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Exchange rates, remittances and expenditure of households with foreign-born members: Evidence from Australia

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Abstract

We examine the impact of the depreciation of the Australian dollar (AU$) on the expenditure of households with foreign-born members (HFBMs) in Australia. Employing a difference-in-differences methodology and using the 2013-2015 Nielson Homescan Panel Survey data, we find that HFBMs spent more on food in 2014 and 2015 compared to their native counterparts. We verify our results for food and estimate the impact on total expenditure using the HILDA survey, a nationally representative panel dataset. We can rule out alternative explanations for our results such as differences between immigrants and natives in consumption of imports, income growth and price changes. Our empirical results provide insights on how exchange rate changes may affect immigrants differently than natives. Our findings are consistent with reduced spending by immigrants both in terms of remittances and in terms of travelling back to their countries of origin.

JEL Codes: D12, D60, I30, Z13, Z18
Keywords: Exchange rate, immigrant, consumption, Australia

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1. Introduction

Exchange rates affect economic agents in many ways. At the macroeconomic level, they impact trade balance and the inflow of foreign capital in a country (Mankiw, 2015; House et al., 2019), and consequently, productivity across different sectors in the economy (Goldberg & Pavcnik, 2007; Berka et al., 2018). Exchange rates directly affect households and individuals through the prices of traded goods and services (Goldberg & Pavcnik, 2007; Bahmani-Oskooee & Xi, 2012). Exchange rates can also affect the inflow or outflow of foreign remittances (Faini, 1994; Yang, 2008). For example, the sudden decline in the exchange rate of the Filipino Peso during the 1997 Asian financial crisis resulted in increased international remittances to the Philippines (Yang, 2008).[1] Exchange rate effects on remittances can thus affect recipient individuals and the macroeconomy.

In an increasingly globalized world, the economic and social impact of immigration, beyond remittances, has received enormous attention among academics and policymakers. The economics literature is largely focused on the labor market integration of immigrants (e.g., Borjas, 1994, 2003; Card, 2005), including a wide range of research on wage differences between natives and immigrants (e.g., Chiswick, 1978; Breunig et al., 2013). Another strand of literature focuses on the differences in financial decisions between immigrants and natives (e.g., Carroll et al., 1994; Cobb-Clark & Hildebrand, 2006; Sinning, 2011; Bauer & Sinning, 2011; Manacorda et al., 2012; Bertocchi et al., 2018). Effects of immigration on prices, including property prices, has also attracted some attention (e.g., Borjas, 2002; Saiz, 2003, 2010; Cortes, 2008). Recently, Nguyen & Connelly (2018); Nguyen & Duncan (2020) have focused on how immigrants' mental health and happiness are affected by macroeconomic volatility in their home country. A large number of studies focus on the welfare impact on households that receive remittances (e.g., Rapoport & Docquier, 2006; Dustmann & Mestres, 2010; Dustmann & Görlach, 2016; Dustmann et al., 2021).

However, little attention has been given to how macroeconomic shocks like movements in exchange rates can affect immigrants differently than natives. If we ignore the impact of depreciation on the prices of domestic consumption items, natives are unlikely to change their consumption while immigrants are likely to increase their consumption. This is due to the fact that depreciation of the

[1] Remittances may result from different motives – altruistic, loan repayment, insurance, inheritance, and exchange of services and can be used for either consumption or investment (Rapoport & Docquier, 2006; Carling, 2008; Dustmann & Mestres, 2010; Bouoiyour & Miftah, 2015).

currency at the destination country makes remittances (be they for consumption or investment) relatively costly in immigrants' country of origin; if consumption at origin and host countries can be considered as normal goods, migrants are likely to substitute their origin country consumption with consumption in the destination country. On the other hand, the income effect will tend to reduce consumption in both countries, and the resulting total effect on consumption in the host country will depend on the strength of those two effects.

The idea presented above is depicted in Figure 1. Migrant households are characterized by the consumption of two goods – x_1, remittances to their home country (or consumption in their home country) and x_2, representing the purchase of consumption goods in the host country. Since the native households do not send remittances, with budget B_1, their spending is represented by a corner solution at point d, which is invariant to the changes in exchange rates of the domestic country. On the other hand, with budget B_1, immigrants' initial equilibrium occurs at point a giving consumption mix (x_1^1, x_2^1). When the value of the host country currency falls, the budget line swings to B_3, producing a new equilibrium at point c with consumption mix (x_1^3, x_2^3).

[Figure 1]

The budget line B_2 is drawn to separate the income and substitution effect by allowing migrants to keep their utility constant. Thus the consumption mix at point b, (x_1^2, x_2^2), demonstrates that both the substitution effect $(x_1^1 x_1^2)$ and income effect $(x_1^2 x_1^3)$ reduce their consumption of x_1. This is equivalent to migrants sending less remittances.[2] The conclusion is not straightforward for x_2; the substitution effect $(x_2^1 x_2^2)$ increases the consumption of x_2 while the income effect $(x_2^2 x_2^3)$ reduces it. In Figure 1, the total effect on x_2 is positive, which may not necessarily be true in other cases. This requires empirical investigation.

The Australian dollar (AU$) significantly reduced its value against the US$ during 2014-2016 (Figure 2). In particular, the unweighted average exchange rate of AU$ in 2013 was US$1.04, which then reduced to US$0.88 in 2014 and US$0.78 in 2015. The same happened for other important foreign currencies for Australia.[3] Around that time, consistent with the discussion above, migrant

[2]Migrants can also travel back to their home country and spend money there. Later, we will present evidence related to both remittances and time spent in Australia. For the purposes of our theoretical model and empirical estimates, remittances and immigrant expenditure in their home country while travelling there can be treated identically.

[3]In 2016, the top foreign countries in terms of the birthplace of Australian residents were England, New Zealand, China, India, Philippines and Vietnam (Australian Bureau of Statistics, 2016) and the observed pattern of the

remittances from Australia reduced significantly. Figure 3 shows that the total outflow of migrant remittances from Australia in 2013 was nearly US$7.0 billion, which reduced to US$6.6 billion in 2014 and US$6.0 billion in 2015. The second part of Figure 3 shows remittances in Australian dollars. The real value of remittances in the recipient countries is reflected by the US$ value.

[Figure 2]

[Figure 3]

Against this background, this paper examines whether currency depreciation affects the expenditure of households with foreign-born members (HFBMs), which we use as a proxy for immigrant families, differently than natives.[4] Motivated by an understanding from consumer theory, we aim to empirically investigate the change in HFBMs' food and total expenditures, compared to natives, that results from a large depreciation of the Australian dollar. We also examine whether any differences can be explained by changes in purchasing power (because of changes in prices or incomes) in the host country or by changes in the behavior of households with foreign-born members. By providing empirical evidence on the impact of depreciation on the expenditure of households with foreign-born members, the first study of this type, our paper makes a unique contribution to the immigration economics literature where limited or little attention has been given to how macroeconomic changes like currency depreciation affect immigrants.

The rest of the paper is organized as follows. Section 2 provides a discussion of our empirical settings and identification strategy. Section 3 includes a description of the data. The results, including all the robustness checks conducted in our analysis, are discussed in Section 4. Section 5 concludes.

2. Empirical framework and identification

For an Australian household with foreign-born member(s), let x_1 be a basket of (normal) goods consumed in the country of origin with price p_1 and x_2 be a basket of (normal) goods consumed in

movement in the value of AU$ against US$ holds against currencies of all those countries. See Appendix Figure A.1 and Table A.1, for details. The Reserve Bank of Australia has no published data for the Philippine Peso before 2014.

[4] We focus on expenditures instead of incomes as consumption habits are persistent and smoother, unlike income (Barrett et al., 2000; Havranek et al., 2017).

Australia with price p_2 (all in AU$).[5] The household needs to solve the following problem

$$\max_{x_1, x_2} u(x_1, x_2) \text{ s.t. } p_1 x_1 + p_2 x_2 = Y, \tag{1}$$

with Y being the nominal income of the household.

A fall (rise) in the value of AU$ would raise (reduce) p_1 as less (more) x_1 will be purchased by the endowment. Ignoring the effect of the fall in AU$ on the prices in Australia for the moment, this indicates that consumption of x_1 will fall due to both substitution and income effects.[6] On the other hand, the increase in p_1 will mean that the consumption of x_2 will reduce due to the income effect but will increase due to the substitution effect. Thus the consumption of x_2 may increase or decrease depending on which effect dominates. Normalizing p_2 equal to 1, the demand for x_2 can be expressed as $x_2(p_1, Y)$. Using superscripts to indicate time, the percentage change in the consumption of x_2 before (0) and after (1) the change in p_1 can be expressed as

$$\frac{x_2(p_1^1, Y) - x_2(p_1^0, Y)}{x_2(p_1^0, Y)} = \frac{x_2(p_1^1, Y(p_1^1, u^1)) - x_2(p_1^0, Y(p_1^0, u^0))}{x_2(p_1^0, Y(p_1^0, u^0))} \tag{2}$$

Given that remittances (representing consumption in the home country) is a small part of total consumption, the change in real income resulting from the change in p_1 (which is equivalent to the change in exchange rate in our setting) would typically be low. Ignoring it, the percentage change in the consumption of x_2 can be expressed as

$$\frac{x_2(p_1^1, Y) - x_2(p_1^0, Y)}{x_2(p_1^0, Y)} = \frac{\partial x_2}{\partial p_1} \frac{\Delta p_1}{x_2} = \left(\frac{\partial x_2}{\partial p_1} \frac{p_1}{x_2} \right) \frac{\Delta p_1}{p_1} = \eta_{p_1} \frac{\Delta p_1}{p_1} \tag{3}$$

where, η_{p_1} is the price elasticity of demand for x_2 with respect to p_1 (or the exchange rate). The elasticity η_{p_1} can be estimated by comparing host country consumption of households with foreign born members before and after the change in the exchange rate (p_1).

However, the change in the exchange rate will cause domestic prices in Australia to change through foreign trade. Therefore, for any analysis, it is important to address such effects. Thus,

[5] Here, x_1 can be thought of representing goods consumed in the origin country by migrants travelling back home or financed by the remittances of foreign-born Australians which, after discounting, can be considered as their consumption.

[6] Which, in our case, will essentially mean that remittances outflow from Australia will fall.

the impact of the change in the exchange rate on an HFBM can be identified by $\frac{\partial x_1}{\partial p_1}\Delta p_1$, $\frac{\partial x_1}{\partial p_2}\frac{\partial p_2}{\partial p_1}\Delta p_1$, $\frac{\partial x_2}{\partial p_1}\Delta p_1$ and $\frac{\partial x_2}{\partial p_2}\frac{\partial p_2}{\partial p_1}\Delta p_1$. The first two terms give the direct and indirect impact of the exchange rate on the consumption in the country of origin of foreign-born Australians, while the last two terms give the direct and indirect impact of the exchange rate on their consumption in Australia, respectively. For a native Australian, only the last term is relevant as, for them, x_1 is zero, and the exchange rate has no direct effect on their consumption (x_2).

Thus, comparing host-country consumption of households with foreign-born members against natives will remove the effect of price changes in Australia and will identify the direct effect of exchange rates on the consumption of the former group in their host country ($\frac{\partial x_2}{\partial p_1}\Delta p_1$). As a result, we use a difference-in-differences (DD) model to identify the impact of exchange rate on the consumption of households with foreign-born Australians in their host country. While the pattern is likely to hold for all types of consumption, we first investigate the case of food because of the availability of high-frequency and high-quality data. We primarily focus on expenditure since using quantity generated from household expenditure data is problematic as it ignores quality (Deaton, 1988, 1997; Gibson & Kim, 2019). Our DD model is as follows:

$$y_{it} = \alpha + \beta z_i + \sum_{t=2014}^{2015} (\gamma_t d_t + \delta_t z_i \times d_t) + \boldsymbol{\theta X_{it}} + \psi_s \times d_t + \phi_i + u_{it}, \tag{4}$$

where, for each household i and year t, y represents (the log of) household food expenditure, z is a dummy indicating whether the household has at least one foreign-born member, d is a dummy taking the value of one for the period t and zero for the reference period (i.e., 2013), $\boldsymbol{X}$ is a vector of control variables, and u captures unobservable effects.[7] $\boldsymbol{X}$ includes variables that can affect households' food consumption behavior including household size, annual household income (reported in 21 ranges), home type and home ownership status. We also control for state × year fixed effects ($\psi_s \times d_t$) to net out the effect of location-specific factors like employment opportunity and price level. It is possible that, with regard to consumption, HFBMs are different from their native

[7] Immigrant households can also be identified by the country of birth of the household head. We repeat the analysis with this alternative definition of immigrant households and find similar results–see Section 4.1 below. We prefer the results with the definition based upon any household members as we believe this can better indicate the connection of the household with the home country.

counterparts. The longitudinal nature of our data allows us to control for individual heterogeneity, and therefore we employ household fixed effects (ϕ_i) in our estimation.[8]

Thus, in our model, the coefficients δ_t are the difference-in-differences estimates, indicating the impact of the depreciation of the domestic currency on the food expenditure behavior of Australian HFBMs. Expressed as a ratio, the DD estimates are $\delta_t = \eta_{p_1} \frac{\Delta p_1}{p_1}$, the quantity arrived at in equation (3).

The DD model relies on comparing the difference in food expenditure between HFBMs and native households before and after the change in the exchange rate of the Australian dollar. The first identifying assumption of this approach is that the difference in food expenditure between HFBMs (treatment) and native households (control) would have remained the same without the change in the exchange rate of the AU$. We cannot test the identifying assumption directly, but by examining historical trends, using two different approaches, we assess the validity of this 'common trends' assumption.

Our approach also relies on the assumption that, except for the change in the exchange rate of the AU$, no other shocks (e.g. political instability, macroeconomic conditions or natural disasters in the origin country of immigrants) have affected natives and HFBMs differently during this time period. This is a strong assumption but we believe that it is likely to hold in our case. The economic situation in the country of origin of Australian immigrants, based upon inspection of key macroeconomic variables, was largely stable during the study period.[9] The exchange rate patterns, relative to the Australian dollar (see Appendix Figure A.1), all follow roughly the same pattern over the study period. In Sections 4 and 4.1 below, we conduct a variety of robustness checks to see whether our results might be driven by factors in the origin countries of immigrants.

3. Data

Validation of our hypothesis requires very accurate consumption data. Unfortunately, such data are not available for all types of consumer goods; however, they are available for food. In this paper,

[8] We include both household and state fixed effects because some households move during the data period. Results are not sensitive to the exclusion of the state × year fixed effects nor to using state effects on their own not interacted with year.

[9] The composition of migrants' origin countries have the following share in the NHPS: New Zealand-11.8, United Kingdom/Ireland-19.4, Greece-0.5, Italy-1.8, Other Europe-6.5, Asia -9.0 and Other-51.0. See their GDP per capita at https://databank.worldbank.org/source/world-development-indicators/preview/on.

we use the 2013-2015 Nielson Homescan Panel Survey (NHPS) data – a nationally representative longitudinal survey of Australian households which collects detailed information on food expenditure. Household-level information in the survey includes socioeconomic and demographic data – household income, family size, location (postcode) of residence, home type, home ownership status and each household member's sex, age, marital status, years of schooling, occupation, employment status (full time or part-time), country of birth, height and weight. The grocery data contain barcode level information on daily food items purchases by the surveyed households. Barcodes can identify the category, brand, price, and quantity of each item purchased. The data also contain information on the outlet from where the product has been purchased and whether the product was on sale at the time of purchase.[10]

The NHPS includes 10,441, 10,574 and 10,561 households for 2013, 2014 and 2015 waves, respectively.[11] We construct a balanced panel of 8,324 households for our analysis. For grocery data, we start with 29,025,586 food purchases made by the survey participants during December 2012-December 2015. From that, we drop 31,377 transactions that do not belong to food items. As we focus on annual expenditures, we also drop 780,810 transactions made in December 2012. Then, for each household and year, we aggregate the remaining 28,213,090 transactions into 128 food categories, reducing our data to 1,959,666 observations.[12] From that, we drop 310 observations with missing price or quantity information. Then, we reshape our data to put the information on 128 categories into columns and end up with a sample of 32,441 observations. Dropping households with no match between grocery and demographic data, missing data on family size, and those who are outside the balanced panel excludes 220, 1 and 7,248 observations, respectively. Thus our final analysis sample consists of 24,972, household $\times$ year observations.

We construct three other samples to conduct supplementary analysis. The *second* sample is to conduct our analysis with prices and quantities. For this, we employ the grocery data without collapsing the grocery items into the 128 food categories. Again we retain observations for households that belong to the balanced panel. This analysis sample includes 1,598,334 observations. The *third* sample is used to validate the assumption of common trends in food expenditure between HFBMs

[10]See Nielsen Corporation (2016); Sharma et al. (2014); Harding & Lovenheim (2017); Eden (2018); Hasan & Sinning (2018), for a detailed description of the data. The program codes used in the paper, in combination with NHPS 2013-2015, can replicate the results and are available online.

[11]See Appendix, Table A.2, for a detailed distribution of households over the years.

[12]See Appendix, Table A.3, for a list of all food categories in our data.

and native households using 2013 weekly expenditure. For that, we again employ the sample of grocery data without collapsing. We drop 12 households with missing family size and anyone who does not have complete grocery data for the year of 2013. This analysis sample includes 330,023 weekly observations on 8,324 households.[13]

To check our results using an unbalanced panel, we followed the process of selecting our *main* sample, but this time retaining all households, even those that only appear in one or two years. This *fourth* sample includes a total of 32,220 observations.

In some of our analysis, we use data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey – a nationally representative panel survey that has been collecting socioeconomic, demographic and labor market data of Australian households since 2001. HILDA is recognized as an ideal source of data for labour market dynamics and household formation and dissolution. Since 2005, HILDA has collected consumption data for over 20 different household expenditure items. These are gathered at a very aggregate level with some expenditure items being self-reported at the weekly level, some at the monthly level and some at the annual level. HILDA combines these responses to impute total household expenditure and total food expenditure. In our sensitivity checks, we use total household expenditure from HILDA, since we do not have total expenditure in the Nielson data, to see if our results hold for total household expenditure. We also combine food expenditure with the more detailed immigrant country of origin data from HILDA as a further sensitivity check on our model. We prefer the higher-quality Nielson data based on actual purchases to the self-reported and less reliable HILDA consumption data for our main results.

With HILDA, we start with 9,555, 9,538 and 9,631 households for 2013, 2014 and 2015, respectively. From that, we drop 4,917 observations with missing or nil household expenditure and further exclude 4,451 observations as the associated households were not available for all three years.[14] Our HILDA analysis sample thus includes 6,452 households with 19,356 observations.[15]

Table 1 presents annual household food expenditure in our main analysis sample, separately for households with and without foreign-born members. Both mean and median values indicate that household food expenditure increased between 2013-2014 and dropped in 2015. The increase

[13]Not all households undertake shopping every week.

[14]In HILDA, we track household heads over time and use information about that individual's household at each wave.

[15]Details of the HILDA survey design can be found from Wilkins & Lass (2018).

in 2014 is higher for HFBMs, while the reduction in the next period is lower than for their native counterparts, indicating a differential change over time rate in the food expenditure of HFBMs and natives.

[Table 1]

4. Results and discussion

As a preliminary check of any difference in food expenditure between HFBMs and native households, we start with a cross-tabulation of mean food expenditures (Table 2). The upper panel of the table compares food expenditure for 2013 and 2014 while the lower panel does the same for 2013 and 2015. The rows split the data by time while the columns split the data by household type – natives versus HFBMs. Each cell shows the mean food expenditure of the group in the column for the period in the row. We also report standard errors of means as well as the number of observations.

[Table 2]

Natives have higher food expenditure than HFBMs in 2013, although the difference is not significant. Food expenditures of both groups increases in 2014. The increase in food expenditure for the HFBMs is around 2.5 percent higher than the natives, resulting in identical reports of average food expenditure in 2014 for the two groups. The difference in growth rates between the two groups is not statistically significant.

As the value of AU$ has been much lower in 2015 compared to 2014, we expect a higher impact when we compare the food expenditures of 2013 with that of 2015. The bottom panel of Table 2 repeats the previous analysis and finds that HFBMs' food expenditure increase by 4.2 percent, which is higher than the impact we observe for 2014. However, the effect is only statistically significant at the 10 percent level, indicating the need for a better model to make the estimates precise.

One of the potential reasons for the lower significance of these simple difference-in-differences (DD) estimates is the differences in the characteristics of the HFBMs, compared to the households who do not have any foreign-born member. Summary statistics for the two groups of households are presented in Table 3. We see significant differences in some characteristics for all the years, 2013-2015. It is likely that the two groups will also differ in terms of some unobservable household characteristics. As a result, in examining the differences in food expenditure between HFBMs and native households, we employ household fixed effects in our estimation. We further control for important household characteristics which may change over time.

[Table 3]

The main results from our analysis are presented in Table 4. Column 1 presents the results that use the model in equation (4) but excludes both the variables listed in vector $\boldsymbol{X}$ and the state fixed effects. The results indicate that HFBMs have higher food expenditure in 2013, which increases in 2014 but reduces in 2015. However, as the DD coefficients indicate, HFBMs experience a positive impact on food expenditures in both periods, compared to that of their native counterparts.[16]

[Table 4]

As other variables may have a significant impact on food expenditure, we incorporate them into the model. The corresponding results are presented in column 2 of Table 4. The difference in food expenditure between HFBMs and native households is positive but becomes statistically insignificant. As the model includes household fixed effects, this coefficient is identified only off of those households which change status from HFBM to native or vice versa.[17] Also, food expenditure increases in 2014 but reduces in 2015. However, the DD estimates remain largely similar in both specifications. Among other variables, a positive impact of household size reveals the fact that larger households are likely to spend more.

Next, we add the state fixed effects into the model of equation (2) to estimate our final and preferred specification. Our results remain largely unchanged with this modification in the specification (column 3); food expenditure increases 2.2 per cent more in 2014 and 4 per cent more in 2015 for HFBMs relative to native households. The overall results in Table 4 indicate that the depreciation of the Australian dollar increases HFBMs' food expenditure relative to natives.[18]

In particular, our estimate in Column 3 of Table 4 indicates that, $\frac{x_2(p_1^1,Y)-x_2(p_1^0,Y)}{x_2(p_1^0,Y)} = 0.0220$ for 2014. Let the US\$ be the basis for p_1 so that AU\$/US\$ reflects p_1. Thus, from Table A.1, $p_1 = 0.96$

[16] All tests are conducted at the 5 percent significance level.

[17] There are 122 households which switch status from foreign-born to native and 61 which switch from native to foreign born over the three years of the sample.

[18] We find similar results when we use per capita food expenditure as the dependent variable.

(in 2013) and 1.14 (in 2014) (implies $\Delta p_1 = 0.18$ between 2013 and 2014) indicates that η_{p_1} (in equation 3)=0.12. The elasticity of food expenditure with respect to the exchange rate is identical for 2015–that is a one per cent depreciation in exchange rate produces a 0.12 per cent increase in food expenditure.

The DD estimates of the impact of the exchange rate depreciation on food expenditure depend upon two key assumptions: the first is that the growth in food expenditure for the two groups would have been identical in this time period in the absence of the exchange rate depreciation. This is sometimes called the parallel trends assumption. The second key assumption is that there were no other macro-economic events that differentially impacted on migrant and host country households. For example, political instability or natural disasters in the origin country could change migrant consumption patterns.

We begin by testing the parallel trends assumption in two ways. First we look at the trends in *weekly* food expenditure in the Nielson Homescan data. We only have data available from December 2012, so we can not compare annual food expenditure over multiple years prior to the exchange rate depreciation, but we can look at the evolution of weekly food expenditure during 2013 while the exchange rate was stable. We use the *third* analysis sample to test whether HFBMs have a different trend of food expenditure than their native counterparts.

Figure 4 plots the partialled out food expenditure (residuals from the semiparametric regression of food expenditure on household characteristics and time dummies) of both groups together with their semiparametric fit. The figure reveals a parallel food expenditure pattern for the two groups, giving us some support for the common trend assumption holding. We have also employed a regression-based analysis to investigate the impact of the presence of foreign-born members on the weekly food expenditure in 2013 and arrive at a similar conclusion. We interact the indicator for HFBM with weekly food expenditure and of the 52 coefficients there is only one that is statistically significant, less than what one would expect just by random chance when testing at the five per cent level. See Appendix, Table A.4, for coefficient estimates using the model of equation (4) and Figure A.2 for the associated plot of the weekly DD coefficient estimates.

[Figure 4]

As previously mentioned, the HILDA data provide detailed consumption and demographic data over a much longer time period which provides us both with an opportunity to check our main results and an opportunity to see if the parallel trends assumption holds. These estimates are presented in Table 5. We arrive at qualitatively similar conclusions using HILDA from 2009 - 2015 as we did with the Nielson Homescan data. Consumption patterns of HFBMs are connected to the exchange rate, as shown in Figure 2, in the way that theory would suggest. In particular, the DD estimates in Table 5 indicate a negative impact on food consumption in 2009-2010, at a period when the exchange rate of AU$ was lower than that of 2013, and a positive impact in 2014-2015 when the situation was opposite. While the coefficients are not always statistically significant, the impact estimates for 2014 and 2015 are not statistically different from those that we find using the Nielson Homescan data. Food expenditure in HILDA, as already pointed out, is self-reported and much noisier than the Homescan data which leads us to prefer the impact estimates of Table 4.[19]

Table 5 also provides evidence for the parallel trends assumption. The impact estimates for 2011 and 2012 are both statistically insignificant and very close to zero. This is consistent with the high and stable exchange rate that prevailed during that period and suggests that in the absence of the exchange rate depreciation in 2014, that the trends in food expenditure would have remained the same for the two groups of households.

[Table 5]

An additional concern for our identification strategy is the possibility that other macro-economic events or political instability may be affecting the consumption of natives and immigrants differently. We try and address this in several ways. First, Figure A.1 shows that the exchange rate shock was ubiquitous. Secondly, if we examine the economic performance of the key sending countries of immigrants to Australia over this period, 2013-2015, we see slow but steady GDP growth and stability in most macro-economic quantities over this period–see footnote 9.

An alternative estimation strategy to attempt to control for this is to use country $\times$ year fixed effects to control for any country-specific shocks that happen in particular years which may be influencing our results. Table 6 presents these results. The coefficient estimates are almost identical to those presented in Table 4, but the standard errors are, unsurprisingly, somewhat

[19] Exchange rates may have asymmetric effects as found by Kandil & Mirzaie (2002); Bergin et al. (2007).

larger as inclusion of these fixed effects removes additional variation from the model. Table 6 provides some comfort that country-specific shocks are not driving the results.

[Table 6]

Another approach to test whether or not the DD estimates are influenced by other macro-economic effects for which we have not controlled is to split the sample into those countries where we think such effects are likely to be concentrated. Recalling that information on immigrant country of origin is grouped into eight categories, we divide the sample into those countries which we think can be reasonably considered as 'stable' and 'potentially unstable.' In the stable group, we put: New Zealand, United Kingdom/Ireland, Greece and Italy. In the potentially unstable group we put: Other Europe, Asia and Other.[20]

Tables 7 and 8 present estimates from equation (4) separately by these two groups. For both groups, we find that the patterns of Table 4 hold–food expenditure is higher in 2014 than in 2013 and higher again in 2015, consistent with a response to the exchange rate appreciation. For the stable group, the impact estimate in 2014 is not statistically significant but it is also not statistically different than what is found in Table 4.

We find larger impacts in the 'potentially unstable' group than in the 'stable' group. There are two potential reasons for this. One could be that the DD estimates for the 'potentially unstable' group are somewhat influenced by other macro-economic phenomena and are thus over-estimating the impact of exchange rate fluctuations. The other possibility is that the income effect is stronger in these groups because immigrant incomes are, on average, lower in this population and exchange rate changes will thus generate larger impacts on income. While we can not determine which of these is the case, our overall investigation leads us to conclude that it is not other macro-economic phenomena that are explaining our results.

[Tables 7 and 8]

Next, we explore other possible explanations for our results. We consider whether incomes of natives and immigrants may have evolved differently over this time period, potentially contributing

[20] One might argue that Greece and Italy are unstable, but their instability is of a relatively stable nature. If we re-estimate the models and move Greece and Italy to the 'potentially unstable' group, the results are almost identical to what we present here.

to different rates of growth in food expenditure. We examine whether differences in consumption of imports, which will be affected by exchange rate variations, can explain our results. We examine whether it is changing prices or quantities that explain the changes in overall food expenditure. Finally, using the HILDA data, we explore total expenditure to see whether the patterns are different than those we observe for food expenditure.

One possible explanation for HFBMs spending more on food, compared to their native counterparts, is the possibility of an increase in earnings for the former group over this time period. For example, Nekoei (2013) found that immigrants may work less hours and earn less when they experience appreciation in the host country currency. While we control for income in our previous analysis, we now specifically investigate whether there is any impact of the depreciation of the AU$ on HFBMs' incomes against their native counterpart.[21] To do so, we again use the framework in equation (4) but now use household income as the dependent variable.

Results in column 1 of Table 9 indicate that HFBMs have higher incomes than natives in the reference period. Incomes of the native households increase over time, both in 2014 and 2015. However, the two insignificant DD estimates indicate that the increases in incomes are similar for the HFBMs and natives. The results remain largely similar as we add more explanatory variables (as listed in vector $\boldsymbol{X}$) in the model (column 2). We also arrive at a similar conclusion when we include state fixed effects (column 3).

[Table 9]

The overall results in Table 9 demonstrate that the depreciation of the Australian dollar has no differential effect on the incomes of HFBMs and native households in Australia. One potential concern of this analysis with income can be the low F-stats for our models, which are expected as our income data are reported only in (a total of 21) ranges–an ordered logit model gives similar conclusions.

Cultural and social backgrounds may induce migrant households to consume a larger proportion of imported goods from their country of origin. Since depreciation is likely to put upward pressure on the prices of imported goods, migrant households may end up spending more on food.

[21] Analyzing both income and expenditure may also show the pattern of consumption-smoothing mechanisms (Attanasio & Pistaferri, 2016).

Unfortunately, the barcode descriptions in our data do not identify food by source country and we cannot differentiate between imported and local food items in our data.

We therefore used international trade data to gauge the import intensity of food items in Australia. Specifically, we used the Food and Agriculture Organization (FAO)'s Trade data for "Crops and livestock products".[22] The data contain export and import quantities of 1,345 crops and livestock commodity categories, although not all the items (like wool) were relevant for our analysis. We considered a category as import-intensive if the value of imports in 2013 is higher than the value of exports. We then manually matched the categories with the NHPS categories. The exercise identified 34/128 NHPS categories as import intensive.

Then we used a triple difference (DDD) model to examine whether there is any difference in the expenditure pattern on imported foods (non-imported foods are the reference category) in 2014 and 2015 (against 2013) between HFBMs and native households.[23] In that model, the DDD estimate will be positive if expenditures on imported food items increase more for HFBMs compared to their native counterparts.

Table 10 presents the results of our triple difference model. Column 1 results are from the model that only uses a basic DDD set up excluding state fixed effects and other controls, $\boldsymbol{X}$. The results show a DDD estimate that is insignificant at any conventional level of significance, indicating that over time changes in expenditures on imported goods are similar for both groups of households. Our results remain unchanged as we add other covariates (column 2) and state fixed effects (column 3).

[Table 10]

Previous literature observes that, in times of crisis, people may spend more time searching for better prices and thus can offset the impact of higher food prices.[24] As locals may have more information about the market price of a product, they can be more efficient in buying at cheaper prices (Lee & Park, 2019). Such behavioral patterns will result in a relatively higher food expenditure for HFBMs. Using the previous DD set up but now using our *second* analysis sample

[22]See, http://www.fao.org/faostat/en/#data/TP.

[23]The model can be written as $Y_{it} = \alpha + \beta Z_{it} + \eta I + Z_{it} \times I + \sum_{t=2014}^{2015}(\gamma_t D_t + \delta_t Z_{it} \times D_t + +\pi_t I \times D_t + \mu_t Z_{it} \times I \times D_t) + \theta X_{it} + \psi_s + u_{it}$, where, in addition to the notation described earlier, I is a dummy variable taking the value of 1 if the purchased good is imported and 0 otherwise.

[24]Households affected by economic shocks may reduce real food expenditure while maintaining calorie purchase and nutritional quality by adjusting shopping effort and the characteristics of their shopping baskets (McKenzie & Schargrodsky, 2011; Aguiar & Hurst, 2007; Griffith et al., 2016; Hasan, 2016, 2019).

and employing price as the dependent variable, we examine whether HFBMs pay higher prices for the food items they purchase.[25] Results are presented in Table 11. Column 1 indicates that HFBMs may pay a higher food price, but the coefficient is significant only at the 10 percent level of significance. The coefficients for the two treatment years 2014 and 2015 indicate that food prices in Australia increased in 2014 and more so in 2015. However, the DD estimate confirms that both groups experience price increases in the same way.

[Table 11]

Next, we add more control variables in the model. Results in column 2 of Table 11 indicate that, when we control for the household characteristics, HFBMs and native households pay similar prices for food items. Furthermore, prices increase over time but similarly for both groups. Column 3 presents results from our final model that adds the state fixed effects into the specification. Again we observe similar results – while food prices increase on average 2.5 percent in 2014 and 3.0 percent in 2015 (compared to 2013), there are no differences over time in the prices paid by HFBMs and native households.[26] Finally, as the mean price can be affected by extreme values, we repeat the same analysis with median prices and obtain similar results. Overall, our analysis with prices offers support to reject the hypothesis that HFBMs in Australia pay higher food prices compared to native households.

We next examine whether increases in the quantity of food items are responsible for the higher food expenditure of HFBMs. We again use the previous DD set up but now use the quantity of food items as the dependent variable and include category fixed effects to net out differences in the purchase of the 128 different food categories. Results from this analysis are presented in Table 12. Again, column 1 presents results with the basic DD set up. It indicates that HFBMs purchase more food items in 2013 and the food consumption of native households significantly reduces in both 2014 and 2015. However, for HFBMs, food consumption increases in 2014 while the reduction in food consumption is much lower in 2015 compared to the natives, resulting in significantly positive DD estimates for both cases.

[25] We control for household $\times$ food category fixed effects to net out the differences in household-specific prices across the 128 food categories.

[26] Against such a large depreciation of the AU$ between 2013 and 2015, these price increases appear low but not unlikely as, for many countries, retail prices of traded goods are sticky in national currencies (Chen et al., 2018; Jacob & Uusküla, 2019).

[Table 12]

Adding other control variables in the model (column 2) and further adding state fixed effects in the specification (column 3) provide similar results. The final and preferred model indicates that native households consume 2.3 percent less food in the reference period. Their consumption reduces 0.3 percent in 2014 and 7.5 percent in 2015. The DD coefficients indicate that HFBMs consume 1.5 percent more food items in 2014 and 2.1 percent more in 2015 when we compare the increase over time in food purchases with the native households. Thus we conclude that HFBMs increase their food consumption compared to their native counterpart as a result of the reduction in the value of the Australian dollar between 2013 and 2014-2015.

Finally, as an additional check on our results, we look at total expenditure using the HILDA data to confirm whether the total consumption of HFBMs, compared to that of natives, also increased in 2014 and 2015 compared to 2013. While the HILDA expenditure data is self-reported and less precise than that in the NHPS, it still provides us with some ability to assess the impact on total expenditure.

To do so, we repeat our main analysis (equation 4) with HILDA survey data but now using (log of) total household expenditure as the dependent variable. Results from that analysis, presented in Table 13, are similar to our previous analysis with food expenditure. In our preferred specification of Column 3, we find statistically significant impacts of the exchange rate appreciation on the total expenditure of immigrants in 2014 and 2015.

[Table 13]

Our estimate in Column 3 of Table 13 indicates that the elasticity of total expenditure with respect to the exchange rate is 0.12 in 2014. In our setting, it indicates that a 1 percent depreciation in the exchange rate of the host country currency increases the host country expenditure of households with foreign born members by 0.12 percent. This is identical to the elasticity of food expenditure that we found in our main analysis using the NHPS data in Table 4. Importantly, this is the lower bound of the estimate as our analysis ignores the (negative) income effect on consumption.

Table 13 also includes information that can be used to test the common trends assumption. We find no statistically significant difference in growth of total consumption between immigrants and natives for the 2011 and 2012 periods when the exchange rate was stable. The estimates for the interaction between HFBM and those two year dummies are close to zero. This provides further confirmation that the parallel trends assumption required for the validity of our DD estimates holds.

Figure 5 shows the point estimates and confidence intervals for the yearly DD estimates. This summarises the key results from Table 13.

[Figure 5]

We now turn to some additional robustness checks.

4.1. Sensitivity checks

We further conduct a series of checks to verify the robustness of our results.[27] Above, we define an HFBM as one in which any member of the household is born overseas. We test this specification by re-estimating the models but re-defining HFBMs as those where the household head is born overseas.[28] We find results that are similar to what we have observed earlier. We also repeat the analysis defining HFBMs based on the birthplaces of the majority of members. The estimated effects are larger compared to what we observe for a single member-based definition which is in keeping with our expectation. Similar results are also observed when we employ a continuous variable for the treatment group given by the ratio of overseas-born to total members in the household. In both cases, households with a higher proportion of immigrant members would have a stronger connection to the origin country and measuring immigrant households in this way may also pick up the larger income effect discussed above. Results for this latter specification are presented in Table A.5.

Our approach pools the model for 2014 and 2015. The relationship between characteristics and consumption may have changed over this period. If we separately estimate the model for 2014 and 2015, using 2013 as the base year, we get results that are nearly identical to Table 4.

Our main analysis uses a balanced panel. Using the unbalanced household panel data provides quantitatively similar results (Table A.6).

[27] Full results of any estimation discussed here are available from the corresponding author upon request.

[28] The country of birth of foreign-born household heads in the NHPS sample is distributed as follows: NZ 304, UK/Ireland 390, Other Europe 169, Asia 178 and Other foreign countries 1,299.

HFBMs and natives may be different in ways that are hard to control for in a regression and this may affect the results. To address this issue, Crump et al. (2009); Gibson & McKenzie (2014) suggest selecting a set of comparable treatment and control observations who belong to the distribution of propensity scores (PSs) in the range [0.1,0.9] and to then conduct the analysis on this selected sample. As it turns out, most observations in our data are relatively similar and all of the estimated PSs in our data fell within the recommended limit. However, we did trim observations belonging to the top and bottom deciles of the distribution of PSs and repeated the entire analysis. Our conclusions remain unaffected–see Table A.7.

Fourth, it could be argued that immigrants from low-income countries may feel compelled to send remittances to meet the necessities of extended families in their home country, which may actually result in reducing their host country consumption. On the other hand, remittances are expected to represent a greater share of income for migrants from low-income countries and therefore, they may react more than their high-income country counterparts. Tables 7 and 8 above indicate that the effect of depreciation on consumption is mostly coming through immigrants from low-income countries. As we discuss above, this could be because of other macro-economic factors or because of a larger income effect for those from poorer countries. It does not seem to be driven by cultural norms or 'obligations' with respect to remittances operating at a stronger level for those from low-income countries.

Annual variation of the exchange rate may not be enough to identify the effects and rule out other aggregate shocks. Thus, including the exchange rate directly into the model may better capture its impact on the consumption of HFBMs. Some related studies found significant effects of the real exchange rate on migrants' income, return migration and other labour market outcomes (Nekoei, 2013; Abarcar, 2017; Nguyen & Duncan, 2017). The NHPS only provides birth country in eight categories–see footnote 9–for which it is nearly impossible (or at best arbitrary) to build a country- or region-specific exchange rate. Instead, we turn to the HILDA data, which provides exact country of birth, to repeat the main analysis using exchange rates.[29]

The exercise provides a large DD estimate, as expected, indicating a one percent increase in real exchange rate increases HFBM's consumption by 0.27 per cent (Table A.8). This is much larger

[29]Specifically, we estimated the following equation $y_i = \alpha + \beta z_i + \gamma d_i + \delta_t z_i \times d_i + \boldsymbol{\theta X_i} + \psi_s + \phi_i + u_i$, in which d is the value of 1 AUD (in USD) while all other symbols are defined earlier.

than than the elasticities we obtain in Table 5 (0.04 averaged across the two years) where we also use HILDA data. The elasticity is more than twice the estimate of 0.12 from our preferred results (Table 4) but is not statistically significant as the standard errors become very large.[30] We think that there are a variety of possibilities for this. One is the imprecision of the food expenditure data in HILDA. Another is the timing effects associated with responses to exchange rates. There may be lags or adjustment which is non-linear. We thus prefer our estimates from Table 4 which allow for a more flexible response.

There are a variety of ways in which immigrants could reduce home country expenditure in response to exchange rate fluctuations, as discussed above. They can reduce remittances but they can also travel back home less frequently. One very indirect way to check this latter effect is to compare shopping frequencies of natives and HFBMs in Australia. Specifically, we calculated the number of weeks with positive spending and using it as the dependent variable, run the DD regression of equation (4).

The results indicate that HFBMs increase their shopping frequency by 3 per cent in 2014 and 4 per cent in 2015, compared to the reference year and the natives (Table A.9). This result provides some support to our hypothesis that immigrants spend fewer days in the origin country as a result of the currency depreciation in the host country.[31]

HFBMs' higher expenditure can be due to changes in remitting behavior. Substantial depreciation of the Australian dollar during 2013-2015 was likely to induce HFBMs to send lower remittances to their country of origin. Lower outward remittances and higher expenditure locally may mean that they substituted home country consumption with that of the host country.[32] Unfortunately no Australian data that we are aware of, including our data, include information on remittances. However, we observe a drop in remittances in the aggregate data, as presented in Figure 3. This is consistent with our theoretical model and our empirical results.

[30] The results are similar if we use total expenditure.

[31] Assuming the shopping frequency elasticity of price of –0.1 percent, estimated in Aguiar & Hurst (2007), our results indicate that HFBMs are paying 0.3-0.4 percent lower price and therefore the real impact on their food expenditure would have been higher without the change in their shopping pattern.

[32] Which of course, more than offsets the opposing income effect.

5. Conclusion

We investigated the impact of currency depreciation on the expenditure of households with foreign-born members. Using the Australian Neilson Homescan Panel Survey data, in combination with a difference-in-difference methodology, reveals that the depreciation of the Australian dollar in 2014 and 2015 increased the food expenditure of households with foreign-born members. Our analysis further revealed that the increased food expenditure by migrants was not due to higher food prices or incomes but from purchases of a larger quantity of food items. The results are robust to a wide variety of changes in the analysis sample and the estimation method. We observe similar patterns for both food and total expenditure when analysing the Household Income and Labour Dynamics in Australia (HILDA) survey data.

Our analysis is the first study to empirically confirm that the increase in the relative price of consumption (and/or investment) in the home country, resulting from falling exchange rates in the host country currency, induces migrants to consume more in the host country and less in their country of origin. Expenditure and consumption may thus be poor measures of welfare for migrant households or at least inferior measures when compared to native households. While the depreciation of the host country's currency always lowers migrant households' welfare by reducing real incomes, higher consumption/expenditure relative to their native counterparts may misleadingly indicate otherwise. We contribute to the migration literature by highlighting how macroeconomic shocks can affect natives and non-natives differently, increasingly important as global migration continues to rise.

Our analysis also contributes to the literature on exchange rates and remittances, although indirectly. Our investigation indicates that remittances may change due to migrants' substitution of expenditure between origin and destination countries. Countries receiving large remittances may take measures like cash incentives or concessionary rates on inward remittances to offset the relative price changes when exchange rates in originating countries depreciate. Thus, our research can provide valuable input to the exchange rate policies of recipient countries, many of which are low-income and dependent on foreign remittances to sustain local consumption and to lower their balance of payment deficits.

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Figures and Tables

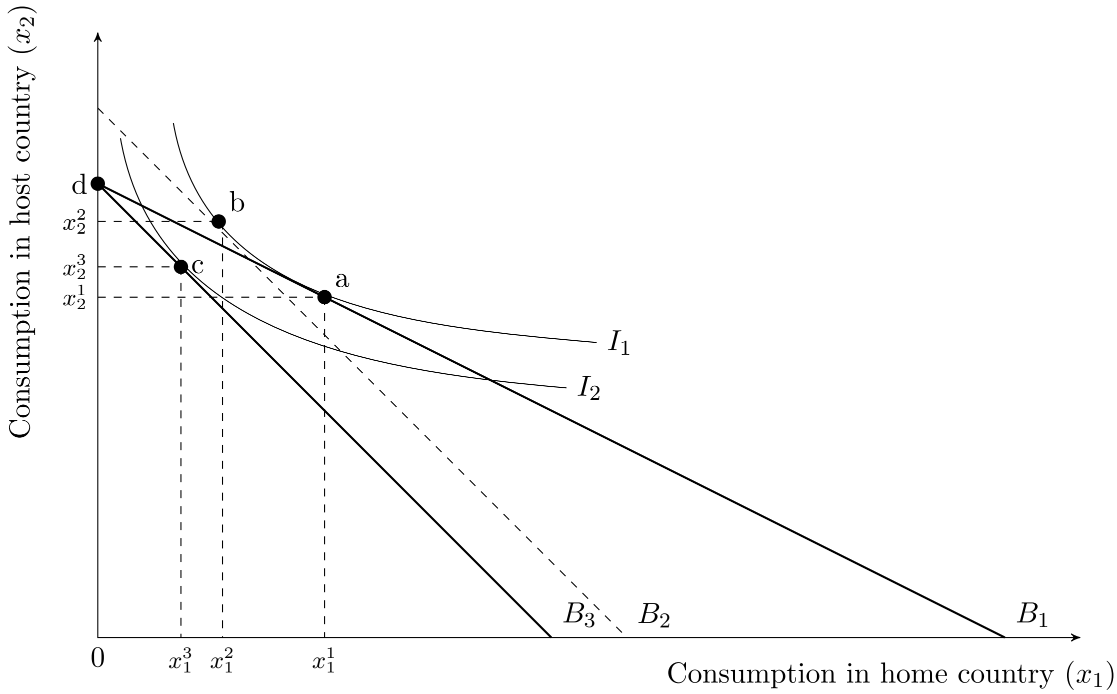
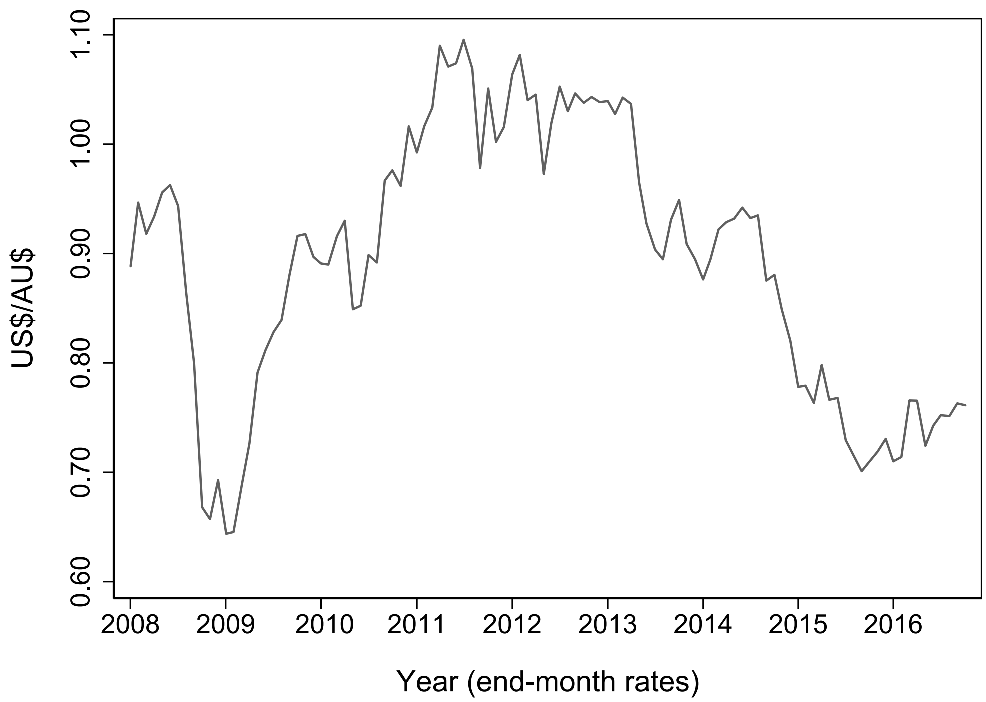
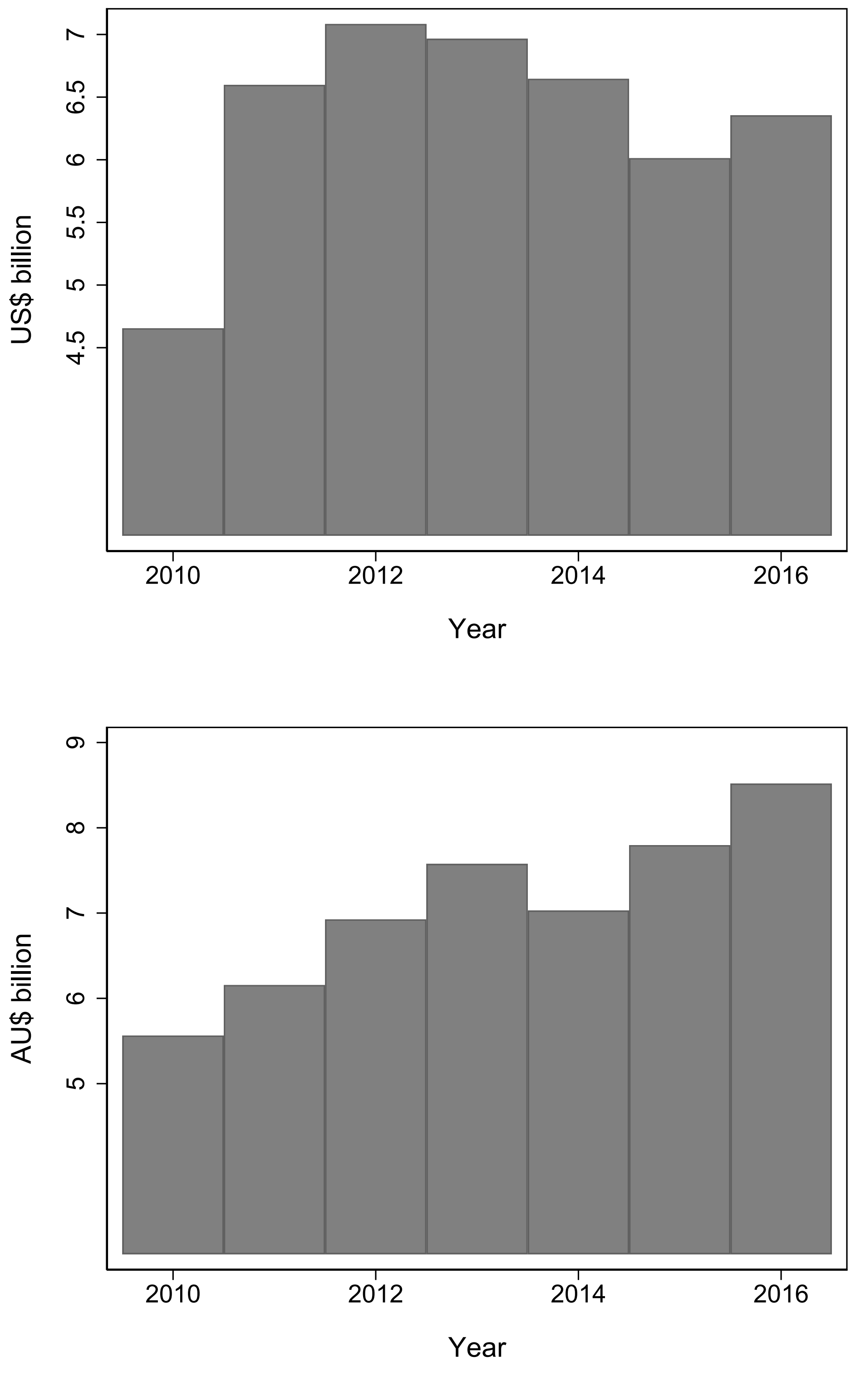


Figure 1: **Impact of a host country currency depreciation**



Source: Reserve Bank of Australia, Web: https://goo.gl/UH27Pt

FIGURE 2: **Exchange Rate of Australian dollar, 2010-2016**



Source: World Bank, Web: https://goo.gl/V5Au26

FIGURE 3: **Migrant Remittance Outflow from Australia, 2010-2016**

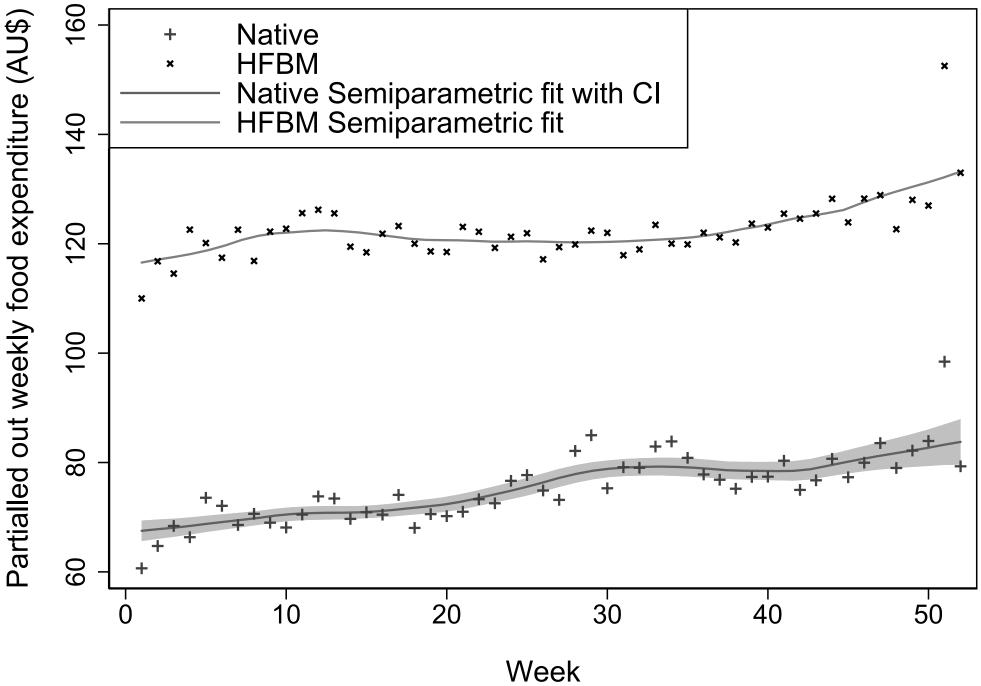


FIGURE 4: **Food expenditure weekly trend by household type in 2013**

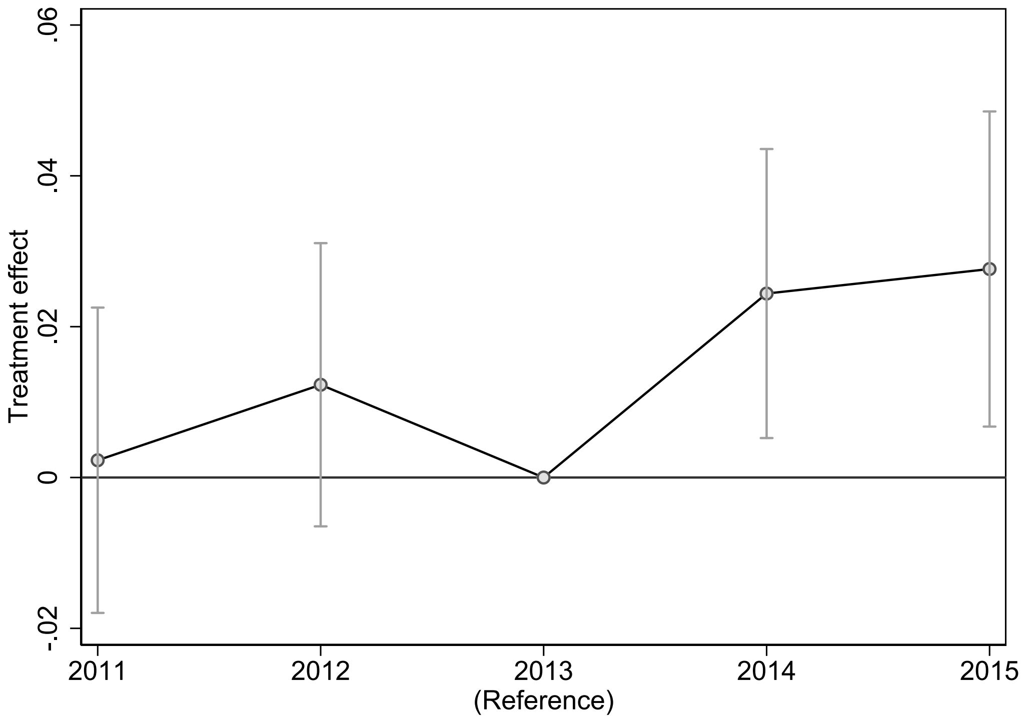


FIGURE 5: **Test of common trend with HILDA data: exchange rate and placebo effects**

Table 1: Mean and median food expenditure

Household type	Years 2013	2014	2015	All
Natives				
Mean food expenditure	4,084	4,258	3,999	4,114
Median food expenditure	3,618	3,783	3,568	3,656
N	[5,580]	[5,610]	[5,611]	[16,801]
HFBMs				
Mean food expenditure	4,063	4,296	4,061	4,140
Median food expenditure	3,628	3,859	3,691	3,730
N	[2,744]	[2,714]	[2,713]	[8,171]
All				
Mean food expenditure	4,077	4,270	4,019	4,122
Median food expenditure	3,623	3,807	3,608	3,685
N	[8,324]	[8,324]	[8,324]	[24,972]

Note: Number of observations are in square brackets.

Table 2: The effect of exchange rate changes on HFBMs' food expenditure

	Household type		
	Natives (1)	HFBMs (2)	Difference (3)
2014 vs. 2013			
January-December, 2013	8.135	8.110	-0.025
	(0.009)	(0.013)	(0.015)
	[5,580]	[2,744]	[8,324]
January-December, 2014	8.189	8.189	0.000
	(0.008)	(0.012)	(0.015)
	[5,610]	[2,714]	[8,324]
2014-2013	0.054	0.080	0.025
	(0.012)	(0.018)	(0.021)
	[11,190]	[5,458]	[16,648]
2015 vs. 2013			
January-December, 2013	8.135	8.110	-0.025
	(0.009)	(0.013)	(0.015)
	[5,580]	[2,744]	[8,324]
January-December, 2015	8.049	8.066	0.017
	(0.011)	(0.016)	(0.020)
	[5,611]	[2,713]	[8,324]
2015-2013	-0.086	-0.044	0.042*
	(0.014)	(0.021)	(0.025)
	[11,191]	[5,457]	[16,648]

Note: Number of observations are in square brackets.

Table 3: Household characteristics

Variable	2013 HFBMs (1)	2013 Natives (2)	2013 *p*-val. (3)	2014 HFBMs (4)	2014 Natives (5)	2014 *p*-val. (6)	2015 HFBMs (7)	2015 Natives (8)	2015 *p*-val. (9)
Household size	2.889	2.647	0.00	2.871	2.635	0.00	2.886	2.639	0.00
	(1.243)	(1.310)		(1.249)	(1.316)		(1.261)	(1.315)	
Free Standing House	0.773	0.831	0.00	0.776	0.836	0.00	0.780	0.834	0.00
	(0.419)	(0.375)		(0.417)	(0.370)		(0.415)	(0.372)	
Terrace/townhouse/	0.114	0.094	0.01	0.116	0.090	0.00	0.117	0.091	0.00
villa/semi detached	(0.318)	(0.292)		(0.320)	(0.286)		(0.321)	(0.287)	
Low rise flats/units	0.077	0.060	0.00	0.071	0.059	0.05	0.067	0.060	0.24
(2 or 3 storeys)	(0.266)	(0.238)		(0.256)	(0.236)		(0.250)	(0.238)	
High rise flats/units	0.031	0.012	0.00	0.031	0.011	0.00	0.031	0.012	0.00
(4 or more storeys)	(0.172)	(0.107)		(0.174)	(0.106)		(0.174)	(0.109)	
Mobile or	0.005	0.003	0.13	0.006	0.003	0.04	0.006	0.003	0.15
improvised dwelling	(0.069)	(0.052)		(0.077)	(0.053)		(0.074)	(0.058)	
Owned outright	0.306	0.332	0.02	0.323	0.341	0.11	0.336	0.349	0.26
	(0.461)	(0.471)		(0.468)	(0.474)		(0.472)	(0.477)	
Owned with a	0.258	0.254	0.73	0.244	0.244	0.99	0.234	0.240	0.57
mortgage	(0.438)	(0.436)		(0.430)	(0.430)		(0.423)	(0.427)	
Rented	0.435	0.414	0.07	0.433	0.415	0.12	0.430	0.412	0.11
	(0.496)	(0.493)		(0.496)	(0.493)		(0.495)	(0.492)	
Annual household income	79,647	70,787	0.00	80,410	71,946	0.00	80,934	72,277	0.00
	(47,231)	(43,877)		(48,389)	(44,915)		(49,223)	(45,548)	
N	2,744	5,580		2,714	5,610		2,713	5,611	

Note: 1. Standard deviations are in parentheses.
2. *p*-values indicate the significance level of the difference in means between treatment and control group.

Table 4: Impact of exchange rate on HFBMs' food expenditure

	(1)	(2)	(3)
HFBMs	0.1314**	0.0473	0.0484
	(0.0544)	(0.0569)	(0.0561)
Year 2014	0.0555***	0.0557***	0.2861
	(0.0053)	(0.0053)	(0.1961)
HFBMs × Year 2014	0.0233**	0.0238**	0.0220**
	(0.0099)	(0.0100)	(0.0099)
Year 2015	-0.0845***	-0.0849***	0.0993
	(0.0090)	(0.0091)	(0.1960)
HFBMs × Year 2015	0.0395**	0.0401**	0.0402**
	(0.0156)	(0.0156)	(0.0157)
Log(household size)		0.1601***	0.1605***
		(0.0252)	(0.0250)
Terrace/townhouse/		-0.0238	-0.0198
villa/semi detached		(0.0404)	(0.0406)
Low rise flats/units		0.0360	0.0349
(2 or 3 storeys)		(0.0401)	(0.0398)
High rise flats/units		0.0357	0.0355
(4 or more storeys)		(0.0511)	(0.0516)
Mobile or improvised		0.0100	0.0001
dwelling		(0.1302)	(0.1291)
Owned outright		-0.0074	-0.0079
		(0.0230)	(0.0229)
Owned with a		-0.0217	-0.0238
mortgage		(0.0225)	(0.0224)
Constant	8.0833***	7.8734***	7.9265***
	(0.0180)	(0.0609)	(0.0805)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	24,972	24,972	24,972
Adjusted R^2	0.030	0.033	0.034
F	136.2	23.5	14.7

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Impact of exchange rate on HFBMs' food expenditure
(Estimates using HILDA data)

	(1)	(2)	(3)
HFBMs	0.1931***	0.0050	0.0060
	(0.0127)	(0.0127)	(0.0127)
Year 2009	-0.0212**	-0.0199**	0.0457
	(0.0102)	(0.0099)	(0.0483)
HFBMs × Year 2009	-0.0383***	-0.0265**	-0.0271**
	(0.0138)	(0.0133)	(0.0133)
Year 2010	0.0029	0.0006	0.0169
	(0.0100)	(0.0097)	(0.0374)
HFBMs × Year 2010	-0.0382***	-0.0213	-0.0215
	(0.0134)	(0.0131)	(0.0131)
Year 2011	-0.0060	-0.0078	0.0936***
	(0.0089)	(0.0088)	(0.0353)
HFBMs × Year 2011	-0.0129	-0.0015	-0.0022
	(0.0118)	(0.0117)	(0.0117)
Year 2012	-0.0054	-0.0064	0.0428
	(0.0084)	(0.0083)	(0.0362)
HFBMs × Year 2012	0.0027	0.0088	0.0079
	(0.0111)	(0.0110)	(0.0111)
Year 2014	0.0292***	0.0296***	0.0812**
	(0.0083)	(0.0082)	(0.0359)
HFBMs × Year 2014	0.0104	0.0051	0.0046
	(0.0111)	(0.0110)	(0.0110)
Year 2015	0.0195**	0.0191**	0.0530
	(0.0087)	(0.0085)	(0.0346)
HFBMs × Year 2015	0.0288**	0.0205*	0.0203*
	(0.0116)	(0.0114)	(0.0114)
Ln(household size)		0.3681***	0.3675***
		(0.0128)	(0.0128)
Terrace/townhouse/		-0.0208*	-0.0204*
villa/semi detached		(0.0110)	(0.0111)
Low rise flats/units		-0.0572***	-0.0573***
(2 or 3 storeys)		(0.0112)	(0.0112)
High rise flats/units		-0.0287	-0.0297
(4 or more storeys)		(0.0215)	(0.0215)
Mobile or improvised		0.0112	0.0115
dwelling		(0.0346)	(0.0344)
Constant	8.8765***	8.7054***	8.6704***
	(0.0079)	(0.0369)	(0.0590)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	51,064	51,064	51,064
Adjusted R^2	0.018	0.069	0.070
F	43.3	55.6	23.1

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table 6: Impact of exchange rate on HFBMs' food expenditure
Model including country/year fixed effects

	(1)	(2)	(3)
HFBMs	0.1314**	0.0473	0.0516
	(0.0544)	(0.0569)	(0.0636)
Year 2014	0.0555***	0.0557***	0.0458***
	(0.0053)	(0.0053)	(0.0082)
HFBMs × Year 2014	0.0233**	0.0238**	0.0199
	(0.0099)	(0.0100)	(0.0157)
Year 2015	-0.0845***	-0.0849***	-0.0862***
	(0.0090)	(0.0091)	(0.0137)
HFBMs × Year 2015	0.0395**	0.0401**	0.0404*
	(0.0156)	(0.0156)	(0.0238)
Log(household size)		0.1601***	0.1622***
		(0.0252)	(0.0251)
Terrace/townhouse/		-0.0238	-0.0169
villa/semi detached		(0.0404)	(0.0406)
Low rise flats/units		0.0360	0.0355
(2 or 3 storeys)		(0.0401)	(0.0398)
High rise flats/units		0.0357	0.0367
(4 or more storeys)		(0.0511)	(0.0515)
Mobile or improvised		0.0100	-0.0064
dwelling		(0.1302)	(0.1289)
Owned outright		-0.0074	-0.0059
		(0.0230)	(0.0231)
Owned with a		-0.0217	-0.0244
mortgage		(0.0225)	(0.0224)
Constant	8.0833***	7.8734***	7.9306***
	(0.0180)	(0.0609)	(0.0806)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
Home country × year FEs	No	No	Yes
N	24,972	24,972	24,972
F	136.2	23.5	11.1

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Impact of exchange rate on HFBMs' food expenditure
(Repeats Table 4 including immigrants from NZ, UK, Ireland, Greece & Italy only)

	(1)	(2)	(3)
HFBMs	0.1652***	0.0885	0.0943
	(0.0627)	(0.0655)	(0.0643)
Year 2014	0.0557***	0.0557***	0.2642
	(0.0053)	(0.0053)	(0.1948)
HFBMs × Year 2014	0.0087	0.0097	0.0053
	(0.0121)	(0.0121)	(0.0120)
Year 2015	-0.0843***	-0.0849***	0.1255
	(0.0090)	(0.0092)	(0.1951)
HFBMs × Year 2015	0.0322*	0.0342*	0.0304*
	(0.0183)	(0.0182)	(0.0184)
Log(household size)		0.1525***	0.1511***
		(0.0279)	(0.0276)
Terrace/townhouse/		-0.0449	-0.0403
villa/semi detached		(0.0434)	(0.0436)
Low rise flats/units		0.0070	0.0035
(2 or 3 storeys)		(0.0438)	(0.0442)
High rise flats/units		0.0058	0.0100
(4 or more storeys)		(0.0700)	(0.0705)
Mobile or improvised		-0.0698	-0.0888
dwelling		(0.1160)	(0.1125)
Owned outright		0.0019	0.0030
		(0.0223)	(0.0221)
Owned with a		-0.0276	-0.0318
mortgage		(0.0245)	(0.0243)
Constant	8.1187***	7.9072***	7.9606***
	(0.0137)	(0.0500)	(0.0749)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	21,309	21,309	21,309
Adjusted R^2	0.031	0.034	0.036
F	113.2	19.8	12.5

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table 8: Impact of exchange rate on HFBMs' food expenditure
(Repeats Table 4 excluding immigrants from NZ, UK, Ireland, Greece & Italy)

	(1)	(2)	(3)
HFBMs	0.1253**	0.0460	0.0470
	(0.0616)	(0.0637)	(0.0629)
Year 2014	0.0555***	0.0557***	0.3850
	(0.0053)	(0.0053)	(0.2555)
HFBMs × Year 2014	0.0325***	0.0328***	0.0323***
	(0.0112)	(0.0113)	(0.0112)
Year 2015	-0.0844***	-0.0847***	0.1944
	(0.0090)	(0.0091)	(0.2570)
HFBMs × Year 2015	0.0448**	0.0441**	0.0461***
	(0.0177)	(0.0177)	(0.0178)
Log(household size)		0.1571***	0.1589***
		(0.0263)	(0.0261)
Terrace/townhouse/		-0.0210	-0.0170
villa/semi detached		(0.0425)	(0.0428)
Low rise flats/units		0.0335	0.0326
(2 or 3 storeys)		(0.0421)	(0.0418)
High rise flats/units		0.0347	0.0352
(4 or more storeys)		(0.0513)	(0.0519)
Mobile or improvised		0.0210	0.0218
dwelling		(0.1711)	(0.1710)
Owned outright		0.0014	0.0004
		(0.0243)	(0.0243)
Owned with a		-0.0206	-0.0228
mortgage		(0.0238)	(0.0237)
Constant	8.0832***	7.8695***	7.9269***
	(0.0171)	(0.0626)	(0.0835)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	23,149	23,149	23,149
Adjusted R^2	0.030	0.033	0.034
F	127.3	21.7	13.6

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table 9: Impact of exchange rate on HFBMs' income

	(1)	(2)	(3)
HFBMs	0.1359***	0.0781**	0.0785**
	(0.0355)	(0.0366)	(0.0366)
Year 2014	0.0121***	0.0132***	0.2855
	(0.0037)	(0.0037)	(0.1756)
HFBMs × Year 2014	-0.0063	-0.0057	-0.0064
	(0.0064)	(0.0064)	(0.0064)
Year 2015	0.0139***	0.0155***	0.2970*
	(0.0046)	(0.0045)	(0.1781)
HFBMs × Year 2015	-0.0065	-0.0061	-0.0067
	(0.0081)	(0.0080)	(0.0081)
Log(household size)		0.1133***	0.1137***
		(0.0186)	(0.0186)
Terrace/townhouse/		-0.0656**	-0.0633**
villa/semi detached		(0.0285)	(0.0285)
Low rise flats/units		-0.0414	-0.0413
(2 or 3 storeys)		(0.0447)	(0.0442)
High rise flats/units		-0.0208	-0.0192
(4 or more storeys)		(0.0380)	(0.0380)
Mobile or improvised		-0.1336	-0.1369
dwelling		(0.1122)	(0.1113)
Owned outright		-0.1074***	-0.1066***
		(0.0291)	(0.0291)
Owned with a		-0.0464**	-0.0492**
mortgage		(0.0220)	(0.0218)
Constant	10.9486***	10.9253***	10.9146***
	(0.0119)	(0.0225)	(0.0401)
State × year FEs	No	No	Yes
N	24,972	24,972	24,972
Adjusted R^2	0.003	0.014	0.015
F	5.3	8.2	4.0

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table 10: Impact of exchange rate on HFBMs' expenditure of imported food

	(1)	(2)	(3)
HFBMs	0.1668***	0.0899	0.0925*
	(0.0538)	(0.0564)	(0.0558)
Year 2014	0.0103*	0.0106*	0.2292
	(0.0057)	(0.0058)	(0.1917)
Year 2015	-0.1518***	-0.1521***	0.0141
	(0.0095)	(0.0096)	(0.1918)
Imported items	-1.6326***	-1.6326***	-1.6326***
	(0.0060)	(0.0060)	(0.0060)
HFBMs × Year 2014	0.0181*	0.0185*	0.0161
	(0.0110)	(0.0110)	(0.0110)
HFBMs × Year 2015	0.0362**	0.0365**	0.0349**
	(0.0168)	(0.0168)	(0.0169)
HFBMs × imported items	-0.0529***	-0.0529***	-0.0529***
	(0.0109)	(0.0109)	(0.0109)
Year 2014 × imported items	0.0072*	0.0072*	0.0072*
	(0.0039)	(0.0039)	(0.0039)
Year 2015 × imported items	0.0049	0.0049	0.0049
	(0.0050)	(0.0050)	(0.0050)
HFBMs × Year 2014	0.0033	0.0033	0.0033
× imported items	(0.0074)	(0.0074)	(0.0074)
HFBMs × Year 2015	0.0053	0.0053	0.0053
× imported items	(0.0093)	(0.0093)	(0.0093)
Log(household size)		0.1520***	0.1520***
		(0.0263)	(0.0260)
Terrace/townhouse/		-0.0111	-0.0071
villa/semi detached		(0.0427)	(0.0430)
Low rise flats/units		0.0450	0.0435
(2 or 3 storeys)		(0.0426)	(0.0423)
High rise flats/units		0.0570	0.0560
(4 or more storeys)		(0.0582)	(0.0586)
Mobile or improvised		0.0401	0.0293
dwelling		(0.1636)	(0.1638)
Owned outright		-0.0051	-0.0056
		(0.0250)	(0.0250)
Owned with a		-0.0355	-0.0370
mortgage		(0.0240)	(0.0239)
Constant	7.2515***	7.0769***	7.1217***
	(0.0180)	(0.0611)	(0.0826)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	49,944	49,944	49,944
Adjusted R^2	0.805	0.806	0.806
F	11762.0	3411.2	2208.6

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. Number of observations is twice of the main sample as food expenditure is divided into imported and non-imported food categories.
4. * p <0.10, ** p <0.05, *** p <0.01.

Table 11: Impact of exchange rate on HFBMs' food price

	(1)	(2)	(3)
HFBMs	0.0094	0.0036	0.0036
	(0.0065)	(0.0067)	(0.0067)
Year 2014	0.0251***	0.0249***	0.0249***
	(0.0008)	(0.0008)	(0.0008)
HFBMs × Year 2014	-0.0010	-0.0009	-0.0009
	(0.0015)	(0.0015)	(0.0015)
Year 2015	0.0302***	0.0301***	0.0301***
	(0.0010)	(0.0010)	(0.0010)
HFBMs × Year 2015	-0.0003	-0.0001	-0.0001
	(0.0018)	(0.0018)	(0.0018)
Log(household size)		0.0083***	0.0083***
		(0.0029)	(0.0029)
Terrace/townhouse/ villa/semi detached		-0.0044	-0.0044
		(0.0044)	(0.0044)
Low rise flats/units (2 or 3 storeys)		-0.0046	-0.0046
		(0.0066)	(0.0066)
High rise flats/units (4 or more storeys)		-0.0015	-0.0015
		(0.0112)	(0.0112)
Mobile or improvised dwelling		-0.0103	-0.0103
		(0.0213)	(0.0213)
Owned outright		-0.0042	-0.0042
		(0.0036)	(0.0036)
Owned with a mortgage		0.0041	0.0041
		(0.0032)	(0.0032)
Constant	1.0303***	1.0110***	1.0110***
	(0.0022)	(0.0068)	(0.0068)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	1,598,334	1,598,334	1,598,334
Adjusted R^2	0.003	0.003	0.003
F	338.3	55.6	55.6

Note: 1. All models control for the household and category fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Impact of exchange rate on HFBMs' food consumption

	(1)	(2)	(3)
HFBMs	0.0829**	0.0223	0.0228
	(0.0325)	(0.0337)	(0.0337)
Year 2014	-0.0033	-0.0027	-0.0027
	(0.0038)	(0.0038)	(0.0038)
HFBMs × Year 2014	0.0152**	0.0154**	0.0154**
	(0.0071)	(0.0071)	(0.0071)
Year 2015	-0.0749***	-0.0746***	-0.0745***
	(0.0050)	(0.0050)	(0.0050)
HFBMs × Year 2015	0.0208**	0.0211**	0.0208**
	(0.0089)	(0.0089)	(0.0089)
Log(household size)		0.1249***	0.1234***
		(0.0157)	(0.0155)
Terrace/townhouse/		-0.0237	-0.0224
villa/semi detached		(0.0234)	(0.0234)
Low rise flats/units		0.0233	0.0241
(2 or 3 storeys)		(0.0275)	(0.0275)
High rise flats/units		0.0456	0.0456
(4 or more storeys)		(0.0423)	(0.0422)
Mobile or improvised		0.0429	0.0431
dwelling		(0.0783)	(0.0783)
Owned outright		-0.0021	-0.0018
		(0.0160)	(0.0160)
Owned with a		-0.0123	-0.0144
mortgage		(0.0145)	(0.0144)
Constant	2.0278***	1.8954***	1.8986***
	(0.0108)	(0.0333)	(0.0492)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	1,598,334	1,598,334	1,598,334
Adjusted R^2	0.004	0.005	0.005
F	101.3	18.9	15.6

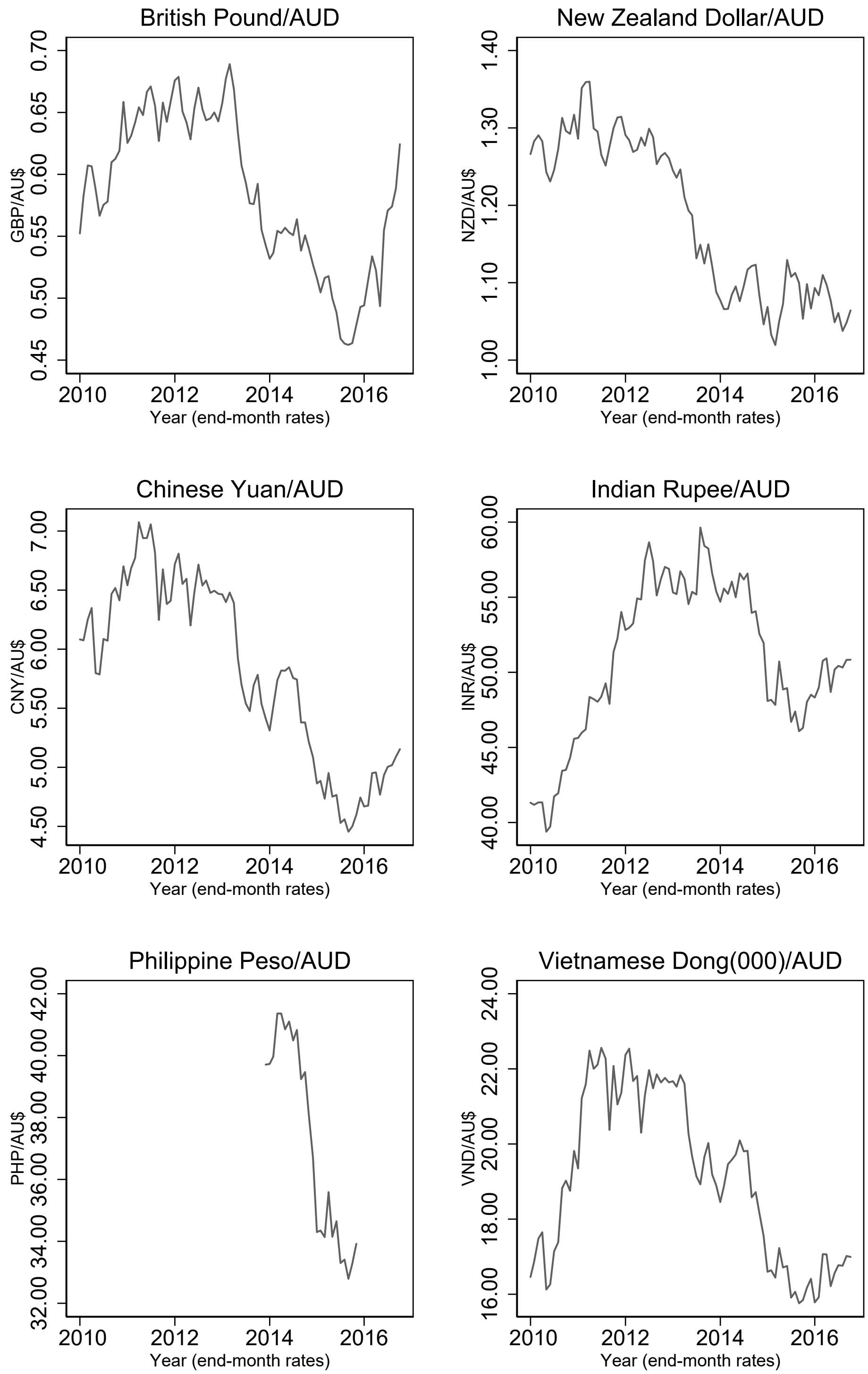
Note: 1. All models control for the household and category fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table 13: Impact of exchange rate on HFBMs' total expenditure
(HILDA data)

	(1)	(2)	(3)
HFBMs	0.1208***	-0.0138	-0.0148
	(0.0119)	(0.0120)	(0.0120)
Year 2011	0.0009	0.0003	0.1115**
	(0.0076)	(0.0075)	(0.0554)
HFBMs × Year 2011	-0.0001	0.0023	0.0020
	(0.0104)	(0.0103)	(0.0104)
Year 2012	0.0191***	0.0162**	0.0491
	(0.0071)	(0.0070)	(0.0597)
HFBMs × Year 2012	0.0138	0.0123	0.0116
	(0.0097)	(0.0096)	(0.0096)
Year 2014	0.0620***	0.0546***	0.1261**
	(0.0074)	(0.0072)	(0.0578)
HFBMs × Year 2014	0.0326***	0.0242**	0.0232**
	(0.0100)	(0.0098)	(0.0098)
Year 2015	0.0466***	0.0366***	0.1083*
	(0.0080)	(0.0077)	(0.0575)
HFBMs × Year 2015	0.0380***	0.0275***	0.0271**
	(0.0110)	(0.0107)	(0.0107)
Ln(household size)		0.2490***	0.2521***
		(0.0125)	(0.0125)
Terrace/townhouse/		-0.0387***	-0.0365***
villa/semi detached		(0.0119)	(0.0119)
Low rise flats/units		-0.0555***	-0.0532***
(2 or 3 storeys)		(0.0112)	(0.0112)
High rise flats/units		-0.0228	-0.0231
(4 or more storeys)		(0.0211)	(0.0212)
Mobile or improvised		-0.0123	-0.0149
dwelling		(0.0444)	(0.0443)
Constant	10.1310***	10.0726***	10.0230***
	(0.0066)	(0.0483)	(0.0519)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	51,758	51,758	51,758
Adjusted R^2	0.014	0.055	0.058
F	52.2	56.3	22.1

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Appendix A: Supplementary figures and tables



Source: Reserve Bank of Australia, Web: https://goo.gl/UH27Pt

Figure A.1: **Exchange rate of Australian dollar, 2010-2016**

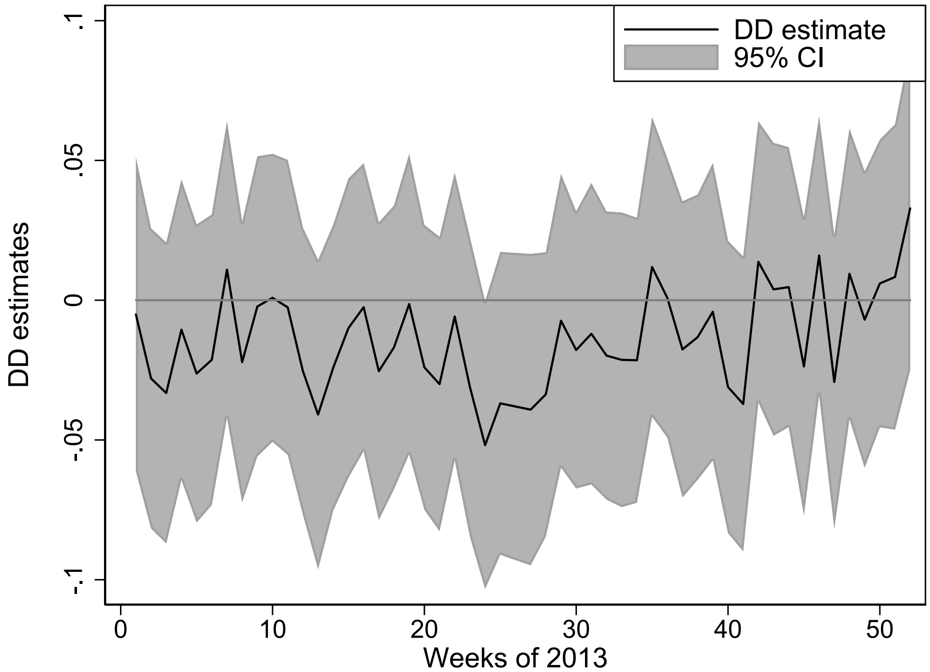


FIGURE A.2: **Distribution of DD coefficients across weeks of 2013**

Table A.1: Movement of exchange rates of major currencies against AU$

Years	United States Dollar	British Pound	New Zealand Dollar	Chinese Yuan	Indian Rupee	Philippine Peso	Vietnamese Dong(000)
2010	0.89	0.55	1.27	6.08	41.32	.	16.46
2011	0.99	0.63	1.29	6.54	45.63	.	19.35
2012	1.06	0.68	1.29	6.72	52.82	.	22.37
2013	1.04	0.66	1.24	6.46	55.32	.	21.67
2014	0.88	0.53	1.08	5.31	54.70	39.73	18.45
2015	0.78	0.52	1.07	4.86	48.09	34.30	16.60
2016	0.71	0.49	1.09	4.67	48.32	.	15.78

Source: Reserve Bank of Australia, Web: https://goo.gl/UH27Pt
Note: 1. End-January rates.

Table A.2: Distribution of households over years

Years available	No of households
All 2013, 2014 & 2015	8,324
Only 2013 &2014	1,032
Only 2013 & 2015	1
Only 2013	1,382
Only 2014 & 2015	1,281
Only 2014	235
Only 2015	1,253

Table A.3: Food categories in the NHPS data

1	Artificial Sweeteners	65	Frozen Meat and Poultry
2	Asian/japan Cooking Misc.	66	Frozen Pastry
3	Baby Food	67	Frozen Pizza
4	Baby Rusks	68	Frozen Rice
5	Baked Beans and Spaghetti	69	Frozen Snacks
6	Baking Powder	70	Frozen Vegetables
7	Biscuits	71	Fruit Juices and Drinks
8	Bottled and Canned Sauces	72	Gelatine
9	Bread	73	Golden Syrup/treacle/molasses
10	Breadcrumbs/coating and Stuffing	74	Herbs and Spices/curry Pwd/pepp
11	Breakfast Cereals	75	Honey
12	Butter and Margarine	76	Ice Cream
13	Cake Decorations	77	Ice Cream Cones and Wafers
14	Cakes/pies and Pasties Fresh	78	Icings and Marzipan
15	Canned Beans/salads	79	Indian Foods
16	Canned Corned Meats	80	Infant Formulas
17	Canned Fish and Seafood	81	Jam and Marmalade
18	Canned Fruit/fruit Snacks	82	Marinades
19	Canned Hams/franks and Hot Dogs	83	Meat and Fish Pastes
20	Canned Meals	84	Mexican Food
21	Canned Vegetables	85	Milk Additives/tonic Food Drink
22	Carbonated Beverages	86	Milk White Fresh and Longlife
23	Carbonated Fruit Juice	87	Mixes and Batters
24	Cheese	88	Mustard
25	Chewing Gum and Bubble Gum	89	New Age Beverages
26	Chilled Cream	90	Non Carbonated Bev Cordial Syrup
27	Chilled Meals	91	Non Carbonated Mineral Water
28	Chilled Meat and Poultry	92	Oils and Fats
29	Chilled Pasta	93	Packaged and Prepared Meals
30	Chilled Savoury Pastry	94	Pasta/noodles
31	Chilled Seafood	95	Pastry Sheets
32	Chilled Vegetable Protein	96	Pate
33	Chocolate Confectionery	97	Peanut Butter
34	Christmas Confectionery	98	Pickles and Relishes
35	Citric Acid/baking Soda/crm Tar	99	Prepacked Smallgoods
36	Cocoa and Cooking Chocolate	100	Prepared Dips
37	Coconut	101	Processed Milk Products
38	Coconut Crm and Milk	102	Ready Made Custard
39	Coffee	103	Rice
40	Coffee Substitutes	104	Salad Dressings
41	Cooking Wine	105	Salt
42	Dr Ck/pudd/chsck Mixes	106	Sauce and Gravy Mixes
43	Dried Fruit	107	Savoury Spreads
44	Dried Vegetables	108	Shelf Stable Desserts
45	Drink Mixers	109	Snack Foods
46	Drink Whiteners	110	Soup
47	Easter Confectionery	111	Soup Mix and Pulses
48	Eggs	112	Stocks and Flavourings
49	Essences and Colourings	113	Sugar
50	Flavoured Milk	114	Sugar Confectionery
51	Flour	115	Sweet Spreads
52	Fresh Bulk Nuts/dried Fruits	116	Tea
53	Fresh Chilled Soup	117	Tomato Juice
54	Fresh Convenience Produce	118	Tomato Paste and Puree
55	Fresh Fruit	119	Toppings
56	Fresh Herbs and Sprouts	120	Unprocessed and Baking Nuts
57	Fresh Salad Produce	121	Vegetable and Yeast Extracts
58	Fresh Seafood	122	Vegetable Juice
59	Fresh Vegetables	123	Vinegar
60	Frozen Chilled Desserts	124	Whole Pickles
61	Frozen Drinks	125	Wrapped Health Snacks
62	Frozen Fish/seafood	126	Yogurt and Dairy Dessert
63	Frozen Fruit	127	Yogurt Drinks
64	Frozen Meals	128	Miscellaneous

Table A.4: Test of difference in weekly food expenditures between HFBMs and natives in 2013

	(1)	(2)	(3)
HFBMs × week=1	-0.0051	-0.0051	-0.0051
	(0.0286)	(0.0286)	(0.0286)
HFBMs × week=2	-0.0280	-0.0280	-0.0280
	(0.0274)	(0.0274)	(0.0274)
HFBMs × week=3	-0.0332	-0.0332	-0.0332
	(0.0275)	(0.0275)	(0.0275)
HFBMs × week=4	-0.0105	-0.0105	-0.0105
	(0.0274)	(0.0274)	(0.0274)
HFBMs × week=5	-0.0262	-0.0262	-0.0262
	(0.0272)	(0.0272)	(0.0272)
HFBMs × week=6	-0.0213	-0.0213	-0.0213
	(0.0265)	(0.0265)	(0.0265)
HFBMs × week=7	0.0110	0.0110	0.0110
	(0.0270)	(0.0270)	(0.0270)
HFBMs × week=8	-0.0221	-0.0221	-0.0221
	(0.0256)	(0.0256)	(0.0256)
HFBMs × week=9	-0.0022	-0.0022	-0.0022
	(0.0274)	(0.0274)	(0.0274)
HFBMs × week=10	0.0009	0.0009	0.0009
	(0.0263)	(0.0263)	(0.0263)
HFBMs × week=11	-0.0026	-0.0026	-0.0026
	(0.0269)	(0.0269)	(0.0269)
HFBMs × week=12	-0.0254	-0.0254	-0.0254
	(0.0262)	(0.0262)	(0.0262)
HFBMs × week=13	-0.0409	-0.0409	-0.0409
	(0.0282)	(0.0282)	(0.0282)
HFBMs × week=14	-0.0241	-0.0241	-0.0241
	(0.0261)	(0.0261)	(0.0261)
HFBMs × week=15	-0.0100	-0.0100	-0.0100
	(0.0273)	(0.0273)	(0.0273)
HFBMs × week=16	-0.0025	-0.0025	-0.0025
	(0.0263)	(0.0263)	(0.0263)
HFBMs × week=17	-0.0254	-0.0254	-0.0254
	(0.0271)	(0.0271)	(0.0271)
HFBMs × week=18	-0.0169	-0.0169	-0.0169
	(0.0259)	(0.0259)	(0.0259)
HFBMs × week=19	-0.0014	-0.0014	-0.0014
	(0.0274)	(0.0274)	(0.0274)
HFBMs × week=20	-0.0240	-0.0240	-0.0240
	(0.0260)	(0.0260)	(0.0260)
HFBMs × week=21	-0.0300	-0.0300	-0.0300
	(0.0269)	(0.0269)	(0.0269)
HFBMs × week=22	-0.0058	-0.0058	-0.0058
	(0.0262)	(0.0262)	(0.0262)
HFBMs × week=23	-0.0310	-0.0310	-0.0310
	(0.0273)	(0.0273)	(0.0273)
HFBMs × week=24	-0.0519**	-0.0519**	-0.0519**
	(0.0262)	(0.0262)	(0.0262)
HFBMs × week=25	-0.0369	-0.0369	-0.0369
	(0.0276)	(0.0276)	(0.0276)
HFBMs × week=27	-0.0392	-0.0392	-0.0392
	(0.0284)	(0.0284)	(0.0284)
HFBMs × week=28	-0.0337	-0.0337	-0.0337
	(0.0259)	(0.0259)	(0.0259)
HFBMs × week=29	-0.0074	-0.0074	-0.0074
	(0.0268)	(0.0268)	(0.0268)
HFBMs × week=30	-0.0178	-0.0178	-0.0178
	(0.0253)	(0.0253)	(0.0253)

(Continued next page ....)

Table A.4: Test of difference in weekly food expenditures between HFBMs and natives in 2013 (Cont.)

	(1)	(2)	(3)
HFBMs × week=31	-0.0120	-0.0120	-0.0120
	(0.0275)	(0.0275)	(0.0275)
HFBMs × week=32	-0.0198	-0.0198	-0.0198
	(0.0263)	(0.0263)	(0.0263)
HFBMs × week=33	-0.0213	-0.0213	-0.0213
	(0.0269)	(0.0269)	(0.0269)
HFBMs × week=34	-0.0215	-0.0215	-0.0215
	(0.0260)	(0.0260)	(0.0260)
HFBMs × week=35	0.0119	0.0119	0.0119
	(0.0273)	(0.0273)	(0.0273)
HFBMs × week=36	0.0009	0.0009	0.0009
	(0.0255)	(0.0255)	(0.0255)
HFBMs × week=37	-0.0176	-0.0176	-0.0176
	(0.0270)	(0.0270)	(0.0270)
HFBMs × week=38	-0.0132	-0.0132	-0.0132
	(0.0260)	(0.0260)	(0.0260)
HFBMs × week=39	-0.0041	-0.0041	-0.0041
	(0.0271)	(0.0271)	(0.0271)
HFBMs × week=40	-0.0310	-0.0310	-0.0310
	(0.0267)	(0.0267)	(0.0267)
HFBMs × week=41	-0.0371	-0.0371	-0.0371
	(0.0269)	(0.0269)	(0.0269)
HFBMs × week=42	0.0137	0.0137	0.0137
	(0.0257)	(0.0257)	(0.0257)
HFBMs × week=43	0.0039	0.0039	0.0039
	(0.0267)	(0.0267)	(0.0267)
HFBMs × week=44	0.0047	0.0047	0.0047
	(0.0255)	(0.0255)	(0.0255)
HFBMs × week=45	-0.0237	-0.0237	-0.0237
	(0.0272)	(0.0272)	(0.0272)
HFBMs × week=46	0.0160	0.0160	0.0160
	(0.0254)	(0.0254)	(0.0254)
HFBMs × week=47	-0.0293	-0.0293	-0.0293
	(0.0268)	(0.0268)	(0.0268)
HFBMs × week=48	0.0095	0.0095	0.0095
	(0.0265)	(0.0265)	(0.0265)
HFBMs × week=49	-0.0070	-0.0070	-0.0070
	(0.0270)	(0.0270)	(0.0270)
HFBMs × week=50	0.0060	0.0060	0.0060
	(0.0263)	(0.0263)	(0.0263)
HFBMs × week=51	0.0083	0.0083	0.0083
	(0.0279)	(0.0279)	(0.0279)
HFBMs × week=52	0.0329	0.0329	0.0329
	(0.0295)	(0.0295)	(0.0295)
State fixed effects	No	No	Yes
Other controls	No	Yes	Yes
N	330,023	330,023	330,023
Adjusted R^2	0.005	0.005	0.005
F	14.1	14.1	14.1

Note: 1. HFBMs are identified by birth country of members.
2. Week 26 is the reference week.
3. Standard errors, clustered at the household level, are reported in the parentheses.
4. * p <0.10, ** p <0.05, *** p <0.01.

Table A.5: Impact of exchange rate on HFBMs' food expenditure
(using proportion of foreign-born to total household members to capture the effect of treatment group)

	(1)	(2)	(3)
Proportion of foreign born	-0.0647	-0.0110	-0.0086
members in household (PFBMH)	(0.0870)	(0.0847)	(0.0837)
Year 2014	0.0519***	0.0527***	0.2783
	(0.0051)	(0.0051)	(0.1959)
PFBMH × Year 2014	0.0550***	0.0555***	0.0530***
	(0.0147)	(0.0148)	(0.0148)
Year 2015	-0.0878***	-0.0877***	0.0903
	(0.0086)	(0.0088)	(0.1956)
PFBMH × Year 2015	0.0815***	0.0821***	0.0829***
	(0.0224)	(0.0223)	(0.0226)
Log(household size)		0.1700***	0.1704***
		(0.0246)	(0.0244)
Terrace/townhouse/		-0.0269	-0.0230
villa/semi detached		(0.0404)	(0.0407)
Low rise flats/units		0.0389	0.0379
(2 or 3 storeys)		(0.0403)	(0.0400)
High rise flats/units		0.0358	0.0357
(4 or more storeys)		(0.0514)	(0.0519)
Mobile or improvised		0.0029	-0.0067
dwelling		(0.1288)	(0.1276)
Owned outright		-0.0071	-0.0075
		(0.0230)	(0.0230)
Owned with a		-0.0215	-0.0237
mortgage		(0.0225)	(0.0224)
Constant	8.1394***	7.8833***	7.9355***
	(0.0174)	(0.0607)	(0.0801)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	24,930	24,930	24,930
Adjusted R^2	0.030	0.034	0.035
F	135.0	23.4	14.7

Note: 1. All models control for the household fixed effects.

2. Standard errors, clustered at the household level, are reported in the parentheses.

3. * p <0.10, ** p <0.05, *** p <0.01.

Table A.6: Impact of exchange rate on HFBMs' expenditure on food (with unbalanced panel data)

	(1)	(2)	(3)
HFBMs	0.0996*	0.0088	0.0101
	(0.0568)	(0.0597)	(0.0592)
Year 2014	-0.0963***	-0.0966***	-0.2143
	(0.0085)	(0.0086)	(0.1697)
HFBMs × Year 2014	0.0191	0.0192	0.0189
	(0.0152)	(0.0152)	(0.0153)
Year 2015	-0.1125***	-0.1138***	-0.1395
	(0.0096)	(0.0097)	(0.1653)
HFBMs × Year 2015	0.0401**	0.0401**	0.0401**
	(0.0167)	(0.0167)	(0.0168)
Log(household size)		0.1681***	0.1661***
		(0.0271)	(0.0268)
Terrace/townhouse/		-0.0711*	-0.0692
villa/semi detached		(0.0419)	(0.0422)
Low rise flats/units		0.0272	0.0237
(2 or 3 storeys)		(0.0533)	(0.0531)
High rise flats/units		0.0517	0.0484
(4 or more storeys)		(0.0597)	(0.0600)
Mobile or improvised		0.0327	0.0237
dwelling		(0.1187)	(0.1169)
Owned outright		-0.0154	-0.0166
		(0.0261)	(0.0260)
Owned with a		-0.0369	-0.0400*
mortgage		(0.0242)	(0.0242)
Constant	7.9196***	7.7036***	7.7745***
	(0.0194)	(0.0599)	(0.0819)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	32,220	32,220	32,220
Adjusted R^2	0.012	0.014	0.015
F	44.6	9.0	6.0

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Impact of exchange rate on HFBMs' food expenditure (with top and bottom 10% observations trimmed)

	(1)	(2)	(3)
HFBMs	0.1040	0.0436	0.0491
	(0.0834)	(0.0852)	(0.0833)
Year 2014	0.0560***	0.0566***	0.4310**
	(0.0061)	(0.0061)	(0.2038)
HFBMs × Year 2014	0.0244**	0.0256**	0.0237**
	(0.0114)	(0.0114)	(0.0114)
Year 2015	-0.0869***	-0.0866***	0.2029
	(0.0105)	(0.0107)	(0.2020)
HFBMs × Year 2015	0.0435**	0.0446**	0.0450**
	(0.0178)	(0.0178)	(0.0179)
Log(household size)		0.2043***	0.2034***
		(0.0428)	(0.0426)
Terrace/townhouse/		-0.0505	-0.0483
villa/semi detached		(0.0771)	(0.0766)
Low rise flats/units		0.0489	0.0484
(2 or 3 storeys)		(0.0620)	(0.0618)
Mobile or improvised		0.0904	0.0203
dwelling		(0.2423)	(0.2245)
Owned outright		0.0045	0.0044
		(0.0259)	(0.0255)
Owned with a		-0.0038	-0.0089
mortgage		(0.0247)	(0.0245)
Constant	8.1580***	7.8431***	7.9142***
	(0.0277)	(0.0893)	(0.1128)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	19,626	19,626	19,626
Adjusted R^2	0.030	0.033	0.035
F	106.3	18.8	11.7

Note: 1. The sample is selected using a PSM technique (selected on household size, home type and home ownership type). Estimates relies on observations belonging to [0.1,0.9] range of the distribution of propensity score, following a rule of thumb suggested in Crump et al. (2009).

2. All models control for the household fixed effects.

3. Standard errors, clustered at the household level, are reported in the parentheses.

4. * p <0.10, ** p <0.05, *** p <0.01.

Table A.8: Impact of exchange rate on HFBMs' food expenditure using HILDA data (including exchange rate in the model to replace years)

	(1)	(2)	(3)
HFBMs	-0.3250	-0.2745	-0.2745
	(0.2957)	(0.2963)	(0.2963)
Log(real exchange rate)	-0.8342	-0.7749	-0.7749
	(0.5915)	(0.5905)	(0.5905)
HFBMs × log(real exchange rate)	0.3337	0.2702	0.2702
	(0.5929)	(0.5921)	(0.5921)
Log(household size)		0.3533***	0.3533***
		(0.0216)	(0.0216)
Terrace/townhouse/		-0.0082	-0.0082
villa/semi detached		(0.0207)	(0.0207)
Low rise flats/units		-0.0330*	-0.0330*
(2 or 3 storeys)		(0.0195)	(0.0195)
High rise flats/units		-0.0147	-0.0147
(4 or more storeys)		(0.0338)	(0.0338)
Mobile or improvised		0.0570	0.0570
dwelling		(0.0591)	(0.0591)
Owned outright		0.0666***	0.0666***
		(0.0222)	(0.0222)
Owned with a		0.0165	0.0165
mortgage		(0.0174)	(0.0174)
Constant	10.2219***	10.1191***	10.1192***
	(0.4944)	(0.5594)	(0.5593)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	19,178	19,178	19,178
Adjusted R^2	0.014	0.052	0.052

Note: 1. All models control for the household fixed effects.
2. Standard errors, clustered at the household level, are reported in the parentheses.
3. * p <0.10, ** p <0.05, *** p <0.01.

Table A.9: Impact of exchange rate on HFBMs' annual shopping frequency

	(1)	(2)	(3)
HFBMs	0.0452	0.0323	0.0352
	(0.0552)	(0.0568)	(0.0557)
Year 2014	0.0290***	0.0293***	0.3174
	(0.0050)	(0.0051)	(0.2102)
HFBMs	0.0270***	0.0269***	0.0247***
× Year 2014	(0.0095)	(0.0095)	(0.0095)
Year 2015	-0.1207***	-0.1210***	0.1402
	(0.0083)	(0.0084)	(0.2102)
HFBMs	0.0413***	0.0415***	0.0403***
× Year 2015	(0.0148)	(0.0148)	(0.0149)
Log(household size)		0.0375*	0.0382*
		(0.0204)	(0.0203)
Terrace/townhouse/		-0.0065	-0.0027
villa/semi detached		(0.0367)	(0.0369)
Low rise flats/units		0.0382	0.0349
(2 or 3 storeys)		(0.0368)	(0.0365)
High rise flats/units		0.0873	0.0892
(4 or more storeys)		(0.0540)	(0.0546)
Mobile or improvised		0.1030	0.0894
dwelling		(0.1369)	(0.1318)
Owned outright		0.0034	0.0031
		(0.0222)	(0.0222)
Owned with a		-0.0124	-0.0136
mortgage		(0.0216)	(0.0215)
Constant	4.1203***	4.0567***	4.1138***
	(0.0182)	(0.0547)	(0.0779)
Control for income	No	Yes	Yes
State × year FEs	No	No	Yes
N	24,972	24,972	24,972
Adjusted R^2	0.041	0.042	0.043
F	151.3	24.5	15.6

Note: 1. Robust standard errors are reported in the parentheses. 2. * p <0.10, ** p <0.05, *** p <0.01.