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Immigration and Economic Growth: Further Evidence

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Abstract

This paper provides evidence that immigration has a positive long-run impact upon economic growth in the US. An earlier study had suggested only one way causation flowing from economic growth to immigration, in the long run. When cointegration methods appropriate for data set with structural breaks are incorporated our results appear more intuitive. Our refined methods establish a long-run bi-directional relation.

Keywords: Causality; Immigration; Cointegration, Structural-Break
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Introduction

This paper examines the long term relation between growth in immigration and economic growth in the USA. In theory, immigrants can contribute by (a) filling an increasing share of jobs overall, (b) taking jobs in labor-scarce regions and (c) filling those jobs native workers often shun. Yet in many parts of the developed world, immigration remains a politically charged issue as academics assess the short and long run impact on the economy.

Despite its importance the relation between immigration and economic growth has not attracted much research attention, with some exceptions. Islam ((2007) examined Canadian data within vector error correction model. He found a long-run positive relationship among *per-capita* GDP, immigration rate and real wages. Robertson (2002) examined the causality between these two series using Urzawa-Lucas approach in which unskilled and skilled labor perform distinct services. He found that an unanticipated increase in unskilled workers due to population boom, or inflow of immigrants can results in a slowdown of human capital growth relative to the balanced path. Jones (1998) shows that rising population growth rate (including immigration) reduce transitional per capita economic growth. This may be due to adverse effect of rising population on capital labor ratio. Borjas (1994) found little or no relation flowing from economic growth to levels of immigration which he argues was due to adoption of strict immigration regulations. As he notes, the changing nature of the skills and the origin of the immigrants (p.1685) can explain his results.

In our bid to establish a possible relation between immigration and economic growth, Morley's (2006) findings offer a relevant starting point. He used Autoregressive Distributed Lag

(ARDL) approach[1] to cointegration and found evidence of long-run causality flowing from per-capita economic growth to immigration, but failed to establish the reverse causality. While it is plausible that growing economies would attract immigrants, it is equally plausible that once these immigrants adjust to new home-environment, they would contribute to economic growth in the host economy as well. Morley's finding that immigrants do not contribute to economic growth in the long-run appears inconsistent with the observed facts. If sustained, the results will have considerable policy implications. By contrast, our paper establishes bidirectional long-run relation between these series, using refined approach and thus is a contribution to the literature.

While Morley's procedure did not test for structural breaks, we considered it reasonable to explore such possibility in his data. Accordingly, we re-examined Morley's data set pertaining to the US for structural breaks, in addition to an independent data set for the US from 1952-2000 to test for the impact of immigration on economic growth. We did find a long run bidirectional relationship within VECM, using both the data sets.

The rest of the paper is organized is follows. Section II describes empirical framework and data sources. Section III reports the results. Section IV draws conclusions.

II. Methodology

A bivariate cointegration methodology is used to investigate the hypothesized long-run equilibrium relationship between immigration growth and real GDP growth. To make cointegration analysis sensible, it is necessary to examine the order of integration. This paper implements Augmented Dickey-Fuller (1981) and Phillips-Perron (1988) procedures for non-stationarity. Due to structural break, we also implement Zivot-Andrews (1992) test to check for unit root.

[1]Annual data for US, Australia and Britain

To explore long-run equilibrium relation between the series we apply VAR procedure following Johansen (1988, 1991), and Johansen and Juselius (1990,1992) to estimate the cointegrating regression. FPE criterion (Akaike, 1969) identifies the appropriate lag-length (p).

Since our data contains structural breaks, we also employ Gregory Hansen (1996) test to accommodate a single unknown structural breaks in cointegration analysis. This cointegration test captures structural breaks and also empirically identifies the break-point.

If the Granger causality test confirms the existence of a cointegrating relationship, the relevant error-correction term (ECT), obtained from the cointegrating regression, must be included in the standard causality test. This helps avoid problems of misspecifications due to omissions of relevant constraints. Due to its ability to combine the long-run relationship with the short-run dynamics, Granger causality test within the Vector Error-Correction Model (VECM) environment is preferable. The existence of cointegration implies that unidirectional or bi-directional (or both) Granger causality exists. The usual *t*-test is applied to the coefficient of the error-correction term, lagged by one period (ECT_{t-1}). A significant t-statistic suggests long-run relationships, and a significant F-statistic for the joint test suggests short-run causality.

Data used are in natural log, annual from 1952 to 2000 and obtained from the Statistical Abstract of the US. Morley's (2006) data set used here are for the US, annual, from 1930-2002.

III. Results

Table-1 presents the results of the Augmented Dickey Fuller and the Phillips-Perron tests. The tests reveal that all the series are nonstationary in levels with a trend, but stationary in first differences, i.e., the series are I(1). Table-2 presents the Zivot-Andrews (1992) test results to the series which fail to rejects the null hypothesis of unit root for both series at the 5% level.

Table 1 shows the results of the Augmented Dickey-Fuller and the Phillips-Perron and tests. Both the tests reveal that all the series are nonstationary in levels, when considered with a trend. But they become stationary in first differences. This confirms that all the variables under investigation depict I(1) behavior. We apply the. Table-2 provides the Zivot-Andrews(1992) unit root test results to our annul data. The results fail to rejects the null hypothesis of unit root for all the variables in level at 5% level.

The test identified the break points as 1964 for RealGDP and 1992 for immigration. It is possible that the former break may have been caused by the major changes in the economy due to the major escalation of the Vietnam War and the Medicare program. As for the immigration series, it may be due to the general amnesty granted to many illegal immigrants in the late 1980's.

Given that unit root tests for the series cannot be rejected in the levels but are rejected in first-difference, a cointegrating relationship between the series is obtained by the Johansen test. Results presented in Table-3 affirm the existence of a cointegrating vector at the 5% level. We also apply the Gregory-Hansen (1996) test to accommodate a structural break in the data as reported in Table-4. Since we reject the null hypothesis of no cointegration, the evidence of cointegration in the presence of a structural break in the model is established.

Since both the standard and Gregory Hansen tests fail to reject the null hypothesis of no cointegration, this establishes a cointegrating relationship between the series. We now estimate the associated vector error-correction model. Table-5 reports the Granger causality results based on the VECM with an optimum lag-structure of 1. The F-test statistics suggest a unidirectional short-run causation running from real GDP to immigration, but no evidence of short-run bi-directional feedback relationships between these series.

The VECM estimates show long run bi-directional causation from immigration to real GDP and vice versa. Both immigration and Real GDP cause each other in the long run. The error-correction terms (based on the results of the t-statistic) show that the burden of short-run endogenous adjustments toward long-run equilibrium, falls both on immigration and real GDP.

An application of our methodology to Morley's US data confirmed our findings as reported in Table-6. Our results suggest that Morley's methodology suffers from a specification problem due to the presence of structural breaks.

IV. Conclusion

We have applied a more refined statistical method, which allows us to test for structural breaks, to both data sets pertaining to the US. Our findings support long-run bidirectional causality between GDP and immigration. This is what one would expect on theoretical grounds. We argue that immigration is not exogenous, but is determined by the growth of an economy. Economic growth raises input prices, makes jobs attractive, and attracts immigrants from all over the world. The finding that immigration does not instantaneously help economic growth in the host nation is due to the friction. It takes time for the new immigrants to adapt to a new culture and learn a new language. However, as the immigrants become part of the labor force they contribute to economic growth.

References

George J. Borjas, 1994, The Economics of Immigration, *Journal of Economic Literature,* 32, 1167-1717.

Gregory, Allan and Bruce Hansen, 1996, Residual Based Tests for Cointegration in Models with Regime Shifts, 70, 99-126.

Islam, Asadul 2007. Immigration Unemployment Relationship: The Evidence from Canada Australian Economic Papers, Vol.46, 52-57.

Johansen, S., 1988, Statistical Analysis of Cointegrating Vectors, *Journal of Economic Dynamics and Control*, 12, 231-54.

Johansen, S., 1991, Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Autoregressive Models, *Econometrica*, 59, 1551-80.

Johansen, S., and Juselius, K., 1990, Maximum Likelihood Estimation and Inference on Cointegration - With Application to the Demand for Money, *Oxford Bulletin of Economics and Statistics*, 52, 169-210.

Johansen, S., and Juselius K., 1992, Testing Structural Hypothesis in a Multivariate Cointegration Analysis of the PPP and UIP for UK, *Journal of Econometrics*, 53, 211-44.

Jones, C.I.,1998, Introduction to Economic Growth, Norton, New York.

Morley, Bruce, 2006, Causality between Economic Growth and Immigration: An ARDL Bounds Testing approach Economics Letters, 90, 72-76.

Perron, P., 1989, The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis, *Econometrica*, 57, 1361-1401.

Robertson, P.E.,2002, Demographic shocks and human capital accumulation in the Uzawa–Lucas model, *Economics Letters*, 74,151–56.

Zivot E. and Donald Andrews, 1992, Further Evidence on the Great Crash, the Oil-Price Shocks, and the Unit Root hypothesis, *Journal of Business and Economic Statistics*, 10, 251-272.

Table-1:ADF and PP Tests

	ADF-Test		PP-Test	
Variable	Level	First-Difference	Level	First-Difference
Immigration	-3.186	-6.663**	-2.201	-6.656**
RealGDP	-3.236	-6.755**	-2.220	-6.708**

*The Phillips-Perron t-test is not sensitive to number of lags in the autocorrelation function. The reported statistics are obtained using 1 lags for both tests. ** Denotes the rejection of null hypothesis at the 1% level. ADF and PP tests the null hypothesis of existence of unit root.

Table-2:Zivot-Andrews Unit-Root Test

	Immigration	RealGDP
T-statistics	-4.12	-4.27
Break-points	1992	1964

For Immigration we assumed break in trend. The 5% critical value, test is -4.42. For RealGDP we assumed break in intercept. The 5% critical value, test is -4.80. They are obtained using 1-lag for both tests. Zivot-Andrews test the null hypothesis of unit-root.

Table-3:Johansen Cointegration Test

Null/Alternative Hypotheses	Max-Eigen Statistic (λ_{max})	Trace (λ_{trace})
H_0: r=0	15.402*	15.631*
H_A: r≤1		
H_0: r≤1	0.000657	0.000657
H_A: r=2		

The r indicates number of cointegrating vector, and * indicates rejection of null hypothesis of no-cointegration at 5% level

Table-4:Gregory-Hansen Cointegration Test

Minimum T-statistics	-5.666**
BreakDate	1988

For Immigration we assume break in trend. The 1% critical value is -5.47. Gregory-Hansen test reports null hypothesis of no-conintegration.
(*) indicates the rejection of the null hypothesis at 1% level. The test assumes a full structural break. Reported statistics are obtained using 1 lags for both tests.

Table-5:Granger Causality Test (VECM)

Dep.Variable	Ind.Variable	F–Statistics	T-Stat:ECT_{t-1}
Immigration	RealGDP	4.84**	-3.522**
RealGDP	Immigration	0.908	-1.649*

Note: Optimal lag-length 1, determined by FPE criterion
**Significant at 1% level
*Significance at 10% level

Table-6:Granger Causality Test (VECM): Morley data

Dep.Variable	Ind.Variable	F–Statistics	T-Stat:ECT_{t-1}
Immigration	PerCapitaRealGDP	5.29**	-4.19**
PerCapitaRealGDP	Immigration	7.05**	-2.48**

Note: Optimal lag-length 1 determined by FPE criterion
**Significant at 1% level

Figure-1: Immigration and Real GDP