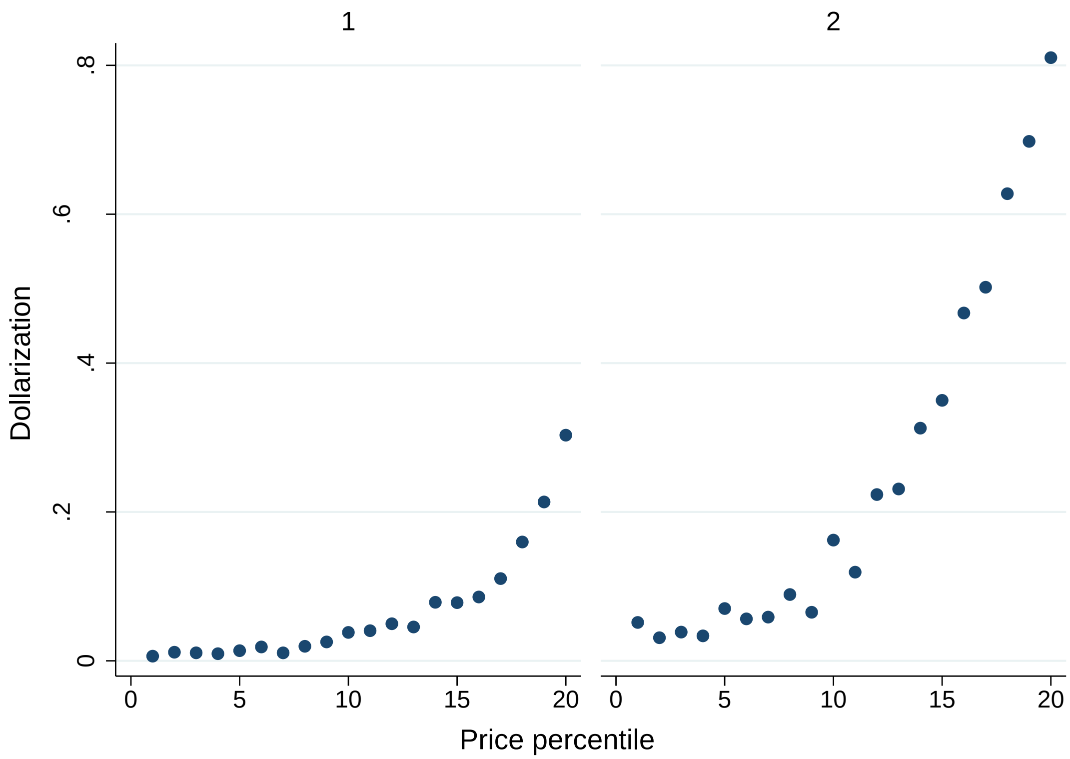
2.2. *Empirical Facts*

In this section we present new facts regarding the probability of prices being set in foreign currency and the time it takes for the good to be sold.

Empirical Finding 1: More expensive goods are more likely to be denominated in foreign currency than cheaper goods.

Figure (1) presents the probability of a good being denominated in foreign currency as a function of its price (denominated in local currency). More specifically, we order the posted prices measured in a common currency and then split them into twenty bins of equal frequency and within each group we computed the fraction of goods with a price set in foreign currency. The fraction of prices posted in foreign currency is an increasing function of prices. In each the country the fraction of prices set in foreign currency is almost zero for very cheap goods. On the other side of the price distribution, the share of prices set in foreign currency is around 30% and 80% in Argentina and Uruguay, respectively. This degree of heterogeneity is consistent with the overall degree of dollarization in both economies. For example, the average share of deposits denominated in foreign currency during the 2003-2012 period was 11% and 81% in Argentina and Uruguay.

Figure 1. Dollarization vs Price percentile



Notes: Each figure shows the fraction of original prices set in foreign currency as opposed to local currency, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins.

One could argue that differences in the currency of denomination of prices could be driven by other factors such as: currency of denomination of input prices, higher import penetration of more expensive goods, etc. In order to alleviate some of these concerns, we replicate the analysis by splitting the sample according to different category groups.[2] Figures (7) and (8) show that similar patterns regarding the degree of dollarization is present in almost all

[2]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 a broader to a more specific classification. The first level of categories indicates broad product types such as computers, books and health/beauty.

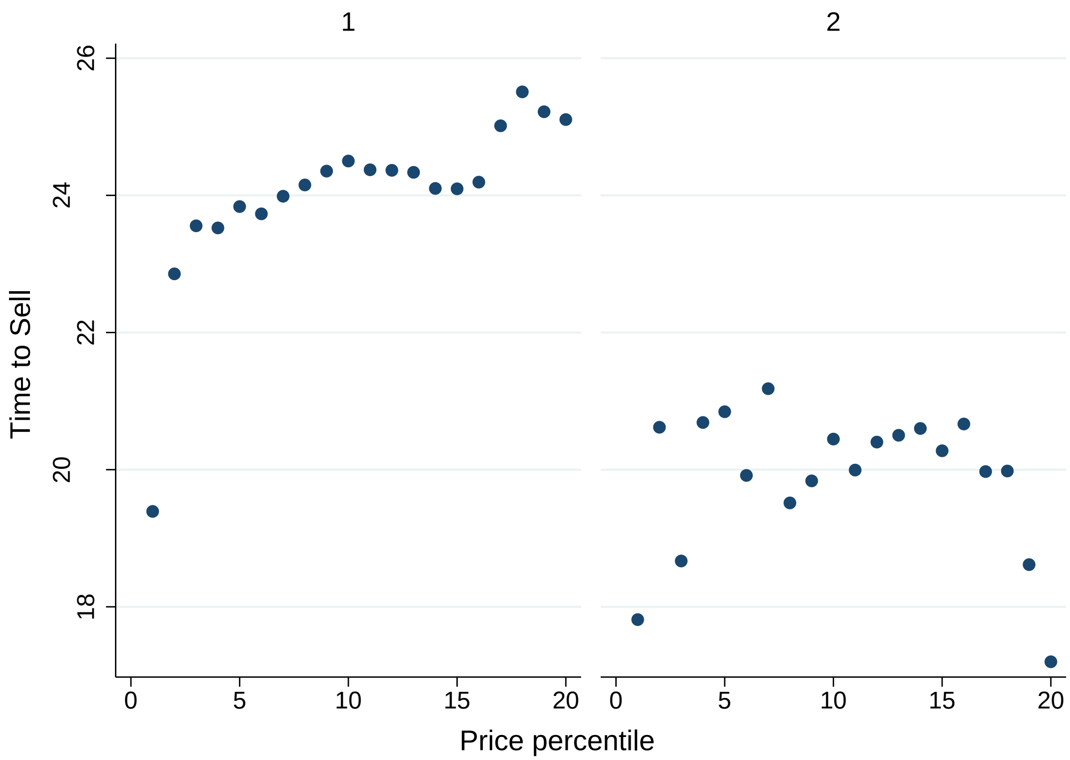
categories (albeit with different degrees) in both countries. Also, differences in the cost structure should have a smaller effect in our setting. In this platform sellers want to sell goods that have already been produced and prices correspond to units available for sale at the moment of the publication. Therefore, the traditional mechanisms behind models with time or state-dependent pricing, according to which prices of goods produced in the future are set beforehand, do not apply in this context.

In order to provide a measure of how much of the degree of dollarization can be explained by the size of the price we estimate a linear probability model that has as the dependent variable an indicator variable that equals one if the price is set in foreign currency. As independent variables we only include time and category-country fixed effects and the original price (converted into local currency). The exercise here is to compare the R^2 of each specification in order to compute how much of the variation can be explained by each set of variables. Results are shown in Table 2 The first two columns shows that category-country fixed effects can explain around 12.5% of the total variation in the data, and time fixed effects can only explain 2.5% of the total variation. The inclusion of the level of original prices as an additional variables increases the fraction of the data that can be explained to 18.4%, a 34% increase relative to the explanatory power of fixed effects only.

Empirical Finding 2: The average time to sell is higher for more expensive goods.

One of the risks sellers face when setting prices is that, if prices are sticky, inflation erodes the real value of their profits. For a given level of inflation, the magnitude of this potential loss is a direct function of the time it takes the good to be sold. Figure (2) shows the average time to sell of goods, measured as the number of days that went by since the day of the post to the day of the sale, as a function of the price set at the moment of the original post. In both countries we observe an increasing pattern. For example, in Argentina it takes around 13 days on average for the cheapest goods to be sold. On the other hand, the average time to sell for prices above the median is 21 days, 60% higher than the average time to sell for the cheapest goods. A similar pattern emerges in Uruguay, although the differences across price bins are smaller.

Figure 2. Time to sell vs Price percentile



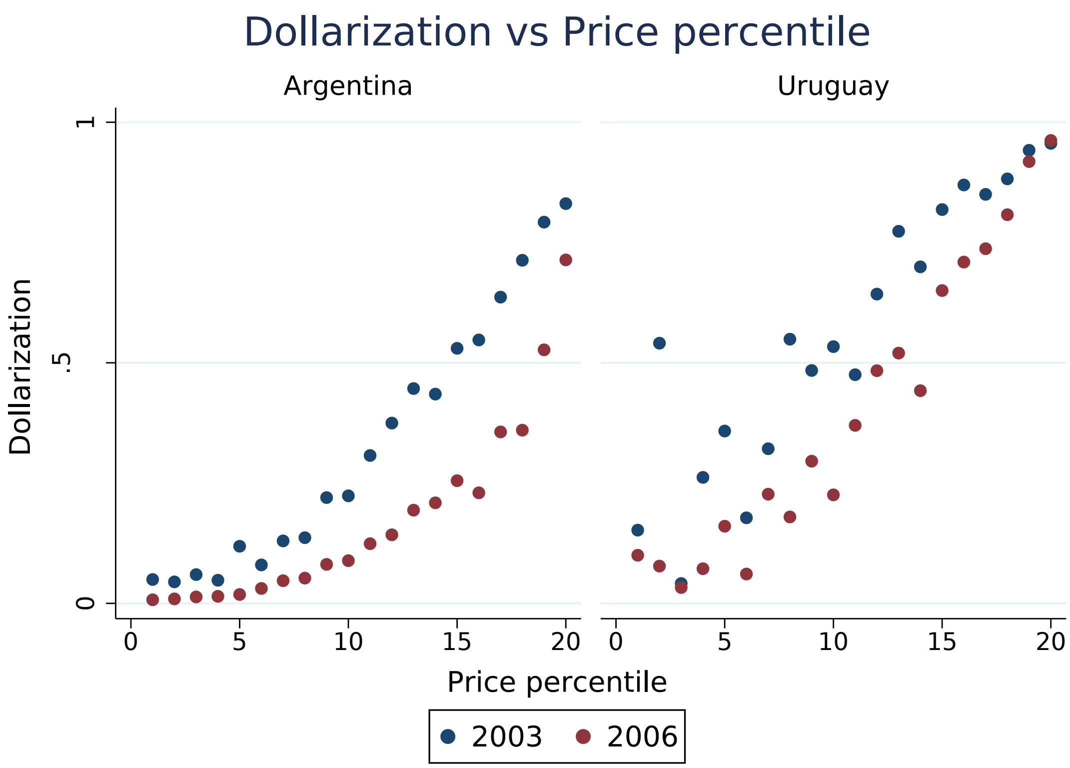
Notes: Each figure shows the number of days it takes the average good to be sold, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins.

If more expensive goods are more likely to be priced in dollars and also take longer to sell, it is to be expected that goods that take longer to sell are also more likely to be priced in dollars. We show that this is the case, even if one conditions on the price of the good. In particular, we estimate a linear probability model that has as the dependent variable an indicator variable that equals one if the price is set in foreign currency. Since we are focusing on correlations only, we only include time and category-country, fixed effects, the original price in thousands (converted into local currency) and the number of days it took the good to be sold. Table (2) shows the results. Here we focus on the last three columns. We can see that higher local prices and higher time to sell is associated with a higher friction of prices posted in foreign currency.

Empirical Finding 3: Price dollarization increases with higher domestic inflation.

If sellers set their prices in dollars is to prevent an erosion their real values, then we should expect that the share of prices denominated in foreign currency increases when domestic inflation is higher. We show that this is the case. Figure 3 shows the patterns of the currency denomination of prices as a function of the price percentiles for 2003 and 2006, two years with different inflation rates in both countries. In 2003 the inflation rate was 15% in Argentina and 19% in Uruguay, in contrast to 10% and 6% in 2006, in Argentina and Uruguay respectively. In both countries, the share of prices in foreign currency is higher in 2003 (the year with high inflation) than in 2006 (the year with low inflation) for every price bin.

Figure 3. Currency Denomination of Prices and Domestic Inflation



Notes: Each figure shows the fraction of original prices set in foreign currency, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. The blue dots correspond to data from the year 2003 (high inflation for both countries) and the red dots to the year 2006 (low inflation for both countries).

This figure provides suggestive evidence that price dollarization increases with inflation. We perform a more formal analysis by estimating regressions on the share of prices in foreign currency on average prices and macro variables including inflation. We use our dataset to construct a panel dataset with the share of prices in foreign currency and average real prices at a monthly frequency for each country-category where categories are defined at level one.[3] Using this panel we then regress the share of prices in foreign currency on the average real price, domestic inflation and other macro variables that include measures of the devaluation rate, dollarization of bank deposits, economic activity, inflation volatility, exchange rate volatility and an index of capital controls. Appendix A provides a detailed description of the regression specifications and the variables included.

Results are presented in Table 3. The fourth column shows the output of the regression for Argentina. The coefficient associated to the inflation rate is positive and statistically significant. The fifth column shows the output of the regression for the case of Uruguay. The coefficient associated to the inflation rate is positive and significant. The point estimates are very different in both countries. Finally, the last column shows the estimates of the regression with both countries. Again, the coefficient associated to inflation is positve and significant. Finally, it is worth noting that the share of prices in foreign currency is procyclical, increasing in the level dollarization of deposits, inflation and exchange rate volatility and decreasing in the index of capital controls.

In summary, this section documents that in Argentina and Uruguay there is a significant share of prices that are posted in dollars, that more expensive goods are more likely to be posted in dollars and take longer to sell, and that the share of prices in dollars increases when inflation increases.

3. Model

In this section we formulate a model of an economy with consumer search 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 for two reasons. First, they correctly characterize the market we analyze in our empirical section: in our online platform, sellers post a price and transactions occur only after a consumer finds the post and agrees to buy. Second, we want to understand the link between currency choice and time to sell of a good, which naturally arises in a search setting. We also depart from the most common ways of modeling price stickiness (e.g. menu costs or Calvo pricing) and assume that prices are attached to individual goods. Firms face no cost of setting prices when posting goods for

[3]We also compute regressions by constructing panels with categories defined at higher levels.

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.

3.1. *Buyers*

There is a continuum of buyers of mass one. The utility of buyers is linear in real income available to spend on goods and discounted at the real interest rate r. Nominal income is denominated in local currency and grows in real terms at the rate r. Buyers search for a good, which is horizontally differentiated, and have different preferences. We assume that there are two varieties of the good and that half of the mass of buyers prefers one variety over the other. More specifically, a buyer receives a flow utility of u_H if he consumes the good he likes the most and a flow utility of u_L if he consume the less preferred variety, with $u_L < u_H$. We model durability by assuming that goods can be consumed until they "break" and become obsolete. Breaking shocks follow a Poisson process with arrival rate α. Therefore, a good with a lower α is more durable on average.

The market features search frictions. Buyers meet sellers according to a Poisson process with arrival rate η. Once the buyer and the seller meet, the buyer observes the variety of the good, the price and the currency of denomination of the price, which could either be expressed in local or foreign currency. If a transaction occurs, the buyer must pay the posted price. Additionally, if the price is denominated in dollars the buyer needs to incur a proportional transaction cost $\kappa > 0$ (expressed in real terms) associated with exchanging currency. Every time the buyer experiences a transaction opportunity he can decide whether to purchase the commodity, in which case he exits the market and only re-enter the market when the purchased good breaks, or refuse to purchase and keep searching.

We can express the value of searching for a given buyer recursively as

$$V^w = \mathbb{E}_\tau \left[\exp(-r\tau) \left\{ \begin{matrix} f \left(\sum_{a=\{L,H\}} \frac{1}{2} \int \max\left\{ V_a^b - s(1+\kappa), V^w \right\} \mathrm{d}G_F(s) \right) \\ +(1-f) \left(\sum_{a=\{L,H\}} \frac{1}{2} \int \max\left\{ V_a^b - s, V^w \right\} \mathrm{d}G_D(s) \right) \end{matrix} \right\} \right], \tag{1}$$

where f is the fraction of goods posted in dollars, $G_D(s)$ and $G_F(s)$ denote the distributions of real prices in domestic and foreign currency, respectively.[4] The expectation is taken over

[4] We use subscripts two type of subscripts: $a = \{L, H\}$ to denote the type of the good, that can be the good the buyer values the least (L) or the most (H), and $c = \{F, D\}$ to denote the currency of denomination that can be foreign currency (F) or domestic currency (D).

the random variable τ, the time when a transaction opportunity arrives. The value of buying is given by

$$V_a^b = \mathbb{E}_d\left[\int_0^d \exp(-rt)u_a \mathrm{d}t + \exp(-rd)V^w\right] = \frac{u_a + \alpha V^w}{\alpha + r}$$

for $a = \{L, H\}$. The expectation is taken over the the random variable d, which denotes the random durability of the good. This equation is intuitive. If the good lasts forever, then $\alpha = 0$ and the value of buying the good is the discounted perpetual flow of u_a. The lower is the expected durability of the good, buyers are returning to the market more often. In the limit with an average durability of zero, the value of buying equals the value of searching V^w.

Since the value of buying and searching do not directly depend on the sampled price, the buyer's optimal choice of which transactions to accept involves reservation prices in foreign currency $p_{a,F}$ and in domestic currency $p_{a,D}$ given by

$$p_{a,D} = p_{a,F}(1+\kappa) = V_a^b - V^w, \tag{2}$$

for $a = \{L, H\}$. Given this strategy we can solve the integrals found in equation (1) using integration by parts and the definition of the reservation prices

$$\int \max\left\{V_a^b - s, V^w\right\} \mathrm{d}G_D(s) = V^w + \int_0^{p_{a,D}} G_D(p)\mathrm{d}p$$

and

$$\int \max\left\{V_a^b - s(1+\kappa), V^w\right\} \mathrm{d}G_F(s) = V^w + \int_0^{p_{a,F}} G_F(p)\mathrm{d}p$$

for $a = \{L, H\}$. These equations state that the extra surplus for the buyer depend 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^w we obtain

$$V^w = \frac{\eta}{\rho}\left[f\left(\sum_{a=\{L,H\}} \frac{1}{2}\int_0^{p_{a,F}} G_F(p)\mathrm{d}p\right) + (1-f)\left(\sum_{a=\{L,H\}} \frac{1}{2}\int_0^{p_{a,D}} G_D(p)\mathrm{d}p\right)\right]. \tag{3}$$

To compute the measure of buyers with a high valuation of each variety searching for goods, we equate the flows into and out of the pool of buyers. Outflows are given by the measure of buyers that meet a seller selling the variety they value more, which occurs with probability $1/2$, and the measure of buyers that meet a seller selling the variety they value less at price below $p_{L,c}$. Inflows are given by the mass of non-buyers whose good breaks/becomes obsolete. In steady state the measure of buyers b is constant, so outflows and inflows must be equal:

$$\eta b \left(\frac{1}{2} + \frac{1}{2} \left(f G_F(p_{L,F}) + (1-f) G_D(p_{L,D}) \right) \right) = \left(\frac{1}{2} - b \right) \alpha.$$

Solving for b we obtain

$$b = \frac{\alpha/2}{\alpha + \eta \left(\frac{1}{2} + \frac{1}{2} \left(f G_F(p_{L,F}) + (1-f) G_D(p_{L,D}) \right) \right)}. \tag{4}$$

If goods are expected to last forever ($\alpha = 0$), then the steady state measure of buyers becomes zero. On the other hand, if goods break instantaneously ($\alpha \to \infty$), the measure of buyers searching for goods becomes one half (recall that half of the buyers prefer one of the varieties over the other).

3.2. *Sellers*

There is a continuum of sellers of mass one. Sellers can produce commodities at a constant marginal cost which we normalize to zero. There is no choice of which variety to produce, so each half of the sellers produce one of the two varieties. They 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.[5] Sellers exit the market after their good is sold and are replaced by new entrants. This implies that the fraction of sellers and buyers actively participating in the market is constant and that the transaction opportunities for sellers arrive at a rate $2\alpha b$, where $b \in (0, 1/2)$ is the measure of buyers with higher preferences over each variety searching for goods (the remaining measure $1 - 2b$ of buyers is consuming the good and therefore not searching for goods).

Sellers discount real profits at the real interest rate r. When analyzing sellers' pricing decisions we can rule out some choices. First, no seller is willing to set a price, either in domestic or foreign currency, higher than the reservation price of a buyer with a high valuation of each variety. 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 reservation price of the buyer with a low valuation of a given variety. The reason is that the seller setting the lowest price can raise it without losing any transactions. Similarly, given our assumption of two varieties, sellers will not post any price between $p_{L,D}$ and $p_{H,D}$ (the

[5]A natural extension is to allow for lower sticker costs that induce price changes in equilibrium.

same applies for reservation prices set in dollars). If a seller did, then it could raise profits by increasing the price, since all buyers with high valuation would not change their purchase decision. This implies that the distribution of initial prices can at most have four prices.

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 π_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).[6] The problem of the seller can be decomposed in two steps. First, for a given currency choice the needs to decide whether to set the high price $p_{H,c}$ or set a price equal to $p_{L,c}$. If the seller sets the low price $p_{L,c}$, she is able to sell to all buyers it meets. If the seller sets the higher price $p_{H,c}$, then she needs to wait either to meet a buyer with a high valuation for the good or wait until inflation erodes the real value of the good so much that even the buyer with a low valuation of the good is willing to purchase it. Second, given this optimal choice, the seller chooses the currency of denomination of the price. By setting the price in foreign currency, it avoids the quicker erosion of the real price due to lower foreign inflation. The cost of setting prices in currency is that $p_{a,F} < p_{a,D}$ for $a = \{L, H\}$.

The seller's expected discount profits of posting a good in currency $c = \{D, L\}$ at the reservation price $p_{L,c}$ and sell to any buyer is given by

$$\begin{aligned} W_{L,c} &= \mathbb{E}_t \left[p_{L,c} e^{-i_c t} \right] \\ &= p_{L,c} \frac{2\eta b}{2\eta b + \rho + \pi_c}. \end{aligned} \tag{5}$$

where $i_c = r + \pi_c$ is the nominal interest rate. By posting the price $p_{H,c}$ the seller is able to sell to buyers with high valuation of the good at a rate ηb during a period of time of length $T_c = \log(p_{H,c}/p_{L,c})/\pi_c$. This is the time it takes for the real value of the nominal price $p_{H,c}$ posted today to be eroded enough by inflation so that it becomes attractive to buyers with a low valuation of the good. After T_c period the real price becomes low enough that the seller

[6]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.

sells to any buyer at a rate $2\eta b$. Thus, the value of setting the high prices is given by

$$\begin{aligned} W_{H,c} &= \mathbb{E}_t\left[p_{H,c}e^{-i_c t}\right] \\ &= p_{H,c}\int_0^{T_c} e^{-i_c t}\eta b e^{-\eta b t}\mathrm{d}t + p_{H,c}\int_{T_c}^{\infty} e^{-i_c t}2\eta b e^{-2\eta b t}\mathrm{d}t \\ &= p_{H,c}\left(\left(1-e^{-(i_c+\eta b)T_c}\right)\frac{\eta b}{\eta b+\rho+\pi_c} + e^{-(i_c+2\eta b)T_c}\frac{2\eta b}{2\eta b+\rho+\pi_c}\right), \end{aligned} \tag{6}$$

where the expectation is taken over the time t of the first transaction opportunity. The optimal choice of currency is the one that delivers the highest value for the seller.

$$W = \max\{W_{L,D}, W_{H,D}, W_{L,F}, W_{H,F}\}.$$

3.3. *Equilibrium Distribution of Prices*

Since sellers post goods at the reservation prices $p_{L,c}$ and $p_{H,c}$ with $c = \{D, F\}$, the distribution of prices of newly posted goods in a given currency has 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 analyze the distribution of prices in both currencies that prevail in a stationary equilibrium. This implies that for any arbitrary interval of time Δt the mass of prices that enter a certain interval should equal the mass of prices that exit the same interval. These conditions are given by

$$G_c(se^{\pi_c\Delta t}) - G_c(s) = \left(1-e^{-2\eta b\Delta t}\right)G_c(s), \forall s \in (0, p_{L,c}) \tag{7}$$

$$G_c(se^{\pi_c\Delta t}) - G_c(s) + \left(\eta b + \eta b G_c(p_{L,c})\right)q_c = \eta b G_c(s) + \eta b G_c(p_{L,c}), \forall s \in [p_{L,c}, p_{H,c}] \tag{8}$$

The left hand side in (7) and (8) is the flow of sellers into the interval $(0, s)$. The inflow rate in (7) is given by the measure of sellers with prices between s and $se^{\pi_c\Delta t}$, which enter the interval $(0, s)$ due to inflation. The inflow rate in (8) 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 q_c of new entrants that post at the price $p_{L,c}$ (the remaining fraction $1 - q_c$ sets a new price equal to $p_{H,c}$). The right hand side in (7) is the flow rate out of the interval $(0, s)$ for $s \in (0, p_{L,c})$, which is given by the measure of all buyers that meet sellers with prices below s during the interval of time Δt. Finally, the right hand side in (8) is the flow rate out of the interval $(0, s)$ for $s \in [p_{L,c}, p_{H,c}]$, which is given by the seller's meeting rate with buyers with a specific preference times the probability that the seller's price is below the reservation price. If we divide both equations by Δt and take the limit as $\Delta t \to 0$ we obtain the following differential equations for the distribution $G_c(\cdot)$:

$$g_c(s)s\pi_c = G_c(s)2\eta b, \forall s \in (0, p_{L,c})$$
$$g_c(s)s\pi_c + \left[\eta b + \eta b G_c(p_{L,c})\right] q_c = \eta b G_c(p_{L,c}) + \eta b G_c(s), \forall s \in [p_{L,c}, p_{H,c}].$$

The solutions of these differential equations are pinned down by the boundary conditions $G_c(p_{H,c}) = 1$ (no seller sets a price above the reservation price of the buyer that values the good the most) and $G_c({p_{L,c}}^-) = G_c({p_{L,c}}^+)$ (the CDF $G_c(\cdot)$ is continuous at price $p_{L,c}$).The resulting price distribution is

$$G_c(s) = \begin{cases} s^{\frac{2\eta b}{\pi_c}} \not{c}_0^c & \text{for } 0 < s < p_{L,c} \\ \\ \frac{q_c - (1-q_c)(p_{L,c}/p_{H,c})^{\eta b/\pi_c}}{2 - q_c - (1-q_c)(p_{L,c}/p_{H,c})^{\eta b/\pi_c}} + s^{\frac{\eta b}{\pi_c}} \not{c}_1^c & \text{for } p_{L,c} \le s \le p_{H,c}, \end{cases} \tag{9}$$

where the constants are given by

$$\not{c}_1^c = \frac{2(1-q_c)\,(p_{H,c})^{-\frac{\eta b}{\pi_c}}}{(2 - q_c - (1-q_c)(p_{L,c}/p_{H,c})^{\eta b/\pi_c})}$$
$$\not{c}_0^c = \frac{q_c + (1-q_c)(p_{L,c}/p_{H,c})^{\eta b/\pi_c}}{{p_{L,c}}^{2\eta b/\pi_c}\,(2 - q_c - (1-q_c)(p_{L,c}/p_{H,c})^{\eta b/\pi_c})}.$$

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) and value of searching (3)
(2) seller's profits (5) and (6)
(3) the cumulative distribution of prices (9)
(4) the fraction of firms selling in currency $c \in \{D, F\}$ and posting price $p_{L,c}$ that satisfies

$$q_c = \begin{cases} 1 & \text{if } W_{L,c} > W_{H,c} \\ \\ x \in [0,1] & \text{if } W_{L,c} = W_{H,c} \\ \\ 0 & \text{if } W_{L,c} < W_{H,c} \end{cases}$$

(5) the fraction of sellers posting in dollars is given by

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

where $W_c = \max\{W_{L,c}, W_{H,c}\}$

(6) and the measure of buyers (4).

3.4. *Equilibrium Characterization*

In this subsection we characterize the equilibrium choices of currency denomination for a particular case of the model with no horizontal differentiation. 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. We work with the following assumption.

ASSUMPTION 1. *Buyers value both type of products equally,* $u_H = u_L$.

In this case reservation prices of the different type of goods are the same in a given currency, $p_{H,c} = p_{L,c}$ for $c = \{F, D\}$, so we can drop the subscript a associated to the good type. This implies that buyers purchase the first commodity they find. While consumers can search, in equilibrium they don't do it (a phenomenon that resembles the 'Diamond Paradox', Diamond (1971)). The mass of buyers actively searching is then given by

$$b = \frac{\alpha}{2(\alpha + \eta)} \tag{10}$$

If goods have are more durable (lower α) there are less buyers actively searching in a stationary equilibrium. This implies that sellers that sell more durable goods will take more time to sell their goods on average since the market is less tight. We formalize this result in the following proposition.

PROPOSITION **1.** *Under Assumption 1, expected time to sell a good is larger for more durable goods.*

All proofs can be found in Appendix B. Using (2), (5) and (10) we obtain an expression for the optimal choice of currency for the seller,

$$f = \begin{cases} 0 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_D}{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_F} < 1+\kappa \\ x \in [0,1] & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_D}{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_F} = 1+\kappa \\ 1 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_D}{\frac{\alpha\eta}{\alpha+\eta}+r+\pi_F} > 1+\kappa. \end{cases} \tag{11}$$

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, sellers are more likely to set prices in foreign currency. If transaction opportunities 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 can come from a lower meeting rate or, as stated in Proposition 1, from a higher good duraibility. We collect these results in the following proposition.

Proposition 2. *If Assumption 1 holds and $\pi^D > \pi^F > 0$, optimal dollarization f is:*

(1) weakly decreasing in κ,

(2) weakly increasing in π^D and weakly decreasing in π^F,

(3) weakly increasing in r,

(4) weakly decreasing in η and α.

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-though, which is a relevant factor in the determination of currency denomination of international prices.[7] 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.

Proposition 2 sheds light on our third empirical finding. When domestic inflation is high, more sellers choose to post prices in foreign currency to avoid a rapid erosion of the real value of their prices. Our results also predict that pricing in foreign currency is more likely in goods that take longer to sell. Proposition 1 argues that these goods are more durable. The following result shows that more durable goods are also more expensive on average. We do this by analyzing how the average price of goods depends on its durability.

PROPOSITION **3.** *Under Assumption 1, for sufficiently low levels of inflation π_D and π_F, the average price of a good is increasing in its durability.*

The intuition behind this result is simple. More durable goods provide a positive utility flow for a longer period of time. This makes buyers willing to pay a higher reservation price for these goods, which in turn increases the average price that they pay in equilibrium. The condition of low inflation rates is needed since they bound the redistributive effects of durability through its effect on the meeting rate. If we combine the results in the three propositions, our theory predicts that more durable goods are more expensive and take longer to sell on average and are more likely to be priced in foreign currency. This is in line with the three empirical findings described in the previous section.

This analysis was carried under the assumption of no horizontal differentiation. The introduction of horizontal differentiation through different type of goods breaks the one-to-one mapping between meetings and transactions. In equilibrium there can be meetings that do not end up in transactions when the buyer meets a seller of the good that she likes

[7]The interaction of differntial 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.

the least that is posted at an excessively high price. This in turn introduces an additional channel through which more durable goods take longer to sell. In addition to having an endogenously less tight markets, more durable goods are characterized by featuring a lower conversion rate of meetings to transactions. In particular, given a meeting a buyer will only be willing to buy the good she likes the least only if its is offered at a relatively lower price. The reason is that the value of waiting to meet a seller that offers the good she likes the most is higher. If the good is more durable, the buyer values more having her most preferred good since she will enjoy the high utility flow for a longer period of time, while she is out of the market.

4. Quantitative Analysis

In this section we calibrate the full model with horizontal differentiation to match key aspects of the distribution of prices and time to sell the goods. We then re-visit our empirical findings using simulated data from our model to assess whether it can account for the patterns observed in the data.

Our model features the market of good of a given durability α that can have two types that are horizontally differentiated. Our dataset features goods of various types both vertically and horizontally differentiated. We introduce vertical differentiation in our model by considering an extended version of our economy that is composed of a continumm of goods with different durabilities with an associated distribution $H(\alpha)$. Each good with a given durability is traded in a segmented market. This allows us to interpret the extended economy as a continumm of replicas of our analyzed economy indexed by the durability of the good and at the same time have more flexibility to better match the data. We parametrize the underlying distribution of durabilities with an exponential distribution with mean $\bar{\alpha}$.

We calibrate our model to a monthly frequency. In continuous time this implies that a time interval of length one is interpreted as one month. The model is parametrized by preference parameters (u_H, u_L, r), parameters related to the distribution of goods and their markets $(\bar{\alpha}, \eta)$ and monetary parameters (π_D, π_F, κ). We calibrate the model to match the features of the Argentinean economy for the period 2003-12.[8] The parameters can be classified into two groups: 1) those that are directly observable in the data or that are frequently used

[8] We calibrate the entire decade since we want the economy to resemble a stationary equilibrium such as the one we consider in the model analysis.

in macro studies, and 2) those that are calibrated to match moments from the data with moments from model-based simulated data.

The calibrated parameters are summarized in Table 1. 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 $\pi_D = 1.17\%$. These values are equivalent to annual inflation rates of 2% and 15%, respectively, which are consistent with inflation rates in the US and in Argentina for the period studied. We normalize the value of u_H.

TABLE 1. Calibrated Parameters

Parameter	Value	Comments/Targets
From Data/Literature		
r	0.33%	Standard value
π_F	0.17%	Average inflation in US
π_D	1.17%	Average inflation in Argentina 2003-12
u_H	1.00	Normalization
Calibrated		
κ	1.25%	Share of prices in foreign currency
$\bar{\alpha}$	6	Moments from time to sell distribution
η	16	Moments from time to sell distribution
u_L	0.99	Moment from distribution of prices

The four remaining parameters $(u_L, \eta, \alpha, \kappa)$ are calibrated to match the following four moments from the data: the share of prices that are posted in foreign currency (which is 5% in the data[9]), the average and standard deviation of time that takes for a good to be sold and the unconditional coefficient of variation prices. The calibrated values are $\kappa = 1.25\%$, $\bar{\alpha} = 6$, $u_L = 0.99$ and $\eta = 16$. While in the joint calibration each parameter can potentially affect all moments, we find that the transaction cost mostly affects the share of prices in foreign currency, the average durability and meeting rate mostly affect the average and standard deviation of time to sell and u_L mostly affects the dispersion of prices. Table 4 in Appendix

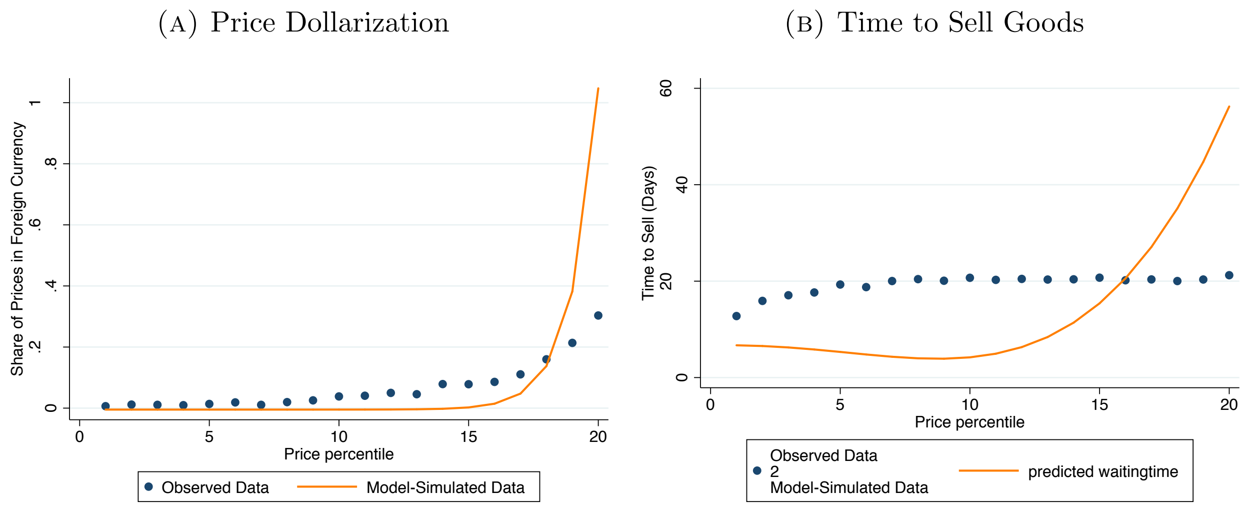
[9]This number is mostly representative of the level of price dollarization in Argentina in the last years of our sample, since most of the observations in our data are from these years given the significant growth in the usage of the platform over time. For the early years in our sample, the level of price dollarization is closer to 15%.

C reports the data moments and their model counterparts used in the joint calibration. All moments are well-approximated, with the exception of the coefficient of variation prices, which in the model is half of its value in the data.

With our calibrated model we then assess the ability of the model to replicate our empirical findings from section 2. To do so we simulate data generated by the model. In particular, we first simulate 100 different durabilities from the distribution $H(\bar{\alpha})$, then we compute the equilibrium associated to each durable good and then simulate 10,000 sellers. 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 graphs. The empirical findings were not targeted by the calibration so they can be used to gouge the model's performance.

Results are shown in Figure 4. The model can reproduce quantitatively the first empirical finding (see Panel 4a). In the model, like in the data, more expensive goods are more likely to be priced in foreign currency. The prices that are posted in foreign currency are those in the top decile. In the data, while the relationship between the share of prices in foreign currency and the price percentile is also exponential, we observe positive shares for the top quartile of prices. The model can also account qualitatively for the second empirical finding but not quantitatively (see Panel 4b). In the model the positive relationship between prices and time to sell a good is observed for the goods that are sold in the top quartile. In the data, the relationship between prices and time to sell is more uniform for all price percentiles and also milder than in the model. The fact that the relationship between prices and time to sell a good in the data is positive but weak suggests that higher prices are associated with additional attributes of goods that are not captured by durability.

FIGURE 4. Price Dollarization and Time to Sell: Model and Data

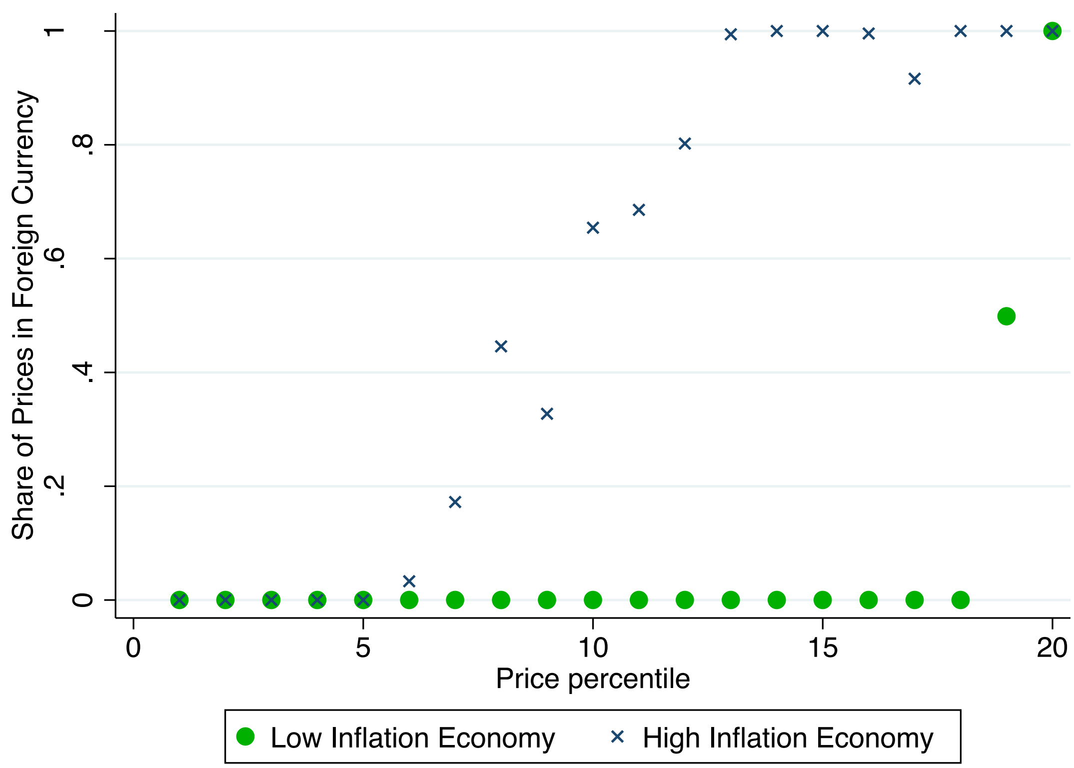


Notes: Panel (A) shows the fraction of original prices set in foreign currency, within each of twenty bins of equal frequency. Panel (B) shows the average time to sell of a good for the same bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. The blue dots are computed with observed data on posted prices for Argentina. The orange solid line corresponds to the exponential fit of relationship generated by simulated data.

We also analyze how the patterns of the currency denomination price change in the model in responses to changes in the inflation rate of domestic currency. We simulate data from two economies with same underlying parameters and different inflation rates. One economy features a low annual inflation rate of 10%, which is the inflation rate observed in Argentina in the years 2005-06, and another with a high annual inflation rate of 22%, which is the inflation rate observed in Argentina in the year 2002-03. We then compare the patterns of the currency denomination of prices in both economies.

Results are shown in Figure 5. In the model of a low-inflation economy the share of prices in foreign currency is 7%, close to the 10% share observed in Argentina during the years 2005-06. In the model of a high-inflation economy this share is 55%, compared to an observed share of 27% in Argentina in 2003. 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.

Figure 5. Currency Denomination of Prices and Inflation in the Model



Notes: This figure shows the fraction of original prices set in foreign currency using model-simulated data, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. The blue squares correspond to an economy with an annual inflation of 22%. The green dots correspond to an economy with an annual inflation of 10%. The remaining parameters are set in their calibrated values.

The model also predicts that if an economy experiences a process of disinflation, the accompanying process of dedollarization occurs gradually at the top price percentiles and then gradually expands to middle price percentiles. The sellers that first change the currency denomination of their good are the ones that sell the most expensive goods. We denominate this pattern a process of *dedollarization from the top*. A similar pattern is observed in the dedollarization process observed in Argentina from 2003 to 2006. According to Figure 3, the largest changes in the share of prices in foreign currency is observed for the 7th to 9th decile of the price distribution.

The fact that the model over-estimates changes in the share of prices in foreign currency in response to changes in domestic inflation suggests that other forces that are not in the model are relevant when deciding the currency denomination of prices. In particular, our setup ignores fluctuations in the exchange rate which in the data is significant and, as pointed in the literature on international prices, is also a relevant margin that can account for currency choices.

5. Conclusion

We use a large dataset on price setting in Argentina and Uruguay to document that: i. a significant fraction of prices are posted in foreign currency, ii. more expensive goods are more likely to be posted in foreign currency and also take longer to sell, and iii. the share of prices in foreign currency increase when domestic inflation increases.

We then rationalize these facts using a model of price-setting in multiple currencies in markets with search frictions. 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 loosing certain willingness to pay from buyers. The sellers of durable goods have the strongest incentives to price in foreign currency since these goods take longer to sell. As in the data, the share of prices in foreign currency decreases when inflation decreases. This process of dedollarization is characterized by most expensive goods changing their currency denomination, leading to changes in relative prices of goods with different durabilities.

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Appendix A. Empirical Appendix

A.1. *Additional Tables*

Table 2 shows the estimates of a set of regressions of a dummy that takes the value of one if the price is posted in foreign currency or zero if it is posted in local currency. The independent variables differ for each column. The first column regresses currency choice only on category-country fixed effects. The second column regresses currency choice only on time fixed effects. The third column regression includes both time and country-category fixed effects. Columns (4) to (6) includes the value of the original price of the post measured in local currency interacted with a country dummy and differ on the inclusion of fixed effects. The positive coefficients are consistent with the first empirical finding: higher prices are associated with a higher likelihood of being denominated in foreign currency. Columns (7) to (9) also include a measure of the number of days that passed since the price was posted until the transaction was made, interacted with country dummies. Each of these columns differ on the inclusion of fixed effects.[10] The positive coefficients associated to the time to sell variable is consistent with the second empirical finding.

To estimate the second set of regressions we use our dataset to construct a panel of certain variables by taking averages at a monthly frequency for a given country and category. The micro variables we compute are the average share of prices in foreign currency, and the average real value of prices. We complement this dataset with the following macro variables at a monthly frequency:

- Inflation: corresponds to the annual inflation rate. For the case of Argentina post-2007 the we compute the annual inflation rate by taking the average of a set of measures from independent and private institutions (see Drenik and Perez (2016)).
- Devaluation: corresponds to the annual devaluation rate of the nominal exchange rate vis-a-vis the US dollar.
- Dollarization of deposits: corresponds to the share of bank deposits that are denominated in dollars.
- GDP (cycle): corresponds to the de-trended real GDP. This variable is computed at the quarterly frequency.

[10]For those posts that had more than one quantity available for sale we computed the time to sell as the average time to sell of all the transactions associated to that post. Those posts that did not have a transaction associated to it were excluded.

- Inflation volatility: corresponds to the standard deviation of annual inflation over rolling window of 3 years.
- Exchange rate volatility: corresponds to the standard deviation of the nominal exchange rate vis-a-vis the US over rolling window of 3 years.
- Capital controls: corresponds to an annual index of capital controls from Fernandez et al. (2016). A higher index reflect a larger degree of capital controls. This variable is computed at an annual frequency.

Table 3 shows the estimates of a set of regressions of the share of prices in foreign currency on average real prices and the set of macro controls. Columns (1) to (3) shows the regressions that include only category fixed effects and the real average prices as independent variables for Argentina, Uruguay and both countries, respectively. In all specifications a higher average real price is associated with a higher share of prices in foreign currency.

Columns (4) to (6) shows the regressions in which we include the set of macro variables, in addition to the real average price and category fixed effects. The fourth column corresponds to the regression for Argentina, the fifth to the regression for Uruguay and the last to the regression with pooled data from both countries. In all three regressions we find that higher inflation rates has associated a higher share of prices in foreign currency, a result that is consistent with the predictions of our model. A higher rate of deposit dollarization has associated a higher share of prices in foreign currency, according to the pooled regression. If we interpret as a higher deposit dollarization facilitating access to foreign currency then this would be equivalent to lowering the transaction cost κ, which would lead to a higher share of prices in foreign currency. Higher inflation volatility also has associated a higher share of prices in foreign currency. If inflation is more volatile then the real value of prices is more volatile if sellers price in domestic currency. If sellers or buyers are risk averse, this would make domestic currency pricing less attractive. Additionally, a higher index of capital controls is associated with a lower share of prices in foreign currency. More restrictive capital controls make it more difficult for agents to obtain foreign currency and is associated with a higher transaction cost in our model. This variable is particularly relevant for the case of Argentina, that implemented severe capital controls starting in 2008 that eventually gave rise to a parallel market for foreign currency. Finally, results also indicate that the coefficients associated to the devaluation rate, exchange rate volatility and the GDP have opposite signs for Uruguay and Argentina.

TABLE 2. Currency Choice Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Original Price$_{Arg}$ (1,000)				0.0359***	0.0434***	0.0396***	0.0357***	0.0448***	0.0396***
				(0.0000502)	(0.0000508)	(0.0000500)	(0.0000502)	(0.0000509)	(0.0000500)
Original Price$_{Uru}$ (1,000)				0.0305***	0.0387***	0.0305***	0.0305***	0.0357***	0.0305***
				(0.0000336)	(0.0000317)	(0.0000333)	(0.0000336)	(0.0000329)	(0.0000332)
Time to Sell$_{Arg}$							0.000139***	0.000312***	0.000530***
							(0.00000270)	(0.00000276)	(0.00000274)
Time to Sell$_{Uru}$							0.000718***	0.00275***	0.00113***
							(0.00000929)	(0.00000726)	(0.00000925)
N	26034190	26034190	26034190	26034190	26034190	26034190	26008797	26008797	26008797
R^2	0.125	0.024	0.138	0.168	0.097	0.184	0.168	0.102	0.186
Time FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Categ.-Country FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes

Notes: The dependent variable is a dummy that takes the value of 1 if the price is set in dollars or zero if it is set in local currency. Standard errors in parentheses. $*$, $**$, and $***$ represent statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3. Dollarization Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Real Avg. Price	0.0670***	0.104***	0.0860***	0.0606***	0.0987***	0.0820***
	(0.000531)	(0.000898)	(0.000476)	(0.000536)	(0.000884)	(0.000472)
Inflation				0.0233***	0.314***	0.0427***
				(0.00525)	(0.0271)	(0.00605)
Devaluation rate				0.0606***	-0.0765***	-0.115***
				(0.0219)	(0.0275)	(0.0159)
Dol. deposits				-0.000140	0.00689***	0.00516***
				(0.000170)	(0.000431)	(0.0000922)
Gdp (cycle)				-0.119***	0.161*	0.276***
				(0.0215)	(0.0829)	(0.0189)
Inflation vol.				0.165***	0.810***	0.516***
				(0.0151)	(0.0796)	(0.0141)
Exch. rate vol.				0.0839***	-0.214***	0.0568***
				(0.00330)	(0.0192)	(0.00393)
Capital control				-0.0131***	-0.430***	-0.109***
				(0.00446)	(0.0927)	(0.00432)
N	141874	66090	207964	141874	66090	207964
R^2	0.742	0.745	0.782	0.748	0.759	0.790
Specification	Argentina	Uruguay	Pooled	Argentina	Uruguay	Pooled
Category FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is a dummy that takes the value of 1 if the price is set in dollars or zero if it is set in local currency. Standard errors in parentheses. $*$, $**$, and $***$ represent statistical significance at the 10%, 5%, and 1% level, respectively.

A.2. *Additional Figures*

Figure 6. Share of Prices in Foreign Currency over Time

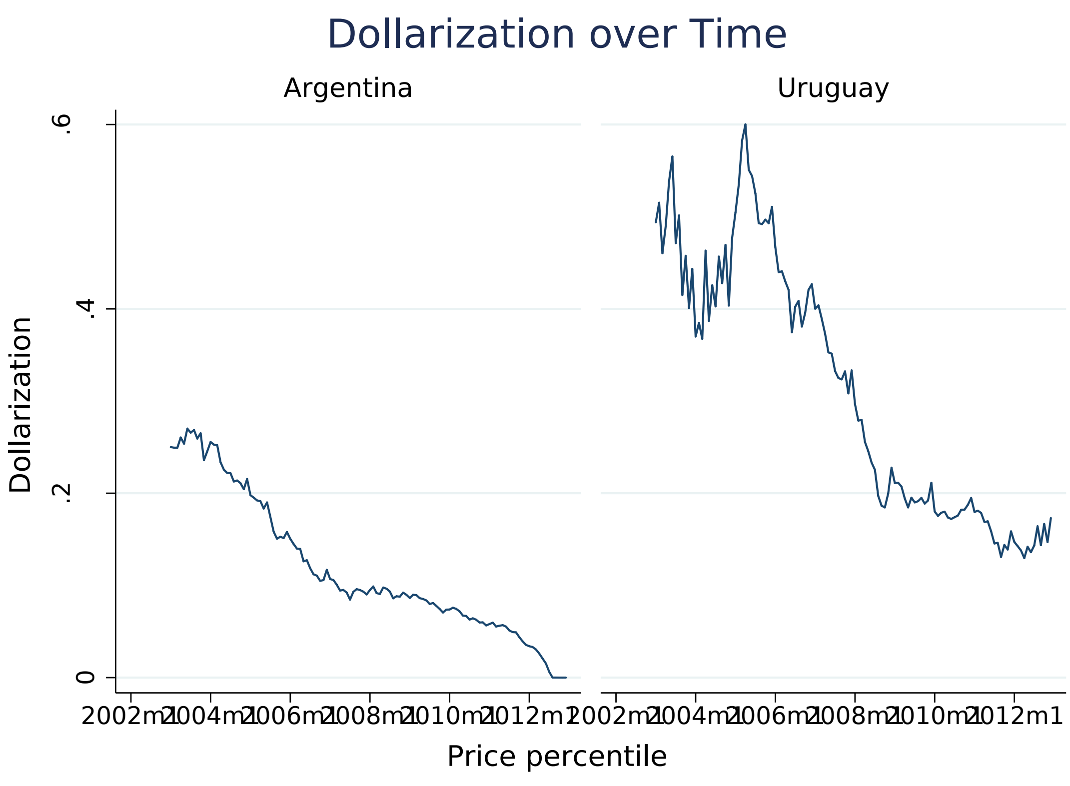
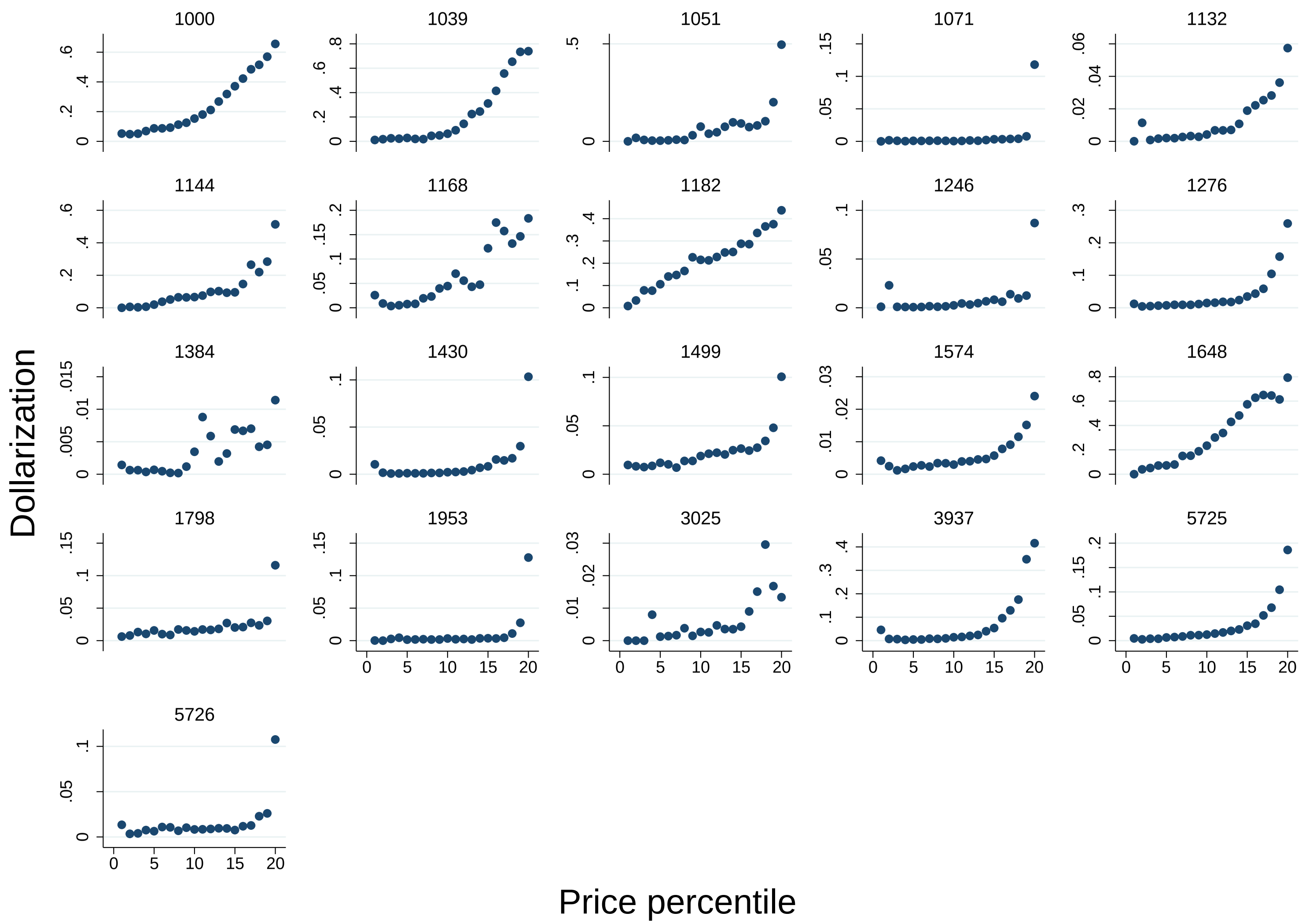
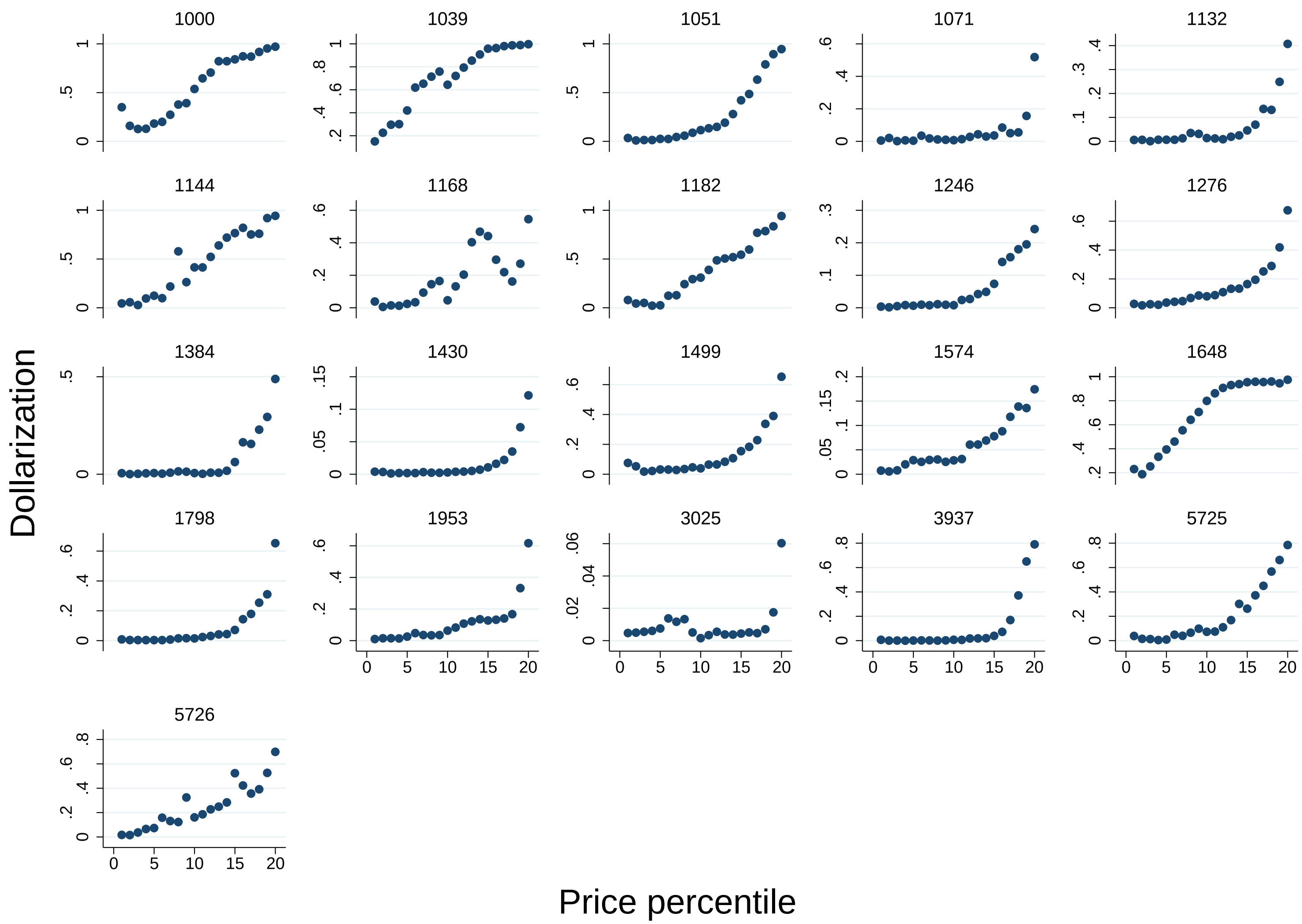


Figure 7



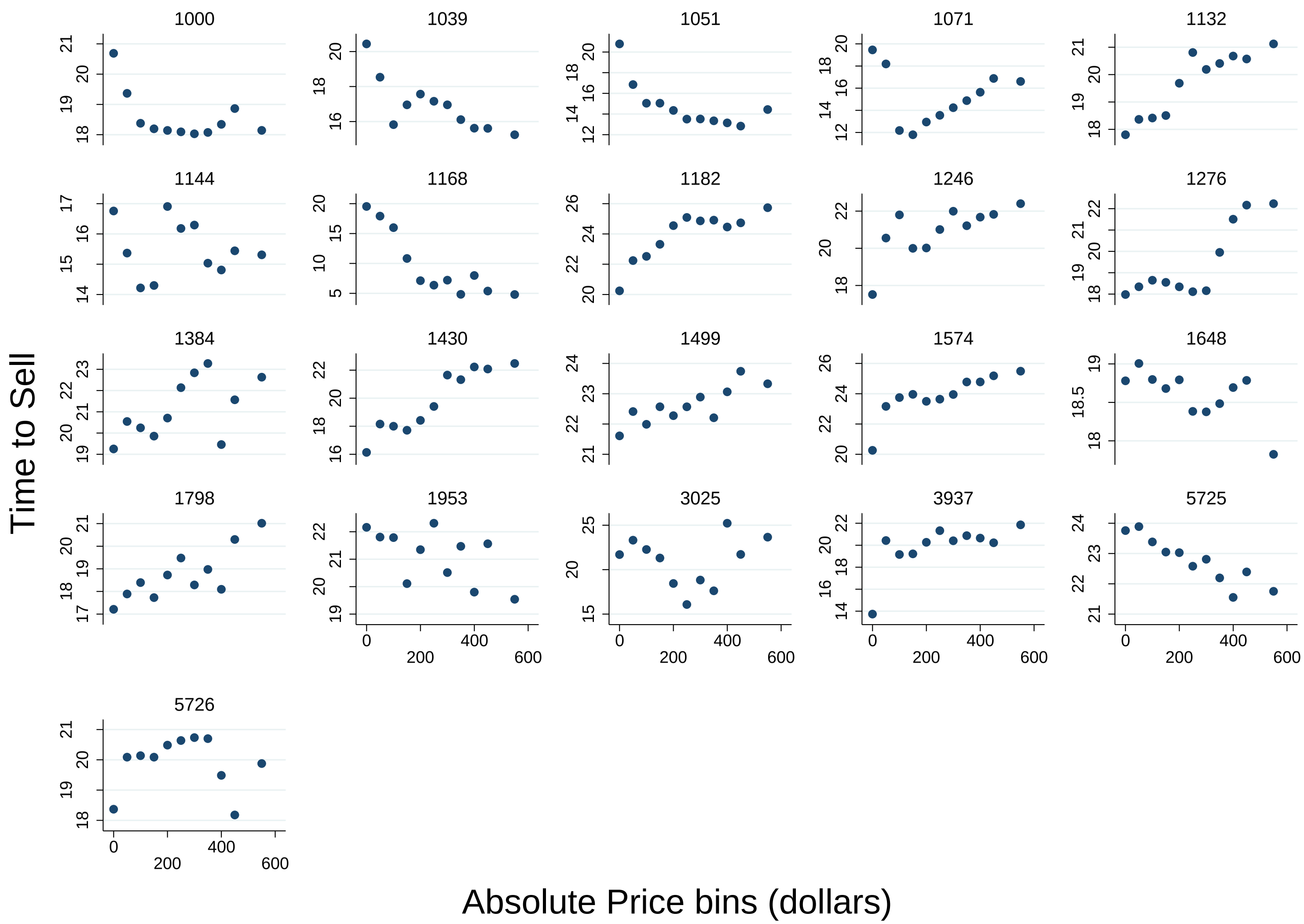
Notes: This figure shows the fraction of original prices set in foreign currency as opposed to local currency in Argentina, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. Each figure shows the degree of dollarization for goods categorized at level 1 by the platform.

FIGURE 8



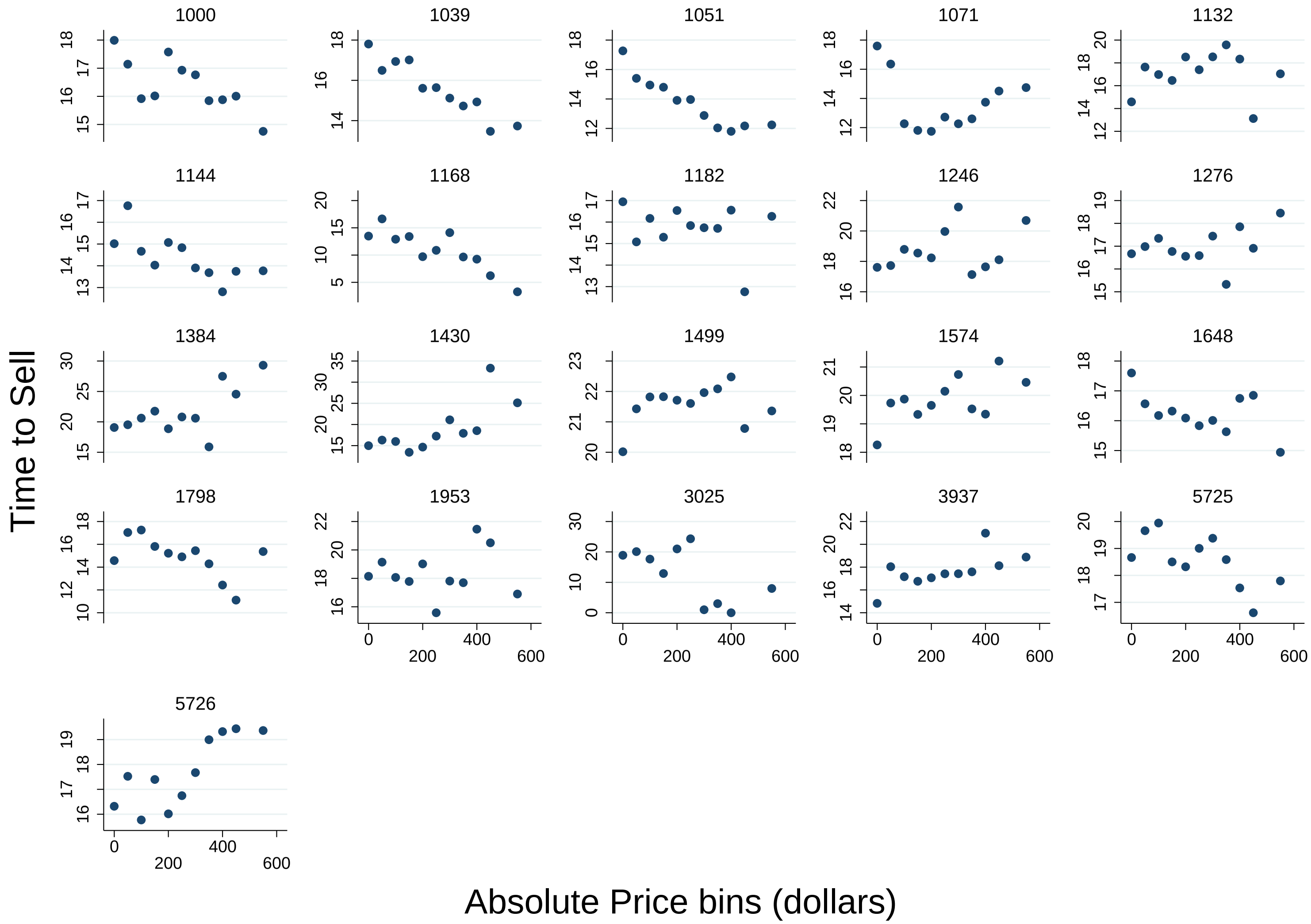
Notes: This figure shows the fraction of original prices set in foreign currency as opposed to local currency in Uruguay, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. Each figure shows the degree of dollarization for goods categorized at level 1 by the platform.

Figure 9



Notes: This figure shows the number of days it takes the average good to be sold in Argentina, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. Each figure shows the degree of dollarization for goods categorized at level 1 by the platform.

Figure 10



Notes: This figure shows the number of days it takes the average good to be sold in Uruguay, within each of twenty bins of equal frequency. These bins are computed by separating prices ordered from low to high into twenty bins. Each figure shows the degree of dollarization for goods categorized at level 1 by the platform.

Appendix B. Theoretical Appendix

B.1. *Proof of Proposition 1.*

If $u_L = u_H$ we have that there is only one reservation price by currency, $p_{H,c} = p_{L,c}$ for $c = \{F, D\}$. 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 one. Therefore, the expected time to sell is the expected time for a meeting to occur

$$\begin{aligned}\mathbb{E}[\tau] &= \int_0^\infty 2\eta b\tau \exp(-2\eta b)\, \mathrm{d}\tau \\ &= \frac{1}{2\eta b} \\ &= \alpha^{-1} + \eta^{-1},\end{aligned}$$

where in the last equality we used equation (10). It follows that the expected time to sell is decreasing in α.

B.2. *Proof of Proposition 2.*

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

$$W_c = p_c \frac{2\eta b}{2\eta b + \rho + \pi_c}. \tag{12}$$

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

$$f = \begin{cases} 0 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} < 1+\kappa \\ x \in [0,1] & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} = 1+\kappa \\ 1 & \text{if } \frac{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_D}{\frac{\alpha\eta}{\alpha+\eta} + r + \pi_F} > 1+\kappa. \end{cases} \tag{13}$$

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.

B.3. *Proof of Proposition 3.*

If $u_L = u_H$ the equilibrium distribution of prices simplifies to

$$G_c(s) = \left(\frac{s}{p_c}\right)^{\frac{2\eta b}{\pi_c}} \quad \text{for } 0 < s < p_c,$$

and the average price is given by $\bar{p}_c = p_c \frac{2\eta b}{2\eta b + \pi_c}$. We prove the proposition for the case of prices in domestic currency. A similar argument can be used for prices in foreign currency using the fact that in equilibrium $p_D = (1+\kappa)p_F$.

Using equation (10) we can express average price in domestic currency as

$$\bar{p}_c = p_D \frac{\eta\alpha}{\eta\alpha + \pi_D(\alpha+\eta)}$$

To prove our result we show that $\frac{\partial \log \bar{p}_D}{\partial \alpha} > 0$ when $\pi_c \to 0$ for both currencies. This derivative is given by

$$\frac{\partial \log \bar{p}_D}{\partial \alpha} = \frac{1}{\alpha} - \frac{\eta + \pi_D}{\alpha(\eta+\pi_D) + \eta\pi_D} - \frac{\partial \log p_D}{\partial \alpha}.$$

The difference between these two terms converge to zero when π_D approaches zero. We now compute the last term and show that it is positive when both inflation rates are small enough. Using (9) and solving for the integrals in (3), we can express the reservation price as

$$p_D = \frac{u}{\alpha+\rho} - \frac{\rho}{\alpha+\rho}\left[\frac{\eta}{\rho}\left(f p_F \frac{\pi_F}{2\eta b + \pi_F} + (1-f)p_D \frac{\pi_D}{2\eta b + \pi_D}\right)\right]$$

Using $p_D = (1+\kappa)p_F$ and solving for p_D we obtain

$$p_D = \frac{u}{\alpha + \rho + \eta\left(f \frac{\pi_F(1+\kappa)}{\frac{\alpha\eta}{\alpha+\eta}+\pi_F} + (1-f)\frac{\pi_D}{\frac{\alpha\eta}{\alpha+\eta}+\pi_D}\right)}$$

Taking derivatives on the log of the reservation price yields

$$\frac{\partial \log p_D}{\partial \alpha} = -\frac{1 + \eta\left(f\pi_F(1+\kappa)\frac{\partial\left(\frac{\alpha\eta}{\alpha+\eta}+\pi_D\right)^{-1}}{\partial\alpha} + (1-f)\pi_D\frac{\partial\left(\frac{\alpha\eta}{\alpha+\eta}+\pi_D\right)^{-1}}{\partial\alpha}\right)}{\alpha + \rho + \eta\left(f \frac{\pi_F(1+\kappa)}{\frac{\alpha\eta}{\alpha+\eta}+\pi_F} + (1-f)\frac{\pi_D}{\frac{\alpha\eta}{\alpha+\eta}+\pi_D}\right)}$$

This expression converges to $(\alpha+\rho)^{-1}$ when π_D, π_F approach zero. Therefore, we have that

$$\lim_{\pi_D,\pi_F \to 0} \frac{\partial \log \bar{p}_D}{\partial \alpha} < 0.$$

Appendix C. Quantitative Appendix

Table 4. Model Fit

Moment	Data	Model
Share of prices in foreign currency	5.0%	7.8%
Average time to sell goods (in days)	17	14
Std. deviation of time to sell goods (in days)	17	27
Coefficient of variation of prices	2.70	1.09