



HOUSE PRICE & IMMIGRATION, VAR ANALYSIS OF U.S

Xin L. Brown¹

¹*Visiting Assistant Professor, Department of Economics, the University of Texas Rio Grande Valley, USA*

Abstract

This paper examines empirically the interaction between immigration and house prices in U.S. I employ panel VECM techniques to use a large annual dataset on U.S over the period 2000-2019. The VECM approach allows to address the cointegration between variables in VAR. Our results provide evidence of migration contribution to the increase of house price in U.S. (positive impact on GDP and negative impact on aggregate unemployment). We also find that migration is influenced by house price in U.S. (migration responds positively to host GDP and negatively to host total unemployment rate and house price).

Keywords

Immigration, Unemployment, Minimum Wage, Capital, Labor Market, GDP

Introduction

International labor migration to U.S. has increased significantly over past decades. Until 2018, nearly 17 percent of work force is foreign-born. About 130 million immigrants make contribution for economics in U.S. (Dan Kosten, 2018). With aging populations and the decline in working-age adults born in the United States in the labor force, more labor migration will be needed in the future in U.S. Immigration helping to expand the working age population. (B. Lindsay Lowell, 2006). Immigration therefore contributes to the stabilization of the working age population and be a solution for labor force shortage.

At the same time, the increasing share of migrants in the labor force raises concerns about the impact of international immigration on labor market, economics, crime and house price in the host countries.

The theoretical studies on the effects of immigration on labor markets do give basic or detailed explanations. Firstly, the effect of immigration on natives' labor market like employment, wage is still ambiguous. Harris and Todaro (1970) employed a two-sector model of migration and unemployment to describe the possible negative effects of immigration on native-born unemployment. G. Basso (2015) used 2SLS method to get the zero to positive relation between immigrants and native wage and employment. Anthony Edo (2019) found the impact of immigration on natives' labor market outcomes is more negative in states where the effective minimum wage is relatively low. Secondly, the effect on the average wage in labor market. Borjas (2013) proved there is a negative relation between immigration and average wage. More immigration, lower average wage. Ottaviano and Peri (2012) pointed out the effect should be discussed on the long run or the short run and the effect should be determined the dynamic response of physical capital accumulation. Thirdly, the effect on the skill component in labor market. Borjas (2014) discussed because of the differences of skill groups, the substitution and complementary effect will be more complex across all groups. Peri and Sparber (2009) showed the immigration pushed natives to work with jobs with more language and communication intensive.

The theoretical studies on the effect of immigration on economics conditions in host countries are still developing rapidly. Morley (2006) examines the causal link between migration and per capita GDP, and finds evidence of a long-run causality running from per capita GDP to immigration using data for Australia, Canada and USA. Giovanni Peri (2012) found that immigration had a strong, positive association with total factor productivity. Mete Feridue (2005) proved if the immigration increase, the GDP will increase, but no effect on unemployment.

Another effect from immigration is crime in host countries. Because of the differences in culture, education, faith and etc., immigrants are regarded as unstable groups in U.S. R Martinez Jr (2000) provided the idea that immigrants are more criminal prone than natives because of stress for adjustment. Jörg L. Spenkuch(2014) suggested there is no significant relation between immigrants and crime by using panel data. Luca Nunziata (2012) also mentioned that the immigrants are not crime prone but associated to the fear of crime in European countries.

Recently, more researches are approaching to property price and immigration. Saiz, A., (2007) said because of the immigration flow in U.S, the house rent and house value in gateway cities are significantly increasing, including New York, Los Angeles. The immigration flow is becoming an important factor for short and long-term inflation of house rent and house price in cities in U.S. Kathrin Degen (2010) also stated that the immigration flow will increase house price in Swiss. Filipa Sá (2015) while prove in U.K there is negative relation between immigration and house price because of the mobility of natives. Abeba Mussa (2017) also mentioned immigration inflow to MSAs will push natives move out of the original MASs. Matthew P.Larkin (2019) analyzed the effect on house price from macroeconomics inspective and found in some countries the house price will increase along the immigration inflow, but for less attractive countries, the house price will not significantly change.

These papers above already proved the positive relation between immigration flow and house price and value from different inspective and in different countries by using various methods, but for U.S, this topic is still on discussion. Only Saiz, A.(2017) used the panel data from big cities in U.S. to prove the positive relation between house price and immigration. Jamie Sharpe (2019) proved the idea of more positive relation between house price and immigration than native flows in U.S by controlling endogeneity. But no paper discuss this topic by using macro method like VAR, SVAR. Also, even if there are papers above talked about the immigration and economics conditions by using VAR, they are mostly about European countries and no one is about U.S. So this paper will make up this gap and give some explanation of house price and immigration in U.S.

Our study is relatively close to the work by Ekrame Boubtane (2018) that employs a panel VAR methodology on European countries to examine the interaction between immigration and economics conditions. In this paper, there is a four variables VAR, immigration rate, host country GDP, and variables for employment opportunities in the host country and house price in host country. Because I have to analyze the house price in U.S, so I will include house price as the fourth variable in this VAR model. Also, I modified the host immigration rate as total unemployment rate in U.S. in VAR. So, in this paper, I will use a four variables VAR: immigration rate, GDP in U.S, total unemployment rate in U.S and Average Sales Price of Houses Sold for the United States.

Econometric methodology

I use 4 dimensional VAR to estimate the impulse response functions. The econometric model takes the following reduced form:

$$\mathbf{X}_{it} = \Pi(L)\mathbf{X}_{it} + \mathbf{u}_i + \mathbf{q}_{it}$$

where \mathbf{X}_{it} is a vector of stationary variables, $\Pi(L)$ is a matrix polynomial in the lag operator with $\Pi(L) = \Pi(L)1 + \Pi(L)2 + \dots + \Pi(L)p$, \mathbf{u}_i is a vector of country specific effects and \mathbf{q}_{it} is a vector of idiosyncratic errors.

$$\mathbf{X}_{it} = (\Delta M_{it}, \Delta Y_{it}, \Delta U_{it}, \Delta Q_{it})$$

where M is the net migration rate in logarithms, Y is GDP and U is unemployment rate in logarithms, Q is the real house price index-a nominal house price index deflated by the consumer price level. Δ is the first difference operator.

Once all the coefficients of the panel VAR are estimated, I compute the impulse response functions (IRFs) and the variance decompositions (VDCs). Impulse response functions describe the response of an endogenous variable over time to a shock in another variable in the system. Variance decompositions measure the contributions of each source of shock to the (forecast error) variance of each endogenous variable, at a given forecast horizon.

Because for immigration the big life decision, the immigrants usually will consider for a long period of time before making decisions and will choose the most suitable host country to immigrate, so immigration will always be decided earlier. Thus, put immigration rate as the first place in VAR is reasonable. Because the GDP in host country will only affect immigration with a lag, not an immediately effect. So I put GDP as the second variable in VAR.

As it is well known, when n variables are non-stationary and cointegrated, a useful specification for their dynamic interaction is a vector-error-correction model (VECM). A VECM places non-linear reduced-rank restrictions on the matrix of long-run impacts from a VAR. King et al. (1991), in particular, propose a distinction between structural shocks with permanent effects on the level of the variables (e.g. a positive technology shock, raising output in the long run) from those with only temporary effects (e.g. a demand shock that can be thought to have zero long-run effect on output and other real variables). The permanent shocks generate the "common stochastic trends" across the series, and the number of these shocks equals the number of variables in the system less the number of cointegration relationships between them. The (remaining) transitory innovations equal the number of cointegration relationships (intuitively, a cointegration vector identifies a linear combination of the variables that is stationary, so that shocks to it do not eliminate the steady state in such a system).

Hypotheses about cointegration

With three variables in VAR, there will be some stochastic trends in this model.

Output and House Prices

Poterba (1984) suggested the house price will have a increasing stochastic trend along time if we assume the supply curve for house and other goods are perfectly elastic and any factor determining real estate supply, such as land, lumber or construction workers, is available in fixed supply. According to above, we can expect house price is cointegrated with GDP per capita. This cointegrated vector can be estimated by the constant fraction of GDP per capita because for the long run, the investment for stock of supplying houses will be a constant fraction of GDP.

Output and unemployment

According to Okun's law, in order to achieve a one percentage point decline in the unemployment rate in the course of a year, real GDP must grow approximately two percentage points faster than the rate of growth of potential GDP over that period. Because output depend on the amount of labor force and unemployment is equal to labor force minus employment, so there is a negative relation between GDP and unemployment.

This law implies the positive relation between output and employment and negative relation between unemployment and output. Fata Azmi (2013) used data to prove this negative relation and also other papers got the same conclusion for this relation. Thus, in the paper, I have to consider the cointegration between output and unemployment.

Output, unemployment and immigration

For immigrants, when they make decision to immigrate, the economic improvement is the main motivation. More work opportunities, higher salary, better working and living will attract the inflow of immigrants. For developed countries, like European, Canada, U.S., immigration has been increasing dramatically. But for developing countries, the immigration inflow is comparably less.

Besides, not only the economics conditions in host countries will affect immigration but also the conditions in original countries. If the salaries in home countries are nearly similar with in host countries, the motivation and attraction of immigration will be lower. In this paper, I assume the economics conditions in home countries will have no effect and not considered in this VAR model.

DATA

I use annual data over the period 2000-2019 for U.S. which is the host country. All variables are taken from U.S. Databases. To characterize immigration, we use net migration rate measured as total annual arrivals less total annual departures (net migration), divided by total population times 100. All the migration data used in this analysis are categorized as permanent and long term. Entries of persons admitted on a temporary basis are not included in the statistics.

Hour price index is from All-Transactions House Price Index for the United States (USSTHPI) in U.S. Federal Housing Finance Agency. Here I use the annually data rather than quarterly data and the basement is first quarter in 1980. (Q1 1980=100). The period of data is from 2000 to 2019.

The other economic conditions variables: Y_t is the log of real GDP inflation adjusted value of the goods and services produced by labor and property located in the United States. This data is provided from Real Gross Domestic Product (GDPC1) in U.S. Bureau of Economic Analysis. U_t is the unemployment rate in U.S expressed in percentages from 2000 to 2019. This data is from Unemployment Rate (UNRATE) in U.S. Bureau of Labor Statistics.

For U.S, the estimated VAR contained a lag length of 3 or 4, depending on which was sufficient to obtain noise like residuals.

Unit root and Cointegration Tests

As a preliminary step and in order to specify the model correctly, the long-run properties of the time-series - degree of integration and the presence of cointegration relationships - must be characterized.

Unit root tests

Two univariate unit-root tests were conducted, the augmented Dickey-Fuller test and the Phillips-Perron (1988) test. Tables 1 and 2 report the results from the tests. The evidence from the tests suggests that the variables are $I(1)$ no matter according from Dickey-Fuller test or Phillips-Perron (1988) test.

Dickey-Fuller unit root test	
Y	0.3795
U	0.8424
Q	0.4827
M	0.9667

Table 1 Augmented Dickey-Fuller unit root tests

Phillips-Perron Unit root test	
Y	0.5564
U	0.7993
Q	0.7312
M	0.7779

Table 2 Phillips-Perron Unit root test

Cointegration tests

The cointegration vectors were estimated with the multivariate cointegration techniques developed by Johansen and Juselius (1990). According to the λ -max statistic, the null hypothesis of no cointegration versus one cointegration vector, of one cointegration vector versus two was rejected at the 90% confidence level in all countries.

Table 3 reports the estimated (restricted) cointegration vectors, together with p-values for the over-identifying restrictions. From Johansen and Juseliu test, we get the cointegration efficiencies for variables. Firstly, the largest eigenvalue generated by the test is 9.668432e-01. From Values of test statistic and critical values of test,

	imm_ts.l1	GDP_ts.l1	unemp_ts.l1	q_ts.l1	constant
imm_ts.l1	1.00000	1.00000	1.00000	1.00000	1.00000
GDP_ts.l1	-2.92500	-0.10559	0.16506	0.45061	0.01479
unemp_ts.l1	2.31100	-0.00284	-0.00443	0.00819	0.00244
q_ts.l1	0.00005	0.00012	-0.00025	-0.00088	0.00000
constant	0.24914	1.01436	-1.52423	-4.15351	-0.16244

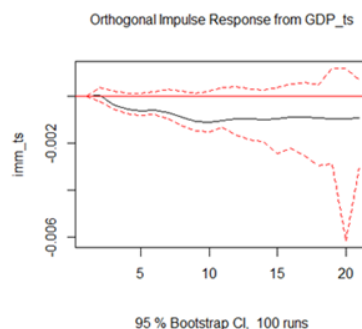
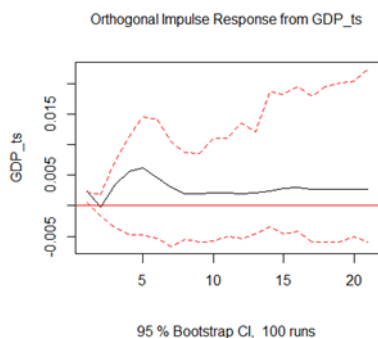
Table 3 Johansen and Juselius test

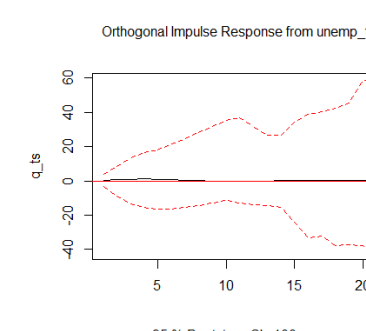
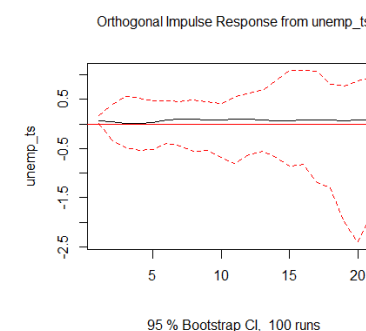
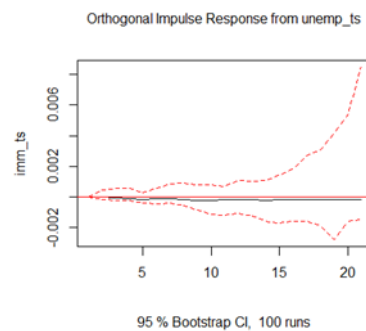
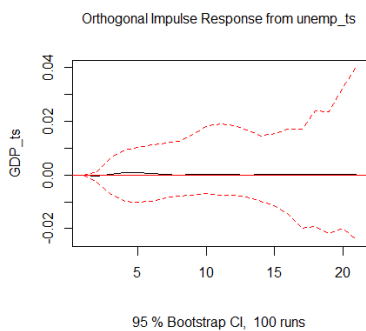
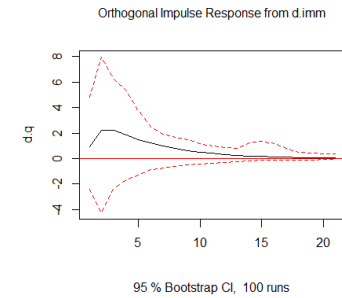
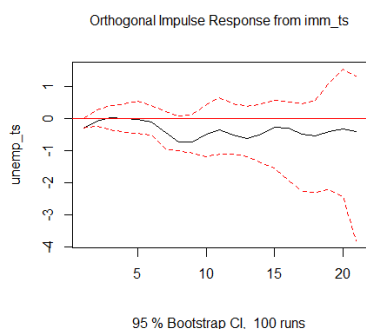
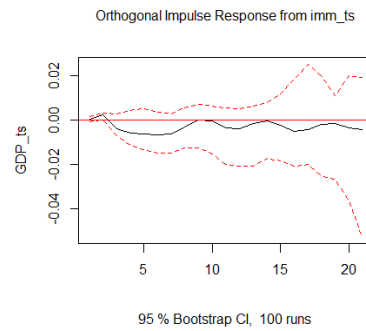
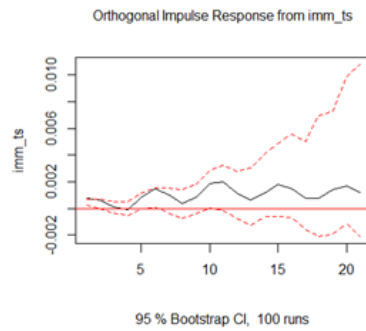
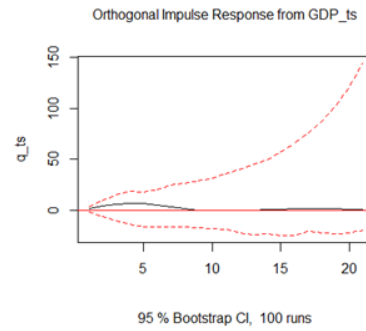
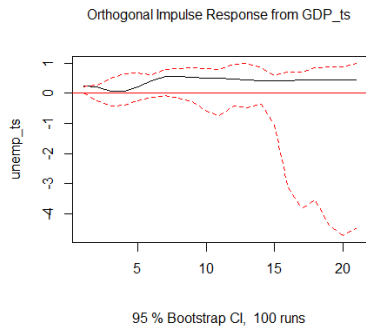
r is equal to 4, means there should be four-time theories to form a stationary series. It's reasonable, because from the unit root test before, we know the four time series are all non-stationary. Also, from this cointegration test, I got the cointegration ecoefficiencies between time series.

The immigration inflow will be positive related to GDP in U.S. The GDP elasticity of net immigration rate is bigger than 1. This could be the consequence of omitting variables in immigration, such as immigration policies, economics conditions in home countries, which is positively correlated with income.

The net immigration is negative related to unemployment rate and house price index. For unemployment rate, this economics condition, usually has bigger impact than house price or other factors to attract immigrants., so the unemployment elasticity of net immigration rate is much higher than house price elasticity. Besides, immigrants usually will firstly rent apartments or houses for live rather than buying or owning houses after immigration because of limited resources. Thus, house price has less relation to net immigration compared with other variables.

Empirical evidence





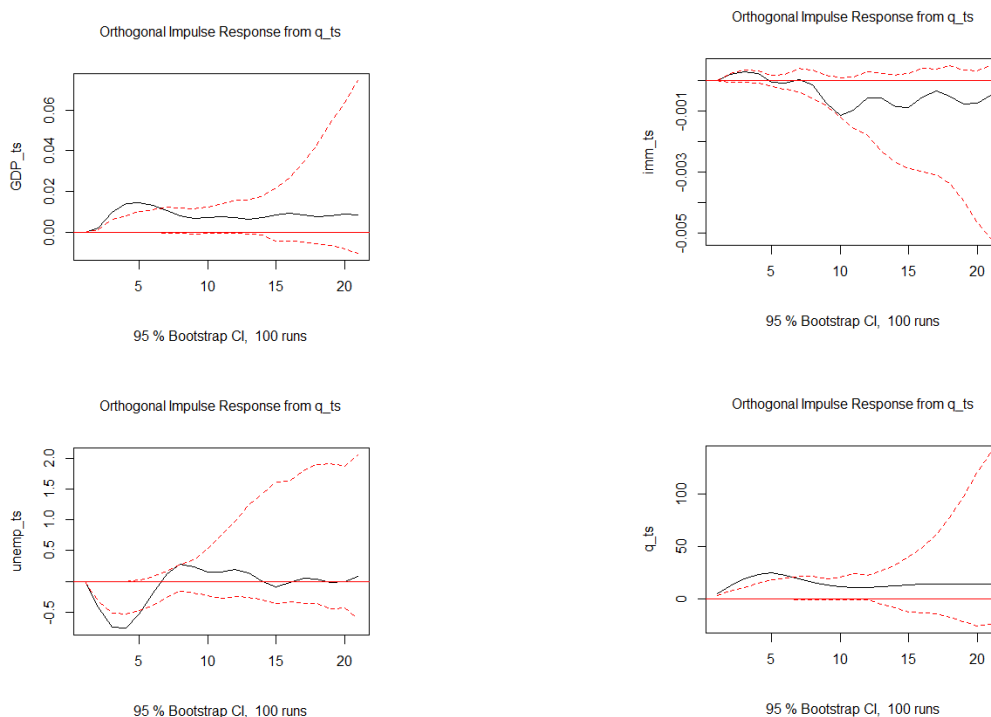


Figure 1 Impulse functions

Impulse Responses

The first four rows in Figures 1 shows the estimated responses to a favorable supply shock (one standard deviation is size), along with one-standard error asymptotic confidence bands.

The initial effect on GDP in U.S is positive. After several periods, the GDP will be increase to a new higher level, because of the positive supply shock. The effect on immigration is opposite with our assumption above. The immigration is declining until to a new lower level after several periods. Actually, because after the immigration enforcement policies are implied, more undocumented immigrants are refused into U.S and illegal immigrants are facing tougher conditions. The immigrants coming is slightly slow, but the removal is increasing, thus the net immigration is gradually decline rather than increasing even though GDP is still increasing along time.

Unemployment rate slightly decreases during the short period of time because of the increasing of GDP and the negative relation between them. Also, the house price will be higher in initially, then get into the equilibrium. Because of the GDP is higher, the investment for housing stock will be rising, so this is a positive relation we explained above.

The second four rows in Figures 1 shows the estimated responses to a immigration shock (one standard deviation is size), along with one-standard error asymptotic confidence bands.

The initial effect on GDP is more complex. But we still can see a slightly increase of GDP in the beginning. Because of more labor getting into labor market, the human capital will higher and produce more output. While this effect is ambiguous, because the skills and quality of immigrants are different and various, they will bring uncertain productivity. We can not say immigrants will definitely benefit for economics. The effect on unemployment is more direct. Because of the immigrants' contribution to GDP's increase, the unemployment declines. The last one is house price. Immigration has a negative impact on house price. From impulse function, we can see the house price will increase in the beginning then gradually getting into equilibrium. So from this impulse, we get the positive relation between immigration and house price in U.S. because of higher demand and supply for housing after immigration.

The third four rows in Figures 1 shows the estimated responses to unemployment shock (one standard deviation is size), along with one-standard error asymptotic confidence bands.

From these impulse functions, we can see the effect from unemployment shock is not significant for GDP, immigration and house price at 95% significant level.

The last four rows in Figure q1 shows the estimated responses to house price shock. The initial effect on GDP is positive and there is a higher GDP then getting into a higher level. Because of the house or real estate is a big investment of economics, if this part of investment is higher, the GDP will boost. In the long-run, the higher house price will push immigrants moving out. For example, in big cities, like New York, more and more people

choose to move out to smaller cities with potential economics development. House price boost will also benefit employment. Actually this effect is more from the increasing of GDP and output in economics.

Conclusions

This paper has shown that the dynamics of house prices can be dealt with using a tractable VAR framework in a straightforward way. I have developed and estimated a simple macroeconomic model driven by four exogenous disturbances, all of which can have effects on house price inflation. In particular, I have shown that immigration shocks can have serious effects on house prices. What supports these findings is that a set of reasonable identifying assumptions yields plausible results for the responses of GDP, unemployment and immigration to shocks.

The results hint that different housing market institutions play a role in this transmission mechanism: however, as institutions change, this relationship might change too. Fiscal, regulatory and legal structure and the new monetary policy regime are likely to affect this relationship

Works Citation

- Harris, J. and Todaro, M. 1970. Migration, Unemployment and Development: A Two-sector Analysis. *American Economic Review*, 60, 1261-1272.
- Basso, Gaetano. "INTRODUCTION: The Association between Immigration and Labor Market Outcomes in the US." *The Economics of International Migration*. 2016. 1-31.
- Edo, Anthony, and Hillel Rapoport. "Minimum wages and the labor market effects of immigration." *Labour Economics* 61 (2019): 1017-1033.
- Borjas, G.J. (2013) The analytics of the wage effect of immigration. *IZA Journal of Migration* 2(1): 22.
- Ottaviano, G.I.P. and Peri, G. (2012) Rethinking the effects of immigration on wages. *Journal of the European Economic Association* 10(1): 152– 197.
- Borjas, G.J. (2014) *Immigration Economics*. Cambridge, MA: Harvard University Press.
- Peri, G. and Sparber, C. (2009) Task specialization, immigration, and wages. *American Economic Journal: Applied Economics* 1(3): 135– 169.
- Morley, B. (2006). Causality between economic growth and immigration: An ARDL bounds testing approach. *Economics Letters*, 90(1), 72-76.
- Peri, Giovanni. "The effect of immigration on productivity: Evidence from US states." *Review of Economics and Statistics* 94.1 (2012): 348-358.
- Feridun, Mete. "Investigating the economic impact of immigration on the host country: the case of Norway." *Prague Economic Papers* 4 (2005): 350-362.
- Martinez Jr, Ramiro, and Matthew T. Lee. "On Immigration and Crime." *Criminal justice* 2000 (2000).
- Spenkuch, Jörg L. "Understanding the impact of immigration on crime." *American law and economics review* 16.1 (2014): 177-219.
- Nunziata, Luca. "Immigration and crime: evidence from victimization data." *Journal of Population Economics* 28.3 (2015): 697-736.
- Saiz, A., 2007. Immigration and housing rents in American cities. *Journal of urban Economics*, 61(2), pp.345-371.
- Degen, Kathrin, and Andreas M. Fischer. "Immigration and Swiss house prices." (2009).
- Filipa Sá, Immigration and House Prices in the UK, *The Economic Journal*, Volume 125, Issue 587, 1 September 2015, Pages 1393–1424.
- Mussa, Abeba, Uwaoma G. Nwaogu, and Susan Pozo. "Immigration and housing: A spatial econometric analysis." *Journal of Housing Economics* 35 (2017): 13-25.
- Weiske, Sebastian. On the macroeconomic effects of immigration: A VAR analysis for the US. No. 02/2019. *Arbeitspapier*, 2019.
- Larkin, Matthew P., et al. "Do house prices ride the wave of immigration?." *Journal of Housing Economics* 46 (2019): 1016-1030.
- Sharpe, Jamie. "Re-evaluating the impact of immigration on the US rental housing market." *Journal of Urban Economics* 111 (2019): 14-34.
- d'Albis, Hippolyte, Ekram Boubtane, and Dramane Coulibaly. "Immigration and Government Spending in OECD Countries." (2018).
- Poterba, J. (1984), "Tax Subsidies to Owner-Occupied Housing: An Asset Market Approach", *Quarterly Journal of Economics*, 99, 729-752.
- Okun, A.M. (1962). "Potential GNP: Its Measurement and Significance", *Proceedings of the Business and Economic Statistics*, pp. 98-103
- U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States [USSTHPI], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/USSTHPI>, April 30, 2020.

- U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis;
<https://fred.stlouisfed.org/series/GDPC1>, April 30, 2020
- U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/UNRATE>, April 29, 2020.
- Azmi, Fata, An Empirical Analysis of the Relationship between GDP and Unemployment, Interest Rate and Government Spending (June 10, 2013).
- Iacoviello, M., 2002. House prices and business cycles in Europe: A VAR analysis. Working Papers in Economics, p.81.
- Barbu, Teodora Cristina, et al. "An assessment of the immigration impact on the international housing price." *Amfiteatru Economic* 19.46 (2017): 682.
- Borjas, George J. "Homeownership in the immigrant population." *Journal of urban economics* 52.3 (2002): 448-476.
- Roche, Maurice. "Will there be a crash in Irish house prices?." *Quarterly Economic Commentary* (2003): 57-72.
- Allen, Jason, et al. "Canadian city housing prices and urban market segmentation." *Canadian Journal of Economics/Revue canadienne d'économique* 42.3 (2009): 1132-1149.