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The Impact of U.S. Regional Business Cycles on Remittances to Latin America

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The current economic slowdown in the United States and the decline in remittance growth to some Latin American countries have intensified the interest in the relationship between these variables. We investigate whether host country conditions affect remittance outflows to Latin America, focusing on the roles of regional U.S. business cycles, geographical variation in immigrant density and sectoral factors. Using quarterly data for 1995-2008, we find that remittance flows are strongly influenced by economic conditions in the specific regions of the U.S. where migrants are clustered, as well as in the sectors especially important for immigrants' employment opportunities. The results are in sharp contrast to previous research suggesting that remittance flows are relatively insensitive to fluctuations in the aggregate U.S. business cycle. Precise estimation of these linkages is also shown to matter for gauging the sensitivity of remittances to economic conditions in the home country, and hence the extent to which remittances might buffer domestic shocks as well as transmitting external ones.

JEL Classification Numbers: E32, F15, F22, F24, R11
Keywords: Remittances, Business Cycles, Central America, Mexico, United States

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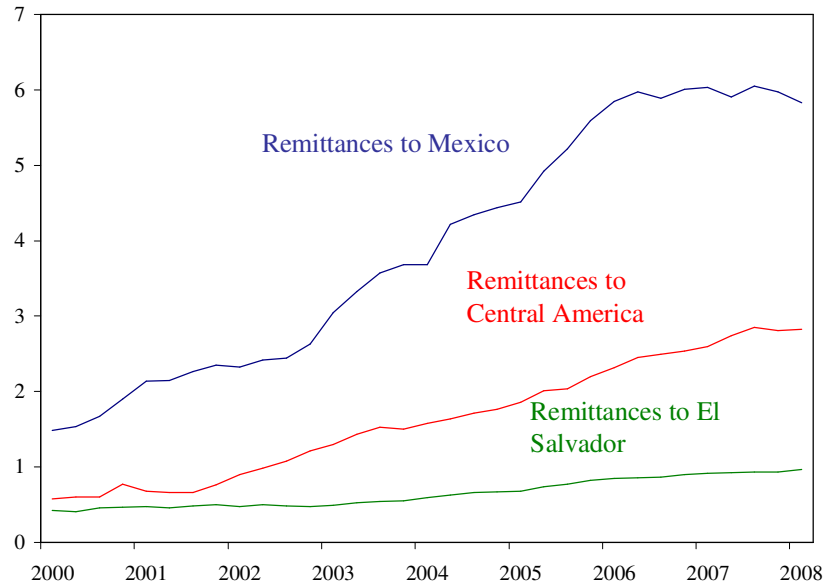
[1] Contact: kristin.magnusson@hhs.se. This project was initiated when the author was an intern in the IMF Western Hemisphere Department, whose hospitality is gratefully acknowledged. I am indebted to Steve Phillips for continuing encouragement and feedback. Maria Albino-War, Dominique Desruelle, Herman Kamil, Martin Kaufman, Shaun Roache, Kornelia Krajnyak, Rodrigo Cubero and seminar participants at the International Monetary Fund provided guidance, suggestions and comments. All remaining errors are mine.

I. INTRODUCTION

Following the rapid growth of workers' remittances over the last decades, they have become a very important source of external financing for many developing countries. In some Central American countries remittances now account for up to 25 percent of GDP and by far outpace e.g. FDI, other capital inflows and aid. Hence it is not surprising that policymakers and researchers have tried to understand the effects of remittances on the recipient economies. Remittances have been argued to possess several attractive features; as unrequited transfers, they create no future obligations, and compared to other types of financial inflows they have appeared more stable. But to properly investigate for example the destabilizing or insurance properties of remittance flows for the receiving countries, or to forecast them, we first need to understand their drivers. This subject has received much less attention so far, and produced very few conclusions.

Figure 1 Remittances to Central America and Mexico



X-axis: Billions of U.S. dollars, seasonally adjusted. Sources: Haver Analytics, national authorities, and IMF International Financial Statistics.

Remittances are usually defined as the portion of migrant workers' earnings sent back to the country of origin. From this it is natural to think that the size of current earnings, or the labor market prospects of immigrants in the host country, could matter for the size of transfers. Indeed recently it often has been suspected that the current economic slowdown in the U.S. is behind the drop or deceleration in remittances to Mexico and a lesser extent El Salvador. It has however been hard to establish linkages between U.S. economic factors and remittances to Latin America at business cycle frequencies (Roache & Gradzka 2007).

Our contribution is to demonstrate econometrically that U.S. economic conditions indeed matter for remittances to Latin America, but that the aggregate business cycle previously studied is not very relevant. Focusing on the U.S. aggregate economy can be seriously misleading because (i) Hispanic immigrants are not uniformly distributed across the U.S. but

instead concentrated in a limited number of states, and (ii) as we demonstrate, regional and state-level business cycles within the U.S. are quite heterogeneous (indeed as different as between EMU countries).

These two key stylized facts help us identify linkages between U.S. state-level and regional economic variables and remittances to Latin America, both through looking at correlation coefficients between cyclical components of series and polynomial lag estimation. We find that remittance flows to LA countries are strongly influenced by economic conditions in the specific regions of the U.S. where migrants are clustered, as well as the sectors especially important for immigrants' employment opportunities. We also find evidence of remittances responding positively to negative macroeconomic conditions at home. Hence remittances can potentially both absorb domestic shocks and transmit external ones. To our knowledge, this paper is the first to study the importance of disaggregate U.S. indicators in this context, and our results are in sharp contrast to the failure to detect strong effects of U.S. variables in previous literature.

By establishing linkages at business cycle frequencies we are able to provide some simple "rules of thumb" for forecasting the effects of U.S. economic conditions on remittances to Latin America. But second, and maybe more important, the empirical findings here also suggest that we should not only think about whether remittances can smooth income declines in the remitters' country of origin but also that shocks in immigrants' host countries could be transmitted via remittances. As we show in our theoretical companion paper (Magnusson, 2008), featuring a two-country general equilibrium model, host country shocks to remittances have substantial implications for the volatility of key macroeconomic variables in the recipient economies. Even if remittances are (weakly) countercyclical to home country GDP, remittances cannot substantially smoothen the home business cycle if aggregate shocks to home and host country output are positively correlated, as is the case for e.g. Mexico, El Salvador and the U.S.

While remittances are sent by most Hispanic subgroups in the U.S., this paper concentrates on those from the Mexican and Salvadoran populations. In absolute terms, Mexico is one of the globally largest recipients of remittances, currently receiving some 25 billion U.S. dollars annually. As a percentage of GDP, remittances however stand at about 3% of GDP in Mexico compared to almost 20% in El Salvador, the second largest recipient of remittances in the hemisphere. Not only are remittances important for these economies, but reliable information on where their remitters work and sufficiently long time series of the data needed are also available. While sharing the U.S. as the most important destination for migrants, Mexico and El Salvador also have some interesting differences in emigrants' location and occupation that will be found important for their ability to diversify the effects of U.S. regional shocks on remittance receipts.

Section II of this paper reviews two distinct strands of earlier literature related to our analysis: the first studying the importance of cyclical economic conditions for remittances and the second concerning U.S. state and regional business cycles. Section III describes the data used and discusses measurement issues. Section IV documents the geographic concentration of Hispanic immigrants and state-level business cycle heterogeneity in the U.S.

Section V presents our econometric procedures and results. Section VI concludes and draws policy implications.

II. LITERATURE

Most of the remittances literature falls into three broad areas: (i) the microeconomic motives for remitting and the sociodemographic profile of remitters and recipients, (ii) institutional features of the remittance market such as the effects of declining transaction costs, and (iii) the effects of remittances on the recipient economies and the importance of conditions in the same countries such as natural disasters, wars, political and macroeconomic factors for the decision to remit. As earlier mentioned, less attention has been paid to the role of "host country" conditions.

The results from the literature on the importance of *home country* conditions are mixed, finding both negative and positive effects on remittances.. This has been justified by remittances having two possible functions: *compensatory transfers* seeking to alleviate recipients' economic distress or *opportunitistic flows* allowing remitters to take advantage of favorable investment opportunities in the home country, thus resulting in either a negative or positive coefficient on home country conditions. The view of remittances as compensatory transfers currently seems to have the most support (Chami et al, 2008, Sayan, 2006). Part of the differences in results may also be due to studies failing to take into account the importance of host country factors.

In the most thorough examination to date of *host country conditions* in the Western Hemisphere, Roache and Gradzka (2007) conclude after using a range of methods that no clear linkages between remittances and U.S. macroeconomic factors can be established. On the other hand, Vargas-Silva and Huang (2006) look at flows from the U.S. to several countries including Mexico and find evidence of linkages using a vector error-correction model. A range of aggregate U.S. indicators are found to Granger-cause remittances to Mexico, although imprecise estimation makes the results somewhat difficult to interpret.

For other regions of the world and with methodologies differing from ours, a few studies have also found positive host country effects. Lueth and Ruiz-Arranz (2006) use a gravity model and per capita income growth as a measure of the host country business stance, and find positive effects on bilateral remittances to the Middle East, Europe and Asia. Positive host country effects have also been found for remittances to Greece and Egypt (Lianos 1997, El-Sakka and McNabb 1999). Studies on the Germany-Turkey remittance corridor from a business cycle perspective have yielded mixed results. Sayan (2004) find no statistically significant linkages while Aydas, Metin-Ozcan and Neyapti (2005) do. Host country conditions have also be used as (valid) instruments for remittances in several studies (Aggarwal and Martinez Peria, 2006, Bugamelli and Paternò, 2008).

Studies on regional business cycles in the U.S. date back to the early works of McLaughlin (1930), Vining (1949), Borts (1960) and Syron (1978). There has recently been a renewed interest in the topic following the finding that business cycles across countries have become more synchronized with increased international economic and financial integration over the last decades. However, and importantly for our analysis, the U.S. is displaying more

heterogeneity in regional and local business cycles since the 1990s compared to earlier decades. In fact, the results in Artis and Zhang (1999) imply that most EMU economies became more synchronized with Germany during the ERM period than U.S. state economies were with each other by the late 1980s and onwards.

The sources of business cycle heterogeneity within the U.S. still seem to be an open question, but most authors favor differences in industry mix as an explanation. Regional and spatial effects (e.g. neighbors' industry mix) seem to be weaker, but most studies find the Midwest to be the region most synchronized with the aggregate U.S. cycle (Owyang, Rapach and Wall, 2007, Partridge and Rickman, 2005). Of special interest to our project, Cañas and Phillips (2008) have noted that the region bordering Mexico in the southwest has become significantly more aligned with the Mexican cycle since the introduction of NAFTA in 1994, but that the effects within this U.S. region again differ depending on industry mix.

III. DATA

A major complicating factor in our analysis is that high-frequency remittance data disaggregated by origin in the U.S. is currently not available. There is some state-by-state-evidence on remittances to Latin America from three annual surveys conducted by the Inter-American Development Bank (IDB henceforth). The nature of the information unfortunately makes it unsuitable for time-series analysis as these surveys cover different states in different years. It is however noteworthy that the states highlighted by the IDB surveys as major origins of remittances are well aligned with the "Hispanic" states that we will identify in the next section. We will instead use data from national central banks on total remittance inflows, measured at the quarterly frequency and starting in 1995 for Mexico and 1998 for El Salvador. We will deal with this aggregate nature of remittances data in various ways in our estimations. Since about 95% of remittances to these countries reportedly come from the U.S. we are rather confident about not picking up large effects of other host countries.

There is an ongoing discussion about whether the available remittance data accurately captures the actual amounts transferred, and how variation in caption over time has affected data. While earlier remittance data from the region mainly included transfers made through official channels, efforts have been made during the latest decade also to include informal remittances e.g. though surveys of returning migrants at the border. This improved capture clearly has contributed to the high growth rates of remittances, but the extent of this effect is not well known.

There are some indications supporting the accuracy of Mexican data. Remittance inflows to a certain area within Mexico are positively correlated with the number of emigrants from the same region, suggesting that remittance patterns can be reconciled with demographic factors. The credibility of high-frequency movements in remittances is supported by data showing seasonal spikes coinciding with important events in the recipient countries such as religious holidays, Mother's Day and the start of the school year (Cañas, Coronado and Orrenius, 2007, IMF, 2006, INEGI, 2008).

Concerning U.S. variables, it is customary to date state recessions from developments in payroll employment. We follow this literature and make use of state-level employment data

from the Bureau of Labor Statistics Current Employment statistics. This survey covers about 400,000 work sites each month. Alternatives could have been state-level output or personal income. Estimates of U.S. output at the state level are available but are subject to a higher degree of uncertainty than at the national level. Personal income on the other hand also includes regional transfers and capital income payments, which makes it less appropriate for business cycle analysis. In addition, state-level price indices required to obtain real income or output are not available (Owyang, Rapach and Wall, 2007, Orrenius, Saving and Caputo, 2005, Partridge and Rickman, 2005, Phillips and Cañas, 2007). Lastly, and most relevant for our topic, we suspect that remitters' income in the U.S. derives far more from their labor than from profit on capital, so a focus on labor market conditions seems appropriate.

We also study two sub-components of total employment per state: employment in the construction and leisure services sectors. The construction sector is often claimed to be of special importance for Mexican immigrants' employment opportunities, although it makes up only 5% of U.S. total employment. The same goes for the service sector and Salvadoran immigrants. While we ideally would have liked to include all service employment this was not available for all states. We however have reasons to believe that our results can be generalized to the broader service sector as employment in the leisure service sector was highly correlated with total service sector employment for the states where both measures were available. Agriculture is also a very important sector, especially for Mexican short-term migrants, but sufficiently long time series of agricultural employment at the state level were unfortunately not available.

Remittance data and recipient country GDP were adjusted for seasonal effects using the U.S. Census Bureau X12 program. Data was deflated using U.S. CPI for remittances and the corresponding GDP deflator for recipient country output series. For most methods employed in this paper the data need to be stationary. This was not the case for any log-level series according to the common Augmented Dickey-Fuller and Phillips-Peron tests, which failed to reject non-stationarity.

Data on the number and state-level location of Hispanic immigrants were taken from the U.S. Censuses for the years 1995, 2000 and 2005. Up to half of the immigrants are however thought unauthorized and the extent to which their activities are captured by official statistics remains an open question (Orrenius, 2008, Chiswick and Hurst 2000, Miller and Neo, 2003). To compare Hispanic immigrants' residency with that for illegal immigrants we used data on the location of issuance of Mexican *matricula consular* identity cards during 2004-2007. These identity cards are used for identification by many illegal Mexicans and can be obtained by the applicant only from the geographically closest of the 47 Mexican consulates in the U.S. As shown in tables 4 and 6 in the appendix, the percentage of issuance of identity cards in a certain state is well aligned with the census data on the Hispanic fraction of population[2]. Hence, we feel rather confident about using the official statistics (Ministry of Foreign Affairs of Mexico, 2008).

[2] Given the Mexicans' dominant share of the Hispanic population, data on people of Hispanic origin is likely to be a good proxy for the Mexican population.

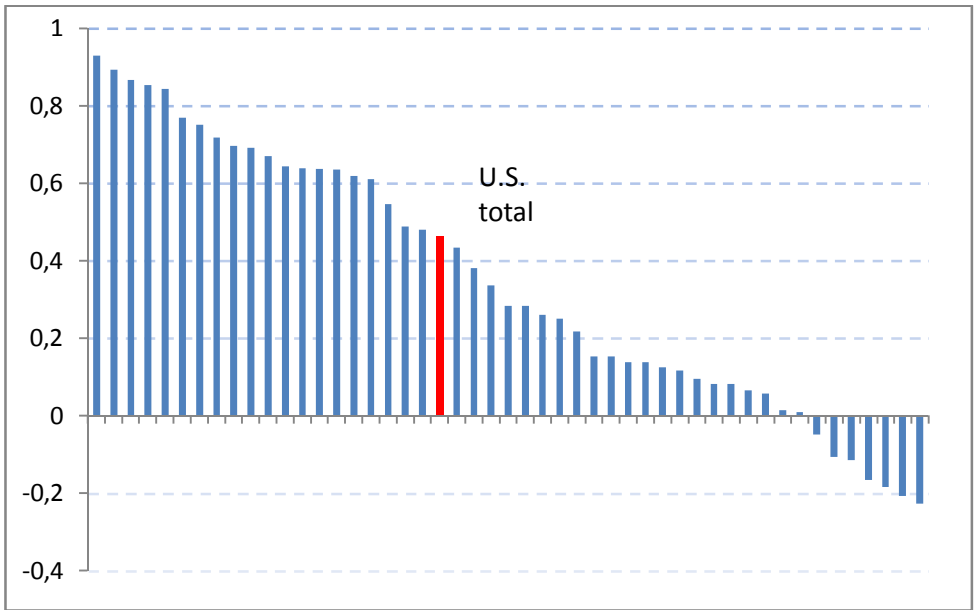
IV. HISPANICS' LOCATION AND STATE-LEVEL CYCLE HETEROGENEITY IN THE U.S.

The first stylized fact we establish is the striking geographical bias in the distribution of Hispanics across states. Almost 35% of individuals of Hispanic origin resided in California in 2005, as shown in table 4 in the appendix. The four border states Arizona, California, New Mexico and Texas were home to almost 60% according to U.S. Census data. In contrast, the 40 least "Hispanic" of the 51 U.S. states only hosted 15% of the population group. Only looking at number of Hispanic individuals also masks some important trends, where traditional "Hispanic" states such as Texas and New York have seen much smaller, and according to some sources negative Hispanic population gains, and instead e.g. Colorado and Georgia that traditionally have had low number of Hispanic immigrants have seen their share rise considerably. Most of geographic transitions by Hispanics however seem to be within states (U.S. Census Bureau 1995, 2000, 2005).

The U.S. census data does not contain state-level information about different sub-nationalities within the Hispanic category. As two-thirds of the Hispanic population in the U.S. is of Mexican origin, the census data may give a reasonably good approximation of Mexicans' distribution across states. For Salvadorans, surveys have found that the majority resides in a dozen states: Arizona, California, Colorado, Florida, Georgia, Illinois, Maryland, New Jersey, New Mexico, New York, Texas and Virginia, but the distribution across these states is unknown. As earlier mentioned, both Mexican and Salvadoran immigrants tend to work mainly in the construction and services sector, with the former being relatively more important for Mexicans and the latter for Salvadorans (Gammage, 2007, Garcia and Palacios, 2008).

We now turn to state the second of our stylized facts, demonstrating business cycle heterogeneity among U.S. states and regions, as measured by correlation coefficients between the cyclical components of HP-filtered data. Figure 2 below illustrates the point with correlations of California—which is the economically largest of the U.S. states, as well as the most "Hispanic"—with each of the other states, and with the aggregate U.S. employment cycle. (Note that California is in a sense more Hispanic than it is economically dominant, with 35% of the U.S. Hispanic population compared to 10% of total employment.)

Figure 2 Distribution of correlations between the employment cycle in California and the rest of the U.S



X-axis: Comovement between California, other U.S. states and total U.S. employment, ordered by magnitude. Y-axis: Size of correlation coefficient. Source: U.S. Bureau of Labor Statistics, Current Employment Survey. Note: Correlations are contemporaneous and between cyclical components of HP-filtered and logged data.

It is clear that very considerable business cycle heterogeneity exists. For more than half of the U.S. states, the correlations are less than 0.3, and some of those are negative. On the other hand, 17 states show correlations of + 0.6 or more. Among these are some states geographically close to California such as Colorado but also other further away. Reflecting this diversity, California's correlation with the aggregate U.S., marked in red, is in between, about + 0.5. The correlations between service employment in California, the other states and the aggregate U.S. look very similar, while the construction sector shows less heterogeneity in cycles across states. The magnitude and patterns of correlation coefficients are broadly in line with estimates in previous literature (Partridge and Rickman, 2005).

Regarding the importance of different industry mix across states, we can only infer differences in relative weights of the services and construction sectors from our data. We find that the construction sector has a larger share of employment in most of the "Hispanic" states outlined above, the exceptions being Illinois and New York. The same is true but to a lesser extent of our service sector measure. There is also as much variation in correlations between the three different employment measures within a certain state as for the same sector between states discussed in the previous paragraph. We find no evidence of Hispanic states having especially strong or weak within-state correlations of the three employment variables compared to states with low fractions of Hispanic population.

V. ESTIMATING LINKAGES

Our main hypothesis is that remittances to Mexico and El Salvador should be more positively affected by U.S. economic conditions in regions and sectors where the majority of remitters work. To test this, we first look at correlation coefficients and then proceed to a multivariate analysis, controlling for other variables, using distributed lag models.

A. Correlation coefficients

To assess the links between remittances and U.S. regional indicators, we calculated correlation coefficients between remittances and the three employment measures for the U.S. 48 contiguous states.[3] We also present correlation coefficients for the aggregate of all state-level variables to put these state-level results in perspective. To make data stationary two separate methods were used, HP-filtering and first-differences. Qualitatively the same pattern was obtained with the two techniques but with first-differenced data correlations were in general lower as were t-statistics.[4] We will only present results obtained from HP-filtered data for space reasons. To account for time effects, we calculated contemporaneous correlation coefficients as well as correlations with 1 to 4 quarter lags of the U.S. indicators. Results were quite similar for one and two quarter lags while correlations decreased for further lags. For clarity of the presentation, Figure 3 on the next page shows results only for states where correlation coefficients were high and significant.[5]

From Figure 3, a number of interesting observations can be made. First, the states where high and significant correlations are found match well with the "Mexican" or "Salvadoran" states outlined in the previous section. Of the states with significant Mexican and Salvadoran populations, Illinois is the only one where no employment indicator is significantly related to remittances to either country. One possible explanation for this is the relative geographic isolation and different regional business cycle of Illinois from e.g. California and the other "Hispanic" states shown earlier.

The pattern of correlation coefficients also seems to pick up some of the differences in geographic location and sectoral occupation between Mexicans and Salvadorans discussed earlier. For remittances to Mexico, results are especially strong for the states along the southwestern border, while Salvadoran remittances seem related to a larger number of states. In fact, given the large number of states with significant coefficients for remittances to El

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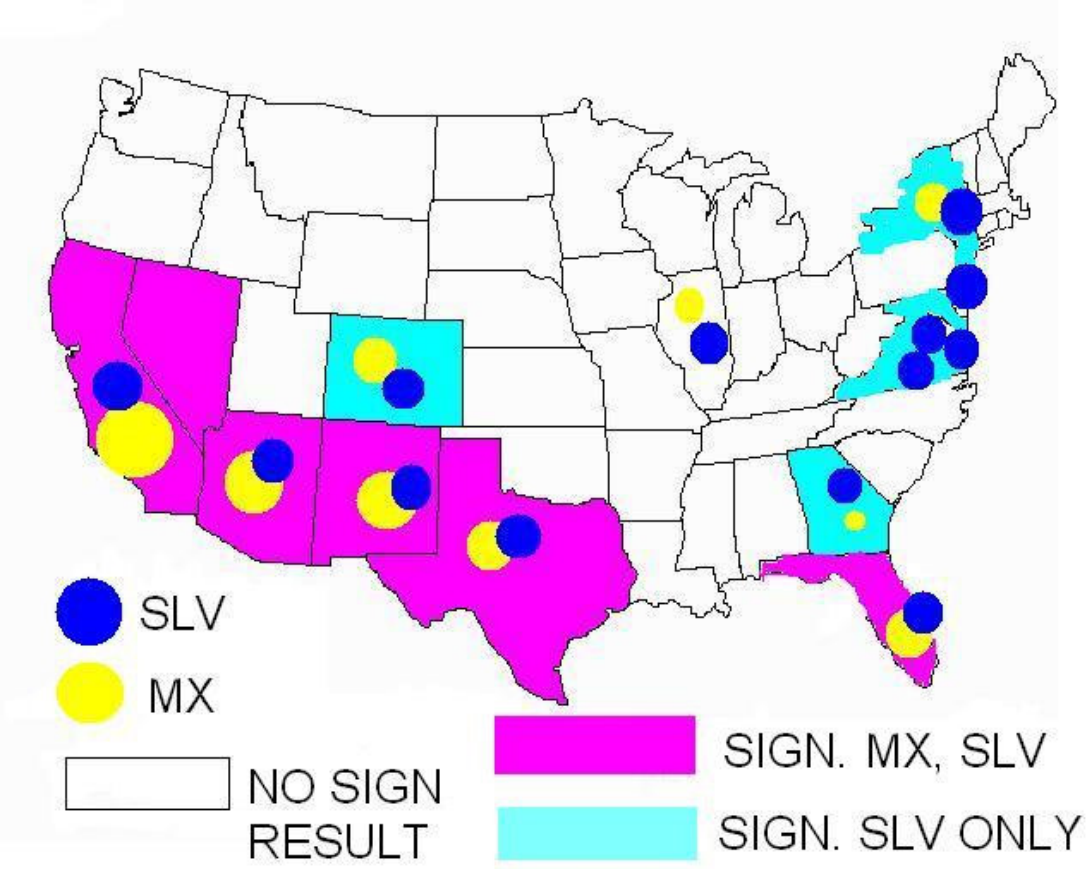
[3] According to the literature on state-level business cycles in the U.S., Alaska and Hawaii display very different characteristics from the 48 contiguous states, and are therefore usually not investigated. We follow this convention. The District of Columbia was not included due to lack of data.

[4] This is in line with the different features of the HP-filter and first differences where the former keep more high-frequency variation which results in higher correlations (Baxter and King, 1999).

[5] For Mexico, very few coefficients were significant for other states. For El Salvador, coefficients were significant for some more states, but their magnitude was smaller than the ones shown in table 7 in the appendix.

Salvador, one would almost expect remittances to that country also to be responsive to aggregate U.S. indicators, a point that is discussed further below.

Figure 3 Significant cyclical correlations between remittances and U.S. variables, and geographic location of Mexican and Salvadoran immigrants



Sources: U.S. Census Bureau, Haver Analytics, author's calculations. Note: "Sign. Result" refers to a correlation coefficient between cyclical components of HP-filtered variables significant at the 5% or higher level. Circles refer to populations of Mexicans and Salvadorans. Their sizes are proportional to shares of population for Mexico, not for Salvadorans as the corresponding information is not available.

Correlations between remittances to El Salvador and various U.S. indicators were in general higher than the corresponding ones for Mexico, as shown in table 7 in the Appendix. Mexicans' often claimed higher dependence on the construction sector also seems reflected in the higher number of significant coefficients compared to services employment.

For comparison, we also calculated correlations with aggregate U.S. total employment, service and construction employment as well as with GDP of the recipient countries. As seen from table 8 in the appendix, remittances to Mexico only show a significant correlation with U.S. aggregate employment in construction, and the coefficient is considerably lower than most found for individual states. Remittances to El Salvador on the other hand seem to be

responsive at high significance levels also to aggregate U.S variables, although again the coefficients are lower than for disaggregate U.S. data.

Home country GDP was significantly and negatively correlated with remittances, consistent with the "remittances as compensatory transfers" hypothesis discussed in the literature review. Coefficients were remarkably similar in magnitude for Mexico and El Salvador and significant at the 10% level. The home country GDP coefficients are considerably lower than the ones we obtain for the U.S. indicators.

To sum up the results from this section, correlations between remittances and U.S. variables are especially strong for the "Mexican" and "Salvadoran" states, suggesting our proposed research strategy might be fruitful. Moreover, and as to be expected given the earlier discussed state-level business cycle heterogeneity in the U.S., the pattern found in correlation coefficients at the aggregate level does not hold up at the state level.

Notice however that these are simple unconditional correlation coefficients not controlling for other variables possibly affecting remittances. This includes possible bias from spillovers between U.S. variables. There is a risk of "over-fitting" total remittances to individual U.S. state-level variables in the sense that e.g. the coefficient on employment in Arizona is not picking up the effects on remittances from that particular state but in fact e.g. spillovers from California. A different, but related problem is that we can only hope to account for a fraction of the variation in remittances with any single state-level variable, given that total remittance flows emanate from many different locations in the U.S. We will address these issues in the next section.

B. **Multivariate distributed lag models**

To assess whether the above preliminary evidence holds up in a more formal econometric framework, we proceed to distributed lag estimation. The hypothesis to be investigated is whether remittances are affected by contemporaneous and lagged values of exogenous U.S. variables.

In the most general form, the model can be written as

$$r_{it} = \alpha_i + \sum_{s=0}^{p} \beta_s x_{t-s} + \sum_{s=0}^{R} \gamma_s z_{t-s} + e_{it} \qquad (1)$$

where r_{it} is the quarterly percentage change in remittance flows to country *i* in period *t*, α_i is a constant, β_s is a sensitivity parameter to be estimated, and x_{t-s} is a stationary state-level U.S. employment variable in period *t-s*. z_{t-s} denotes a set of control variables. In many cases, the high collinearity of current and lagged values of the x's and z's defeats direct estimation. The number of parameters to be estimated is instead reduced by using polynomial distributed lags which imposes a smoothness condition on the lag coefficients. Smoothness is expressed as requiring that the coefficients lie on a polynomial of relatively low degree. A polynomial distributed lag model with order *p* restricts the β coefficients to lie on a p-order polynomial of the form:

$$\beta_s = \varphi_1 + \varphi_2(s-\bar{c}) + \varphi_3(s-\bar{c})^2 + ... + \varphi_{q+1}(s-\bar{c})^q \quad (2)$$

for $s = 1,2,....P$, where $\bar{c}$ is a pre-specified constant given by

$$\bar{c} = \left\{ \frac{P}{2}, \frac{(P-1)}{2} \right\} \text{ for } P = \{even, odd\}. \quad (3)$$

This specification allows us to estimate a model with *P* lags using only *q* parameters.

Regarding the choice of control variables, there is as earlier mentioned an ongoing discussion about to what extent remittances respond to macroeconomic conditions in the home countries, and whether remittances can act as a stabilizing factor of their business cycles. Including GDP in the recipient countries as an explanatory variable is therefore important to assess and control for the effect of e.g. a shock to recipients' income. There are also other, pure econometric, reasons to include home country GDP. If business cycle or economic growth indicators are highly correlated across countries, omission of origin country regressors would be a serious specification error. High correlations indeed seem to be the case both for aggregate and state-level variables in the case of Mexico, Central America and the U.S. (Phillips and Cañas, 2007, Roache, 2008, Sosa, 2008).

Moreover, the Mexican (real) peso/dollar exchange rate could be an important factor to take into account for the decision of sending remittances in currency or kind. The sign of the exchange rate coefficient is a priori not clear. If families target a certain consumption level in domestic currency, a depreciation would result in a negative sign through falling remittances. But if the consumption basket also contains a considerable share of imported goods, a depreciated peso would be associated with an increase in remittances so as to preserve recipients' purchasing power. El Salvador has been dollarized though most of the period under study why the exchange rate was not included in the regressions for that country.

Lacking a theoretical model of how long it should take for a shock to the exogenous variables to affect remittance outflows, we rely upon measures of fit. After estimating equations with various lag and polynomial orders, we report below the ones with the lowest Akaike information criteria. In most specifications, this was achieved for 4-6 quarter lags of the explanatory variables, with polynomials of degree two to three. In polynomial lag estimation, the sum of the coefficients on the explanatory variable can be interpreted as the elasticity of the dependent variable to an innovation in the former over the estimation period. The coefficients should be interpreted as an upper bound on estimated effects as they measure accumulated effects over time assuming immigrants do not change geographical residence or sectoral occupation, arguably a strict assumption.

We estimated two sets of regressions: first on state-by-state and second on regional and re-weighted variables, to address the problems with state-level analysis outlined earlier. Regarding the first problem of "over-fitting" remittances to individual state-level variables and to tackle that results from state-level indicators are not instead picking up an aggregate

U.S. factor, we estimate regressions with and without the aggregate U.S. total employment, employment in services and construction respectively. This way, we make sure that in the state-by-state regressions we only pick up the effect of a certain state over and above the impact of the aggregate U.S. cycle. The results from state-level regressions, reported in tables 9 and 10 in the appendix, confirmed the evidence obtained from looking at correlation coefficients. For Mexico, remittances were again significantly affected by especially construction sector employment in the "Mexican" states and the Southwestern border states outlined before. Salvadoran remittances were again sensitive to a large number of states or a broad U.S. cycle compared to Mexico's remittance inflows.

Which aggregate U.S. cycle matters for total remittances?
The second problem with state-level analysis outlined earlier is that any individual state can explain at best a fraction of total remittances. At the same time, discarding information from other states (beyond the U.S. aggregate control variable) that may have largely orthogonal business cycles reduces our ability to explain total remittances. What we would like is instead to get a picture of the economic conditions facing the larger majority of Mexican and El Salvadoran immigrants in the U.S. In this way, we can hope to capture more of the variation in total flows of remittances. This also makes the magnitude of the effects we find more comparable with previous studies using aggregate data.

To this end, we aggregate the state-level data in such as fashion that we give higher weights to the states that matter most for immigrant employment opportunities. We do so in two ways: first, by constructing weighted aggregate "Mexican" and "Salvadoran" variables for total employment, employment in the services and construction sector, and second by looking at the Southwestern border states separately. At least 60% of Mexican immigrants are thought to reside in the four border states; for Salvadoran immigrants we have no reason to believe this region to be of special importance.

We begin by stating the results for aggregate U.S. variables for comparison. In the below regressions, the control variables were the respective home country's GDP, and in the case of Mexico also the real peso/dollar exchange rate.

Table 1 Distributed Lag Estimation, remittances and aggregate U.S. variables

Mexico				
	US variable	MX GDP	Exchange rate	R-sq
US total employment	2.80 (0.79)	1.61 (0.86)	2.21 (1.19)	0.35
US construction	6.06 (1.12)	4.33 (0.54)	1.06 (0.34)	0.36
US services	-1.12(-0.14)	0.75 (0.76)	1.20 (0.45)	0.28
El Salvador				
	US variable	SLV GDP		R-sq
US total employment	1.13*(1.54)	-3.03 (-1.18)		0.49
US construction	4.10 (1.27)	-5.03** (-1.72)		0.48
US services	6.89** (1.77)	-4.61** (-1.97)		0.35

Source: Author's calculations. *, **, *** denotes significance at the 10, 5 and 1 % level respectively. T-statistics in parenthesis.

The above table confirms the results from simple correlation coefficients; remittances to Mexico are not significantly affected neither by total U.S. employment, nor U.S. employment in the construction and services sectors. Neither do remittances to Mexico seem to be affected by domestic developments. Remittances to El Salvador, on the other hand, show sensitivity both to aggregate U.S. employment and employment in the services sector. Coefficients on Salvadoran GDP were negative and significant in two out of three regressions, and of about the same magnitude as the coefficients on the U.S. variables. This suggests a bad income shock in El Salvador could affect remittances positively even after controlling for host country factors.

We keep these results, or lack thereof in the Mexican case, in mind when continuing to estimations for remittances to Mexico, El Salvador and weighted U.S. variables. For the "Mexican" variables we aggregate the state-level variables using as weights the percentage of Hispanics living in each state using the U.S. 2000 Census.[6] Given the dominant share of Mexicans in the Hispanic population, the Hispanic shares of population are good proxies for where Mexicans reside. For the "Salvadoran" variables we simply add up states where there is evidence of significant populations residing, and control for the aggregate U.S. variables.[7]

[6] We also tried using the 1995 and 2005 weights as well as an average and results did not change.

[7] These states are Arizona, California, Colorado, Florida, Georgia, Illinois, Maryland, New Jersey, New Mexico, New York, Texas and Virginia.

Table 2 Distributed Lag Estimation, remittances and U.S. "Mexican" and "Salvadoran" variables

Mexico				
	U.S. variable	MX GDP	Peso/dollar Exchange rate	R-squared
US "Mexican" employment	2.02*** (1.60)	-2.20* (-1.49)	2.49** (1.76)	0.58
US "Mexican" construction	11.24** (2.67)	-7.88** (-2.69)	1.47* (1.60)	0.58
US "Mexican" services	6.94 (0.22)	-1.11 (0.57)	1.53 (1.22)	0.33
El Salvador				
	U.S. variable	SLV GDP		R-squared
US "Salvadoran" employment	1.67* (1.44)	-4.09 (-1.02)		0.76
US "Salvadoran" construction	4.14* (1.35)	-3.25* (-1.34)		0.60
US "Salvadoran" services	9.27** (1.88)	-3.64* (-1.50)		0.48

Source: Author's calculations. *, **, *** denotes significance at the 10, 5 and 1 % level respectively. T-statistics in parenthesis.

The striking differences in the above table compared to the results for the un-weighted aggregate variables in Table 1 concern Mexico. Remittances to Mexico show strongly significant relationships with our constructed "Mexican" variables for both total employment and employment in the construction sector as opposed to the lack of results for un-weighted variables. This again lends support to the idea that certain states are of major importance for Mexican immigrant employment opportunities and hence also ability to remit.

Interpreting the estimated coefficients as elasticities suggests that as a "rule of thumb," remittances to Mexico can be expected to fall by about 2% over six quarters following a 1% initial decline in the U.S. "Hispanic" employment situation, or by 11% following a similar decline in the "Hispanic" construction sector. While not exactly comparable due to differences in methodology, the magnitude of the 2% coefficient is similar and the 11% somewhat larger than those found in Lueth and Ruiz-Arranz (2006) for other parts of the world. Interestingly enough, when we try to estimate the effects on the aggregate U.S. economy especially relevant for Mexicans we also find stronger effects for the Mexican control variables. This suggests that remittances might increase either in response to a positive shock in the host country or a negative one in remitters' country of origin.

For El Salvador, results are also stronger in terms of significance levels for the constructed "Salvadoran" variables compared to the un-weighted ones. Coefficients are however remarkably similar for the un-weighted and weighted variables, again confirming the more general sensitivity of Salvadoran remittances to U.S. variables both at the aggregate and state

level, as well as the larger importance of the service sector. As a "rule of thumb", a 1% fall in "Salvadoran" employment would lead to almost a 2% decline in remittances, or a 1% fall in services employment to an almost ten-fold effect. This is again in the ballpark of the estimated effects in Lueth and Ruiz-Arranz (2006). Again, the Salvadoran control variables are also significant, with a negative sign, suggesting remittances' dual response to conditions in both countries.

Border States

A possibility most relevant for Mexico is that the four states on the U.S. southwest border are especially important for remittances. Recall that about 60 percent of Hispanics in the U.S. reside in those states, and about 65 percent of the identity cards issued by Mexican consulates are issued there. Moreover, the region has a long history of circular migration and the transaction costs of remitting are possibly lower due to the smaller geographical distances between home and host countries. To investigate this hypothesis, we aggregate respectively state-level total employment, employment in the services and construction sectors for the border states California, Arizona, New Mexico and Texas.

Again, we control for the U.S. aggregate respective employment variable, home country GDP and in Mexico's case the exchange rate. Here, we view El Salvador as something of a control case. If we obtain equally strong results for "border" variables for El Salvador and Mexico, we are probably not picking up the effects of distance to the border per se as these ought to be weaker for El Salvador than Mexico (since the former do not share a border with the U.S). Luckily for our hypothesis, results were not significant for any "border" variable for El Salvador after controlling for the aggregate U.S. variables. Hence, we only report results for Mexico in Table 3 below.

Table 3 Distributed Lag Estimation - U.S. "border" variables and Mexican remittances

	U.S. variable	MX GDP	Peso/dollar Exchange rate	R-squared
U.S. "border" construction employment	9.37** (2.67)	-3.46 (-0.80)	0.28 (0.43)	0.72
U.S. "border" total employment	13.23** (1.72)	-2.04 (-0.45)	0.86 (0.78)	0.77
U.S. "border" services employment	13.54** (1.66)	-4.58 (-0.79)	0.11 (0.05)	0.62

Source: Author's calculations. *, **, *** denotes significance at the 10, 5 and 1 % level respectively.

The above table indicates that the border states indeed seem to play an especially important role for remittances to Mexico for all three different employment measures, and even more so than the "Mexican" employment variables investigated before. Coefficients are high and significant and R-squares are considerable. However, while the Mexican GDP control variables still had the expected signs in most cases, they were no longer statistically significant. This is probably due to the very high correlation of the U.S. border state variables with the Mexican GDP variable. It is possible that what we are picking up is not only the

effect of the economic conditions in the border states but also other factors such as increased immigration control which is possibly correlated with economic variables (see below).

Robustness checks

We conducted a number of tests to assess the plausibility of our results. First, we estimated all regressions using only the sample up to 2006:1, so as to control for the possible effects of the commonly perceived tightened security along the U.S.-Mexico border during the last two years. Early 2006 was also the period when growth in remittances to Mexico began to decline—and when the series for U.S. "housing construction starts" began to turn downward. Using this shorter sample only affected the results for the constructed "Mexican" and border state construction sector employment variables, where coefficients were smaller (but still significant) for the shorter sample period. This provides some indirect evidence that U.S. border security developments and the construction sector have played a role for the recent developments in remittances to Mexico.

Second, we estimated an AR (1) specification, that is included a lagged term for the change in remittances among the explanatory variables. This did not change the results. As regards endogeneity concerns, it is possible that remittances may affect growth and exchange rates in the recipient countries. (This is perhaps more a concern for the analysis of El Salvador, where remittance inflows are much larger in relation to the domestic economy than in Mexico.) We believe our estimation method with its included lags should help diminish the contemporaneous effects on these variables, and hence the bias their interaction might produce.

VI. CONCLUSIONS

While it seems plausible that workers' remittances could depend positively on economic conditions in the host country, such linkages to the U.S. economy have been hard to establish formally for recipient countries in the Western Hemisphere. Our starting point in this paper was that this may partly be due to earlier studies concentrating on the stance of the overall U.S. economy. After documenting significant variation in immigrant density across U.S. states and heterogeneity in business cycles at the U.S. state level, we provided new evidence that remittances to El Salvador and Mexico are in the short run significantly and positively affected by the economic conditions where their remitters work, as well as the sectors especially important for their employment opportunities. The pattern we obtained is consistent with demographic information showing the Salvadorans to be more spread across the U.S. compared to the Mexicans who cluster in California and the other Southwestern border states. Remittances to El Salvador seem related to so many—and diverse— U.S. states that a relationship to remittances also shows up in the results using aggregate U.S. data, so one could as well argue these flows are in fact responding to a broader U.S. cycle. Remittances to Mexico on the other hand show some quite dramatic and interesting differences between the aggregate and state level: while strongly related to employment in a limited number of states, we find no significant relationships to total U.S. employment.

To assess the picture facing the "average" Mexican or Salvadoran immigrant, we constructed aggregate variables weighted by the share of Hispanic population in each state. Again, we obtained strongly significant results in contrast to the aggregate variables un-weighted by Hispanic population. We also found the four border states to be of special importance for remittances to Mexico, which is not surprising given that around 60% of its immigrants reside there. We also found macroeconomic conditions in remitter' home countries to matter, suggesting that remittances could increase both in response to a negative shock at home or a positive one abroad.

Future research using remittance data surrounded by less uncertainty will be able to estimate the links between remittances and local or regional host country economic activity more precisely. A major step forward would be to better match origins and destinations of remittances by using data disaggregated by U.S. source states, possibly from market intermediaries.

Our analysis has important policy implications. Once we know more about which host country conditions matter for remittances, we are much better equipped to e.g. forecast remittance flows. Given the considerable social and macroeconomic importance of remittances in many recipient economies, this is highly desirable and timely task.

We however think our most important policy contribution is to suggest new links for how remittances affect the macroeconomic performance of the recipient economies. This paper, although purely empirical, has suggested that remittances might not only smooth home country shocks due to their possibly countercyclical features but also transmit shocks originating in the host countries. As shown in our theoretical companion paper, Magnusson (2008), this mechanism is quantitatively important for the volatility of e.g. consumption in the recipient economies. For recipient countries whose aggregate economic cycles are highly correlated with those of the countries where their remitters work, this also means remittances will fall simultaneously with negative shocks to domestic output. Future research, as well as the current worsening economic situation facing the U.S. and the remittances-receiving economies in Latin America, will shed further light on this matter.

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VII. APPENDIX

Table 4 Fraction of Hispanic population in the U.S., per state

	1995	2000	2005		1995	2000	2005
Alabama	0,11%	0,21%	0,23%	Montana		0,05%	0,05%
Alaska	0,08%	0,07%	0,08%	Nebraska		0,16%	0,27%
Arizona	3,44%	3,69%	3,70%	Nevada		0,68%	1,12%
Arkansas	0,08%	0,24%	0,29%	New Hampshire		0,05%	0,06%
California	33,76%	31,08%	34,88%	New Jersey		3,20%	3,16%
Colorado	2,04%	2,09%	2,02%	New Mexico		2,71%	2,16%
Connecticut	0,89%	0,90%	0,84%	New York		9,41%	8,09%
Delaware	0,07%	0,11%	0,11%	North Carolina		0,36%	1,07%
DC	0,13%	0,13%	0,11%	North Dakota		0,02%	0,02%
Florida	7,32%	7,61%	7,65%	Ohio		0,60%	0,61%
Georgia	0,51%	1,23%	1,51%	Oklahoma		0,37%	0,51%
Hawai	0,36%	0,25%	0,22%	Oregon		0,53%	0,77%
Idaho	0,26%	0,29%	0,29%	Pennsylvania		1,01%	1,11%
Illinois	3,92%	4,32%	4,02%	Rhode Island		0,19%	0,26%
Indiana	0,43%	0,60%	0,62%	South Carolina		0,14%	0,27%
Iowa	0,14%	0,23%	0,24%	South Dakota		0,02%	0,03%
Kansas	0,41%	0,53%	0,10%	Tennessee		0,15%	0,35%
Kentucky	0,10%	0,17%	0,18%	Texas		19,96%	18,91%
Louisiana	0,40%	0,30%	0,28%	Utah		0,41%	0,57%
Maine	0,03%	0,03%	0,03%	Vermont		0,02%	0,02%
Maryland	0,54%	0,64%	0,70%	Virginia		0,72%	0,94%
Massachusetts	1,22%	1,22%	0,41%	Washington		1,00%	1,25%
Michigan	0,88%	0,93%	0,85%	West Virginia		0,04%	0,04%
Minnesota	0,23%	0,40%	0,41%	Wisconsin		0,41%	0,55%
Mississippi	0,07%	0,11%	0,11%	Wyoming		0,11%	0,09%
Missouri	0,27%	0,33%	0,35%				

Source: U.S. Census Bureau

Table 5 Salvadorans and Mexicans in the U.S.

Unit: Hundreds of thousands

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
El Salvador	656	701	607	723	761	765	829	868	1,019	955	1,121	1,091
Mexico	6,668	6,679	7,017	7,119	7,197	7,841	8,259	9,659	9,967	10,453	10,805	10,900

Source: U.S. Census Bureau

Table 6 Percentage of matricula consular identity cards issued in different U.S. states

	2004	2005	2006	2007
California	37,34%	38,60%	40,23%	42,52%
Texas	15,61%	15,58%	16,20%	15,78%
Illinois	12,68%	11,46%	9,76%	8,79%
Georgia	4,25%	3,91%	3,84%	3,28%
Arizona	3,74%	4,06%	4,07%	4,72%
Florida	3,32%	2,46%	2,74%	2,91%
North Carolina	2,45%	2,67%	2,55%	2,11%
Indiana	2,40%	2,10%	1,98%	1,45%
Oregon	2,40%	2,33%	2,10%	1,74%
New York	2,37%	2,28%	2,01%	3,33%
Colorado	2,19%	2,25%	2,13%	2,30%
Nevada	2,18%	2,93%	2,85%	2,33%
Washington	1,96%	1,79%	1,75%	1,07%
Pennsylvania	1,16%	0,74%	0,86%	0,53%
Utah	1,09%	1,64%	1,53%	1,45%
Nebraska	1,03%	0,83%	0,89%	0,73%
New Mexico	1,00%	1,00%	1,00%	1,00%
Missouri	0,89%	0,94%	0,84%	0,78%
DC	0,81%	1,06%	0,99%	1,17%
Michigan	0,77%	0,72%	0,57%	0,42%
Massachusetts	0,11%	0,11%	0,11%	0,11%
Arkansas	0,00%	0,00%	0,00%	0,71%
Minnesota	0,00%	0,56%	0,89%	0,90%

Source: Ministry of Foreign Affairs of Mexico

Table 7 Correlations between cyclical components of HP-filter, remittances and U.S. state-level variables

	Mexico		**El Salvador**	
	Coeff.	T-stat	Coeff.	T-stat
AZ Output	0.35	(2.67)	0.75	(7.94)
AZ Construction	0.68	(6.54)	0.72	(7.38)
AZ Services	0.31	(2.33)	0.70	(6.89)
CA Output			0.64	(5.89)
CA Construction	0.60	(5.24)	0.71	(7.13)
CA Services			0.63	(5.72)
CO Output			0.52	(4.28)
CO Construction			0.61	(5.40)
FL Output	0.42	(3.26)	0.83	(10.48)
FL Construction	0.78	(8.73)	0.70	(7.02)
FL Services	0.35	(2.62)	0.56	(4.77)

GA Output			0.62	(5.58)
GA Construction			0.55	(4.66)
GA Services			0.55	(4.71)
NV Output	0.53	(4.44)	0.74	(7.74)
NV Construction	0.78	(8.83)	0.58	(4.97)
NV Services			0.51	(4.21)
NJ Output			0.56	(4.82)
NJ Construction			0.45	(3.55)
NM Output	0.34	(2.58)	0.69	(6.72)
NM Construction	0.52	(4.33)	0.78	(8.84)
NY Output			0.62	(5.87)
TX Output			0.65	(6.27)
VA Output			0.72	(7.33)
VA Construction	0.60	(5.36)	0.79	(9.11)
VA Services			0.69	(6.78)

Source: Author's calculations. Note: All of the above correlation coefficients are significant at the 5% level.

Table 8 Correlations between cyclical components of HP-filtered data, remittances, host and home country aggregate variables

	Mexico		El Salvador	
	Coeff.	T-stat	Coeff.	T-stat
U.S. employment, total	-0.09	-0.5	0.64***	7.04
U.S. employment, construction	0.35***	2.55	0.56***	4.61
U.S. employment, services	-0.05	-0.33	0.47***	3.59
MX GDP	-0.21*	-1.41		
SLV GDP			-0.21*	-1.35

Source: Author's calculations. Note: *, **, *** denotes significance at the 10, 5 and 1 % level respectively.

Table 9 Distributed Lag Estimation, Mexican remittances and state-level U.S. variables

Mexico

With U.S. average, origin GDP and exchange rate control

	Sum of coefficients on US variables	T-stat	R squared		Sum of coefficients on US variables	T-stat	R squared
Arizona construction	3.43**	2.21	0.46	Florida services	8.07***	2.43	0.51
Arizona employment	7.94**	1.92	0.44	New Mexico construction	4.39***	2.68	0.59
Arizona services	2.86*	1.36	0.52	New Mexico employment	4.38**	1.76	0.82
California construction	2.13**	1.70	0.88	Nevada construction	1.18**	1.40	0.39
California employment	5.08**	2.60	0.81	Nevada employment	8.12***	2.79	0.52
Colorado construction	5.90**	1.83	0.49	Nevada services	10.86***	3.43	0.62
Colorado services	10.54*	1.40	0.54	New York construction	10.25**	1.97	0.70
Florida construction	2.88**	2.40	0.51	New York employment	3.03*	1.38	0.37
Florida employment	4.74***	1.72	0.79	Texas construction	7.11**	1.92	0.78

Source: Author's calculations. *, **, *** denotes significance at the 10, 5 and 1 % level respectively.

Table 10 Distributed Lag Estimation, Salvadoran remittances and state-level U.S. variables

El Salvador

	With origin control						
	Sum of coefficients on US variables	T-stat	R squared		Sum of coefficients on US variables	T-stat	R squared
Arizona construction	0.62**	2.13	0.22	New Mexico employment	8.67**	1.81	0.22
Arizona employment	2.20**	2.11	0.29	Nevada construction	0.59*	1.51	0.27
Arizona service	4.44**	3.14	0.46	Nevada employment	2.72**	1.89	0.28
California construction	1.01*	1.32	0.17	Nevada services	1.51**	1.71	0.25
California employment	3.53*	1.35	0.19	New York employment	1.74*	1.39	0.18
California services	3.27*	1.31	0.21	New York Services	7.61**	2.36	0.23
Colorado employment	2.54*	1.39	0.23	New Jersey employment	4.78**	1.77	0.19
Florida construction	2.12**	1.96	0.17	New Jersey services	5.51*	1.41	0.13
Florida employment	3.16**	1.73	0.22	Texas output	3.07**	2.18	0.32
Florida services	4.22*	1.42	0.11	Virginia construction	1.917*	1.55	0.16
Georgia employment	3.55**	1.88	0.19	Virginia employment	4.22*	1.32	0.18
Georgia services	4.78**	1.96	0.23	Virginia services	5.31**	1.74	0.11
New Mexico construction	1.21*	1.51	0.24				

Source: Author's calculations. *, **, *** denotes significance at the 10, 5 and 1 % level respectively.