

Federal Reserve Bank of Dallas
Globalization and Monetary Policy Institute

Working Paper No. 35

<http://www.dallasfed.org/institute/wpapers/2009/0034.pdf>

European Hoarding: Currency Use Among Immigrants in Switzerland*

Andreas M. Fischer
Swiss National Bank

August 2009

Abstract

Do immigrants have a higher demand for large denominated banknotes than natives? This study examines whether cash orders for CHF 1000 notes, a banknote not used for daily transactions, is concentrated in Swiss cities with a high foreign-to-native ratio. Controlling for a range of socio-economic indicators across 250 Swiss cities, European immigrants in Switzerland are found to hoard less CHF 1000 banknotes than natives. A 1% percent increase in the immigrant-to-native ratio leads to a reduction in currency orders by CHF 4000. This negative correlation between immigrant-to-native ratio and currency orders for CHF 1000 notes holds irrespective of the European immigrants' country of origin. Hoarding of large denominated banknotes by natives is attributed tax avoidance.

JEL codes: E41, E69

* Andreas M. Fisher, Swiss National Bank, Postfach 8022, Zurich, Switzerland. andreas.fischer@snb.ch. (+41-1) 631-32-94. The author would like to thank Simon Wehrmüller for data assistance and Peter Eltschinger for useful discussions. The views in this paper are those of the author and do not necessarily reflect the views the Swiss National Bank, the Federal Reserve Bank of Dallas or the Federal Reserve System.

1. Introduction

An unresolved puzzle in money demand studies is what drives the demand for large denominated banknotes? While it is frequently acknowledged that large banknotes are used for storage purposes, the motives for hoarding are disputed. Rogoff (1998) links the demand for EUR 500 notes to Europe's shadow economy. Porter and Judsen (1996) estimate that two-thirds of the USD 100 notes are held outside the United States. Boeschoten and Fase (1992) with the use of survey data show that the hoarding of large Dutch banknotes is motivated by tax evasion. In this study, I examine an alternative channel that considers the hoarding preferences of immigrants. More specifically, I ask whether European immigrants residing in Switzerland have a higher or lower demand for large banknotes than Swiss citizens?

This study examines whether cash orders for CHF 1000 notes is concentrated in Swiss cities with a high foreign-to-native ratio. The Swiss case of matching immigrant preferences to large banknotes is of particular interest. First, immigration in Switzerland is an economic phenomenon unmatched in the G-10 industrialized world. Immigrants constitute 22.1% of the Swiss resident population in 2007 with 60.1% coming from the European Union. On the European continent only Liechtenstein (33.9%) and Luxembourg (41.6%)

yield higher percentages for the immigrant-to- population ratio. Second, the CHF 1000 note possesses unique characteristics. It is the banknote with the largest nominal value in Europe.¹ The CHF 1000 note is not used in daily transactions, yet its volume makes up 55% of total Swiss currency. This currency amount of CHF 22.4 billion for the largest denominated note means that the average Swiss resident (Swiss population was 7.4 million in 2007) possesses at least three CHF 1000 banknotes in 2007.

The empirical analysis uses a micro framework to investigate the impact of the immigrant-to-native ratio on large banknotes across 250 Swiss cities from 2006:Q1 to 2007:Q4. A priori, the correlation's direction is unclear. A positive relation between cash and immigrant cities may reflect a low level of financial participation in banking services, strong links to the shadow economy, or imported habits on the part of immigrants. Alternatively, a negative correlation may arise because of long-standing preferences of Swiss citizens to hold large sums of cash. Here, traditional motives for precautionary money demand linked to Switzerland's country-specific factors of high income, low inflation, low tax regime, and low crime serve as explanations.

¹Historically, the CHF/EUR exchange has hovered around 1.5, yielding 666 euros. The EUR 500 note is the second largest banknote in nominal value.

The empirical analysis makes three contributions, each touching the domains of immigration and monetary policy. First, this country study is the first to estimate a currency demand specification at the city level. Previous studies on regional money demand used only bank deposits.² I overcome this deficit through the use of currency orders at the bank-branch level.

A second contribution of the paper is the direct link between monetary policy and immigration. This is of interest, especially for central banks, as domestic aggregate demand through openness and price developments might be closely related to the development of currency used for domestic transactions. Previous studies have focused on the relationship between prices and immigration with conflicting results. Micro studies by Lach (2007), Cortes (2008), and Fratinni (2008) show that immigration's impact on consumer prices is not uniform across goods and countries.³ A contentious issue in

²Recent micro studies include Bover and Watson (2007), Fischer (2007), Fujiki (2002). See also the earlier studies by Fujiki and Mulligan (1996), Mulligan (1997), and Mulligan and Sala-i-Martin (1992). In a related study to this one, Jankowski et al. (2007) match currency orders with Hispanic immigrant concentration for the Chicago area using census data from 2000. It is unclear whether the cross-section estimates are valid at the state level or nationwide.

³See also Ottiviano and Peri (2005, 2006) and Saiz (2007) for evidence of an immigration effect on house prices.

these studies is the separation between demand and supply effects. This identification issue in the case of currency orders is simplified, because it is strictly demand oriented.

A third contribution is methodology. An indirect method is presented to capture currency held for hoarding purposes, separating it from other motives of holding cash. Rather than using an identification strategy to determine the amount of banknotes held beyond the domestic borders, the foreign-to-native ratio is used in this study to determine the currency demand of immigrants residing within the domestic borders. This new identification strategy internalizes the debate on the foreign demand for banknotes.⁴

The empirical results show that the impact of immigration on the demand for large banknotes is heavily dependent on estimation assumptions. I show that the hoarding of large banknotes among European immigrants living in Switzerland is less prevalent than among natives when instrumenting for missing variables. A 1% percent increase in the immigrant-to-native ratio leads to a reduction by CHF 4000.

⁴Unlike the USD 100 note, indicative evidence (i.e., international shipments or surveys, see Maradan 2007) suggests that the CHF 1000 note is held largely within the national borders.

The paper is organized as follows. Section 2 reviews several motives that links immigrants to cash holdings. Section 3 presents the empirical framework together with the data. Section 4 presents the main results with robustness checks. Section 5 offers conclusions.

2. Why Should Immigrants Hoard more than Natives?

Four channels linking hoarding to immigrants at the city level are reviewed in this section. It is argued only the channels of precautionary money demand and tax avoidance are germane for the Swiss case. Both channels conjecture that immigrants should hold less large denominated banknotes.

I begin with the traditional arguments of precautionary money demand. In the microfoundations literature developed by Whalen (1966), Miller and Orr (1966), and Frenkel and Jovanovic (1988), the real quantity of money balances demanded for transactions and precautionary purposes is a function of real income, the variance of real income, the rate of interest on an alternative asset, and a set of demographic variables. Aside from income differences between regions, the fact that immigration masks important socio-demographic traits such as age and education is another way how the immigrant-to-native ratio enters the empirical specification. Tin (2008), for example, using in-

formation from the Survey of Income and Program Participation estimates a precautionary money demand function for U.S. households that includes family traits. Important for immigration at the city level, he finds that age and education are positively correlated with non-interest earning checking accounts. Similarly, Duca and Whitesell (1995) show that age is positively correlated with the demand for credit cards.

Immigrants in Switzerland reveal contrasting traits with respect to Swiss natives. First, immigrants are younger in age than natives. The share of immigrant workers below the age of 40 was 56% in 2006, whereas for Swiss workers it was 44%. Second, the average educational background of immigrants is lower than the Swiss. Table 1 shows the absolute numbers and their percentages for three education categories: high school certificate, apprenticeship, and university degree. A striking feature of the data is the high percentage of immigrants with only a high school degree (30%) versus the Swiss (18%). These demographic features of immigrants should yield a negative correlation between immigrant cities and money. Since the demographic characteristics affect all money balances, a negative correlation with immigrant cities is expected for large as well as small denominated banknotes.

A second motive for holding large banknotes is tax avoidance, see Boeschoten

and Fase (1992). The tax channel also has its links with immigrant cities in Switzerland. The avoidance of Swiss wealth taxes is frequently mentioned as a motive for holding large banknotes, see Maradan (2007). The Swiss wealth tax is annual and is levied at the cantonal level.⁵ The basis of assessment is as follows. Residents pay an annual wealth tax on the value of all assets located in Switzerland, whereas non-residents pay an annual wealth tax on assets derived from firms and real estate situated in Switzerland. The progressive wealth tax varies between cantons with a maximum of around 1.5% levied on net assets. Individuals whose wealth is below a threshold of CHF 250000 (even up to CHF 500000 for certain cantons) are exempted from the tax.

The high deductible means that the less wealthy, which especially includes immigrants, have a lower incentive to evade (or better are not affected by) the wealth tax. While there is no direct comparative information on the wealth of immigrants and natives in Switzerland, several indicators suggest

⁵Several other European countries impose a wealth tax. They include France, the Netherlands, Norway, Greece, and Liechtenstein. This tax was recently lifted in Austria (1997), Finland (2006), Germany (1997), Iceland (2006), Luxembourg (2006), Sweden (2007), and Spain (2008). Countries without a wealth tax include Belgium, Italy, Portugal, and the United Kingdom.

that the average wealth of natives is higher than that of immigrants. A first measure is salary and employment. Immigrants in Switzerland on average earn less and are more likely to be unemployed than the Swiss. According to the Swiss Bureau for Statistics (BfS) (2008), the median monthly salary in 2006 for immigrants was CHF 5000, while for Swiss it was just under 6000. Similarly, the unemployment rate for immigrants was 7.1% in 2006, while only 2.6% for Swiss. A second measure of wealth is home ownership. Again according to the BfS (2008), Swiss home ownership stood at 52.7% in 2007:Q2, whereas immigrant home ownership was just 18.6%. The higher incentive to avoid the wealth tax on the part of wealthier natives means that a negative correlation between immigrant cities and large denominated notes is expected. For CHF notes with storage characteristics, this includes the CHF 200 and CHF 1000 note.

A third motive for holding large notes on the part of immigrants as advanced by Jankowski et al. (2007) is migrant remittances, especially to low-income countries. Currency remittances operating through global cash transfer services are attractive for select immigrant groups that send cash to recipient countries with a weak financial infrastructure. Although the practice of cash remittances is widespread in the United States and Saudi

Arabia, several factors speak against this argument as a viable explanation of currency holdings among immigrants in Switzerland.

The first counterargument is the small size of currency remittances. Arapovic and Brown (2009) estimate the total amount of remittances for 2006 is only CHF 0.7 billion for 404000 immigrants from the Balkans and Turkey, i.e., the most likely users of cash transfer services. These annual transfers yield CHF 1700 per immigrant: an amount well below the average holdings for CHF 1000 notes per person. Further, irrespective of whether these figures are measured correctly, immigrants from the Balkans and Turkey comprise only 25% of the immigrant population living in Switzerland. It is thus unlikely that these immigrant groups at the city level can influence the demand for large banknotes in the aggregate.

Lack of financial participation is another motive advanced why immigrants hoard. This argument again rests on the U.S. experience. Jankowski et al. (2007) show empirically for the Chicago area that Hispanics, in contrast to other immigrant groups, hoard USD 100 notes. The conjectured motive advanced by the authors is that the Hispanics exhibit a low of financial participation. Frictions in banking services for Hispanic immigrants in the United States include the lack of a common language, the lack of

residence documentation, and the salary payment in cash or check.

The unbanked argument does not readily apply to immigrants in Switzerland. Independent of their skill-level or language skills, employees in Switzerland need a bank account to receive their salary. Almost all salary payments in Switzerland are electronic transfers. The use of cash or checks as means of payment for the monthly wage is unrepresentative of the formal sector in Switzerland.

3. Econometric Specification and Data

This section first presents the empirical model together with the instrumentation strategy. Empirical estimates from the first-stage regression are shown.

In a second subsection, the data are discussed.

3.1 Empirical Specification

The econometric model estimates the demand effect of immigrants to natives of a Swiss city on currency orders in the same city. Currency orders are volume measures in Swiss francs for six banknotes: CHF 10, CHF 20, CHF 50, CHF 100, CHF 200, and CHF 1000. The following specification adapted from Lach (2007) and Frattini (2008) defines the currency order, CO_{jct} , for Swiss banknote j ($j = 10, 20, 50, 100, 200, \text{ and } 1000$) in city c ($c = 1, \dots,$

250) for the quarterly sample from 2006:Q1 to 2007:Q4 for t is

$$\log CO_{jct} = \mu_t + \mu_c + \delta(I_{ct}/N_{ct}) + \beta \log(I_{ct} + N_{ct}) + \lambda X_{ct} + u_{jct}, \quad (1)$$

where I_{ct} and N_{ct} are the number of immigrants and natives in city, c , in quarter t , μ 's are time and city effects, X_{ct} are additional city specific factors (i.e., the unemployment rate as a proxy for economic activity), and u_{jct} is a shock to currency orders in quarter t . Total population in city, c , for quarter, t , equals $I_{ct} + N_{ct}$.

The variable of interest in equation (1) is δ . An insignificant coefficient estimate for I/N says that preferences for cash holdings between immigrants and natives are similar. Alternatively, if δ is positive this says that European immigrants in Switzerland have strong preferences to hoard currency. Similarly, the opposite holds, when δ is negative.

Irrespective where immigrants settle in Switzerland, currency orders are demand driven. Thus, there is no endogeneity conundrum between supply and demand. However, missing variables, such as prices or income unavailable at the city level, influence an immigrant's decision to reside in a particular Swiss city and are certainly correlated with money orders. The omitted variables problem biases the estimates of δ in (1). In the case of rising income, this leads to an upward biased estimate of δ . I resolve this problem of

omitted variables by instrumenting for I_{ct}/N_{ct} .

The instrument variable is based on settlement patterns of previous immigrants. Following Card (2001), I construct a variable that predicts immigrant flows in each city in each quarter. The intuition is to exploit the location choices of past immigrants from each area of origin to predict the settlement decisions of immigrants from the same country. The instrument variable predicts immigrant inflows filtering local contemporary demand factors.

In a first step, immigrants are divided into 11 European countries of origin. I then calculate I_{it} , the number of immigrants from each country, i , that reside in Switzerland in quarter t .⁶ Next, the fraction of immigrants from country, i , in city, c , is the quarterly average for the year 2005, $\bar{\lambda}_{ci} = \bar{I}_{ci}/\bar{I}_i$. The predicted number of immigrants from country i in quarter t is $\bar{\lambda}_{ci}I_{it}$. By summing over i , a measure of the predicted total immigrant inflow into city c at time t is obtained that is free of local shocks. A final step normalizes the instrument by the number of natives in the city two years before at $t - 8$:

$$SP_{ct} = \sum_{i=1}^{11} \frac{\bar{\lambda}_{ci}I_{it}}{N_{ct-8}}. \quad (2)$$

Table 2 presents the first-stage regressions of the immigrant-to-native

⁶The countries of origin are Austria, France, Germany, Italy, Netherlands, Serbia, Portugal, Serbia, Spain, Turkey, United Kingdom, and others.

ratio on the supply push instrument, SP_{ct} . The OLS regressions are from 2006:Q1 to 2007:Q4 with city effects. In each regression, the instrument has a t-value above 5, suggesting that SP passes the critic of weak instruments. The first regression in column 1 is unrestricted. It includes information on immigrants from 2675 cities. Next in column 2, the sample is restricted to 243 cities receiving UBS cash orders for CHF 1000 notes in 2006 and 2007. Column 3 shows the restricted first-stage regression of column 2 with time effects. The last specification in column 4, which is used in the analysis in section 4, includes $\log(\text{population})$ and the unemployed-to-population ratio in the specification of column (3).

3.2 The Data

The quarterly sample from 2006:Q1 to 2007:Q4 covers a maximum of 251 cities. Data on cash orders at the bank-branch level are aggregated to the city level. The quarterly data are from UBS, the largest national distributor of banknotes in Switzerland.⁷ UBS handles one-third of the total distribution activity in Switzerland.

⁷The distribution of banknotes is fully privatized in Switzerland. Most distributors operate only regionally. Information on the location of notes returned to the Swiss National Bank is unavailable.

Coverage of the currency orders is documented graphically together with statistical information. The geographical coverage of UBS' distribution activities in Swiss cities is shown in figure 1. The sparse areas in figure 1 are consistent with Switzerland's mountain regions. Further statistical coverage of the currency orders is given in Table 3. The first column shows the number of cities served. They range between 199 and 251. Column 2 shows the percentage of German speaking cities served. Apart from the CHF 50 note, the currency percentages lie close to the national average of 72% of the German-speaking population. Next, columns 3 to 6 provide information on the average, minimum and maximum, and standard deviation of the quarterly total of the distributed currency. In the last column, the quarterly average from column 3 is divided by the average quarterly outstanding currency for the respective banknote. Except for the CHF 10 and the CHF 200 banknote, the percentages lie between 10% and 15%. The low percentage for the CHF 10 note (0.005%) suggests that UBS coverage is problematic, whereas the distribution of CHF 200 note (46%) may be over-representative with respect to the other notes.

The postal code from the currency orders allows us to match the currency orders with various other sources. From the Federal Office for Migration, I

obtained data on the number of foreigners by groups of their origin for each commune in Switzerland. The data is available at the quarterly frequency. Further, the number of unemployed workers for each commune is from the State Secretariat for Economic Affairs. The monthly data is averaged at the quarterly level. In addition, I obtained data on the total resident population and on spatial characteristics for each commune from the Federal Office of Statistics. The population data, which is only available at annual frequency, is disaggregated by a linear interpolation over a 20 year period from 1989 to 2008.

4. Empirical Results

This section presents the empirical results. In a first subsection, the main result for large banknotes is documented: the correlation between currency orders and the immigrant-to-native ratio is negative. In a second subsection, I control for income effects by excluding geographical areas where poorer natives reside (i.e., mountainous and rural areas). These results show that the hoarding effect is linked to wealthier natives.

4.1 The Main Results

Table 4 presents OLS and IV regression estimates for CHF 200 and CHF

1000 banknote orders at the city and time level. All regressions are for the full sample and control for city effects. The coefficient estimates for the immigrant-to-native ratio are sensitive to estimation type and the introduction of time effects. The sequential introduction of population and the number of unemployed do not influence the coefficient estimates for the immigrant-to-native ratio.

OLS estimates are presented in the top panel of Table 4. The immigrant-to-native ratios are insignificant for all specifications of the CHF 200 banknotes. The introduction of city size (log population), economic activity (unemployed-to-population ratio), or time effects does not change the result that the demand for 200 banknotes does not differ between immigrants and natives. A similar picture emerges for the OLS estimates for the CHF 1000 notes. The immigrant-to-native ratio is positive and significant in the regression without time effects, see column 5. The introduction of time dummies to control for aggregate trend effects reduces the coefficient estimate of the immigrant-to-native ratio fourfold and eliminates its significance, see columns 7 and 8.

The bottom panel of Table 4 shows IV estimates of different specifications of equation (1). The F-tests from the first-stage regression are all highly sig-

nificant, suggesting that the critic of weak instrument does not apply. The coefficient estimates for the immigrant-to-native ratio are negative and significant at the 1% critical level in the regression for the CHF 200 banknotes. The coefficient size for I/N jumps from -10 to -20 with the introduction of time effects. In other words, a one percent increase in the immigrant-to-native ratio leads to a reduction by CHF 4000. This result is partially compensated by population size by 1000 (i.e., it has a coefficient size of 5). These results are not sensitive to the introduction of the unemployed-to-population ratio. It enters with a positive coefficient and is significant at the 5% level.

The IV estimates for CHF 1000 banknotes resemble those for CHF 200 banknotes. The coefficient estimates for I/N fall from 7.7 to -7.7 with the introduction of the time effects, see columns 6 and 7. The coefficient estimates of I/N are negative and significant at the 10% level in the regressions with time effects, see column 7. The regressions with time effects show that a one percent increase in the immigrant-to-native ratio leads to a CHF 7000 reduction in the demand for large banknotes. Again, this result is compensated by population size in the order of CHF 3000.

Next, I examine whether the disproportionate effect between immigrants and natives for large banknotes holds for other banknote denominations. A

significant negative result across all banknote denominations is consistent with the view that the immigrant-to-native ratio is capturing demographic traits linked to immigrants (i.e., income or age). The IV regressions in Table 5 are based on specifications (4) and (8) from Table 4. Only the coefficient estimates for the immigrant-to-native ratio are shown. The results show that the immigrant demand for smaller banknotes is not distinct from natives, except for the CHF 20 notes. The coefficient estimates are insignificant for the CHF 10, CHF 50, and the CHF 100 banknote, whereas for the CHF 20 note it is negative and significant at the 5% level. I interpret these results as further evidence of hoarding on the part of natives.

A further consideration is whether the hoarding of large CHF banknotes is identified with a particular immigrant group. The four largest immigrant groups in Switzerland are Germans, Italians, Serbians, and Portuguese. These four immigrants groups have different levels of education. German immigrants have the highest percentage of university degrees (64% in 2007, see Table 1) and the Portuguese the lowest (6% in 2007). The IV regressions in Table 6 again show only the estimates of the immigrant-to-native ratio for the full specification of equation (1). The instruments have been adjusted so that only the fixed immigrant share at the city level in 2005 is multiplied by

the aggregate of the respective immigrant group. The IV regressions show that the coefficients are negative except for Serbian immigrants in the demand specification for CHF 1000 notes. The negative and significant results for the more educated immigrants (i.e., Germans and Italians) however is not consistent with evidence from micro studies that find education to be positively correlated with money.

4.2 Controlling for City and Regional Characteristics

As robustness checks, I control for income and non linear effects based on sample splits for city and geographic characteristics. The evidence reveals that these factors are non neutral, however the main result that natives hoard more than immigrants holds.

Table 7 presents coefficient estimates for I/N in regressions with CHF 200 and CHF 1000 banknotes that control for city characteristics. Panel A divides the sample based on a city population below or above 10000 residents. The results show stronger evidence of hoarding on the part of natives for CHF 200 notes in smaller cities. The opposite result holds for the largest banknote. The immigrant-to-native ratio is negative and significant at the 10% level for large cities. This hoarding result is consistent with the fact that incomes are higher in larger cities.

Next in panel B, the sample is split around the unemployment-to-population ratio of 0.01 (i.e., the sample average). For both banknotes, the hoarding effect is strongest in cities with a higher unemployment rate. In the sample of cities with low unemployment, the demand for large denominated banknotes between natives and immigrants is indistinguishable.

The role of special tax reductions is examined in panel C of table 7. The sample is divided between cities that are exempt from special taxes because of their weak financial position. The coefficient estimates for I/N show that cities not benefitting from the tax reduction, hoarding prevails. The coefficient estimates are close to the full sample estimates recorded in table 4, but their level of significance is higher. The insignificant estimates for the sample of cities enjoying tax benefits however must be interpreted with care. The sample size is small and the F-test values from the first-stage regressions are low.

Table 8 considers the influence of geographic location on the distribution of CHF 200 and CHF 1000 banknote orders. The sample is split at the city level in three ways: border versus non border cantons, rural versus urban areas, and mountain versus low-land regions. The sample splits are motivated by location of commercial activity: cross border transactions (border can-

tons), agriculture sector (rural), and tourism (mountain region). The border cantons are marked by a greater degree of openness, whereas the agriculture (8.1% immigrant labor participation in 2006) and tourist (51%) sector control for income effects and contrasting immigrant participation rates in the labor force.

Panel A shows IV estimates for samples defined as border and non border cantons. For the CHF 200 notes, the demand by immigrants living in the central region of Switzerland is significant and the point estimate of -19 is consistent with the full sample results for Switzerland shown in Table 4. The immigrant effect of border cantons is -8 and insignificant. For the CHF 1000, the coefficient values are similar to the unrestricted sample of table 4, but they are insignificant. The evidence suggests that Swiss residing in the central area (non border cantons) hoard more than immigrants living in the same area.

Panel B shows the results for rural and non rural areas. This sample split controls for higher-income effects and higher labor participation effects on the part of immigrants in non rural areas. Only for the non rural areas is a negative and significant result obtained. Again, the results reconfirm the conjecture that wealthier Swiss are driving the demand for large banknotes.

The result for the rural areas has to be interpreted with caution because of the low F-test values from the first-stage regressions.

Panel C divides the sample based on elevation. Only for the low lands is a negative and significant result for I/N obtained. The estimates for the immigrant-to-native ratio are insignificant for cities in the mountain areas. The insignificance result can be explained by the fact that the incomes of cities in the mountain areas lie well below the national averages. This is consistent with the view that poorer residents are not influenced by wealth taxes.

5. Conclusions

This paper presents new evidence on the impact of European immigration on money demand in Switzerland. Despite a diverse literature studying demographic effects on money demand, this is the first study to examine the impact of immigration on banknote circulation. Immigrants in Switzerland are younger and less wealthier than natives. I use the immigrant population as a control group to examine the role of hoarding for large banknotes.

The empirical results show that immigrant cities have a lower demand for the largest Swiss banknotes. Controlling for population size, a one percent

increase in the native-to-population ratio reduced the demand for the CHF 1000 note by CHF 4000. The effect for the CHF 200 note is found to be similar, while for most of the smaller denominated notes no immigrant effect was found. These pronounced effects are too large to be explained by simple demographic traits. Rather I interpret these the negative immigrant effect to be evidence of hoarding linked to tax avoidance on the part of natives. This hoarding behavior is strongest in the wealthier regions of Switzerland.

References

- Arapovic, Domagoj and Martin Brown, 2009, "Remittance Outflows from Switzerland," *Aussenwirtschaft* 64(1), 7-18.
- Boeschoten, Willem C. and Martin M. G. Fase, 1992, "The Demand for Large Bank Notes," *Journal of Money, Credit and Banking* 24(3), 319-337.
- Bover, Olympia and Nadine Watson, 2005, "Are There Economies of Scale in the Demand for Money by Firms? Some Panel Estimates," *Journal of Monetary Economics* 52(8), 1569-1589.
- BfS, 2008, "Ausländerinnen und Ausländer in the Schweiz," Bundesamt für Statistik, Neuchâtel, Switzerland.
- Card, David, 2001, "Immigration Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration," *Journal of Labor Economics* 19(1) 22-64.
- Cortes, Patricia, 2008, "The Effect of Low-Skilled Immigration on U.S. Prices: Evidence from CPI Data," *Journal of Political Economy* Vol. 116(3), 381-422.
- Duca, John V. and William C. Whitesell, 1995, "Credit Cards and Money Demand: A Cross-sectional Study," *Journal of Money, Credit and Banking* 27(2), 604-623.
- Fischer, Andreas M., 2007, "Measuring Income Elasticity for Swiss Money Demand: What do the Cantons say about Financial Innovation," *European Economic Review* 51(7), 1641-1660.
- Frattini, Tommaso, 2008, "Immigration and Prices in the UK" University College London, *mimeo*.
- Frenkel, Jacob, and Boyan Jovanovic, 1980, "On Transactions and Precautionary Demand for Money," *Quarterly Journal of Economics* 95, 25-41.
- Fujiki, Hiroshi, 2002, "Money Demand near Zero Interest Rate: Evidence from Regional Data," Bank of Japan *Monetary and Economic Studies* 20(2), 25-41.

- Fujiki, Hiroshi and Casey B. Mulligan, 1996, "A Structural Analysis of Money Demand: Cross-Sectional Evidence from Japan," Bank of Japan *Monetary and Economic Studies* 14(2), 53-78.
- Jankowski, Carrie, Richard D. Porter, and Tara Rice, 2007, "Against the tide - Currency use among Latin American immigrants in Chicago," *Economic Perspectives* Federal Reserve Bank of Chicago 2Q, 2-21.
- Lach, Saul, 2007, "Immigration and Prices," *Journal of Political Economy* Vol. 115(3), 548-87.
- Mankiw, N. Gregory, 1992, "Comments and Discussion," *Brooking Papers on Economic Activity* 2, 330-334.
- Maradan, Guy 2007, "Die Nationalbank im Zahlungsverkehr," in Die Schweizerische Nationalbank 1907-2007, Verlag Neue Zürcher Zeitung.
- Miller, Merton H. and Daniel Orr, 1966, "A Model of the Demand for Money by Firms," *Quarterly Journal of Economics* 79, 413-435.
- Mulligan, Casey B., 1997, "Scale Economies, the Value of Time, and the Demand for Money: Longitudinal Evidence from Firms," *Journal of Political Economy* 105, 1061-1079.
- Mulligan, Casey B. and Xavier Sala-i-Martin, 1992, "U.S. Money Demand: Surprising Cross-sectional Estimates," *Brooking Papers on Economic Activity* 2, 285-329.
- Porter, Richard D. and Ruth Judson, 1996, "The Location of U.S. Currency: How Much is Abroad?," *Federal Reserve Bulletin*, Board of Governors of the Federal Reserve System, 82, October, 883-903.
- Ottiviano, Gianmarco I. P. and Giovanni Peri, 2006, "The Economic Value of Cultural Diversity: Evidence from US Cities," *Journal of Economic Geography* Vol. 6(1), pp. 9-44.
- Ottiviano, Gianmarco I. P. and Giovanni Peri, 2005, "Cities and Cultures," *Journal of Urban Economics* Vol. 58 (2), 304-337.
- Rogoff, Kenneth, 1998, "Blessing or curse: Foreign and underground demand for euro notes," *Economic Policy* 13, 263-303.

Saiz, Albert, 2007, "Immigration and Housing Rents in American Cities,"
Journal of Urban Economics Vol. 61(March), 345-71.

Tin, Jan, 2008, "An empirical examination of the inventory-theoretic model
of precautionary money demand," *Economic Letters* 99, 204-205.

Whalen, Edward L., 1966, "A Rationalization of the Precautionary Demand
for Cash," *Quarterly Journal of Economics* 80, 314-324.

Swiss Cities with Cash Orders



Table 1: Education of Swiss and Immigrants (thousands)

	2006	2007	2006	2007
High School Certificate	680	675	0.168	0.164
Swiss	410	408	0.128	0.128
Immigrants	270	267	0.318	0.305
Germany	3	3	0.031	0.023
France	3	4	0.067	0.082
Italy	54	52	0.332	0.318
Spain and Greece	18	15	0.337	0.309
Portugal	70	73	0.676	0.661
Serbia	71	70	0.445	0.431
Apprenticeship	2198	2204	0.543	0.535
Swiss	1852	1850	0.579	0.570
Immigrants	346	354	0.407	0.404
Germany	36	38	0.348	0.333
France	16	16	0.381	0.357
Italy	83	84	0.510	0.518
Spain and Greece	25	23	0.479	0.467
Portugal	28	31	0.273	0.281
Serbia	79	82	0.494	0.507
University Degree	1173	1243	0.290	0.302
Swiss	939	988	0.293	0.304
Immigrants	234	255	0.275	0.291
Germany	64	74	0.622	0.644
France	23	25	0.553	0.561
Italy	26	26	0.158	0.163
Spain and Greece	10	11	0.184	0.224
Portugal	5	6	0.051	0.058
Serbia	10	10	0.060	0.062
Total	4051	4122	1.000	1.000
Swiss	3201	3246	1.000	1.000
Immigrants	850	876	1.000	1.000
Germany	103	115	1.000	1.000
France	43	45	1.000	1.000
Italy	163	162	1.000	1.000
Spain and Greece	52	50	1.000	1.000
Portugal	103	110	1.000	1.000
Serbia	159	161	1.000	1.000

Notes: source Swiss Federal Statistics Office. Sake Survey

Table 2: Immigrant-to-Native Ratio and the Instrument SP

	(1)	(2)	(3)	(4)
	<i>unrestricted</i>	<i>restricted</i> CHF 1000 only	<i>restricted</i> CHF 1000 only	<i>restricted</i> CHF 1000 only
OLS Estimation				
SP	1.690*** (0.310)	1.730*** (0.1760)	1.931*** (0.424)	2.028*** (0.400)
In population	no	no	no	yes
unemployment/population	no	no	no	yes
time effects	no	no	yes	yes
Number of observations	20414	1859	1859	1859
Number of cities	2675	243	243	243

Notes: Estimation is OLS with fixed (city) effects. SP is the instrument. Sample is from 2006:Q1 to 2007:Q4. *, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.

Table 3: Statistics on UBS Currency Orders

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	total cities	German speaking cities only	average per quarter	min	max	St. Dev.	ave cur. order.to ave outstanding
CHF 10	199	0.754	3.0	2.3	3.8	0.6	0.005
CHF 20	249	0.715	194	169	213	14.7	0.148
CHF 50	173	0.867	188	150	229	26.7	0.106
CHF 100	242	0.736	948	835	1280	149.0	0.125
CHF 200	251	0.708	2760	2560	3110	178.0	0.461
CHF 1000	244	0.713	2220	1870	2840	392.0	0.102

Notes: Total cities are number of cities covered by UBS currency orders. German speaking cities is the percentage of German speaking cities to total cities served by UBS. Ave. per quarter denotes the average currency volume for a particular banknote in millions. min and max are with respect to the quarterly volume from 2006:Q1 to 2007:Q4. st. dev. is the standard deviation in millions. ave cur order to ave outstanding is the average quarterly volume of currency orders to the quarterly average of notes in circulation.

Table 4: Immigrant-to-Native Ratio and large Banknotes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CHF banknotes	200	200	200	200	1000	1000	1000	1000
OLS Estimation								
Immigrant/Natives	-0.042 (0.950)	0.500 (0.983)	-0.421 (0.909)	-0.472 (0.910)	3.523*** (0.213)	2.727*** (0.791)	0.753 (0.622)	0.725 (0.603)
In population		-2.099*** (0.784)	-0.321 (0.800)	-0.281 (0.802)		3.058** (1.077)	0.473 (1.048)	0.495 (1.046)
unemployment/population				4.839* (2.584)				3.382 (2.366)
time effects	no	no	yes	yes	no	no	yes	yes
Number of observations	1911	1911	1911	1911	1859	1859	1859	1859
Number of cities	249	249	249	249	243	243	243	243
R-square	0.940	0.942	0.945	0.945	0.930	0.930	0.954	0.961
IV Estimation								
Immigrant/Natives	-9.790*** (3.412)	-10.845** (4.411)	-21.047*** (6.313)	-20.586*** (6.241)	9.206*** (2.928)	7.741** (3.746)	-7.703* (4.129)	-7.416* (4.091)
In population		1.188 (1.716)	5.192** (2.202)	5.106** (2.185)		1.651 (1.465)	2.753* (4.129)	2.693* (1.464)
unemployment/population				6.586** (3.315)				3.913* (2.314)
time effects	no	no	yes	yes	no	no	yes	yes
Number of observations	1911	1911	1911	1911	1859	1859	1859	1859
Number of cities	249	249	249	249	243	243	243	243
R-square	0.130	0.001	0.061	0.063	0.175	0.286	0.115	0.120
F-test (first stage regression)	184.3	129.95	34.24	31.10	181.04	127.83	33.81	30.65

Notes: Estimation is OLS or IV with fixed (city) effects. Sample is from 2006:Q1 to 2007:Q4.

*, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.

Table 5: Immigrant-to-Native Ratio on Currency Orders of Different Denomination

CHF banknotes	10	20	50	100	200	1000
Immigrant/Natives	-11.465 (14.095)	-21.938** (8.715)	7.476 (11.831)	-11.936 (7.753)	-20.568*** (6.241)	-7.416* (4.091)
Number of observations	896	1764	1497	1884	1991	1859
Number of cities	198	248	241	250	249	243
R-square	0.158	0.056	0.126	0.110	0.063	0.120
F-test (first stage regression)	21.64	29.25	23.01	31.24	31.10	30.65

Notes: Only the estimates of the immigrant-to-native ratio from an IV regression with fixed effects at the city time level (that includes ln population, unemployment/population, and time effects) are shown. F-Test(10, Observations-cities-10) is from the first stage regression that includes the instrument (see equation 2). Sample is from 2006:Q1 to 2007:Q4. *, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.

Table 6: Ethnic cities and large currency orders

	Germans	Italians	Serbians	Portuguese
CHF 200 banknote				
Immigrant group				
Immigrant/Natives	-19.277*** (5.592)	-69.889 (63.580)	-593.963 (848.131)	-8.516 (22.308)
Number of observations	1911	1911	1911	1911
Number of cities	249	249	249	249
R-square	0.197	0.130	0.018	0.108
F-test (first stage regression)	224.79	27.31	20.84	23.06
CHF 1000 banknote				
immigrant group				
Immigrant/Natives	-0.864 (3.944)	-80.994* (47.887)	1.020 (161.464)	-6.368 (15.985)
Number of observations	1859	1859	1859	1859
Number of cities	243	243	243	243
R-square	0.247	0.119	0.245	0.192
F-test (first stage regression)	223.33	27.10	20.84	22.94

Notes: Only the estimates of the immigrant-to-native ratio from an IV regression with fixed effects at the city time level (that includes ln population, unemployment/ population, and time effects) are shown.

F-Test(10, Observations-cities-10) is from the first stage regression that includes the instrument (see equation 2). Sample is from 2006:Q1 to 2007:Q4. *, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.

Table 7: City Characteristics, Immigrant-to-Native Ratio, and Cash Orders

CHF Banknotes	200	200	1000	1000
A: City population < 10000	yes	no	yes	no
Immigrant/Natives	-22.799** (8.965)	-11.592 (8.375)	-5.454 (6.459)	-9.052* (4.796)
Number of observations	1096	815	1060	799
Number of cities	143	107	139	105
R-square	0.018	0.104	0.000	0.045
F-test (first stage regression)	15.79	20.10	15.21	20.91
B. Unemployed/population < 0.01	yes	no	yes	no
Immigrant/Natives	-9.997 (13.861)	-17.775** (7.277)	14.678 (11.632)	-8.797* (4.853)
Number of observations	527	1384	507	1352
Number of cities	118	228	115	223
R-square	0.006	0.104	0.017	0.096
F-test (first stage regression)	10.28	25.13	10.37	24.78
C. Special Tax Treatment	yes	no	yes	no
Immigrant/Natives	-132.339 (363.628)	-18.146*** (6.302)	91.544 (126.117)	-10.533*** (3.970)
Number of observations	343	1569	333	1526
Number of cities	43	206	42	201
R-square	0.130	0.070	0.100	0.102
F-test (first stage regression)	1.50	30.94	1.34	30.44

Notes: Only the estimates of the immigrant-to-native ratio from an IV regression with fixed effects at the city time level (that includes ln population, unemployment/ population, and time effects) are shown.

F-Test(10, Observations-cities-10) is from the first stage regression that includes the instrument (see equation 2). Sample is from 2006:Q1 to 2007:Q4. *, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.

Table 8: Geographical Characteristics, Immigrant-to-Native Ratio, and Cash Orders

CHF Banknotes	200	200	1000	1000
A: Border Canton	yes	no	yes	no
Immigrant/Native	-8.192 (16.422)	-19.144*** (7.472)	6.383 (14.308)	-6.676 (4.637)
Number of observations	538	1373	504	1355
Number of cities	68	181	64	179
R-square	0.050	0.005	0.070	0.002
F-test (first stage regression)	19.61	21.77	19.73	21.37
B: Rural area	yes	no	yes	no
Immigrant/Native	-63.301 (68.018)	-15.416** (6.239)	12.297 (20.009)	-10.075*** (3.881)
Number of observations	608	1303	595	1264
Number of cities	79	170	77	166
R-square	0.004	0.003	0.001	0.064
F-test (first stage regression)	7.64	30.04	7.50	29.13
C: Alp - mountain area	yes	no	yes	no
Immigrant/Native	-10.658 (7.338)	-20.098*** (7.814)	4.961 (6.638)	-11.760** (4.762)
Number of observations	762	1149	760	1099
Number of cities	98	151	98	145
R-square	0.039	0.149	0.045	0.191
F-test (first stage regression)	18.46	20.09	18.57	19.85

Notes: Only the estimates of the immigrant-to-native ratio from an IV regression with fixed effects at the city time level (that includes ln population, unemployment/ population, and time effects) are shown. F-Test(10, Observations-cities-10) is from the first stage regression that includes the instrument (see equation 2). Sample is from 2006:Q1 to 2007:Q4. *, **, *** denotes significance at the 10%, 5%, and 1% level. Standard errors are in brackets.