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Welfare and the Locational Choices of New Immigrants

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I find little evidence to support the contention that new immigrants will choose their destinations based on welfare generosity. New immigrants are attracted to areas with large immigrant populations.

New restrictions on immigrants' eligibility for welfare benefits will account for 44 percent of the expected $55 billion reduction in federal welfare expenditures over the next few years. Most noncitizens are now ineligible for federally funded programs, and states may restrict legal immigrants' access to other public assistance programs. States have the option to continue extending benefits to immigrants at state expense. These changes have raised concerns that states that continue to provide benefits to immigrants risk becoming "welfare magnets." In this article, I examine whether differences in benefit levels across states affect the locational choices of new immigrants in an effort to determine whether states that continue to offer benefits to immigrants will face an influx of immigrants.

The strictest restrictions in the 1996 welfare law, which ends the guarantee of public assistance to impoverished persons, are imposed on immigrants. Most legal immigrants are automatically barred from receiving food stamps and Supplemental Security Income (SSI), which provides cash benefits to the disabled and elderly poor. Future legal immigrants will also be ineligible for Aid for Families with Dependent Children (AFDC) and Medicaid for the first five years they are in the United States.[1] States have discretion to determine noncitizens' eligibility for AFDC, Medicaid, and other public assistance programs previously jointly funded by federal and state governments.[2] Since the law was signed in August 1996, thirty-six states have promised to maintain AFDC benefits to immigrants already in the country, and four states have said they will not do so.

The new welfare law affects a potentially large number of immigrants. In 1996, 2 million noncitizens received food stamps, 800,000 received SSI, and 640,000 received AFDC.[3] An estimated 9.5 million legal, permanent-resident noncitizens live in the United States, about 40 percent of whom are in California.

Some officials who believe that many immigrants came to the United States to take advantage of public assistance are now concerned that low-income households will migrate to the states offering the highest benefits. Differences in maximum AFDC payments across states are already large—ranging from $923 a month in Alaska to $120 in Mississippi in 1996 for a family of three—and will become larger when immigrant eligibility rules vary across states. As one policy analyst claims, immigrants are "quite prepared to move. They already have."[4]

Beliefs that immigrants have disproportionately high rates of welfare recipiency moti-

vate much of the concern that immigrants move to states with high welfare benefits. Economists disagree about whether immigrants are more likely than natives to receive welfare. Borjas (1994) summarizes the literature. In 1970, immigrants were less likely than natives to receive welfare, but by 1990 they were slightly more likely than natives to receive welfare. Differences in socioeconomic characteristics, such as household composition and educational attainment, account for the disparity between immigrant and native welfare recipiency rates; recent immigrants are less skilled than both natives and previous immigrants. Immigrants as a whole are therefore more likely than natives to receive welfare benefits, but immigrants' recipiency rate is the same as that of similar natives.

Previous research suggests that differences in welfare benefits across areas affect the locational decision of low-income households. Blank (1988) finds that low-income female-headed households are 12 percentage points more likely to leave areas with low welfare payments and low wages than areas with high payments and high wages. Gramlich and Laren (1984) find that households receiving AFDC that move are more likely to relocate to a high-benefit state than to a low-benefit state.

Little research has been done on how welfare affects the locational choices of immigrants. Borjas (1996) concludes that immigrant welfare recipients are more clustered in high-welfare states than are other immigrants and natives. The effect is particularly pronounced among new immigrants, who may have lower interstate migration costs than natives or earlier immigrants. His findings are driven by California, where 45 percent of new immigrants who receive welfare live, versus 29 percent of new immigrants who do not receive welfare, 12 percent of natives who receive welfare, and 10 percent of natives who do not receive welfare. Buckley (1996) claims that the settlement patterns of new immigrants are positively correlated with state welfare generosity; this research is discussed in greater detail below.

In this article, I estimate the determinants of new immigrants' destinations, focusing on whether immigrants respond to differences in the generosity of public assistance payments across states. The results indicate that the location of other immigrants is the primary determinant of new immigrants' destinations. However, since earlier immigrants are clustered in high-welfare states, it appears that new immigrants are attracted by welfare generosity unless the presence of other immigrants and constant immigration patterns across states are controlled for. In the next section, I summarize the basic characteristics of immigrants' locational choices. I then discuss the results of an econometric analysis of the determinants of immigrants' destinations.

Immigrants are highly clustered . . .

In the 1980s, the United States experienced its greatest wave of immigration since the turn of the century. More than 10 million persons were granted permanent-resident status between 1980 and 1992, including more than 2.65 million aliens who adjusted to legal status under the Immigration Reform and Control Act (IRCA) of 1986. In 1990, almost 8 percent of the population was foreign-born, a considerable increase over the rate of 4.8 percent in 1970.

The immigrant population is highly concentrated in a few states. In 1990, almost 33 percent of the foreign-born population lived in California; 14.4 percent lived in New York, 8.4 percent in Florida, and 7.7 percent in Texas. Even though these are the four most populous states, immigrants also make up a larger proportion of the population in these states than in other parts of the country.

New immigrants choose the same destinations as previous immigrants, possibly because the presence of a foreign-born population attracts other immigrants. Six states accounted for the intended residences of almost three-quarters of new immigrants in 1992: California, Florida, Illinois, New Jersey, New York, and Texas. California alone was the intended residence of more than 34 percent of new immigrants in 1992. In addition to having a high proportion of the population that is foreign-born, these states have relatively high welfare benefits, except for Texas and Florida (*Table 1*).

. . . and attracted to areas with other immigrants

Previous research on the locational choices of immigrants concludes that the presence of earlier immigrants affects the locational choices of new immigrants. Using cross-sectional data on immigrants from eleven Western Hemisphere countries in 1987, Dunlevy (1991) finds that the number of immigrants is positively correlated with a state's stock of immigrants. Dunlevy also finds that immigrants are attracted to urbanized states; he does not estimate the effect of welfare on settlement patterns. Bartel (1989) finds that ethnic stock is the primary determinant of male immi-

Table 1
Concentration of Locational Choices

State	Percent of immigrants in 1992	Percent of foreign-born in 1990	Maximum AFDC and food stamps benefits in 1991
California	34.6	21.7	$853
Florida	6.3	12.9	571
Illinois	4.5	8.3	629
New Jersey	5.0	12.5	671
New York	15.3	15.9	787
Texas	7.8	9.0	461
Other	.6	3.5	624

NOTES: "Other" is the average of the remaining forty-two mainland states and the District of Columbia. AFDC and food stamps are the maximum for a three-person family with one parent.

SOURCES: U.S. Immigration and Naturalization Service, U.S. Bureau of the Census, and U.S. House Ways and Means Committee.

grants' location. In the cross-sectional data she uses, generous public assistance payments also appear to attract male immigrants, a surprising result since single males and most male-headed households are not eligible for AFDC.[5]

In this article, I focus on the destinations of immigrants from eighteen countries who arrived in the United States in 1982 and 1992.[6] These countries are the source countries of the majority of immigrants, accounting for 68.3 percent of immigrants in 1992 and 63.8 percent in 1982. Mexico was the source country of the largest number of immigrants in 1992, and Vietnam was the largest in 1982. The data do not include new refugees but do include refugees converting to permanent-resident status and immigrants converting from illegal to legal status under the IRCA; about 163,000 immigrants (primarily from Mexico) converted to legal status under the IRCA in 1992.

The next section presents the empirical model used to estimate the determinants of locational choice. The model is based on individuals choosing the utility-maximizing location. (See the box titled "A Model of Locational Choice" on page 6.) I use the model to estimate how state economic conditions and demographic characteristics affect the number of immigrants "pulled" to a state; the model does not focus on source country conditions that might "push" immigrants to move because such factors are likely to affect the number of immigrants who leave but not specific destinations within the United States.

I use aggregate data on immigration levels to the United States published by the U.S. Immigration and Naturalization Service (INS). The data are annual aggregate cross-tabulations by destination state and country of birth for major source countries. Individual-level characteristics that are likely to influence locational choices, such as education and occupation, are not available in the cross-tabulated data. Therefore, I examine the effect of state-level variables on the number of immigrants from a particular country but cannot control for other characteristics of those immigrants that might affect the choice of destination. The next section uses an analysis of covariance model to examine the determinants of immigrants' destinations.

The empirical model

In the general model estimated here using ordinary least squares (OLS), the number of immigrants is regressed on state-level economic and demographic conditions, or

$$(1) \qquad I_{jkt} = \alpha + X_{kt-1}\beta + F_{jkt-1}\gamma + D_{jk}\delta + K_k\sigma + J_{jt}\rho + \eta_{jkt},$$

where j indexes the country of origin, k the destination state, and t the year (1982 or 1992). The variable I_{jkt} is the number of persons immigrating from country j to state k in year t.[7] The vector X_{kt-1} includes the unemployment rate, per capita personal income less transfers, the percentage of the population living in metropolitan areas, the per capita tax level, the percentage of employment in manufacturing and agriculture, and the maximum combined AFDC and food stamps benefits available for a family of three in state k at year $t-1$.[8] All monetary variables are deflated using the consumer price index for urban consumers. The covariates are lagged for two reasons: to avoid the possibility of endogeneity bias, which is discussed in greater detail below, and to reflect the information upon which immigrants are likely to base decisions.[9] All the variables except the unemployment rate and the tax level are expected to be positively correlated with the number of immigrants. The error term η_{jkt} is corrected for heteroscedasticity.

F_{jkt-1} is the proportion of the state population that was born in the same country as the immigrant group. As discussed above, the presence of other foreign-born residents is a key determinant of immigrants' destinations. Immigrants are more affected by the size of the population from the same country of origin, not the total foreign-born population. For example, 83 percent of Cuban immigrants in 1992 settled in Florida, the state with the largest Cuban population. The variable is available only in census years, 1980 and 1990, during the sample time frame. Because of the likely importance of this variable, I examine in detail the sensitivity of the

results to including it; it is expected to be positively correlated with the number of immigrants.

D_{jk} is the distance in miles between the largest city in the origin country and the largest city in the destination state.[10] The variable captures the psychological and monetary costs of moving and is expected to be negatively correlated with the number of immigrants.

Fixed effects are also included in some specifications. The state effects K_k control for time-invariant characteristics assumed to be equally attractive for all immigrant groups, such as climate and location. The vector J_{jt} includes interactions of country and time effects to capture any "push" effects from country j in year t that are common to all states and any changes in national immigration policy or the business cycle. When the fixed effects are included, the estimated coefficients show correlations between changes in the number of immigrants and changes in economic and demographic variables within states and countries of origin over time. Equation 1 is estimated using data on the number of immigrants from eighteen countries to the forty-eight mainland states and the District of Columbia in 1982 and 1992.

This analysis offers several improvements over previous research. By disaggregating the data by country of origin, I can estimate the sensitivity of specific groups to differences in welfare across states. I can also better estimate the importance of the stock of previous immigrants in a location by using country-specific data on the number of previous immigrants. Time-invariant state characteristics can be controlled for by including state fixed effects, the importance of which is discussed below, because two years of data are used. Buckley (1996) uses panel data for the years 1985–91 but does not control for state fixed effects; he also uses a linearly interpolated measure of the stock of immigrants since only decennial data are available. Linear interpolation automatically makes the immigrant stock covariate correlated with the error term, leading to identification problems in Buckley's results.[11]

The estimation results are discussed in the next section.

The results

The estimation results clearly indicate the importance of controlling for the stock of previous immigrants and for differences across states and countries. When immigrant stock and fixed effects are not controlled for, welfare payments are positively correlated with the number of immigrants. As shown in the first column of Table 2, a $1 increase in a state's maximum combined AFDC and food stamps payment is correlated with an increase of three in the number of immigrants. As expected, higher income, a more metropolitan population, and a more agricultural economy are positively correlated with the number of immigrants; the tax level is negatively correlated with the number of immigrants. Surprisingly, a manufacturing-oriented economy appears to discourage immigrants, and a high unemployment rate appears to attract immigrants. Many of these relationships are not robust to using other specifications, as discussed below.

Welfare payments are not correlated with the number of immigrants when the percentage of the population comprised of earlier immigrants from the same country is controlled for. The estimated coefficient reported in column 2 implies that the number of immigrants increases by almost 6,500 when the percentage of the population from the same country increases by one point. The substantial increase in the goodness of fit, as measured by the *R*-squared, indicates the importance of other immigrants in determining locational choice. Agricultural employment remains positively correlated with

Table 2
Determinants of Immigrants' Destinations

Covariate	(1)	(2)	(3)	(4)
Unemployment rate	95.432 (37.605)	48.643 (24.521)	29.716 (47.761)	30.608 (40.051)
Income	.690 (.305)	.270 (.422)	–1.937 (2.023)	–.671 (1.377)
Metropolitan population	21.300 (4.050)	2.356 (6.022)	–84.304 (63.989)	–82.828 (57.329)
Taxes	–.392 (.137)	–.095 (.226)	.106 (.348)	–.862 (.707)
Manufacturing employment share	–13.170 (4.854)	15.832 (12.022)	–8.303 (22.371)	–19.931 (29.456)
Agriculture employment share	849.604 (316.976)	346.170 (120.647)	–282.895 (301.400)	–252.222 (212.232)
Welfare	3.144 (1.746)	.955 (.764)	10.891 (6.954)	5.703 (3.759)
Foreign-born population (*1,000)	—	6.478 (2.482)	—	6.615 (2.537)
Distance	.008 (.041)	.142 (.034)	–.985 (.267)	–.003 (.264)
Fixed effects	No	No	Yes	Yes
Adjusted *R*-squared	.060	.481	.187	.555

NOTES: The dependent variable is the number of persons immigrating from one of eighteen countries to one of forty-nine states in 1982 or 1992, a total of 1,764 observations. See the text for details of the data. Heteroscedasticity-corrected standard errors are shown in parentheses.

A Model of Locational Choice

This box presents the derivation of the empirical model, which is based on individuals (or households) choosing the utility-maximizing location. The specific destination chosen by an immigrant depends on a multitude of characteristics, including those of the individual, the individual's country of origin, and all potential destinations. An individual should choose the utility-maximizing location, which depends on location-specific amenities, individual characteristics, and previous location. Using similar notation to that of Blank (1988), individual i's expected utility in location k at time t, given that the individual lived in location j at time $t-1$, can be expressed as

$$U_{ijkt} = U(X_{ikt}, F_{ijkt,} D_{jk}), \tag{B.1}$$

where X_{ikt} is location-specific amenities in location k at time t. X_{ikt} includes variables that affect an individual's expected income, such as average earnings, the unemployment rate, and welfare benefits. F_{ijkt} is a vector of household characteristics that affect a person's utility of living in location k at time t, given that the person lived in j at time $t-1$. These characteristics do not change across locations but may be associated with different utility levels across locations. For example, a person from the Philippines will likely have higher utility living in a location where other Filipinos live. D_{jk} reflects time-invariant monetary and psychological costs of moving from location j to location k, which are assumed to be expressible in the same utility units as X_{ikt} and F_{ijkt}.

Research on individuals' locational choices typically assumes that utility can be expressed as a linear combination of variables, or

$$U_{ijkt} = X_{ikt}\alpha + F_{ijkt}\beta + D_{jk}\gamma + \epsilon_{ijkt}, \tag{B.2}$$

where ϵ_{ijkt} is an error term assumed to be orthogonal to the covariates.

A person chooses the utility-maximizing location at time t, conditional on living in location j at time $t-1$. The conditional probability of individual i choosing location k from N possible locations is then

$$Pr(k_{it}|j_{it-1}) = Pr(U_{ijkt} = \text{MAX}(U_{ij1t}, U_{ij2t}, \ldots, U_{ijNt})). \tag{B.3}$$

A multinomial logit model is usually used to estimate the effect of location-specific amenities, individual characteristics, and previous location on the probability that an individual chooses a certain location.

The above model can be used to estimate determinants of individuals' locational choice, but in this article I use aggregate data on immigration levels to the United States. Equation B.3 can be aggregated across individuals to generate a model that can be applied to aggregate data. The number of individuals moving to a location is the number of individuals whose utility is maximized at that location, or

$$I_{jkt} = \sum_i \Pr(U_{ijkt} = \text{MAX}(U_{ij1t}, U_{ij2t}, \ldots, U_{ijNt})), \tag{B.4}$$

where I_{jkt} is the number of immigrants moving to location k from location j at time t. The number of immigrants moving to a location is assumed to be a linear function of the variables that affect individuals' locational choice, or

$$I_{jkt} = X_{kt}\alpha + F_{jkt}\beta + D_{jk}\gamma + \eta_{jkt}, \tag{B.5}$$

where η_{jkt} is an error term assumed to be uncorrelated with the covariates. The model estimated also includes state, time, and country-of-origin fixed effects in some specifications.

the number of immigrants. The unemployment rate and the distance from the country of origin are positively correlated with the number of immigrants, but these results are also sensitive to the inclusion of additional controls.

None of the variables that reflect economic conditions, including the welfare variable, is well correlated with the number of immigrants when fixed effects are included in the regression. As discussed above, the state fixed effects control for state characteristics that are fixed over time and the country-of-origin time effects control for factors that push immigrants to immigrate to the United States in a given year and for changes in immigration policy. Only the distance between the country of origin and the state is negatively correlated with the number of immigrants when the foreign-born population is not controlled for, as shown in column 3. The foreign-born population is the only variable well correlated with the number of immigrants when it is included as a covariate, as shown in column 4.

The sensitivity of many of the estimated coefficients to the inclusion of the fixed effects indicates that immigrant settlement patterns within states do not change significantly over time in response to changes in economic conditions and welfare payments. When the fixed effects are not included, other variables proxy for the unchanging settlement patterns of immigrants. The only variable that appears to affect the number of immigrants settling in a state over time is the stock of previous immigrants.

Using other measures of welfare generosity, such as SSI and Medicaid, yields results similar to those reported in Table 2. The locational choices of older immigrants are more likely to depend on SSI benefits, for which the impoverished elderly qualify, than on AFDC levels, which require the presence of dependent children in the household. When equation 1 is estimated using the combined maximum SSI and food stamps payment for an individual living alone as the measure of welfare benefits, the results do not indicate that the number of immigrants depends on SSI payments when the presence of other immigrants and fixed effects are controlled for.[12] Similarly, the results do not change when average Medicaid benefits are added to the maximum AFDC and food stamps benefits.[13] After fixed effects are controlled for, only the percentage of the population that is born in the same country is significantly correlated with the number of immigrants.

The results are also robust to modifying the dependent variable in order to examine the determinants of the distribution of new immigrations across states. Equation 1 was estimated using the fraction of all immigrants from a country going to a state instead of using the number of persons immigrating to the state, or

$$\frac{I_{jkt}}{\sum_k I_{jkt}} = \alpha + X_{kt-1}\beta + F_{jkt-1}\gamma + D_{jk}\delta + K_k\sigma + T_t\theta + \eta_{jkt}, \tag{1'}$$

where all variables are as defined above. This dependent variable may better capture the determinants of immigrants' settlement patterns

among the states, conditional on immigrants' decisions to come to the United States, because it avoids any level effects associated with the large differences in the number of immigrants across countries.[14]

As shown in Table 3, the results do not change. After fixed effects are controlled for, only the foreign-born percentage of the population is well correlated with the percentage of immigrants settling in a state.

The regression results thus indicate that welfare benefits do not affect the number of new immigrants settling in a state. These results are robust to a variety of sensitivity and specification checks discussed in the appendix. The percentage of the population comprised of earlier immigrants from the same country is the only factor that affects immigrants' locational choices over time. However, the effect of welfare payments on locational choices may differ across immigrants based on their country of origin. This possibility is investigated next.

Differences across immigrants

To test whether the effect of welfare on locational choices differs across immigrants based on their country of origin, variables interacting country-of-origin dummy variables with the welfare variable were included in equation 1. The specification also included all the variables measuring state-level economic and demographic conditions, including the foreign-born variable, the distance variable, and the fixed effects.

The results indicate substantial differences across immigrant groups. As shown in Table 4, welfare benefits are positively correlated with the number of immigrants from China, El Salvador, the Philippines, the former Soviet Union, and Vietnam. The coefficients for China, the Philippines, and Vietnam are significant at the 5 percent level, and the other two are significant at the 10 percent level. Except for persons from the Philippines, these immigrants are more likely than other immigrants to be converting from refugee to legal permanent-resident status, a finding that raises the possibility that refugees' locational choices are influenced by welfare even though immigrants' choices are not. Refugees are more likely than nonrefugee immigrants to participate in the welfare system (Borjas 1994), so it is not surprising that their locational choices are more responsive to differences in welfare payments across states.

Other interesting findings include the estimated coefficient for immigrants from Mexico, which is the largest in magnitude but is

Table 3
Determinants of Immigrants' Destinations

Covariate	(1)	(2)	(3)	(4)
Unemployment rate	.298	.248	.042	.042
	(.064)	(.056)	(.075)	(.071)
Income	.904	.460	1.414	2.500
	(1.024)	(.981)	(2.870)	(2.738)
Metropolitan population	.085	.065	–.028	–.026
	(.010)	(.008)	(.098)	(.093)
Taxes	–.002	–.002	–.001	–.001
	(.0004)	(.0003)	(.001)	(.001)
Manufacturing employment share	–.062	–.031	.077	.067
	(.019)	(.015)	(.072)	(.062)
Agriculture employment share	2.073	1.541	–.197	–.171
	(.383)	(.319)	(.385)	(.322)
Welfare	.010	.008	.004	–.001
	(.002)	(.002)	(.009)	(.008)
Foreign-born population (*1,000)	—	6.846	—	5.673
		(1.142)		(1.101)
Distance	–.001	.001	–.001	.001
	(.001)	(.001)	(.001)	(.001)
Fixed effects	No	No	Yes	Yes
Adjusted *R*-squared	.174	.322	.436	.536

NOTES: The dependent variable is the fraction of persons immigrating from one of eighteen countries to one of forty-nine states in 1982 or 1992, a total of 1,764 observations. See the text for details of the data. Heteroscedasticity-corrected standard errors are shown in parentheses.

Table 4
Responsiveness of Immigrants to Welfare Differences By Country of Origin

Country	Estimated coefficient	Standard error
Canada	–12.612	6.792
China	7.826	3.779
Colombia	3.984	3.975
Cuba	6.463	5.125
El Salvador	6.427	3.718
Germany	–.466	4.058
Guyana	5.821	4.180
Haiti	4.323	4.119
India	6.259	3.900
Iran	5.584	3.978
Jamaica	4.917	4.064
Mexico	22.454	16.688
Philippines	10.694	4.438
Poland	1.444	4.083
South Korea	5.338	3.924
Former Soviet Union	7.573	4.034
United Kingdom	–.362	3.885
Vietnam	15.289	7.098

NOTES: Shown is the coefficient on a variable measuring the maximum AFDC and food stamps payment interacted with an indicator variable of country of origin. The dependent variable is the number of persons immigrating from one of eighteen countries to one of forty-nine states in 1982 or 1992. See the text for details of the data and specification.

not significantly different from zero. The number of immigrants from Canada is negatively correlated with welfare benefits. The *F*-test statistic of whether all of the coefficients displayed in Table 4 are equal is 3.37, which rejects the hypothesis that they are equal at the 1 percent level.

Conclusions

Much of the motivation for eliminating most immigrants' access to federally funded public assistance benefits was concern that persons migrate to the United States because of the availability of welfare benefits. The 1996 welfare law makes noncitizens ineligible for food stamps and SSI payments and allows states to discontinue AFDC, Medicaid, and other public assistance benefits to noncitizens. Several states intend to continue extending benefits to noncitizens, whereas others are likely to cut off benefits, widening the already substantial differences in welfare benefits across states. These differences in policy create concern that immigrants will move in response to interstate differentials and that states that continue to allow immigrants to receive welfare payments will become welfare magnets.

In this article, I find little evidence to support the contention that new immigrants will choose their destinations based on welfare generosity. New immigrants are attracted to areas with large immigrant populations. Because earlier immigrants are disproportionately located in high-welfare states, it may appear that high welfare benefits attract immigrants. However, immigrants do not respond to interstate differentials in welfare generosity but rather to differences in the sizes of the foreign-born populations. Immigrants are also attracted to a specific subset of states—namely California, New York, Florida, and Texas—and do not respond to changes in welfare benefits within states over time. The recent historical evidence gives little reason to be concerned that new immigrants will choose their destinations based on the welfare differentials created by the new welfare law.

Notes

I thank Lori Taylor and Jason Saving for helpful comments.

1 Refugees are eligible for benefits the first five years they are in the United States, and legal immigrants who have worked in the United States for at least ten years without receiving any federal means-tested benefits remain eligible for federally funded benefits. The eligibility rules for immigrants who have received U.S. citizenship are the same as for natives.

2 Previously, the federal government partially reimbursed states' AFDC and Medicaid costs. The 1996 law replaces these federal payments with block grants to states, and the AFDC program was replaced by Temporary Assistance for Needy Families (TANF).

3 See Hutt (1996). Current welfare statistics generally do not distinguish between legal and illegal immigrants. Although illegal immigrants have always been barred from receiving federally funded welfare benefits, the rule has not been enforced until now. Similarly, a provision stating that the income of an immigrant's sponsors is used in determining an immigrant's eligibility for public assistance is now supposed to be enforced. The law also requires states to report known illegal aliens to the U.S. Immigration and Naturalization Service. States can enact laws to continue benefits to illegal immigrants under state-funded programs.

4 Douglas Besharov, a senior fellow at the American Enterprise Institute, quoted in Havemann (1996).

5 Adult males were present in less than 10 percent of AFDC-recipient households in 1979, according to Blank (1985).

6 The countries are Canada, China, Colombia, Cuba, El Salvador, Germany, Guyana, Haiti, India, Iran, Jamaica, Mexico, the Philippines, Poland, South Korea, the former Soviet Union, the United Kingdom, and Vietnam. The immigrant data are for fiscal years, which run from October of the preceding year through September of the given year.

7 The immigration data are from the INS publication *Statistical Yearbook*. The data include the country in which immigrants were born, which is assumed to be the country of origin.

8 The unemployment rate and manufacturing employment data are from the Bureau of Labor Statistics (BLS) publication *Employment and Earnings*. The income data are from the Bureau of Economic Analysis publication *Survey of Current Business*. The metropolitan population and tax data are from the U.S. Bureau of the Census publication *Statistical Abstract*. The agricultural employment data are from the BLS publication *Employment and Wages*. The immigrant stock data are from the 1980 and 1990 censuses.

9 All fiscal-year variables are lagged one year, and all annual variables are lagged two years to avoid any overlap in the time periods of the dependent variable and the covariates.

10 The distance data were graciously supplied by Jeff Gorham of the U.S. Department of Transportation, Bureau of Airline Statistics.

11 Any shock in the number of immigrants in a given year will be reflected in the next census count of immigrant stock; a linear interpolation of the immigrant stock will therefore make the covariate correlated with the error term. Although Buckley (1996) recognizes this problem and attempts to correct it using two-stage least

squares estimation, the equation he estimates is unidentified.

[12] The SSI data are from the U.S. House Ways and Means Committee. All results not included in tables here are available from the author on request.

[13] The Medicaid data are average payments per recipient and are from the *Statistical Abstract*.

[14] The variables interacting the country and time fixed effects control for differences across countries in the number of immigrants, but they also capture other unmeasured variables. The interactions are omitted in the results shown in Table 3, but including them does not change the reported results. A dummy variable for the year 1982 (a time fixed effect) is included here instead.

Appendix
Sensitivity and Specification Checks

The regressions results indicate that immigrants' locational choices have not been affected by changes in welfare benefits within states. The estimated coefficients on the welfare variable are imprecisely estimated, however, and may be subject to bias from several sources. The estimates may be subject to multicollinearity or endogeneity problems. In addition, a failure to control fully for differences across states in the cost of living may bias the estimates. Finally, California, a potential outlier because of its large number of immigrants and high welfare benefits, may be driving the results. The sensitivity of the results to each of these potential problems is examined.

Multicollinearity may underlie the large standard errors estimated for many of the variables, making it difficult to determine what affects immigrants' locational choice. An examination of the correlations between the covariates shows that per capita income, taxes, and maximum welfare benefits are highly correlated.[1] Equation 1 was therefore reestimated without the income and tax variables, and the results are similar to those reported in Tables 2 and 3. The welfare variable is not correlated with the number of immigrants after controlling for the stock of previous immigrants in equation 1 and fixed effects in equation 1′.[2]

The estimates reported in Tables 2 and 3 are also potentially subject to endogeneity bias because the number of immigrants may affect state economic conditions. In particular, policymakers may cut welfare benefits in response to high levels of immigration. If welfare and immigration are simultaneously determined, the estimated coefficient on the welfare variable may be biased and inconsistent. However, the specification estimated here should not be subject to endogeneity bias because the right-hand-side variables are lagged. One of the usual means of correcting for endogeneity bias in a panel is first-differencing the data and then using an instrumental variables estimator in which the instrument is lagged values of the right-hand-side variables (Holtz-Eakin, Newey, and Rosen 1988). The method used here is a reduced-form version of the same procedure.

Another specification concern is that equation 1 may not fully control for cost-of-living differences across states that affect immigrants' locational choices. Equation 1 does not contain variables that explicitly capture differences in the cost of living across states or within states over time; however, the state fixed effects control for time-invariant differences across states. To control more fully for differences within states, equation 1 was reestimated and a variable that measures the real median rent in the state was included. Housing, the second largest expenditure category for poor households, is likely to be the largest source of within-state variation in the cost of living over time.[3] Controlling for housing costs does not significantly affect the estimated coefficient on the welfare variable in any of the specifications.

The large number of persons migrating to California and the state's high welfare benefits may drive the estimation results that find a positive correlation between immigration and welfare in some specifications. Borjas (1996) finds that welfare is not correlated with the distribution of immigrants across states when California is omitted from his analysis. If California is omitted from the data used here, the results indicate a weaker correlation between the number of immigrants and welfare. The estimated coefficient on the welfare variable is not positive and significant in any of the specifications.

[1] The partial correlation between income and welfare benefits is 0.50, and the partial correlation between taxes and welfare benefits is 0.46. The Belsley condition number for the regressions results reported in Table 2, column 2, is 27.6, which is above the acceptable level.

[2] The condition number for the equation corresponding to Table 2, column 2 without the income and tax variables is 11.4, indicating that multicollinearity is not a problem in the reestimated specification.

[3] The median rent in a state is from the 1980 and 1990 censuses. The average poor family spent more than 22 percent of income on shelter in 1992–93, compared with about 16 percent for a nonpoor family (Federman et al. 1996).

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Output, Growth, Welfare, and Inflation: A Survey

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Formal statistical analyses fail to find a significant positive correlation between inflation and per capita output growth.

Inflation's effect on economic activity, and ultimately on people's well-being, is a primary concern of monetary policymakers and has been the focus of much study. For instance, analysts have questioned whether a permanent change in the inflation rate raises or lowers the rate of economic growth.

In this article, I review both theoretical and empirical literature on this subject. I begin with the theoretical literature, which examines the relationship between monetary policy and welfare, the level of output, and the rate of output growth. Like Stein (1970) and Orphanides and Solow (1990), I find that equally plausible models yield qualitatively different predictions for the relationship between the inflation rate and per capita output. However, when the inflation rate is initially steady at zero and then increases permanently, there is no ambiguity—the average person suffers a welfare loss. Thus, policymakers may face a dilemma: reducing inflation may raise the average person's welfare, but the growth rate of per capita output may fall.

I next survey the empirical literature on the correlation between inflation and per capita output growth. The preliminary evidence shows a significant negative correlation. However, recent studies have raised doubts about this relationship, showing that the correlation may not be robust. In particular, researchers have shown that inflation is not significantly related to per capita output growth when either a common set of control variables is included in the regressions or a different measure of the trend rate of output growth is used. Notably, the formal statistical analyses fail to find a significant positive correlation between inflation and per capita output growth. Thus, with all the caveats, the evidence suggests a nonpositive relationship between inflation and output growth.

The neoclassical growth model is the framework for analysis in this article. Adoption of this framework makes it easier to account for the qualitative differences in the relationship between inflation and output growth. As in previous surveys, there is still disagreement about the direction in which output moves in response to a change in inflation, even in the neoclassical economies. What distinguishes the model economies is the role for fiat money. In some cases, the researcher highlights money's transactions features, whereas others focus on money as a store of value. My review suggests that money's different roles are key determinants of the direction output growth takes in response to a change in inflation.

I also review some recent developments in the inflation–output growth literature. Several researchers have raised the issue of whether permanent changes in the inflation rate can permanently affect the rate of output growth. In the neoclassical model, long-run growth is driven by perpetual technological advancement. Because inflation does not drive technological advancement, movements in the inflation rate potentially affect the growth rate only along the transition path from one steady-state value of the capital–labor ratio to the next. In short, inflation may have permanent effects on output level but not on output growth rates. The endogenous-growth literature, led by Romer (1986) and Lucas (1988), shows that economies can unboundedly grow in equilibrium without exogenous technological change. In view of the Romer and Lucas results, it is natural to wonder whether differences in inflation rates account for any of the differences in growth across countries.

The first section of the article reviews the various mechanisms through which inflation affects capital accumulation in the neoclassical setting. Next, it briefly surveys the theoretical studies on inflation and growth. The third section is an overview of the empirical results on the correlation between inflation and growth. The final section summarizes the survey.

Theories on inflation and growth

Persistent inflation is a post–World War II phenomenon. Before then, the history of price indexes shows bouts of inflation followed by periods of deflation. In other words, the price level cycles showed no discernible upward or downward trend.[1]

In the absence of persistent inflation, the early inflation–output growth theories were built on such cyclical observations. Economic expansions generally coincided with inflation, and contractions typically coincided with deflation.[2] Theory, therefore, sought to account for a positive correlation between inflation and output growth. The textbook aggregate demand–aggregate supply framework could account for a positive correlation between inflation and output growth. In that theory, the chief mechanism is a positive association between aggregate demand and the growth rate of money. Inflation and faster output growth are joint products of faster money growth.

Mundell (1963) was the first to articulate a mechanism relating inflation and output growth through something other than the excess demand for commodities. In Mundell, an increase in inflation immediately reduces people's wealth. To accumulate the desired wealth, people save more, thus driving down the real interest rate. Greater saving means greater capital accumulation and thus faster output growth.

Neoclassical economies. Tobin's (1965) contribution to the inflation–output growth literature is a study of the issue in the context of the neoclassical growth model. Tobin follows Solow (1956) and Swan (1956) in making money a store of value in the economy. Hence, people can save for future consumption by either holding money or acquiring capital. In Tobin's setup, people hold a fraction of their income to meet their transaction needs, despite capital's offering a higher rate of return.

To formalize the portfolio mechanism, consider the following simplified version of Tobin's economy. The model is characterized by the following two equations:

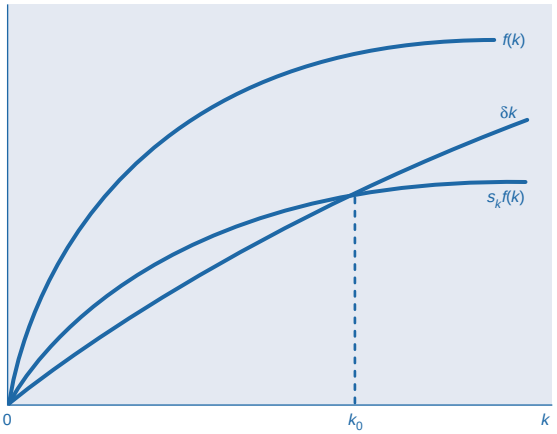
$$(1) \qquad k_{t+1} = (1 - \delta)k_t + i_t, \text{ and}$$

$$(2) \qquad i_t = s_k f(k_t),$$

where k is the capital stock; i is gross investment spending; $f(k)$ is the production technology, using capital as the sole input; δ is the constant rate of capital depreciation; and s_k is the fraction of output saved to acquire additional capital stock.

Equations 1 and 2 describe how this economy operates by characterizing how capital evolves over time and by specifying the equilibrium condition, respectively. In equilibrium, saving, characterized as a known fraction of output, equals gross investment; that is, $s_t = s_k f(k_t) = i_t$. In steady state, the capital stock is constant over time, so that equation 1 reduces to $\delta k = s_k f(k)$. In Figure 1, which depicts the equilibrium for this simple economy, the steady state occurs

Figure 1
Steady State in the Neoclassical Economy



where the δk line intersects the s_k line.

Figure 2 depicts the portfolio mechanism. Consider a once-and-for-all increase in the inflation rate from π_0 to π_1 ($\pi_1 > \pi_0$), which is equivalent to saying that the return to money has fallen. In Tobin's portfolio mechanism, people will substitute away from money, with its lower return, and toward capital. In Figure 2, this substitution is depicted by a shift in the s_k line to s_k'. As Figure 2 shows, the portfolio mechanism results in a higher steady-state capital stock (from k_0 to k_1).

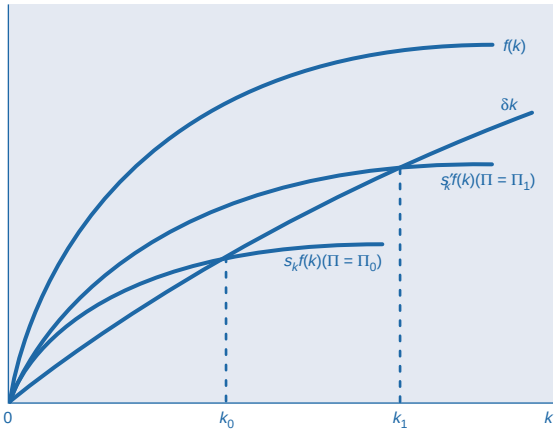
As Figure 2 shows, once the economy has achieved steady state, there is no growth. Instead, Tobin's framework shows that a permanently higher inflation rate permanently raises the level of output. However, the effect on output growth is temporary, occurring during the transition from steady-state capital stock, k_0, to the new steady state with capital stock, k_1.[3] Indeed, growth in the neoclassical economy is driven by exogenous technological advancement—upward shifts in the $f(k)$ curve—not by a once-and-for-all change in the inflation rate.

Within the neoclassical setup, the next major development in the study of inflation effects comes from Sidrauski's (1967) superneutrality result. In Sidrauski's study, people choose the saving ratio to maximize their happiness, as opposed to Tobin's assumption that saving is a fixed ratio of output. Money has an implicit transaction feature in Sidrauski. Formally, this is reflected in the notion that people's happiness is directly related to their holdings of real money balances.[4] The main result in Sidrauski's economy is that an increase in the inflation rate, for example, does not affect the steady-state capital stock. Thus, neither output nor output growth is related to changes in the inflation rate.[5]

Why is Sidrauski's result different from Tobin's? People's saving behavior plays a crucial role in determining whether inflation affects output growth. In Tobin's model, the portfolio mechanism describes how people move from money to capital when inflation rises. In Sidrauski's economy, people's saving ratio falls in response to an increase in inflation, as do their real money balances. Indeed, people match their decline in saving dollar for dollar with a decline in money balances. Capital is unchanged in the Sidrauski model.

To demonstrate that the Tobin effect does not depend on the assumption that saving is a constant fraction of output, I review several model economies in which a Tobin effect is present and people choose their saving rate optimally.

Figure 2
The Tobin Effect



One example is a study by Freeman and Huffman (1991) in which they specify an economy populated by heterogenous people; specifically, people are identifiable by their level of wealth. To consume in the future, people can either hold money or hold capital.[6] The rate of return on money is strictly less than the rate of return on capital, but people willingly hold money because a flat fee must be paid to acquire capital. The fixed cost means that capital's after-fee real return is inversely related to the size of the capital stock purchase. In other words, small savers will prefer to hold money. Provided that people are identical except for their wealth holdings, Freeman and Huffman derive a break-even value for saving, w^*, at which the return to money is identical to the after-fee return to capital. Correspondingly, people saving less than w^* will hold money balances, and people saving more than w^* will prefer capital.

Consider an increase in the inflation rate in the Freeman–Huffman model. With a lower return on their money holdings, some of the small savers who had held money will now find it more appealing to pay the fee and acquire capital. The bottom line is that Freeman and Huffman specify a simple portfolio-substitution effect in an explicit, optimizing framework. As in the Tobin economy, an increase in the inflation rate results in a permanently higher steady-state level of output.

Ireland (1994) also presents a model in which a Tobin effect is present, but it results from a consumption–saving decision rather than a portfolio-substitution mechanism. Ireland specifies two alternative payment forms: government money and credit. In using credit, people must pay for an intermediary's services. Two key assumptions are made regarding the intermedi-

ary's cost function: at a given date *t*, costs increase with the amount of credit, and for a given quantity of credit, costs decline over time. The latter assumption is designed to capture financial innovations, while the former assumption is crucial for people to want government money.

The inflation rate affects the composition of consumption financed by credit and by government money. With a cash-in-advance restriction, people must acquire money balances one period prior to their actual expenditures. Consequently, with an increase in the inflation rate, people buy less with money because its purchasing power erodes at a faster rate. In this economy, time also plays an important role. Instead of substituting away from money and toward more credit, people may wait and consume more when financial innovations have lowered the cost of using credit. Capital is the means by which people can practice such patience. Over the near term, greater capital accumulation yields temporarily faster growth. Eventually, people will draw down their capital reserves at a faster rate to enjoy more consumption. Hence, a rise in inflation initially results in output growing faster than trend, but then output grows slower than trend at some future date. In the long run, output grows at the same trend rate, regardless of the inflation rate.

The research by Sidrauski and Freeman and Huffman shows that money can play a decisive role in terms of output's long-run response to an increase in the inflation rate. Sidrauski identifies money as a means of payment, whereas Freeman and Huffman see money as competing with capital as a store of value. Feenstra (1986) offers an interpretation of the Sidrauski model that makes the distinction clear. According to Feenstra, an increase in the inflation rate causes people to economize on their money balances. Moreover, the composition of output shifts from the consumption good to financial services. As in Sidrauski's model, total output—the sum of consumption and financial services—is unchanged. An increase in the inflation rate, therefore, does not affect the level of total output but does affect its composition. Thus, the Feenstra interpretation shows that how we pay for total output—in this case, the ratio of output to money—may respond to the inflation rate, but the overall level of economic activity is unaffected. In Freeman and Huffman, because money is a competing store of value, a rise in the inflation rate makes capital more attractive. Inflation induces people to produce more total output, not just change output's composition.

Welfare considerations. Although a rise in the inflation rate does not instigate a change in the level of output in the Sidrauski model, it would be incorrect to conclude that inflation has no effect on people's welfare. Here again, Feenstra's interpretation is useful for assessing the welfare costs associated with an increase in the inflation rate. As noted above, the composition of total output shifts away from the consumption good and toward financial services as the inflation rate rises. Since people's happiness is directly related to the quantity of the consumption good, welfare is unambiguously lowered when the inflation rate goes up.

An increase in the inflation rate also reduces people's welfare in the models presented by Freeman and Huffman and by Ireland. In Freeman and Huffman, all moneyholders suffer when the inflation rate rises because the return to money falls. With a lower real return, less savings are available to acquire the consumption good. In Ireland's research, people's consumption–saving decision is distorted by inflation. People save more to avoid the increased costs associated with purchasing the consumption good with either financial services or with lower yielding money.

Thus, even though output may rise in response to an increase in the inflation rate, a review of the neoclassical economies shows that people's welfare will fall.[7] As such, the theoretical evidence points to a conundrum: if monetary policy raises the inflation rate, output could increase, but what the benevolent policymaker seeks to maximize—people's happiness—would fall.

The Stockman effect. Stockman (1981) develops a model in which an increase in the inflation rate results in a lower steady-state level of output and people's welfare declines. In Stockman's research, money is a complement to capital, accounting for a negative relationship between the steady-state level of output and the inflation rate.

Stockman's insight is prompted by the fact that firms frequently put up some cash in financing their investment projects. Sometimes the cash is directly part of the financing package, whereas other times, banks require compensating balances. Stockman models this cash investment feature as a cash-in-advance restriction on both consumption and capital purchases. Since inflation erodes the purchasing power of money balances, people reduce their purchases of both the cash good and capital when the inflation rate rises. Correspondingly, the steady-state level of output falls in response to an increase in the

inflation rate. Insofar as money acquisition is necessary for capital accumulation, Stockman presents a model in which money and capital are complementary goods. The term *Stockman effect* generally applies to all theoretical results in which output is inversely related to the inflation rate.

Inflation and labor. The Stockman effect can also operate through effects on the labor–leisure decision. Greenwood and Huffman (1987) develop the basic labor–leisure mechanism, and Cooley and Hansen (1989) identify the implications for capital accumulation.

In Greenwood and Huffman's research, people hold money to purchase the consumption good and derive utility from both consumption and leisure. Fiat money is valued because there is a cash-in-advance constraint on the consumption good. Greenwood and Huffman show that the return to labor falls when the inflation rate rises. Cooley and Hansen simplify the mechanism, noting that people substitute away from the cash good—consumption—and choose to enjoy more leisure. Consequently, people facing an increase in the inflation rate will substitute away from consumption and toward leisure.

Cooley and Hansen (1989) extend the Greenwood–Huffman mechanism to consider capital accumulation.[8] The key assumption is that the marginal product of capital is positively related to the quantity of labor. Thus, when labor quantity declines in response to a rise in the inflation rate, the return to capital falls and the steady-state quantities of capital and output decline. As Cooley and Hansen show, the level of output permanently falls in response to an increase in the inflation rate. The mechanism described by Cooley–Hansen emphasizes labor's role in determining the response of steady-state output to inflation.

With an increase in the inflation rate, the typical person suffers a welfare loss in the Stockman and Cooley and Hansen setups. In the Stockman economy, inflation distorts people's decisions regarding the purchase of all cash goods, including capital. With less wealth, people can afford a smaller stream of consumption spending, making them worse off. In the Cooley–Hansen setup, people respond to an increase in the inflation rate by wanting less of the cash good and more of the credit good, leisure. While more leisure partially offsets the loss of the consumption good, the main point is that an increase in the inflation rate has distorted people's choices. In effect, the Cooley–Hansen resident consumes too much leisure and too little of the consumption good, resulting in a welfare loss.

The literature review shows that models in the neoclassical framework can yield very different qualitative results with regard to inflation's effect on the steady-state level of output. Depending on money's role, an increase in the inflation rate can result in less output (the Stockman effect), more output (the Tobin effect), or no change in output. The theoretical review does, however, reveal one consistent result: people's welfare is inversely related to changes in the inflation rate.

Endogenous growth models. Kaldor (1961) observed persistent differences across countries in terms of growth rates of per capita output. This observation stimulated efforts by Romer (1986) and Lucas (1988) to specify economies that could grow unboundedly.

One feature accounts for the chief difference between the endogenous growth models and the neoclassical economies. In the neoclassical economy, the marginal product of capital declines as more capital is accumulated. In the simplest versions of the endogenous growth models, per capita output continues to increase because the marginal product of capital does not fall below a positive lower bound. Indeed, for unbounded growth, the marginal product of capital must be greater than the rate at which people discount future consumption.[9] The basic intuition is that only if the rate of return on capital is sufficiently high will people be induced to continue accumulating it.

Several studies have looked at the effect inflation has on output growth. The studies reviewed here find that an increase in the inflation rate retards growth. As with the Stockman effect, a welfare loss accompanies a rise in the inflation rate. In the endogenous growth models, the distortionary effects identified above are compounded by the reduction in growth. As will be seen, the way in which money is introduced has a great bearing on the size of the inflation rate effects on output growth.

The earliest versions of the endogenous growth economies find that the inflation rate effects on growth will be small. Gomme (1993) studies an economy similar to the one specified by Cooley and Hansen; that is, an inflation rate increase results in a decline in employment. In Gomme's research, efficient allocations satisfy the condition that the marginal value of the last unit of today's consumption equals the marginal cost of the last unit of work. With a rise in the inflation rate, the marginal value of today's last unit of consumption falls. Accordingly, the efficiency condition is satisfied provided people work less. With less labor, the marginal product

of capital is permanently reduced, resulting in a slower rate of capital accumulation. Gomme calculates the effect a permanent change in the inflation rate would have in this economy. He finds that eliminating a moderate inflation rate (for example, 10 percent) results in only a very small (less than 0.01 percentage point) gain in the growth rate of output.

Jones and Manuelli (1995) use fiscal policy distortions as the mechanism through which inflation might affect growth. Jones and Manuelli specify a model in which the tax code includes a nominal depreciation allowance. With a rise in the inflation rate, the discounted value of depreciation tax credits falls; hence, the effective tax on capital income is higher. People accumulate capital at a lower rate because of the reduction in after-tax real returns. Correspondingly, there is a reduction in output growth. As in Gomme, Jones and Manuelli calculate the inflation rate effect, finding that the growth rate reduction will be quite small. In both Gomme and Jones and Manuelli, inflation does not directly influence capital accumulation. Instead, the capital accumulation response is a second-order effect.

Alternative models examine how inflation might directly affect capital accumulation and hence output growth. Marquis and Reffert (1995) and Haslag (1995) specify economies in which capital and money are complementary goods. Marquis and Reffert examine inflation rate effects in a Stockman economy: there is a cash-in-advance constraint on capital. In Haslag's research, banks pool small savers but are required to hold money to satisfy a reserve requirement. The reserve requirement is binding because money offers a return strictly below that of capital. In a reserve requirement economy, the equilibrium return to deposits is then a weighted sum of returns to money and capital. Thus, an inflation rate increase drives down the return to deposits, resulting in deposits being accumulated at a slower rate. Since capital is a fraction of deposits, capital accumulation and output growth both slow. In both the Marquis and Reffert and Haslag studies, the inflation rate effects on growth are substantially greater than those calculated in Gomme and Jones and Manuelli. For instance, Haslag finds that economies with 10 percent inflation will grow 0.2 percentage point slower than economies with zero inflation.[10]

Economic theory reaches a striking variety of conclusions about the responsiveness of output (or the growth rate of output) to changes in the inflation rate. In the neoclassical models, money's role in the economy determines whether a permanent increase in the inflation rate stimulates, retards, or has no effect on the level of output. In short: (1) if money is a complement to capital, inflation and the output level are negatively related; (2) if money and capital are substitutes, inflation and the level of output are positively related; and (3) if money is primarily a medium of exchange and some substitute payment medium exists, inflation and the output level are independent. Whereas the neoclassical models predict that the inflation rate affects the level of output, the newer literature asks how a rise in the inflation rate can affect the growth rate of per capita output. In the endogenous growth setting, research shows that money's role determines whether the quantitative effects are large or negligible.

Theories are useful insofar as they account for some observed phenomenon. In the next section, I review the literature on the empirical evidence relating inflation to growth.

The empirical evidence on inflation and growth

The chief aim of this section is to identify the relationship between inflation and growth. More specifically, Is the secular trend in the inflation rate systematically related to the secular trend rate of output growth?

Table 1 summarizes the findings of the empirical papers cited in this article. Clearly, a majority of studies find that inflation and growth are systematically and negatively related. However, Levine and Renelt (1992), Bullard and Keating (1995), and Ericsson, Irons, and Tryon (1993) fault this conclusion. Levine and Renelt contend that the inflation–output growth relationship is simply too tenuous. Bullard and Keating and Ericsson, Irons, and Tryon question whether the early studies use the correct notion of trend.

Figure 3 plots the average values for the inflation rate and per capita real GDP growth rate across countries. The sample consists of average rates of inflation and per capita real GDP growth for eighty-two countries. The sample means are based on annual observations spanning the period 1965–90. The plot shows a weak negative correlation between per capita output growth and the inflation rate. The countries with lower than average growth rates tend to be the ones that have higher than average inflation rates. The notion of trend applied in these data is multiyear averages. (The issue of what constitutes trend is examined in greater detail later in this survey.)

In the literature, regression analysis is a

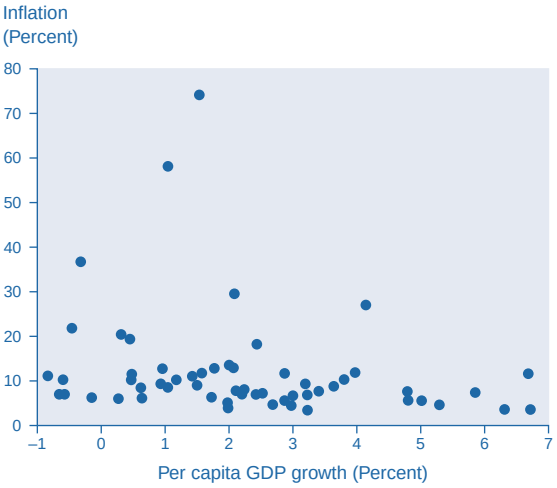
Table 1
Empirical Evidence on the Inflation–Growth Relationship

Author(s)	Samples	Methodology	Synopsis of results
Kormendi and Meguire	46 countries 1948–77, varying periods	Cross-country regression using sample means	Negative and significant relationship between output growth and inflation exists.
Fischer	73 countries	Comparison of sample means from fast- and slow-growing groups	Inflation in fast-growth group is lower than in slow-growth group.
DeGregario	12 Latin America countries, 1950–85	Cross-country regression using 6-year averages, nonoverlapping	Negative and significant relationship between output growth and inflation exists.
Gomme	82 countries 1949–89, varying periods	Cross-country simple correlations using annual data	Output growth and inflation are negatively correlated.
Bullard and Keating	58 countries	Regressions for each country	Inflation has no significant long-run effect on the level of output.
Ericsson, Irons, and Tryon	G–7 countries	Regressions for each country	Inflation has no significant long-run effect on output growth.

frequently used tool. Examples include Kormendi and Meguire (1985), Fischer (1991), DeGregario (1993), and Gomme (1993).[11] In general, these studies find that the correlation between inflation and per capita output growth is negative and significant. Thus, the more formal analyses are consistent with the ocular econometrics used in analyzing Figure 3: countries with higher than average inflation typically experience slower than average output growth.

In addition to regression analysis, Fischer employs simple nonparametric methods to look at inflation and growth. He calculates the average inflation rates for two smaller groups of countries; namely, those that grow at least one standard deviation faster than the average rate and those that grow, at most, one standard deviation slower than the average rate. Fischer reports that the slow-growth countries have an average inflation rate slightly above 30 percent, while the fast-growth countries average only 12 percent inflation.

Figure 3
Cross-Country Plots of Inflation Versus GDP



SOURCE: International Financial Statistics.

An obvious concern is whether the inflation–output growth relationship is robust. Sarel (1996) and Judson and Orphanides (1996) ask whether the relationship between inflation and growth is linear. The idea is that a 1 percentage point increase in a low inflation rate may have a smaller effect on output growth than a 1 percentage point increase in a moderate to high inflation rate. Both studies find that the effect of an increase in the inflation rate depends on whether the initial rate is high or low. Specifically, an inflation rate increase does retard output growth when the inflation rate is moderate or high (defined as an inflation rate exceeding 10 percent) but is not significantly related to output growth when inflation is low (less than 10 percent). Thus, the cross-country evidence suggests that the inflation–output growth relationship is robust but most likely depends on the initial inflation rate.

Other researchers have questioned whether a systematic relationship between the inflation

rate and growth even exists. Levine and Renelt (1992) argue that one must first control for a set of essential growth determinants before testing for a systematic relationship between inflation and output growth. Levine and Renelt find that after including measures of physical and human capital accumulation rates, the inflation rate is not significantly related to per capita output growth.[12] Thus, Levine and Renelt conclude that the inflation–output growth relationship is fragile. The implication is that policymakers should not assume that a rise in the inflation rate will, on average, slow growth.

The Levine–Renelt criticism may overstate the weakness in the inflation–output growth relationship. The theoretical literature shows that inflation effects operate through movements in capital accumulation—both physical and human. If one controls for capital accumulation directly in the regression—as Levine and Renelt do—it is less likely that inflation will be significantly related to output growth. Barro and Sala-i-Martin (1995) show that per capita output growth is the sum of total factor productivity growth and growth in both physical and human capital. Based on this growth accounting expression, it is difficult to imagine how inflation, or any policy variable, could be significantly related to per capita output growth in regressions that include measures of physical and human capital accumulation rates.

Even before Levine and Renelt's investigation, researchers were wary of putting too much faith in the inflation–output growth relationship. In particular, high-inflation countries are also likely to experience highly volatile inflation rates. If only inflation is included in the estimated regression equation, it is impossible to determine whether it is the inflation rate or inflation uncertainty that is determining growth.[13]

The final issue is whether multiyear averages should be used to measure the trend rate of output growth.[14] Statistical methods permit the extraction of trend from annual observations. The implication is that much greater country-specific variation in the trend will occur when the dataset has a time series of trend rates than when the trend is single valued. Greater variability in the time series highlights the basic trade-off facing a researcher; potentially, too much of the high-frequency (read business cycle) movement in the series will be incorporated into the trend measure. Consequently, regressions with more variable trend rates of output growth potentially pollute the attempt to identify the relationship between long-run output growth and inflation.

In Bullard and Keating's research, the cross-country evidence shows that there is no systematic long-run relationship between inflation and the level of output. Bullard and Keating (1995) identify trend inflation and output for fifty-eight countries. Here, trend is associated with long-run relationships between series with stochastic trends. The authors do not pool results across countries. Instead, they estimate separate regressions for each country, permitting each country's long-run relationships and short-run dynamics to be different. In their examination of the long-run relationship, Bullard and Keating find that permanent changes in the inflation rate are not systematically related to the level of output.[15]

Summary and conclusions

In this article, I survey the theoretical and empirical literature examining the relationship between movements in the inflation rate and output, output growth, and welfare. In the theoretical literature, an inflation rate increase unambiguously reduces the average person's welfare. However, inflation's qualitative effect on the level of output is ambiguous. I suggest that inflation's effect on output depends on why people hold money. If the researcher emphasizes money as a substitute for capital, a rise in inflation raises the long-run level of output. If the researcher emphasizes money's role as a complement to capital, a rise in inflation results in lower long-run levels of capital.

The most recent theoretical research has studied inflation's effect on growth rates. These theories generally find that a rise in inflation either results in slower growth or has no impact on the growth rate.

In the empirical literature, research attempts to find the relationship between the trend rate of per capita output growth and the trend inflation rate. In this article, empirical results differ, owing mostly to the notion of trend applied. Many cross-country studies use multiyear averages as the measure of trend. Early studies show that high-inflation countries tend to grow slower that low-inflation countries. More recent studies suggest that countries with inflation rates above 10 percent tend to exhibit a negative relationship between inflation and growth, whereas in countries with average inflation rates below 10 percent, there is no significant relationship. Studies that use the trend rate of growth each year fail to find a significant relationship between per capita output growth and inflation.

Thus, the survey produces two uncontested

findings. First, there is no empirical evidence that there is a positive relationship between the secular trend rate of inflation and the secular trend rate of output growth. Second, economic theory tells us that an inflation rate increase makes the average person worse off.

Notes

[1] For example, the U.S. producer price index in 1943 was slightly below its 1810 value.

[2] Fischer's (1926) original study established the negative comovement between inflation and the unemployment rate. With Okun's law, the negative association between inflation and unemployment is a positive relationship between inflation and output growth.

[3] The capital stock monotonically approaches its steady state in the neoclassical economy. Under different conditions, the capital stock could cyclically converge to its steady state. With cyclical convergence, the capital stock could exhibit periods in which it rises and falls as it approaches the new steady-state level. Hence, growth could either rise or fall in response to a rise in the inflation rate.

[4] Rather than interpreting real money balances as something that makes people happier, the money-in-the-utility-function specification is a proxy for some transaction technology. Feenstra (1986) shows that money in the utility is functionally equivalent to a cash-in-advance payment technology.

[5] See Abel (1985) and Koenig (1987) for details on the capital–labor ratio along the transition path.

[6] More precisely, people can hold deposits that are used to finance capital.

[7] In much of this research, the optimal inflation rate is equal to the person's time rate of preference—the Friedman rule. Akerlof, Dickens, and Perry (1996) argue that a moderate steady inflation rate permits maximum employment. Inflation substitutes for the desire to avoid lowering nominal wages. Akerlof et al. compare outcomes by the effect on employment and output, not welfare. Consequently, their findings do not overturn the welfare implications reported in this article.

[8] Cooley and Hansen are primarily interested in the business-cycle properties of an economy in which the inflation rate changes. Interestingly, they find that the business-cycle properties are not substantially affected by changes in the inflation rate. My interest here is in the features of their model related to inflation's effect on the steady-state levels of capital and welfare.

[9] The assumption that the marginal product of capital does not always diminish is based on the common definition of capital, which includes physical quantities—buildings and machines—and human features, such as accumulated knowledge.

[10] The impact of the inflation rate on growth depends on the size of the reserve requirement. With a 15 percent reserve requirement, an economy with 10 percent inflation grows at a rate 0.67 percentage point slower than an economy with zero inflation. With only a 5 percent reserve ratio, the effect on growth is only 0.2 percentage point.

[11] These studies differ primarily in terms of the variables included in their regressions. Kormendi and Meguire, for example, include measures of fiscal policy, whereas Fischer includes measures of physical and human capital accumulation. Details on the countries sampled and the time periods are in Table 1.

[12] Levine and Renelt's baseline regression includes the investment share of real GDP, the initial (1960) level of real GDP per capita, the initial secondary-school enrollment rate, and the annual rate of population growth.

[13] Tommassi (1994) models the effect of inflation uncertainty on economic activity. In Tommassi, inflation uncertainty results in people putting more effort into activities that are not counted in national income accounts.

[14] Ericsson, Irons, and Tryon (1993) identify three methodological problems with the typical cross-country regressions: aggregation over countries, aggregation over time, and the use of growth rates instead of output levels. Aggregation over countries lumps low-inflation countries with high-inflation countries. Ericsson et al. argue that the systematic relationship owes almost entirely to the inclusion of a small group of African and Latin American countries. In aggregation over time, the unit of observation is average inflation over periods as long as several decades. Ericsson et al. show that contemporaneously uncorrelated variables can be either positively or negatively related when averaged data are used. Finally, using first-differences as the unit of observation, the authors point out, imposes an unnecessary restriction on the dynamic relationships in the data.

[15] In Bullard and Keating, the first-difference in the inflation rate and output growth is a stationary series. The interpretation is that the sample mean is the best forecast of output growth over an infinite horizon. Bullard and Keating's forecasting equations, in which output growth eventually returns to its long-run average value, are consistent with the neoclassical theory that a permanent change in the inflation rate can have only temporary effects on output growth. Interestingly, Bullard and Keating find evidence that the transition phase exhibits cyclical convergence, as opposed to the monotonic convergence predicted by the neoclassical models.

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