# Effects of a Mandatory Local Currency Pricing Law on the Exchange Rate Pass-Through*

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**Abstract**

We analyze whether a 2004 law requiring firms to express prices in the local currency in Peru, which had experienced a high degree of price dollarization, affected the exchange rate pass-through (ERPT). We hypothesize that the enactment of the law introduced menu costs for those firms that set their prices in dollars, prompting several of them to make a permanent switch from dollars to soles. Using disaggregated consumer price index (CPI) data, we find that after the enactment of the law, the ERPT was completely offset for non-durable goods with dollarized prices, and partially offset for durable goods with dollarized prices. These effects could be due to different shares of the imported content, market power and varying mark-ups.

Keywords: exchange-rate pass through, price dollarization, local currency pricing

JEL Codes: D04, D49

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**Resumen**

En este documento se analiza si la ley 28300, promulgada en 2004 y que obliga a las empresas a publicar la lista de sus precios en moneda local en el Perú, afectó el traspaso del tipo de cambio sobre los precios. Se postula que la promulgación de la ley introdujo costos de menú para las firmas que publicaban sus precios en dólares, haciendo que muchas de ellas pasen a publicar sus precios en soles. Usando datos desagregados del índice de precios al consumidor (IPC), se encuentra que luego de la promulgación de la ley el traspaso cayó completamente para los bienes no durables con precios dolarizados, y cayó parcialmente para bienes durables con precios dolarizados. Estos efectos podrían darse debido diferentes proporciones de contenido importado en los insumos, distintos niveles de poder de mercado y a los márgenes cambiantes.

Palabras Clave: traspaso de tipo de cambio, dolarización de precios, precios en moneda local

Códigos JEL: D04, D49

# 1. Introduction

The hyperinflation and several macroeconomic imbalances endured by Peru in the late 1980s caused a process of price dollarization in the country's economy (Quispe, 2000).[1] Within a context of high inflation, pricing in dollars protects firms against the risk of depreciation and the loss of the real value of their goods and services (Armas, 2016; Drenik and Perez, 2018). The flip side is that consumers bear the depreciation risk because they are exposed to the variations in the exchange rate through the prices they pay.

The degree to which prices respond to exchange rate movements is known as the exchange rate pass-through (ERPT). For Peru's partially dollarized economy, previous works have found that the ERPT went from levels ranging from 30 to 50 percent in the 1990s to levels ranging from 20 to 0 percent the following decade.[2] This reveals how important exchange rate movements are in Peru. However, the fact that the ERPT fell throughout the 2000s also suggests changes in how the ERPT is determined.

In this paper we measure whether or not a law in force in Peru to tackle price dollarization explains part of the reduction of the ERPT over the 2000s. Law 28300, first proposed by the Central Reserve Bank of Peru (CRBP) and approved in 2004, was a modification to the Consumer Protection Law, which stipulated that all prices be denominated in soles, the local currency (and optionally in any other currency).

Using disaggregated consumer price index (CPI) data, we find that the enactment of the law reduced the overall ERPT. Moreover, we find evidence of differentiated effects of the law on the ERPT. Specifically, we find a complete offset for non-durable goods with dollarized prices, and a partial offset for durable goods with dollarized prices. In addition, we utilize the share of imported content as a proxy for the sensitivity of costs to exchange rate movements. We find that greater imported content implies a larger ERPT. After controlling for the law on local currency pricing, we observe a reduction in the effect of imported content on the ERPT. The results are robust when we control for two different events that occurred in the Peruvian economy alongside the enactment of the law: the adoption of the IT regime and the broader de-dollarization process.

To the best of our knowledge, this is the first paper to provide an analysis of the Peruvian ERPT using disaggregated

[1] For Peru, there are studies on overall dollarization (Armas et al., 2007) as well as on more specific issues such as financial dollarization (Castillo et al., 2016; Garcia-Escribano, 2010; Vega, 2015), and price dollarization (Castellares, 2017; Contreras et al., 2016). For a macroeconomic view on the effects of dollarization on small open economies, see Castillo et al. (2013), and Chang and Velasco (2002).

[2] Miller (2003) finds that the ERPT on consumer prices is situated at around 7 percent and 16 percent when the effect on consumer price is considered. Winkelried (2003) finds the ERPT related to consumer prices is highly non-linear and depends on the phase of the business cycle, the size of the exchange rate movements, and the inflation dynamics. Using rolling window estimations, Winkelried (2014) notes that the ERPT fell from around 50 percent at the end of the 1990s to around 10 percent a decade later. Perez Forero and Vega (2015) observe a non-linear 1-year accumulated ERPT of approximately 20 percent for depreciations and 10 percent for appreciations. Maertens et al. (2012) analyze how the ERPT interacts with the inflation targeting regime. They find that once the inflation targeting regime was adopted, the 1-year ERPT for the CPI fell from 30 percent to 0 percent, while the long-run ERPT fell from 43 percent to 6 percent.

CPI data, as previous ERPT studies for Peru were carried out at an aggregate level. Moreover, this is also the first paper to discuss the effects of law 28300 on the ERPT.[3]

The structure of the paper is as follows. In the second and third sections we explain the price dollarization process in Peru and the law enforcing local currency pricing. In the fourth section we present a brief literature review. In the fifth section we discuss our identification strategy with regard to the law's effects on the ERPT. In the sixth section we provide details on the data. In the seventh section we report the results of the estimations. In the eighth section we present the results of the robustness checks. Finally, in the ninth section we conclude.

## 2. Price dollarization in Peru

After a period of hyperinflation in the late 1980s and early 1990s, the Peruvian economy progressively dollarized as the value of the local currency, the sol, fell.[4] Within this context, many firms decided to set their prices in dollars.

As an example of price dollarization, Figure 1 shows advertisements typical of the kind published before the enactment of the law, from 1995 to August 2004, taken from El Comercio, one of the main Peruvian newspapers. The advertisements show that a significant number of prices were set in US dollars ($) rather than the local currency, (S/.).[5]

Figure 1: Examples of price dollarization


Source: El Comercio.

Based on advertisements from El Comercio, we classify goods and services into those with dollarized prices and those with non-dollarized prices for the 10 years preceding the enactment of the law. To this end we use CPI data, which is

[3]The only paper to have analyzed the effects of the law is Montoro (2006), which finds that the correlation between the exchange rate and price indices for various goods and services collapsed after the enactment of the law.

[4]In Peru, dollarization occurred at three different levels: financial dollarization, transactional dollarization and price dollarization (Montoro, 2006).

[5]Until 2016, the symbol for the sol was "S/.". Since 2017, the symbol used for the currency has been "S/" without the point.

composed of price sub-indices that follow a hierarchical order: from 6 digits (the most-disaggregated groups) to 1 digit (the most-aggregated groups). Then, we adopt the following criteria:

1. We obtain information taken from advertisements published in El Comercio between 1995 and August 2004.
2. We identify which advertisements show prices in soles, and which in dollars.
3. We match the advertisements to each of the 174 price indices at the 6-digit CPI classification.
4. We aggregate the 6-digit price indices into the 4-digit CPI classification, composed of 55 price indices.
5. We consider a 4-digit price index to be dollarized if 15 percent or more of the 6-digit price indices that comprise it are priced in dollars.

Table 1 presents the dollarized price indices at the 4-digit CPI level based on our criteria. It also shows the dollarized goods and services further divided into three categories: non-durable goods, durable goods, and services. The set of non-durable goods with prices denominated in dollars includes mostly items sold in department stores and supermarkets. The group of durable goods includes processed items, mostly technology-intensive and not produced in Peru. Lastly, the group of services denominated in dollars includes mostly services used by relatively high-income consumers (see Figure 12 in the Appendix).

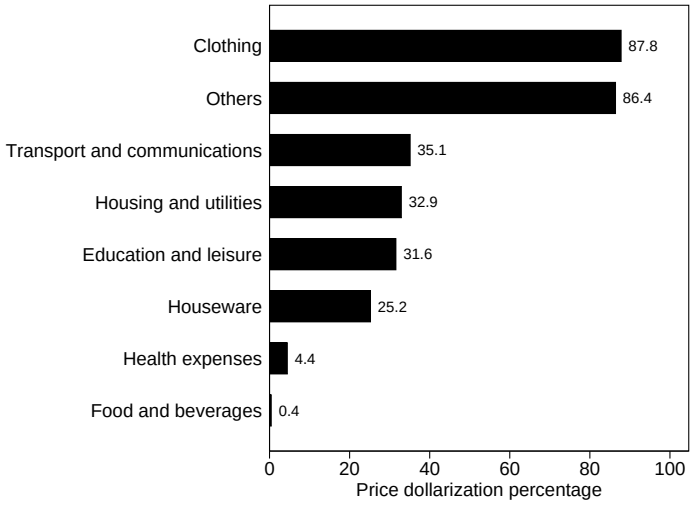
Table 1: Goods and services with dollarized prices (1995-2004)

| | |
|---|---|
| Non-durable goods | alcoholic beverages; clothing and textiles; personal care items; shoes |
| Durable goods | electrical appliances; electronic equipment; furniture; jewelry; tableware; therapeutic equipment; vehicles |
| Services | air transportation; entertainment; ground transportation; hotels; housing rental and home improvement; insurance; personal care services; postal and telephone services; tourist services |

Source: El Comercio.
Note: The classification uses 4-digit price indices. We consider a 4-digit price index to be dollarized if 15 percent or more of the 6-digit price indices that comprise it are priced in dollars, according to the advertisements published in El Comercio between 1995 and August 2004. Therefore, it is possible that some of the individual prices that compose these dollarized 4-digit price indices were actually denominated in soles. We further discuss this in the data section.

Figure 2 displays the aggregated price indices at the 1-digit CPI classification. The groups with the largest degree of price dollarization were clothing (88 percent) and others (86 percent), which includes most of the dollarized services.

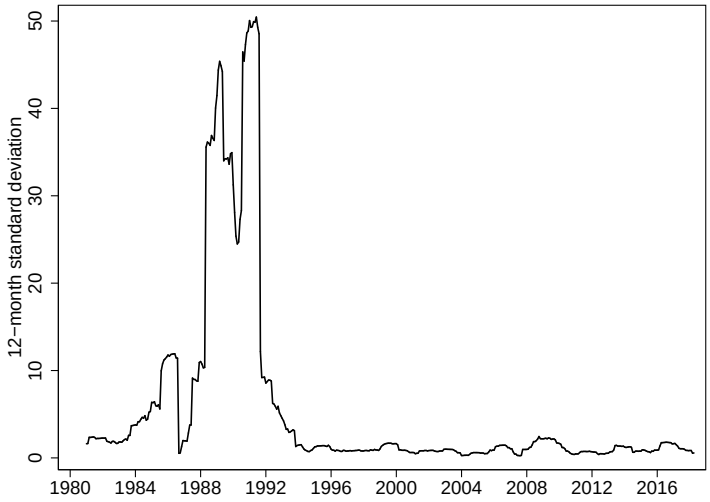
Figure 2: Price dollarization by category (1995-2004)




Source: Peruvian National Statistics Institute (INEI).
Note: These are 1-digit price index groups. The values show the percentage of dollarized prices among the goods and services that compose each category according to the El Comercio advertisements between 1995 and August 2004.

Figure 3 shows the standard deviation of the monthly exchange rate variation for the previous 12 months. The month-to-month volatility of the exchange rate was very high during the late 1980s and early 1990s. This could be one of the reasons for price dollarization in Peru, since firms look to set their prices in the more stable currencies so as to prevent the loss of real value (Drenik and Perez, 2018).[6]

Figure 3: 12-Month standard deviation of the monthly exchange rate variation

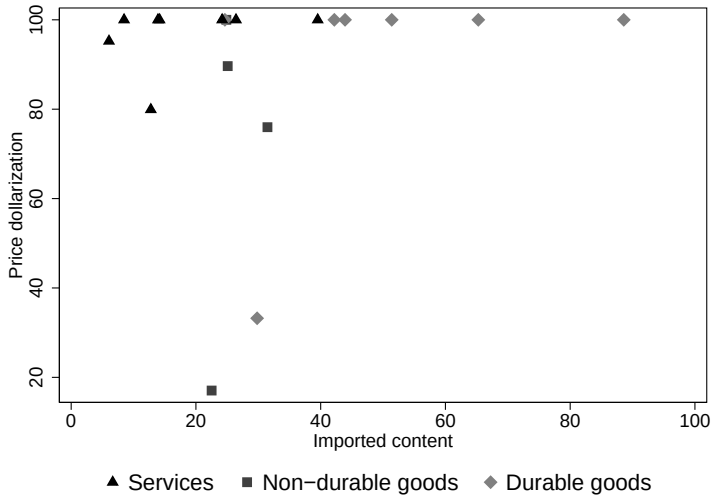



Source: Peruvian National Statistics Institute (INEI).
Note: The figure shows the evolution of the standard deviation of the monthly exchange rate variation for the previous 12 months.

[6]The international economics literature reaches a similar conclusion, finding that exporters invoice their goods abroad in the less volatile currencies. See Devereux et al. (2004), Donnenfeld and Haug (2008), Engel (2006), Gopinath et al. (2010).

A high correlation between the exchange rate and prices through imported input costs is another stylized fact for Peru. Using data from the 2007 input-output table, we define imported content as the share of imported consumption (including intermediate and final goods) corresponding to each price index.[7] The imported content works as a proxy for dollarized costs, as most of the Peruvian imports are priced in dollars.[8] According to Figure 4 there is a positive relation between price dollarization and imported content. This could be a second reason for price dollarization in Peru, with firms setting prices in dollars as a means of paying for their inputs (Armas, 2016; Contreras et al., 2016). In contrast, non-dollarized price indices have lower average imported content (see Figure 13 in the Appendix).

Figure 4: Price dollarization and imported content




Source: Peruvian National Statistics Institute (INEI).
Note: The figure presents information for 19 of the 20 goods and services with dollarized prices listed in Table 1. Imported content is defined as the percentage of imported intermediate or final goods corresponding to each input-output table category for 2007. These categories are then matched with the 4-digit price indices. The price dollarization data corresponds to the period from January to August 21, 2004. The only omitted price index corresponds to postal and telephone services, for which we did not record any dollarized prices in 2004.

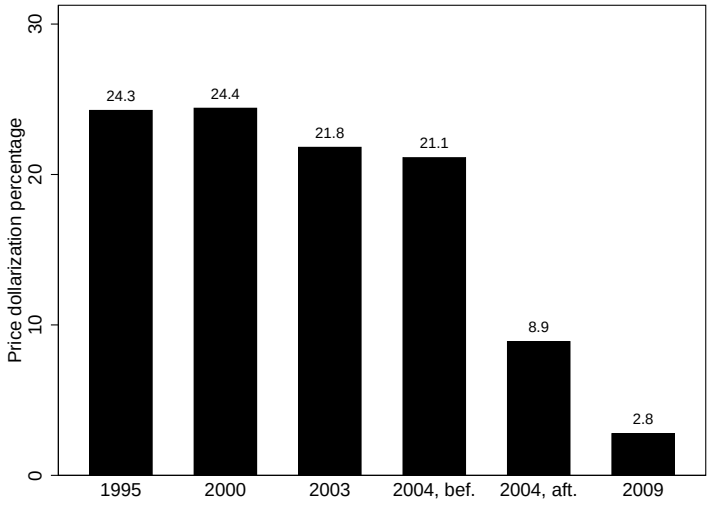
Figure 5 presents the evolution of price dollarization over time. The reported percentages are the proportion of the CPI that was dollarized in each year. From 1995 to August 2004, the total price dollarization exceeded 20 percent of the CPI. Then, there was a sudden drop in 2004. The cut-off date is August 22, the date the law on local currency pricing went into effect. As we discuss in the next section, firms quickly changed their pricing currency upon enactment of the law, reducing the level of price dollarization by more than half. By 2009, 5 years after the law was enacted, the level of price dollarization was just 3 percent.[9]

[7] Carriere-Swallow et al. (2016) propose a similar measure.

[8] Castellares (2017) finds 88 percent of the 2016 Peruvian imports were invoiced in dollars.

[9] After the law some firms began simultaneously posting prices in soles and in dollars for the same good or service, which fully complies with the law. The percentages for 2004 after the law and 2009 correspond mostly to these firms.

Figure 5: Price dollarization over time




Source: Peruvian National Statistics Institute (INEI).
Note: The percentages represent the part of the headline CPI that was dollarized. The "2004, Before" label refers to the period from January to August 21, during which the law was not in effect. The "2004, After" label refers to the period from August 22 to December, during which the law was in effect.

# 3. A mandatory law on local currency pricing

In July 2004, following a proposal from the CRBP, the Peruvian congress enacted Law 28300, which went into effect on August 22, 2004. This was a modification of the Consumer Protection Law, which stipulated that all prices be displayed in soles (and optionally in any other currency), as a way of curbing price dollarization.[10] In practice, this law introduced menu costs for those firms that set their prices in dollars, prompting several of them to make a permanent switch from dollars to soles for the denomination of certain goods and services.[11] Thus, the law changed the pricing behavior of Peruvian firms.[12]

Figures 6 and 7 provide an example of how the law worked. They present the same advertisement from the same store selling the same goods, but at two different moments. The first advertisement, published before the law went into effect (August 16, 2004), shows prices in dollars. The second advertisement, published after the law went into effect (August 28, 2004), exhibits prices in soles.

[10] The period between the law's proposal and approval was barely a month, so firms could not anticipate the effects of this law. In addition, this law seemed of minor interest since there was no news or discussion about it in the media.

[11] Since these firms must change their price tags in soles each time the exchange rate moves.

[12] As mentioned before, after the law some firms simultaneously posted prices in soles and in dollars for the same good or service, which complies with the law. In case there were differences in posted prices in soles and dollars due to variations in the exchange rate, these firms unilaterally assign a referential exchange rate. This referential exchange rate is usually set higher (in times of depreciation) or lower (in times of appreciation) than the official one, so it can absorb small and medium exchange rate shocks without needing to change. Then, a customer has the option to pay either in dollars or, after converting the price with the referential exchange rate, in soles. Moreover, in Peru the customers can never be forced to pay in dollars.

Figure 6: Price dollarization in advertisements before the law


Source: El Comercio, August 16, 2004.

Figure 7: Advertisements after the law

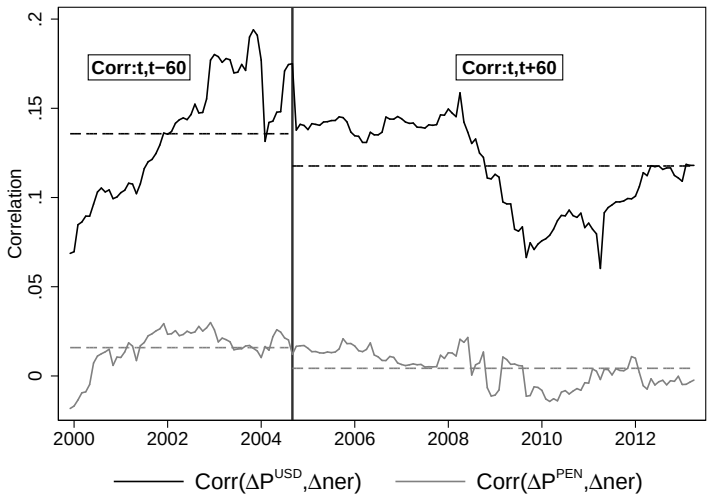

Source: El Comercio, August 28, 2004.

Figure 8 shows that this law reduced the correlation between the variation in the nominal exchange rate, $\Delta ner$, and the variation in the dollarized price indices, $\Delta P^{USD}$.[13] Meanwhile, the correlation between the variation in the exchange rate and the variation in the non-dollarized price indices, $\Delta P^{PEN}$, did not change with the enactment of the law.[14] This analysis hints at a lower ERPT after the enactment of the law, with an emphasis on dollarized goods and services.

[13] The variation refers to the 1-month percentage change in the variables. This follows the classification from Table 1.

[14] One could expect the correlation of the prices of these goods given the exchange rate to be 1 prior to the law and 0 after the law. This would be true if these aggregated price indices considered individual dollarized prices alone. Nonetheless, the aggregated price indices classified as dollarized also consider prices that are denominated in soles, thus obtaining a correlation different from 1. This is further discussed in the data section.

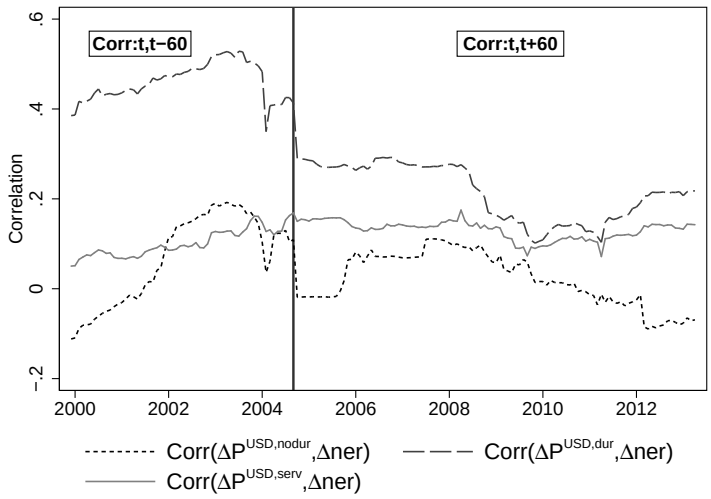
Figure 8: Correlation between prices and the nominal exchange rate (1)




Source: CRBP, Peruvian National Statistics Institute (INEI).
Note: We plot the 60-month lagged correlation for the period prior to the enactment of the law, and the 60-month ahead correlation for the period after its enactment. Horizontal lines denote the mean for the periods before and after the enactment of the law. The variation refers to the 1-month percentage change in the variables. The vertical line denotes the enactment of the law. We use September 2004 as the cut-off date, as it is the first full month to be affected by the law.

Figure 9 displays the previous correlation but for different groups of goods and services: non-durable goods, $P^{USD,nodur}$; durable goods, $P^{USD,dur}$; and services, $P^{USD,serv}$. For dollarized durable goods and dollarized non-durable goods, the correlation collapses after the enactment of the law. On the other hand, the correlation for dollarized services remains roughly the same. This suggests the law has possible heterogeneous effects on the ERPT depending on the type of goods or services.

Figure 9: Correlation between prices and the nominal exchange rate (2)




Source: CRBP, Peruvian National Statistics Institute (INEI).
Note: We plot the 60-month lagged correlation for the period prior to the enactment of the law, and the 60-month ahead correlation for the period after its enactment. Horizontal lines denote the mean for the periods before and after the enactment of the law. The variation refers to the 1-month percentage change in the variables. The vertical line denotes the enactment of the law. We use September 2004 as the cut-off date, as it is the first full month to be affected by the law.

# 4. Literature review

Figures 8 and 9 suggest the ERPT may vary depending on the type of goods and services. In this regard, the literature proposes three main reasons why the ERPT can vary from one period to another or across goods and services: nominal rigidities, marginal costs, and mark-ups.[15]

Nominal rigidities refer to the fact that firms cannot change prices every period. Given that the ERPT measures changes in prices, it will vary if the firm is able to alter its prices. Thus, different degrees of price stickiness can explain why goods and services have different ERPTs. For instance, Gopinath and Itskhoki (2010) find that the ERPT to US import prices is higher for those goods whose prices change more frequently. This is a channel also explored in Devereux et al. (2004) and Gopinath et al. (2010).

Marginal costs play a key role in price determination and, by extension, on the ERPT. The more sensitive marginal costs are to the exchange rate, the higher the ERPT. Therefore, different values of imported inputs (and local content, such as distribution costs) may imply that marginal cost has different sensitivities to the exchange rate. The importance of imported inputs in price setting is discussed, for example, by Goldberg and Campa (2010), who from a sample of 21 OECD countries, find that the imported input channel is the main channel through which exchange rate movements

[15] See Burstein and Gopinath (2014) for a survey and a baseline theoretical model.

affect the CPI. The reason is that imported inputs represent 10 to 48 percent of the costs of tradable goods, and 3 to 22 percent of the costs of non-tradable goods.[16]

Finally, in response to an exchange rate shock, firms may opt to adjust their mark-ups rather than adjusting their prices, thus providing an explanation for incomplete ERPTs. Theoretical references that discuss this fact include Arkolakis and Morlacco (2017) and Atkeson and Burstein (2008). Other papers such as Copeland and Kahn (2012), Goldberg and Hellerstein (2013) and Nakamura and Zerom (2010) use micro data for specific markets to find empirically that varying mark-ups are part of the explanation for incomplete ERPTs. However, varying mark-ups could also help explain why there are different ERPTs between firms or why ERPTs vary over time.

# 5. Estimation

To find the effects of the law on the ERPT we estimate the following reduced form equation:

$$\begin{aligned}\Delta p_{it} = & \sum_{j=0}^{J}\beta_j \Delta ner_{t-j} + \sum_{j=0}^{J}\gamma_j X_{t-j} + \sum_{i=1}^{N}\delta_i Z_i \\ & + \sum_{n=1}^{N}\sum_{j=0}^{J}\zeta_{ij} Z_i \times \Delta ner_{t-j} \\ & + \sum_{j=0}^{J}\eta_j D_{t-j}^{law} \times \Delta ner_{t-j} + \sum_{i=1}^{N}\sum_{j=0}^{J}\theta_{ij} D_{t-j}^{law} \times Z_i \times \Delta ner_{t-j} + \varepsilon_{it}.\end{aligned} \tag{1}$$

The dependent variable, $\triangle p_{it}$, is the percentage change of the price index $i$ between periods $t$ and $t-1$. The main independent variable, $\Delta ner_t$, is the percentage change of the nominal exchange rate between periods $t$ and $t-1$. We define the ERPT as the sum of the $\beta_j$ coefficients associated with $\Delta ner_t$. $X_t$ includes time-varying control variables common for all the price indices, while $Z_i$ represents price index-specific control variables.

The second row of Equation 1 controls for the heterogeneous price index-specific effects on the ERPT through the interaction term $Z_i \times \Delta ner_t$. The third row includes interaction terms that consider the indicator variable $D_t^{law}$, which equals 1 for the period in which the law has been active (September 2004 and onwards).[17] The coefficient related to $D_t^{law} \times \Delta ner_t$ is interpreted as the differential of the overall ERPT before and after the law, while the coefficient associated with $D_t^{law} \times Z_i \times \Delta ner_t$ captures the heterogenous effects of the law on the ERPT for different groups of goods and services.[18] Lastly, $\varepsilon_{it}$ contains the price index fixed effects and the error term.

[16] Similarly, Burstein et al. (2003) find that local distribution costs account for more than 40 percent of retail prices in the United States and 60 percent of retail prices in Argentina, which leads them to find that these costs are an important factor for the real exchange rate.

[17] We use September 2004 as the cut-off date as it is the first full month to be affected by the law.

[18] These are basically differences-in-differences estimators.

# 6. Data

For the exchange rate, we only take into account the bilateral soles/dollars nominal exchange rate, as the use of foreign currencies other than the dollar is very limited in the Peruvian economy.[19]

We use individual price indices at the 4-digit CPI classification from January 1995 to March 2018.[20] At this level there are 55 price indices, which are aggregations of lower-level price sub-indices and are denominated in soles.[21]

We use the imported content from the 2007 input-output table as a proxy for dollarized costs.[22] The imported content is defined as the share of imported consumption (including intermediate and final goods) corresponding to each price index.[23] Given that the input-output table is only available for one year, we assume constant values for this variable within $\pm 5$ year and $\pm 7$ year time windows.

The control variables include the output gap ,$y_t$, to control for economy-wide demand shocks; the percentage change in the oil price, $\triangle poil_t$, to control for economy-wide supply shocks; the percentage change in the aggregate CPI, $\pi_t$, to control for internal cost shocks; and the percentage difference in the trade partners price index, $\pi_t^*$, to control for external cost shocks. We calculate all percentage change series between periods $t$ and $t-1$. We retrieved the series from the CRBP database, seasonally adjusted them, and checked them for stationarity (where applicable).

# 7. Results

## 7.1. Effects of the law

In this section we evaluate the effects of the law on the ERPT by estimating different specifications of Equation 1. According to the estimates reported in column 1 of Table 2, before the law, the ERPT was 19 percent. After the law, the coefficients for the interaction term $D_t^{law} \times \Delta ner_t$ and its lag imply that the ERPT fell by 13 percentage points.

The results presented in column 2 of Table 2 differentiate the ERPT between goods and services with dollarized and non-dollarized prices by multiplying the terms with the indicator variable $D_i^{USD}$, which takes the value of 1 for those goods and services that had dollarized prices before the law, per Table 1. In this specification the value of the overall

[19] See Contreras et al. (2016).

[20] The CPI data is collected by the Peruvian National Statistics Institute (INEI). The CPI is classified into price sub-indices which follow a hierarchy that goes from the most disaggregated groups (6 digits) to the most aggregated groups (1 digit). For more details on the Peruvian CPI see Armas et al. (2009). We omit the tubers price index from our estimates because of its high volatility and strong seasonality.

[21] If one good or service has a price quoted in foreign currency, this index also takes into account the exchange rate to convert such price to soles.

[22] The table was published by the Peruvian National Statistics Institute (INEI).

[23] See Carriere-Swallow et al. (2016) for an example on the use of input-output tables for ERPT calculations.

ERPT is 6 percent. The coefficients for the interaction term $D_i^{USD} \times \triangle ner_t$ and its lag are interpreted as the additional ERPT of goods and services with prices denominated in dollars. This additional ERPT is 27 percentage points over the original 6 percent. The coefficient for the lag of the interaction term $D_t^{law} \times D_i^{USD} \times \triangle ner_t$ suggests that the ERPT fell by around 10 percentage points for dollarized goods and services after the enactment of the law.

Table 2: Effects of the law (1)

| | (1) | (2) |
|---|---|---|
| $\Delta ner_t$ | 0.110*** | 0.060* |
| $\Delta ner_{t-1}$ | 0.080*** | 0.033 |
| $D_t^{law} \times \Delta ner_t$ | -0.061** | -0.045 |
| $D_{t-1}^{law} \times \Delta ner_{t-1}$ | -0.064** | -0.028 |
| $D_i^{USD} \times \triangle ner_t$ | | 0.139*** |
| $D_i^{USD} \times \triangle ner_{t-1}$ | | 0.131** |
| $D_t^{law} \times D_i^{USD} \times \triangle ner_t$ | | -0.046 |
| $D_{t-1}^{law} \times D_{i-1}^{USD} \times \triangle ner_{t-1}$ | | -0.102* |
| $N$ | 14,876 | 14,876 |
| $R^2$ | 0.020 | 0.024 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables. Robust standard errors clustered at the month-year level.

Table 3 shows the results when considering the classification of the dollarized price categories between durable goods, non-durable goods and services from Table 1. For these categories we introduce the indicator variables $D_i^{USD,nodur}$, $D_i^{USD,dur}$ and $D_i^{USD,serv}$, respectively. With this specification we find that the additional ERPT is 13 percentage points for dollarized non-durable goods, 35 percentage points for dollarized durable goods, and 16 percentage points for dollarized services. This points to the existence of heterogeneous ERPTs depending on the type of good or service.

After the enactment of the law, the ERPT is fully offset for dollarized non-durable goods, while it is only partially offset for dollarized durable goods. One reason for this difference could be the different shares of dollarized costs. As shown in Figure 4, in 2007, dollarized durable goods had a greater imported content than dollarized non-durable goods.

In the case of dollarized services, the ERPT did not change significantly after the enactment of the law. A tentative explanation for this result could be that firms providing dollarized services adjusted their mark-ups to leave their ERPT almost unchanged. Unfortunately, there is no data on mark-ups available to test this hypothesis.

Table 3: Effects of the law (2)

| | $k = nodur$ | $k = dur$ | $k = serv$ |
|---|---|---|---|
| $D_i^{USD,k} \times \triangle ner_t$ | -0.028 | 0.207*** | 0.163** |
| $D_i^{USD,k} \times \triangle ner_{t-1}$ | 0.131*** | 0.143*** | 0.122 |
| $D_t^{law} \times D_i^{USD,k} \times \triangle ner_t$ | 0.017 | -0.125** | -0.016 |
| $D_{t-1}^{law} \times D_i^{USD,k} \times \triangle ner_{t-1}$ | -0.137*** | -0.112** | -0.077 |
| $N$ | | 14,876 | |
| $R^2$ | | 0.025 | |

*** p<0.01, ** p<0.05, * p<0.1

Note: All columns belong to the same regression. Omitted coefficients for control variables, $\Delta ner_t$, $\Delta ner_{t-1}$, $D_t^{law} \times \Delta ner_t$ and $D_{t-1}^{law} \times \Delta ner_{t-1}$. $k = [nodur, dur, serv]$ denotes the type of good or service. Robust standard errors clustered at the month-year level.

## 7.2. Imported content

In this section we use the imported content from the input-output table as a proxy for dollarized costs. Due to data limitations, there is only information available for the 2007 input-output table. Thus, we assume constant values for the imported content variable within $\pm 5$ year ($share_i^{m,5}$) and $\pm 7$ year ($share_i^{m,7}$) time windows starting from 2007.

The first column of Table 4 shows the estimated coefficient associated with the interaction term $share_i^{m,5} \times \triangle ner_t$, which indicates how sensitive the ERPT is to the imported content. When we consider the $\pm 5$ year time window, for each percentage point increase in the imported content, the ERPT increases by 0.2 percent. Therefore, considering that the average imported content is 24 percent, then the average ERPT equals 4.8 percent. When we consider the $\pm 7$ year time window in the second column, the term $share_i^{m,7} \times \triangle ner_t$ shows a similar result. Given the absence of a statistically significant effect of $\Delta ner_t$ or its lag in these specifications, one could infer that the ERPT is given mainly because of the imported content.

Table 4: Imported content

| | $h = 5$ | $h = 7$ |
|---|---|---|
| $\Delta ner_t$ | 0.006 | 0.009 |
| $\Delta ner_{t-1}$ | 0.010 | 0.013 |
| $share_i^{m,h} \times \triangle ner_t$ | 0.002*** | 0.002*** |
| $share_i^{m,h} \times \triangle ner_{t-1}$ | 0.001 | 0.001 |
| $N$ | 7,074 | 9,643 |
| $R^2$ | 0.020 | 0.015 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables. $h = [5, 7]$ denotes the size of the time windows. Robust standard errors clustered at the month-year level.

In Table 5 we evaluate the effect of the law on the ERPT after controlling for imported content. Considering the $\pm 5$

year time window in the first column, the coefficient corresponding to the interaction term $share_i^{m,5} \times \triangle ner_t$ shows that the ERPT increases by 0.5 percentage points for each percentage point increase in imported content. After the law's enactment, the coefficient for the interaction term $D_t^{law} \times share_i^{m,5} \times \triangle ner_t$ indicates this ERPT sensitivity fell by 0.4 percentage points.

The specification that considers the $\pm 7$ year time window in the second column of Table 5 shows that the ERPT increases by 0.3 percentage points when the imported content increases by 1 percentage point ($share_i^{m,7} \times \triangle ner_t$). However, within this time window we find no evidence of lower ERPT sensitivity to imported content after the law's enactment.

Table 5: Imported content and the effects of the law (1)

| | $h=5$ | $h=7$ |
|---|---|---|
| $\Delta ner_t$ | -0.063 | 0.017 |
| $\Delta ner_{t-1}$ | 0.096* | 0.013 |
| $share_i^{m,h} \times \triangle ner_t$ | 0.005*** | 0.003* |
| $share_i^{m,h} \times \triangle ner_{t-1}$ | -0.001 | 0.002 |
| $D_t^{law} \times \triangle ner_t$ | 0.073 | -0.010 |
| $D_{t-1}^{law} \times \triangle ner_{t-1}$ | -0.092 | -0.002 |
| $D_t^{law} \times share_i^{m,h} \times \triangle ner_t$ | -0.004* | -0.002 |
| $D_{t-1}^{law} \times share_i^{m,h} \times \triangle ner_{t-1}$ | 0.002 | -0.002 |
| $N$ | 7,074 | 9,643 |
| $R^2$ | 0.021 | 0.016 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables, $D_t^{law} \times share_i^{m,h}$ and $D_{t-1}^{law} \times share_i^{m,h}$. $h = [5,7]$ denotes the size of the time windows. Robust standard errors clustered at the month-year level.

Table 6 builds upon the previous result by differentiating between dollarized and non-dollarized goods and services. The coefficient of $D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_t$ shows that, before the enactment of the law, dollarized goods and services has an ERPT sensitivity of 0.9 percentage points for each percentage point of imported content within the $\pm 5$ year time window and of 0.8 percentage points for each percentage point of imported content within the $\pm 7$ year time window. The coefficient of $D_t^{law} \times D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_t$ shows that after the enactment of the law, the sensitivity of the ERPT fell by 0.6 percentage points for the $\pm 5$ year time window and by 0.4 percentage points for the $\pm 7$ year time window. Thus, imported content is mainly channeled through goods and services with dollarized prices.

Table 6: Imported content and the effects of the law (2)

| | $h=5$ | $h=7$ |
|---|---|---|
| $share_i^{m,h} \times \triangle ner_t$ | -0.002 | -0.003 |
| $share_i^{m,h} \times \triangle ner_{t-1}$ | -0.001 | 0.003 |
| $D_t^{law} \times share_i^{m,h} \times \triangle ner_t$ | 0.001 | 0.002 |
| $D_{t-1}^{law} \times share_i^{m,h} \times \triangle ner_{t-1}$ | 0.002 | -0.002 |
| $D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_t$ | 0.009*** | 0.008*** |
| $D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_{t-1}$ | 0.000 | -0.001 |
| $D_t^{law} \times D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_t$ | -0.006* | -0.004* |
| $D_{t-1}^{law} \times D_{it}^{USD} \times share_i^{m,h} \times \triangle ner_{t-1}$ | 0.000 | 0.001 |
| $N$ | 7,074 | 9,643 |
| $R^2$ | 0.023 | 0.018 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables, $\Delta ner_t$, $\Delta ner_{t-1}$, $D_t^{law} \times share_i^{m,h}$, $D_{t-1}^{law} \times share_i^{m,h}$, $D_t^{law} \times \Delta ner_t$ and $D_{t-1}^{law} \times \Delta ner_{t-1}$. $h = [5,7]$ denotes the size of the time windows. Robust standard errors clustered at the month-year level.

We also performed exercises to show how the ERPT for dollarized non-durable goods, durable goods and services responds to the imported content. These results appear in Tables 13 and 14 in the Appendix.

# 8. Robustness checks

## 8.1. Inflation targeting

One of Peru's most significant economic policies of recent times is the adoption of the inflation targeting (IT) regime.[24] The CRBP implemented the IT regime in January 2002, 12 years after the period of hyperinflation undergone by the Peruvian economy. Initially, the explicit inflation target was set at an annual, 12-month variation inflation rate of 2.5 percent $\pm 1$ percentage point tolerance. After 2007 the inflation target was set at 2 percent. The consensus among experts is that the adoption of the IT regime has been successful in controlling the inflation rate (Armas et al., 2015; Dancourt, 2015). For example, the average year-end 12-month inflation rate between 2002 and 2017 was 2.8 percent, which is lower than the 1992-2001 average of 15.3 percent.[25]

The previous works that study the impact of the IT adoption on the ERPT in Peru are Maertens et al. (2012) and Winkelried (2014). Both use the aggregate CPI and time series methodologies and find that the ERPT falls after implementation of the IT, because of the lower exchange rate uncertainty associated with the IT. Nonetheless, in their

[24] See Armas et al. (2015) for a discussion on the implementation of the IT regime in Peru.

[25] Also, there is evidence that suggests the IT regime helped to reduce other kinds of dollarization. For example, Catão and Terrones (2016) find that the adoption of the IT regime in Peru led to a reduction in financial dollarization.

analysis, Maertens et al. and Winkelried do not take into account the local currency pricing law at all. In this section we look at whether the results by Maertens et al. and Winkelried can also be obtained using disaggregated CPI data, and whether there is some degree of complementarity between the IT and the law on local currency pricing on the ERPT.

To identify the effects of the IT policy within our empirical framework we introduce a dummy variable $D_t^{IT}$, which takes a value of 1 within the IT period. Column 1 of Table 7 shows the results when we control for this policy only: specifically, that it reduced the ERPT. Column 3 presents a similar result when controlling for goods and services with dollarized prices.

However, these conclusions change once we control for the enactment of the law in columns 2 and 4. If we consider both policies at the same time, we find that the IT regime has no effect on the ERPT (no statistically significant effect of the coefficients of $D_t^{IT} \times \Delta ner_t$, $D_t^{IT} \times D_i^{USD} \times \triangle ner_t$ or their lags), while the law on local currency pricing does (especially with regard to the effect of $D_t^{law} \times D_i^{USD} \times \triangle ner_t$).

Table 7: Inflation targeting

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $\Delta ner_t$ | 0.116*** | 0.116*** | 0.072* | 0.072* |
| $\Delta ner_{t-1}$ | 0.080*** | 0.080*** | 0.029 | 0.029 |
| $D_t^{law} \times \Delta ner_t$ | | -0.022 | | 0.037 |
| $D_{t-1}^{law} \times \Delta ner_{t-1}$ | | -0.066 | | -0.061 |
| $D_t^{IT} \times \Delta ner_t$ | -0.065** | -0.045 | -0.058 | -0.094 |
| $D_{t-1}^{IT} \times \Delta ner_{t-1}$ | -0.060** | 0.002 | -0.021 | 0.037 |
| $D_i^{USD} \times \triangle ner_t$ | | | 0.124*** | 0.124*** |
| $D_i^{USD} \times \triangle ner_{t-1}$ | | | 0.143** | 0.143** |
| $D_t^{law} \times D_i^{USD} \times \triangle ner_t$ | | | | -0.159* |
| $D_{t-1}^{law} \times D_{i-1}^{USD} \times \triangle ner_{t-1}$ | | | | -0.013 |
| $D_t^{IT} \times D_i^{USD} \times \triangle ner_t$ | | | -0.021 | 0.129 |
| $D_{t-1}^{IT} \times D_{i-1}^{USD} \times \triangle ner_{t-1}$ | | | -0.111* | -0.100 |
| $N$ | 14,876 | 14,876 | 14,876 | 14,876 |
| $R^2$ | 0.020 | 0.020 | 0.024 | 0.024 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables. Robust standard errors clustered at the month-year level.

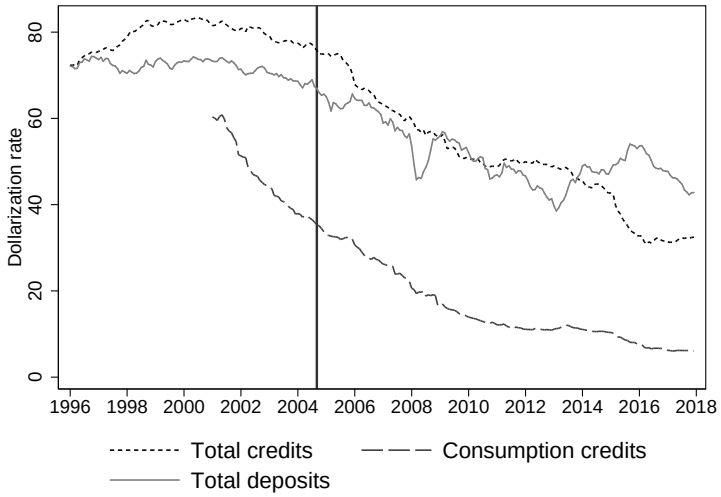
The main difference between the results reported by Maertens et al. and Winkelried is that they use the aggregated CPI, while we use disaggregated CPI data, which allows us to differentiate between goods and services with dollarized prices and those with non-dollarized prices. These results may point to some degree of complementarity between both policies: the IT regime shows an impact on reducing the ERPT at a macro level, while the law on local currency pricing has the greatest impact on diminishing the ERPT at the micro level, particularly on those goods and services with dollarized prices.[26]

[26]These results do not mean that the IT regime was not effective in controlling inflation. As was stated previously, it successfully controlled the

## 8.2. Financial de-dollarization

The years close to the enactment of the law coincided with a financial de-dollarization process of the Peruvian economy.[27] Figure 10 shows a downward trend in financial dollarization in Peru, both in terms of credit and deposits.[28] In this regard, it could be argued that lower credit and deposit dollarization caused by external reasons other than the ERPT might be associated with a lower demand for goods and services priced in dollars and/or relatively less dollars in the economy with which to pay for goods and services priced in that currency.[29] Therefore, lower rates of credit and deposit dollarization could force firms to choose local currency pricing, effectively reducing the ERPT.

Figure 10: Credit and deposit dollarization




Source: CRBP.
Note: The dollarization rate consists in the percentage of dollar credits/deposits divided by the total credits/deposits (dollar credits/deposits plus soles credits/deposits). To be able to add together the two kinds of credits/deposits, we converted dollar credits/deposits to soles using the current exchange rate of each period.

To check whether the fall in the ERPT was more affected by financial de-dollarization than by the law on local currency pricing, Table 8 presents the results considering the variation between periods $t$ and $t-1$ of the dollarization coefficients for the total deposits, $\Delta dol_t^{depo}$; the total credits, $\Delta dol_t^{cred}$; and the consumption credits, $\Delta dol_t^{cons}$. To identify the effects of financial dollarization on the ERPT, we introduce interaction terms that take into account the variation in the exchange rate and the variation in the deposit and credit variables.

inflation rate in Peru.

[27] See Armas (2016), Castillo et al. (2016), and Catão and Terrones (2016) for a discussion on the reasons for financial de-dollarization in Peru.

[28] It should be noted that there are no statistics on credits or deposits denominated in other foreign currencies, as these credits or deposits are not available to the general public.

[29] Additionally, in Peru, the households that have access to credit are also the ones with higher levels of income. Coincidentally, according to Figure 12 in the Appendix, these households are more likely to purchase goods and services with prices in dollars.

Table 8: Financial de-dollarization

| | $k = depo$ | | $k = cred$ | | $k = cons$ | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta ner_t$ | 0.049*** | 0.073** | 0.024 | 0.061* | 0.002 | 0.002 |
| $\Delta ner_{t-1}$ | 0.017 | 0.027 | 0.020 | 0.026 | -0.004 | 0.016 |
| $D_t^{law} \times \Delta ner_t$ | | -0.043 | | -0.059 | | 0.001 |
| $D_{t-1}^{law} \times \Delta ner_{t-1}$ | | -0.026 | | -0.021 | | -0.023 |
| $\Delta dol_t^k$ | -0.058*** | -0.048*** | 0.018 | 0.003 | -0.004 | -0.014 |
| $\Delta dol_{t-1}^k$ | 0.022 | 0.030* | 0.030 | 0.033 | 0.061** | 0.064** |
| $\Delta dol_t^k \times \Delta ner_t$ | 0.003 | 0.003 | -0.016 | -0.027 | -0.003 | -0.000 |
| $\Delta dol_{t-1}^k \times \Delta ner_{t-1}$ | 0.000 | -0.002 | 0.011 | 0.002 | -0.042 | -0.039 |
| $D_i^{USD} \times \triangle ner_t$ | 0.110*** | 0.140*** | 0.123*** | 0.132*** | 0.126*** | 0.281*** |
| $D_i^{USD} \times \triangle ner_{t-1}$ | 0.063** | 0.133** | 0.059* | 0.136** | 0.019 | 0.054 |
| $D_t^{law} \times D_i^{USD} \times \triangle ner_t$ | | -0.049 | | -0.027 | | -0.163* |
| $D_{t-1}^{law} \times D_{i-1}^{USD} \times \triangle ner_{t-1}$ | | -0.102* | | -0.119** | | -0.040 |
| $\Delta dol_t^k \times D_i^{USD} \times \triangle ner_t$ | -0.006 | -0.006 | 0.052* | 0.045* | 0.106* | 0.134** |
| $\Delta dol_{t-1}^k \times D_{i-1}^{USD} \times \triangle ner_{t-1}$ | -0.002 | -0.007 | 0.001 | -0.030 | -0.031 | -0.025 |
| $N$ | 14,876 | 14,876 | 14,876 | 14,876 | 11,060 | 11,060 |
| $R^2$ | 0.023 | 0.025 | 0.022 | 0.024 | 0.017 | 0.018 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Omitted coefficients for control variables. $k = [depo, cred, cons]$ denotes total deposits, total credits and consumption credits, respectively. Sample for consumption credits covers the period between January 2001 and March 2018. Robust standard errors clustered at the month-year level.

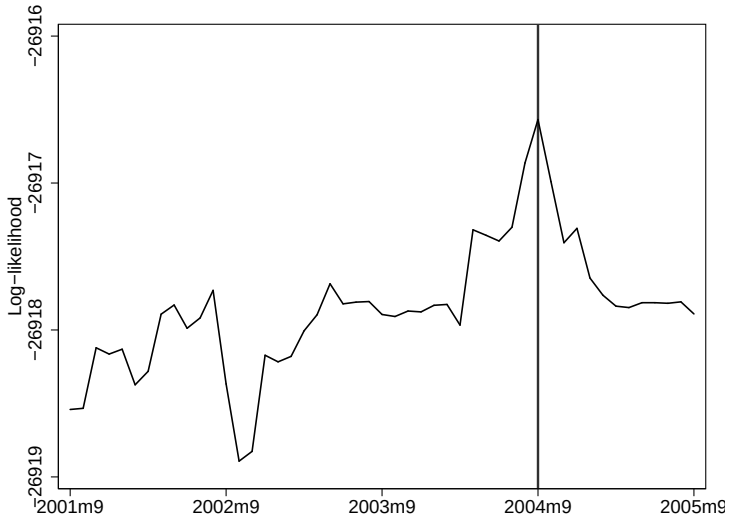
The coefficients associated with $\Delta dol_t^{cred} \times D_i^{USD} \times \triangle ner_t$ and $\Delta dol_t^{cons} \times D_i^{USD} \times \triangle ner_t$ evidence that lower total credit and consumption credit dollarization are associated with a lower ERPT of the goods and services with dollarized prices. This effect is not found for total deposit dollarization. However, the coefficients for the $D_t^{law} \times D_i^{USD} \times \triangle ner_t$ terms and their lags show that even after controlling for the financial de-dollarization, the law on local currency pricing still has a negative effect on the ERPT of the goods and services with dollarized prices.

## 8.3. Different enactment dates

In this section we test, in a different way, whether or not the estimated reduction of the ERPT is related exactly to the enactment of the law. If the law actually causes the lower ERPT, then the likelihood of observing the data should be maximized in a model that considers the actual date on which the law was enacted.

Following the specification from column 2 of Table 2, Figure 11 shows the corresponding log-likelihood of a set of estimations that use different starting dates of the law's enactment as a placebo (from September 2001 to September 2005). For each estimation we use the full data sample. We find the log-likelihood reaches its maximum in September 2004. This result would imply that the law plays an integral part in explaining the data generating process, more than any other event that could have occurred in the months close to the actual enactment date.

Figure 11: Different enactment dates




Note: Values correspond to the log-likelihood obtained by estimating column 2 of Table 2, but changing the law's enactment date to each month shown. The vertical line denotes the actual month of the law's enactment.

## 8.4. Immediate effects of the law

To capture the immediate effects of the law on the ERPT and rule out other possible subsequent reasons for the reduction in the ERPT, we delimit the estimation sample period to 2 and 3 years after the enactment of the law. Based on the specification of Table 3, the results reported in Table 9 show a reduction in the ERPT due to the law's enactment even after shortening the sample.[30] These results provide evidence that the ERPT decreased right after enactment in 2004. These estimates are also consistent with the correlations from Figures 8 and 9, in which the correlation between the variation in the price indices and the variation in the exchange rate fell after 2004; and with the rolling window estimations of the ERPT (see Figures 14, 15 and 16 in the Appendix), where the ERPT also decreased after 2004.

[30] We also performed the same exercise but changing the end date of the sample from 2008 to 2017. However, the results remain the same.

Table 9: Immediate effects of the law

| | 1995-2006 Sample | | | 1995-2007 Sample | | |
|---|---|---|---|---|---|---|
| | $k = nodur$ | $k = dur$ | $k = serv$ | $k = nodur$ | $k = dur$ | $k = serv$ |
| $D_i^{USD,k} \times \triangle ner_t$ | -0.025 | 0.206*** | 0.144** | -0.025 | 0.206*** | 0.145** |
| $D_i^{USD,k} \times \triangle ner_{t-1}$ | 0.136*** | 0.144*** | 0.101 | 0.135*** | 0.143*** | 0.103 |
| $D_t^{law} \times D_i^{USD,k} \times \triangle ner_t$ | -0.085 | -0.217** | 0.038 | -0.018 | -0.173** | -0.000 |
| $D_{t-1}^{law} \times D_i^{USD,k} \times \triangle ner_{t-1}$ | -0.241*** | -0.168** | -0.004 | -0.207*** | -0.135* | -0.022 |
| $N$ | 7,586 | | | 8,234 | | |
| $R^2$ | 0.036 | | | 0.035 | | |

*** p<0.01, ** p<0.05, * p<0.1

Note: Samples begin in January 1995 and end in December of the last year shown. All columns in each set of results belong to the same regression. Omitted coefficients for control variables, $\Delta ner_t$, $\Delta ner_{t-1}$, $D_t^{law} \times \Delta ner_t$ and $D_{t-1}^{law} \times \Delta ner_{t-1}$. $k = [nodur, dur, serv]$ denotes the type of good or service. Robust standard errors clustered at the month-year level.

# 9. Conclusions

After a hyperinflationary process in the late 1980s and the early 1990s, the Peruvian economy became increasingly dollarized as the value of the local currency, the sol, decreased. A significant number of firms decided to set their prices in dollars so as to protect themselves against the risk of depreciation in the exchange rate risk and a decline in the real value of their goods and services. In July 2004, a decade after the hyperinflation, upon a proposal by the CRBP, the Peruvian congress enacted Law 28300, which amended the Consumer Protection Law to stipulate that all prices be displayed in soles (and optionally in any other currency), as a measure to curb price dollarization.

Using disaggregated CPI data, we find that this law reduced the overall ERPT. Moreover, we find evidence of heterogeneous effects of the law on the ERPT for different goods and services. We find a complete offset in the case of dollarized non-durable goods, and a partial offset for the dollarized durable goods.

In addition, we measure the effects of the level of imported content on the ERPT, a proxy for the sensitivity of costs to the exchange rate. We find that a larger imported content implies a larger ERPT. However, this effect falls after the enactment of the law.

The results are robust to two different events that occurred in the Peruvian economy alongside the enactment of the law: the adoption of the IT regime and the broader de-dollarization process. First, while there is prior evidence that the IT regime is associated with a lower ERPT at the aggregate level (Maertens et al., 2012; Winkelried, 2014), we find the law had a key role in reducing the ERPT for a specific set of goods at the disaggregate level. These results may point to some degree of complementarity between both policies: the IT regime had an impact on reducing the ERPT

at a macro level, while the law on local currency pricing had the largest impact on diminishing the ERPT at the micro level, particularly on those goods and services with dollarized prices. In another exercise we find that our results do not change after controlling for the financial de-dollarization process of the economy.

# 10. References


Arkolakis, C., and Morlacco, M. (2017). Variable Demand Elasticity, Markups, and Pass-Through.

Armas, A. (2016). Dolarización y Desdolarización en el Perú. In Winkelried, D. and Yamada, G. Política y Estabilidad Monetaria en el Perú: Homenaje a Julio Velarde, 61-94.

Armas, A., Batini, N., and Tuesta, V. (2007). Peru's Experience with Partial Dollarization and Inflation Targeting. In IMF Country Report 07/53, 31-46.

Armas, A., Vallejos, L., and Vega, M. (2009). Measurement of Price Indices Used by the Central Bank of Peru. BIS Papers, 49, 259-283.

Armas, A., Santos, A., and Tashu, M. (2015). Monetary Policy in a Partially Dollarized Economy: In Peru's Experience with Inflation Targeting. Peru: Staying the Course of Economic Success, 191-206. IMF.

Atkeson, A., and Burstein, A. (2008). Pricing-to-Market, Trade Costs, and International Relative Prices. American Economic Review, 98(5), 1998-2031.

Burstein, A., and Gopinath, G. (2014). International Prices and Exchange Rates. In Handbook of International Economics, 4, 391-451. Elsevier.

Burstein, A., Neves, J., & Rebelo, S. (2003). Distribution Costs and Real Exchange Rate Dynamics During Exchange-Rate-Based Stabilizations. Journal of Monetary Economics, 50(6), 1189-1214.

Carriere-Swallow, Y., Gruss, B., Magud, N. E., and Valencia, F. (2016). Monetary Policy Credibility and Exchange Rate Pass-Through. IMF Working Paper 16/240.

Castellares, R. (2017). Condiciones de Mercado y Calidad como Determinantes del Traspaso del Tipo de Cambio: Evidencia a partir de Microdatos. Revista Estudios Económicos, 33, 29-41.

Castillo, P., Montoro, C., and Tuesta, V. (2013). An Estimated Stochastic General Equilibrium Model with Partial Dollarization: a Bayesian Approach. Open Economies Review, 24(2), 217-265.

Castillo, P., Vega, H., Serrano, E., and Burga, C. (2016). De-Dollarization of Credit in Peru: The Role of Unconventional Monetary Policy Tools. BCRP Working Paper 2016-002.

Catão, L., and Terrones, M. (2016). Financial De-Dollarization: A Global Perspective and the Peruvian Experience. IMF Working Paper 16/97.

Chang, R., and Velasco, A. (2002). Dollarization: Analytical Issues. NBER Working Paper 8838.

Contreras, A., Quispe, Z., Regalado, F., and Martínez, M. (2016). Dolarización Real en el Perú. Revista Estudios Económicos, 33, 43-56.

Copeland, A., and Kahn, J. (2012). Exchange Rate Pass-Through, Markups, and Inventories. Federal Reserve Bank of New York Staff Reports 584.

Dancourt, O. (2015). Inflation Targeting in Peru: The Reasons for the Success. Comparative Economic Studies, 57(3), 511-538.

Devereux, M. B., Engel, C., and Storgaard, P. E. (2004). Endogenous Exchange Rate Pass-Through When Nominal Prices are Set in Advance. Journal of International Economics, 63(2), 263-291.

Drenik, A., and Perez, D. (2018). Pricing in Multiple Currencies in Domestic Markets. Mimeo.

Donnenfeld, S., and Haug, A. A. (2008). Currency Invoicing of US Imports. International Journal of Finance and Economics, 13(2), 184-198.

Engel, C. (2006). Equivalence Results For Optimal Pass-Through, Optimal Indexing To Exchange Rates, And Optimal Choice Of Currency For Export Pricing. Journal of the European Economic Association, 4(6), 1249-1260.

Garcia-Escribano, M. M. (2010). Peru: Drivers of De-Dollarization. IMF Working Paper 10/169.

Goldberg, L. S., and Campa, J. M. (2010). The Sensitivity of the CPI to Exchange Rates: Distribution Margins, Imported Inputs, and Trade Exposure. Review of Economics and Statistics, 92(2), 392-407.

Goldberg, P. K., and Hellerstein, R. (2013). A Structural Approach to Identifying the Sources of Local Currency Price Stability. Review of Economic Studies, 80(1), 175-210.

Gopinath, G., and Itskhoki, O. (2010). Frequency of Price Adjustment and Pass-Through. Quarterly Journal of Economics, 125(2), 675-727.

Gopinath, G., Itskhoki, O., and Rigobon, R. (2010). Currency Choice and Exchange Rate Pass-Through. American Economic Review, 100(1), 304-336.

Maertens, L., Castillo, P., and Rodríguez, G. (2012). Does the Exchange Rate Pass-Through Into Prices Change when Inflation Targeting is Adopted? The Peruvian Case Study Between 1994 and 2007. Journal of Macroeconomics, 34, 1154-1166.

Miller, S. (2003). Estimación del Pass-Through del Tipo de Cambio a Precios: 1995–2002. Revista Estudios Económicos, 10, 137-170.

Montoro, C. (2006). Dolarización de Precios. BCRP Nota de Estudios 14-2006.

Nakamura, E., and Zerom, D. (2010). Accounting for Incomplete Pass-Through. Review of Economic Studies, 77(3), 1192-1230.

Perez Forero, F., and Vega, M. (2015). Asymmetric Exchange Rate Pass-Through: Evidence from Peru. BCRP Working Paper 2015-011.

Quispe, Z. (2000). Política Monetaria en una Economía con Dolarización Parcial: el Caso del Perú. Estudios Económicos, 6, 13-37.

Vega, M. (2015). Monetary Policy, Financial Dollarization and Agency Costs. BCRP Working Paper 2015-019.

Winkelried, D. (2003). ¿Es Asimétrico el Pass-Through en el Perú?: Un Análisis Agregado. Revista Estudios Económicos, 10, 1-29.

Winkelried, D. (2014). Exchange Rate Pass-Through and Inflation Targeting in Peru. Empirical Economics, 46(4), 1181-1196.

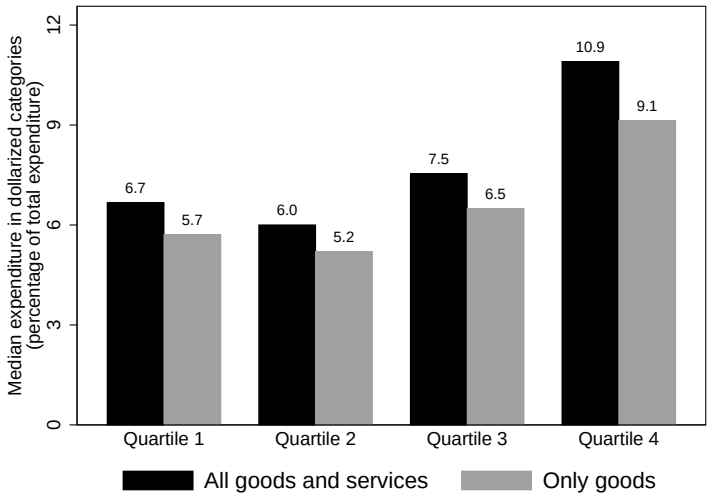
# 11. Appendix

## 11.1. Expenditure dollarization

Drenik and Perez (2018) document that households with higher incomes are more likely to purchase goods with prices in dollars. Figure 12 reports the median expenditure in dollarized goods and services by level of income for the

Peruvian economy (quartiles). According to the figure, with the exception of the second quartile, there is an increasing expenditure in the dollarized goods and services as income increases.

Figure 12: Expenditure dollarization by income (2004)

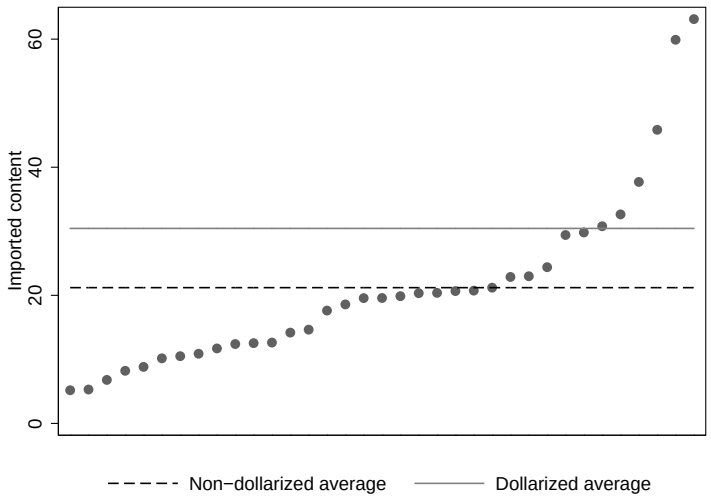



Source: Peruvian National Statistics Institute (INEI).
Note: The quartiles correspond to the reported household income in the 2004 Peruvian Household Survey (ENAHO). The survey only takes into account 33 of the 55 4-digit price indices. The sample is composed by 19,305 households surveyed in any moment of the year.

## 11.2. Non-dollarized prices and imported content

To get a better idea of the imported content, Figure 13 shows the imported content for each of the non-dollarized price indices. The average imported content for the non-dollarized price categories is 21 percent. In contrast, the average imported content for the dollarized price categories is 30 percent. This shows that non-dollarized price indices tend to have lower percentages of imported content.

Figure 13: Imported content for non-dollarized goods and services




Source: El Comercio, Peruvian National Statistics Institute (INEI).
Note: The imported content is defined as the percentage of imported intermediate or final goods corresponding to each 2007 input-output table category. These categories are then matched with the 4-digit price indices.

## 11.3. Baseline results

Table 10 shows the results of a baseline specification considering only the variation of the nominal exchange rate and the control variables. In this baseline specification the ERPT is 11 percent. An increase of 1 percentage point in the nominal exchange rate is met with an increase of 0.11 percentage points in the individual price indices, on average. As to the control variables, we find that increases in the lagged output gap, $y_{t-1}$, and the lagged variation of the oil price, $\triangle poil_{t-1}$, both have a positive relationship with the endogenous variable, which implies that individual price indices are, on average, sensitive to demand shocks and supply shocks at the economy-wide level. Also, there is a positive coefficient for the lagged value of the inflation rate, $\pi_{t-1}$, which implies that the individual price indices are sensitive to what happens with the other price indices.[31]

[31] We consider first lags for the control variables to prevent a possible simultaneity issue.

Table 10: Baseline results

| | (1) |
|---|---|
| $\Delta ner_t$ | 0.071*** |
| $\Delta ner_{t-1}$ | 0.042*** |
| $y_{t-1}$ | 1.222* |
| $\triangle poil_{t-1}$ | 0.005*** |
| $\pi_{t-1}$ | 0.292*** |
| $\pi^*_{t-1}$ | -0.009 |
| $N$ | 14,876 |
| $R^2$ | 0.019 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Robust standard errors clustered at the month-year level.

## 11.4. Long-run exchange rate pass-through

In this section we estimate the long-run ERPT, which is defined as the sum of the coefficients corresponding to the current and lagged values of the nominal exchange rate variation up to a given period.[32] In column 1 of Table 11 we show the results from an estimation up to the twelfth lag of the nominal exchange rate variation. The sum of all the statistically significant coefficients gives a long-run EPRT of 16 percent.[33]

The results also show that most of the coefficients stop being statistically significant at the 1 percent level after the first lag. In column 2 we show the results of an estimation that only considers the current and first lagged values for the nominal exchange rate variation, which is the number of lags we have used throughout all estimations. The sum of the coefficient gives an ERPT of 13 percent. We define this two-coefficient sum as the short-run ERPT.

[32] See Burstein and Gopinath (2014).

[33] This result is close to other long-run ERPT estimates for Peru, such as Miller (2003), Winkelried (2014), and Perez Forero and Vega (2015), among others.

Table 11: Long-run ERPT

| | (1) | (2) |
|---|---|---|
| $\Delta ner_t$ | 0.061*** | 0.064*** |
| $\Delta ner_{t-1}$ | 0.040*** | 0.048*** |
| $\Delta ner_{t-2}$ | 0.001 | |
| $\Delta ner_{t-3}$ | 0.021 | |
| $\Delta ner_{t-4}$ | 0.033** | |
| $\Delta ner_{t-5}$ | -0.011 | |
| $\Delta ner_{t-6}$ | 0.021 | |
| $\Delta ner_{t-7}$ | -0.006 | |
| $\Delta ner_{t-8}$ | 0.019 | |
| $\Delta ner_{t-9}$ | -0.016 | |
| $\Delta ner_{t-10}$ | 0.005 | |
| $\Delta ner_{t-11}$ | 0.024* | |
| $\Delta ner_{t-12}$ | 0.003 | |
| $N$ | 14,293 | 14,293 |
| $R^2$ | 0.015 | 0.013 |

*** p<0.01, ** p<0.05, * p<0.1

Note: We shorten the sample for column 2 so the number of observations is the same as in column 1. No control variables were considered. Robust standard errors clustered at the month-year level.

In Table 12 we present the specification from column 2 of Table 2, but considering 12 lags, in order to show how the effects of the law vary with a greater number of lags. Considering only the statistically significant coefficients, the additional ERPT for goods and services with prices denominated in dollars equals 30 percent, similar to the results reported in Table 2 (27 percent). Table 12 also shows that the law reduced the effect of the ERPT by 13 percentage points, close to the results from Table 2 (10 percent). Thus, we find that the law's effects do not change by much if we consider a larger number of lags.

Table 12: Long-run ERPT with effects of the law

| | $D_i^{USD} \times \triangle ner_{t-k}$ | $D_{t-k}^{law} \times D_i^{USD} \times \triangle ner_{t-k}$ |
|---|---|---|
| $k=0$ | 0.149*** | -0.055 |
| $k=1$ | 0.149*** | -0.110* |
| $k=2$ | -0.094*** | 0.089** |
| $k=3$ | -0.052 | 0.039 |
| $k=4$ | 0.060 | -0.081 |
| $k=5$ | 0.025 | -0.072 |
| $k=6$ | 0.047 | 0.016 |
| $k=7$ | -0.058 | 0.021 |
| $k=8$ | 0.010 | 0.035 |
| $k=9$ | 0.004 | -0.019 |
| $k=10$ | 0.081* | -0.079 |
| $k=11$ | 0.094** | -0.113** |
| $k=12$ | -0.080*** | 0.056 |
| $N$ | 14,293 | |
| $R^2$ | 0.032 | |

*** p<0.01, ** p<0.05, * p<0.1

Note: All columns belong to the same regression. Omitted coefficients for control variables (up to the twelfth lag), $\Delta ner_t$, ..., $\Delta ner_{t-12}$, $D_t^{law} \times \Delta ner_t$, ..., $D_{t-12}^{law} \times \Delta ner_{t-12}$. $k$ denotes the lag. Robust standard errors clustered at the month-year level.

## 11.5. Additional imported content results

Tables 13 and 14 show how ERPT sensitivity for dollarized non-durable goods, durable goods and services responds to the imported content. After the law's enactment, within the $\pm 5$ year time window and the $\pm 7$ year time window, we find that the ERPT sensitivity to imported content falls only for the dollarized durable goods. This could indicate that for pricing decisions, imported content is more relevant for dollarized durable goods (which have a higher percentage of imported inputs) than for dollarized non-durable goods (which have a lower percentage of imported inputs) and for dollarized services (which require a lesser amount of imported input).

Table 13: Imported content and effects of the law, $\pm 5$ year time window

| | $k = nodur$ | $k = dur$ | $k = serv$ |
|---|---|---|---|
| $D_{it}^{USD,k} \times share_i^{m,5} \times \triangle ner_t$ | 0.004 | 0.009*** | 0.013 |
| $D_{it}^{USD,k} \times share_i^{m,5} \times \triangle ner_{t-1}$ | -0.000 | -0.001 | 0.005 |
| $D_t^{law} \times D_{it}^{USD,k} \times share_i^{m,5} \times \triangle ner_t$ | -0.004 | -0.007** | -0.003 |
| $D_{t-1}^{law} \times D_{it}^{USD,k} \times share_i^{m,5} \times \triangle ner_{t-1}$ | -0.001 | 0.001 | -0.003 |
| $N$ | 7,074 | | |
| $R^2$ | 0.027 | | |

*** p<0.01, ** p<0.05, * p<0.1

Note: All columns belong to the same regression. Omitted coefficients for control variables, $\Delta ner_t$, $\Delta ner_{t-1}$, $D_t^{law} \times share_i^{m,5}$, $D_{t-1}^{law} \times share_i^{m,5}$, $D_t^{law} \times \Delta ner_t$, $D_{t-1}^{law} \times \Delta ner_{t-1}$, $share_i^{m,5} \times \triangle ner_t$, $share_i^{m,5} \times \triangle ner_{t-1}$, $D_t^{law} \times share_i^{m,5} \times \triangle ner_t$ and $D_{t-1}^{law} \times share_i^{m,5} \times \triangle ner_{t-1}$. $k = [nodur, dur, serv]$ denotes the type of good or service. Robust standard errors clustered at the month-year level.

Table 14: Imported content and effects of the law, ±7 year time window

| | $k = nodur$ | $k = dur$ | $k = serv$ |
|---|---|---|---|
| $D_{it}^{USD,k} \times share_i^{m,7} \times \triangle ner_t$ | 0.001 | 0.006*** | 0.016*** |
| $D_{it}^{USD,k} \times share_i^{m,7} \times \triangle ner_{t-1}$ | 0.001 | -0.002 | 0.002 |
| $D_t^{law} \times D_{it}^{USD,k} \times share_i^{m,7} \times \triangle ner_t$ | -0.001 | -0.004** | -0.007 |
| $D_{t-1}^{law} \times D_{it}^{USD,k} \times share_i^{m,7} \times \triangle ner_{t-1}$ | -0.002 | 0.002 | -0.000 |
| $N$ | | 9,643 | |
| $R^2$ | | 0.021 | |

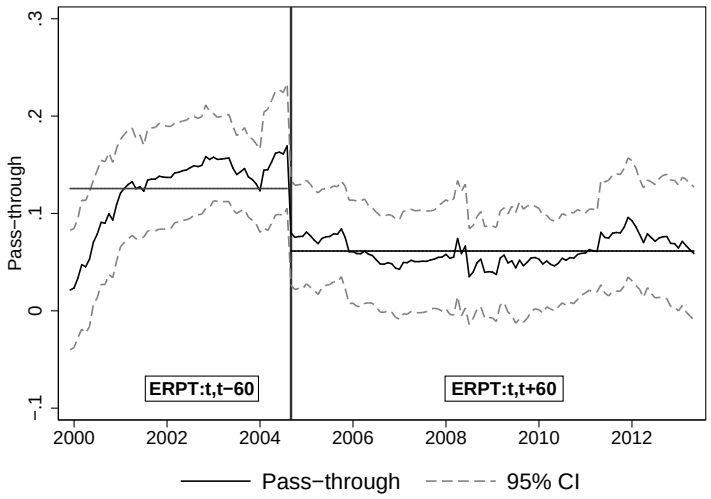
*** p<0.01, ** p<0.05, * p<0.1

Note: All columns belong to the same regression. Omitted coefficients for control variables, $\Delta ner_t$, $\Delta ner_{t-1}$, $D_t^{law} \times share_i^{m,7}$, $D_{t-1}^{law} \times share_i^{m,7}$, $D_t^{law} \times \Delta ner_t$, $D_{t-1}^{law} \times \Delta ner_{t-1}$, $share_i^{m,7} \times \triangle ner_t$, $share_i^{m,7} \times \triangle ner_{t-1}$, $D_t^{law} \times share_i^{m,7} \times \triangle ner_t$ and $D_{t-1}^{law} \times share_i^{m,7} \times \triangle ner_{t-1}$. $k = [nodur, dur, serv]$ denotes the type of good or service. Robust standard errors clustered at the month-year level.

## 11.6. Rolling window estimations

To take into account the possibility that the ERPT may vary over time, we estimate the evolution of the ERPT. We present rolling window estimations with a 60-period time window following the baseline specification of Table 10. Figure 14 presents a lower mean for the rolling window ERPT in the period after the enactment of the law.

Figure 14: Rolling window ERPT (1)

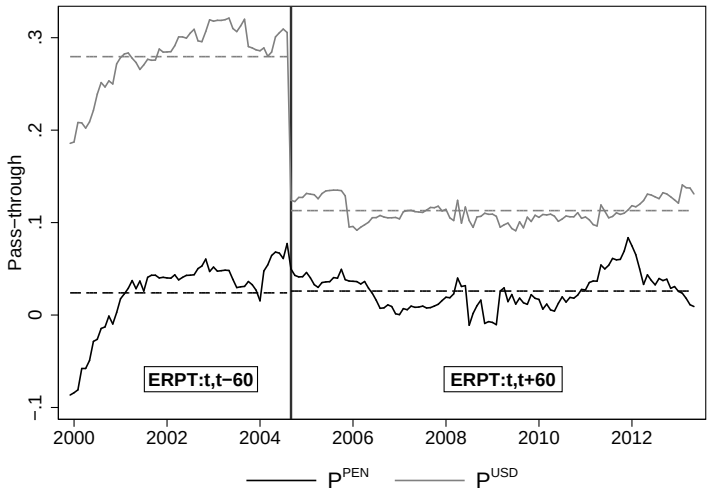



Note: For the period prior to the enactment of the law, the estimated ERPT is based on the data corresponding to the 60 previous months. For the period after the enactment of the law, the estimated ERPT is based on the data corresponding to the following 60 months. Horizontal lines denote the mean for the periods before and after the enactment of the law. The vertical line denotes the enactment of the law.

In Figure 15 we analyze the dynamics of the price indices separating them between dollarized and non-dollarized. The rolling window ERPT for goods and services with non-dollarized prices ($P^{PEN}$) shows values close to 0 either before

or after the law. On the other hand, there was a significant decrease in the average rolling window ERPT for goods and services with dollarized prices ($P^{USD}$) after the enactment of the law. This is consistent with the previous results.

Figure 15: Rolling window ERPT (2)

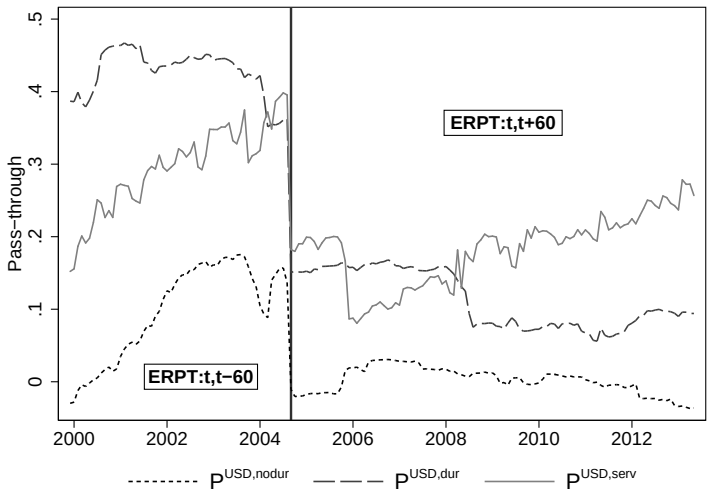



Note: For the period prior to the enactment of the law, the estimated ERPT is based on the data corresponding to the 60 previous months. For the period after the enactment of the law, the estimated ERPT is based on the data corresponding to the following 60 months. Horizontal lines denote the mean for the periods before and after the enactment of the law. The vertical line denotes the enactment of the law.

For our analysis of Figure 16 we separate the dollarized goods and services into dollarized non-durable goods, $P^{USD,nodur}$; dollarized durable goods, $P^{USD,dur}$; and dollarized services, $P^{USD,serv}$; as presented in Table 1. Dollarized non-durable goods exhibit the lowest ERPT before the enactment of the law, but this is completely offset afterwards. Dollarized durable goods have the highest ERPT before the enactment of the law, but after the law this is partially offset. These findings are consistent with the previous results.

In the case of dollarized services, there is a slight reduction in the ERPT in the period after the law's enactment. This variation is not captured by the previous estimations.

Figure 16: Rolling window ERPT (3)



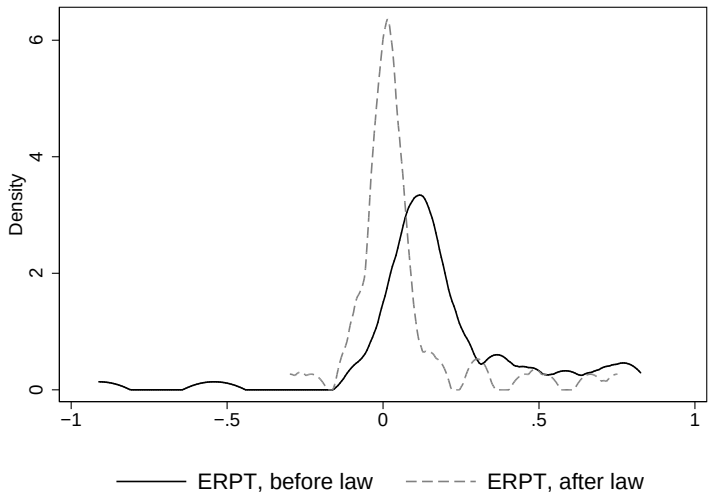

Note: For the period prior to the enactment of the law, the estimated ERPT is based on the data corresponding to the 60 previous months. For the period after the enactment of the law, the estimated ERPT is based on the data corresponding to the following 60 months. Horizontal lines denote the mean for the periods before and after the enactment of the law. The vertical line denotes the enactment of the law.

## 11.7. Individual estimations

In this section we estimate the ERPT individually for the 4-digit price indices.[34] For each price index we perform an estimation for the periods before and after the enactment of the law following the baseline specification of Table 10. The distribution of the individual ERPTs appears on Figure 17. First, we find that the enactment of the law entailed an average reduction in the individual ERPTs, which is consistent with the previous findings. In second place, we find that the law served to reduce the variance in the individual ERPTs. Thus, we find evidence that the law may have diminished the uncertainty of how prices respond to exchange rate variations.

[34] As before, we omit the tubers price index from out estimations because of its high volatility and strong seasonality.

Figure 17: Individual ERPT distributions




Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.

Tables 15 and 16 outline the ERPT statistics corresponding to non-dollarized and dollarized goods and services. In each case, the mean, standard deviation, and median ERPT fall after the enactment of the law. These results are consistent with the previous findings.

Table 15: ERPT for goods and services with non-dollarized prices

| | Mean | Std. dev. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Before law | 0.063 | 0.236 | -0.911 | 0.092 | 0.427 |
| After law | 0.016 | 0.142 | -0.299 | -0.000 | 0.457 |

Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.

Table 16: ERPT for goods and services with dollarized prices

| | Mean | Std. dev. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Before law | 0.344 | 0.269 | -0.056 | 0.209 | 0.826 |
| After law | 0.117 | 0.224 | -0.061 | 0.041 | 0.751 |

Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.

Tables 17, 18 and 19 show the summary statistics for goods and services with dollarized prices classified by type. For each of the three groups, the mean, standard deviation, and median fall with the enactment of the law. Focusing on the mean and the median, the greatest reduction is recorded for dollarized non-durable goods, where the ERPT is completely offset, consistent with the previous results. Dollarized durable goods presented the largest mean and largest

median among the three groups before the law, but these values fell after the law. These results are also consistent with the previous findings.

Dollarized services were also subject to a reduction in the mean and median ERPT after the law, albeit the variation is not as drastic as in the case of dollarized non-durable goods or dollarized durable goods. This partially contrasts with the previous estimations, according to which the ERPT for dollarized services did not significantly change after the enactment of the law.

Table 17: ERPT for non-durable goods with dollarized prices

| | Mean | Std. dev. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Before law | 0.169 | 0.027 | 0.138 | 0.172 | 0.194 |
| After law | -0.013 | 0.032 | -0.061 | -0.000 | 0.008 |

Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.

Table 18: ERPT for durable goods with dollarized prices

| | Mean | Std. dev. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Before law | 0.448 | 0.278 | 0.109 | 0.411 | 0.792 |
| After law | 0.119 | 0.244 | -0.026 | 0.048 | 0.665 |

Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.

Table 19: ERPT for services with dollarized prices

| | Mean | Std. dev. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Before law | 0.378 | 0.313 | -0.056 | 0.414 | 0.826 |
| After law | 0.194 | 0.263 | -0.015 | 0.093 | 0.751 |

Note: The ERPT displayed is the sum of the coefficients corresponding to the current value and the first lagged value of the nominal exchange rate percentage variation.