2-1977

The Explanation of Inflation: Some International Evidence

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Explanations of inflation can be subdivided into two major groups. "Sociological theories" assert that movements of prices and wages proceed independently of market conditions. Economic theories on the other hand elaborate the essential dependence of price-wage movements on evolving market conditions. Sociological theories, dominant in Europe, emphasize the role of a wide array of institutional arrangements. In contrast, according to economic theory all forces and events affect inflation via market processes.

Within the class of economic theories, there are substantial differences in emphasis. Many of the differences are about the nature of dominant impulses. Which forces or actions produce disturbances that are systematically related to inflation? Many policy disputes have as their central, intellectual issue, the nature of the impulses generating inflation and unemployment.

Most recent discussion in economics has been about the details or properties of the mechanisms by which inflation is transmitted from one market to another. Such studies are valuable, but they cannot resolve policy disputes about the relative importance of financial and real disturbances in the generation of inflation. This paper is addressed to the material involved in such disputes. It reports on work in progress by a group concerned with the comparison of the relative importance of various impulses in the inflationary process. Observations drawn from five countries are used to assess the major issues bearing on crucial questions of policy.

I. General Remarks on the Class of Economic Theories

To distinguish the inflation problem from other adjustments of the aggregate price level, it seems useful to partition the observed relative change of the price level \( \Delta p \) into two components \( \pi \) and \( \rho \), where \( \Delta p = \pi + \rho \). The first component, \( \pi \), refers to a persistent and sustained increase in the price level, and \( \rho \) summarizes the many passing effects involving once and for all adjustments in the price level. Price theory informs us that the price level reflects an interaction between financial and real conditions. Changes in the price level result from changes in underlying real or financial circumstances modifying the general market conditions of an economy. An application of price theory therefore, directs attention to both real and financial factors. Further differentiation in the analysis emerges at this stage from different evaluations of the relative role of real and monetary factors in the observed adjustment of the price level. These alternative evaluations yield alternative approaches within the price-theoretical approach.

One thesis advances an eclectic view. The price level adjusts to a continuous series of erratic events or random changes in real or financial conditions. Any change or event is equally possible or probable and their combined evolution moves the aggregate price level over time. This thesis assigns no significance to \( \pi \) beyond its representation as a statistical average. The movements of \( \rho \) coincides essentially with \( \rho \), and the inflation problem is interpreted as a
sequential short-run adjustment of the price level from period to period.

An alternative thesis emphasizes the occurrence of systematic and dominant impulses. This thesis seems to us a more promising avenue for the development of a useful explanation of inflation. Two steps are required for the explanation. The first interprets the nature of dominant impulse patterns, and the second relates these patterns to the decomposition of the observed rates of price change, \( \hat{p} \).

Financial shocks emitted by fiscal actions and monetary events are among the dominant impulses. Occasionally, the literature refers also to autonomous movements of the anticipated net yield on real capital, the Keynes-Wicksell impulse. We believe that this impulse can be discarded from the list of systematic forces. The consequences of its operation are inconsistent with the observations made on asset prices and investment spending in Italy, Germany, United Kingdom and other countries where real returns declined with inflation. We also discard the operation of systematic real shocks from the list of dominant impulses. Experiences of the past three years show that real shocks occur, but they do not occur in the manner required to explain a persistent increase in the price level. Real wealth and real income would have to fall continuously to satisfy this requirement.

The occurrence of real shocks, including Wicksellian impulses, is related to the \( \rho \) component. Real shocks induce once for all adjustments in the price level and explain transitory changes in both directions. The persistent and sustained movements of the price level, the \( \pi \) component, are attributed to the financial impulses. The issue can be described in a diagram in the price-output plane, juxtaposing an aggregate demand curve with an aggregate supply curve.\(^1\) Expressed in diagrammatic terms, the hypothesis states that the position of the supply curve adjusts, beyond the short run, to the movements of the demand curve. Adjustments of expectations and the interaction between wages and prices, or labor and output market, link the position of the supply curve over a longer run to variations in the position of demand.\(^2\) We may note in passing that many aspects emphasized in sociological explanations can be naturally reinterpreted and integrated into the account outlined above.

Our account has been restricted so far to a closed economy and is thus applicable to the world as a whole. An examination of the inflation problem confronting single countries enmeshed in international transactions introduces additional issues, notably the relative role of domestic and external factors in domestic inflation.

Our analysis specifies four channels conveying external influences. Two channels operate on aggregate demand, and two others simultaneously on supply and demand. Inflation abroad produces a balance of payment surplus and raises export demand. The latter affects aggregate demand for domestic output immediately. The payments surplus raises the monetary base and also affects aggregate demand by changing interest rates and asset prices. But foreign inflation also raises import prices, including the prices of inputs to domestic production. Domestic wages also respond to rising import prices. The rise in input prices and wages shifts the supply curve. But changes in input prices induce substitutions of domestic for foreign products and increases in wages increase aggregate demand. An open economy with a fixed exchange rate system experiences in this manner some relatively autonomous influences operating independently of its own conditions. The role of these autonomous external impulses has been much emphasized in European literature (particularly by John R. Hicks) and in American discussions in past years.

The influence of external effects on domestic inflation deserves investigation. Our previous

\(^1\)These curves were described in several articles. The reader should note that the aggregate demand curve is really a semireduced form. A point on the curve represents \((p-y)\) combinations satisfying the output and the asset market equations. Properties of asset markets are thus impounded into the demand curve.

\(^2\)The length of this run depends on the public's assessment of future policy patterns based on its past experiences.
II. A Summary of the Preliminary Findings

A comparison of the relative importance of various impulses in the generation of inflation in the United States, Germany, France, Italy, The Netherlands, and Sweden is a principal aim of our study. One of the first tasks was the measurement of the financial impulses and of the external impulses. A fiscal impulse was computed for each country. The fiscal impulse, \( fI \), is a weighted combination of relative changes of government expenditures and tax revenues, with proper adjustment of both expenditures and revenues for feedback effects from prices and real income. The detail varies somewhat from country to country, reflecting the particular country’s circumstances. The relative change of the money stock (usually \( M_1 \)) was used as a measure of the monetary impulse, \( MI \). Two comments are needed in this context. First, the monetary impulse contains both domestic effects and also one channel (via the balance of payments) of the external effect. These separate effects embedded in monetary growth can be examined by "going behind the money stock." Second, monetary growth was not adjusted for feedbacks through the balance of payments accounts. These feedbacks introduce a negative relation between domestic inflation and monetary growth over the sample period (with fixed exchange rates) considered here. Unadjusted monetary growth, containing these feedbacks, cannot bias the statistical results in favor of the monetary impulse.

Two external effects were measured, \( EI(P) \) summarizes the price impulse via imports, and \( EI(Q) \) expresses the direct impulse via expanding foreign demand for domestic output. Once again, some unavoidable differences occurred in the detailed construction of the two external impulses for the various countries examined.³

The method of evaluation uses a nonparametric and a variety of parametric methods. Tables 1 and 2 summarize a preliminary set of nonparametric tests bearing on alternative, narrowly conceived dominant impulse hypotheses. Each one of the four impulses is subjected to an examination as a dominant impulse with respect to changes in the price level (usually represented by a consumer price index) and with respect to a measure of output. Even if one is inclined to admit, as our analysis implies, that all four impulses are expected to exert simultaneous influence on changes in the price level and output, the comparison of the single impulse tests yields some useful information about broad orders of magnitudes operating over the sample periods. The test is based on a three-by-three contingency table with rows and columns distinguished according to the sign of the variables involved (+, −, 0). First differences of the impulse measures were required for the test, i.e., acceleration of the price level (first difference \( \Delta p \) of \( p \)) and similar first differences of \( fI \), \( MI \), \( EI(P) \) and \( EI(Q) \). All cases are based on annual data. Some results (e.g., The Netherlands) use concurrent values of the variables, whereas in others (e.g., Germany) the results are based on lag patterns yielding the best results for the variable under consideration. The reader should be warned not to interpret a negative \( V_p \) statistic as reflection of a negative association. The negative sign of the nonparametric statistic simply reflects dominant effects via the off-diagonal cells in the contingency table. The negative sign reveals a dominant negative or zero association.

³The detailed measures and procedures are described in the papers prepared by the authors for the respective countries. These papers will be publicly available at the Carnegie-Rochester Conference on Public Policy, April 1977, at the University of Rochester.
TABLE 1—THE \( V_p \) STATISTIC MEASURING THE ASSOCIATION BETWEEN CHANGING IMPULSES AND ACCELERATIONS OF THE PRICE LEVEL

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>Netherlands</th>
<th>Germany</th>
<th>Italy</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td>( FI )</td>
<td>-2.6</td>
<td>.6</td>
<td>6.7</td>
<td>.17</td>
<td>.04</td>
</tr>
<tr>
<td>( MI )</td>
<td>2.0</td>
<td>3.3</td>
<td>23.3</td>
<td>.46*</td>
<td>.35*</td>
</tr>
<tr>
<td>( EI(P) )</td>
<td>-4.8</td>
<td>2.3</td>
<td>52.1</td>
<td>.56*</td>
<td>.09</td>
</tr>
<tr>
<td>( EI(Q) )</td>
<td>.8</td>
<td>.8</td>
<td>19.4</td>
<td>.38*</td>
<td>-.01</td>
</tr>
</tbody>
</table>

*The \( V_p \) statistic has been standardized for the United States, Germany and The Netherlands. It is not standardized for Italy and France.

The significance levels for the standardized statistic are: 1.65 for 5 percent, and 2.33 for 1 percent.

The stars in the columns describing Italian and French statistics indicate statistical significance at the 1-%-level.


Inspection of Table 1 shows that monetary impulses appear significantly in all five countries at the 5 percent level (1.65), and it is significant in four at the 1 percent significance level (2.33). The data offer good reason to reject the chance hypothesis and assign substantial economic significance to the monetary impulse. The fiscal impulse, on the other hand, is not significant in four cases even at very high levels of significance (i.e., substantially above 5 percent). Germany yields, however, a different pattern and produces a \( V_p \) statistic well above the 1 percent significance level. The \( V_p \) value for the monetary impulse is, however, almost four times the \( V_p \) value for the fiscal impulse. The external impulses appear significantly (at the 1 percent level) in the case of Germany and Italy. Neither France nor the United States shows any significant positive association between the inflationary accelerations and changes in these impulse measures over the sample period. But we find for the Netherlands however a \( V_p \) value for \( EI(P) \) almost touching significance level at 1 percent. Remarkable is the irrelevance of the external quantity effect in the Dutch case. There emerges from Table 1 a strong support for the monetary impulse, a comparatively weak case for the role of the fiscal impulse, and some partial support for external impulses based on experiences in Germany, Italy and The Netherlands.

Table 2 summarizes tentative results for three countries bearing on the output-impulse relation. The monetary impulse again is significant for all countries (at the 1 percent level). The fiscal impulse emerges only in the German case and with a fraction of the \( V_p \) value assigned to the monetary impulse. Even the external quantity impulse \( EI(Q) \) appears for Germany with much sharper significance than the fiscal impulse. The external quantity impulse does not operate very significantly in the United States and The Netherlands. The external price impulse occurs significantly (at 5 percent) for The Netherlands, and at 1 percent for the United States. The positive association is, of course, defined between output changes and a negative valued \( EI(P) \). Tables 1 and 2 convey, in summary, a comparatively strong impression about the importance of the monetary impulse, with a somewhat marginal effect appearing for the fiscal impulse, and a limited effect for the external impulses.

TABLE 2—THE \( V_p \) STATISTIC MEASURING THE ASSOCIATION BETWEEN CHANGING IMPULSES AND ACCELERATION OF OUTPUT

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>Netherlands</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>( FI )</td>
<td>-9</td>
<td>-2</td>
<td>6.6</td>
</tr>
<tr>
<td>( MI )</td>
<td>4.8</td>
<td>4.8</td>
<td>57.9</td>
</tr>
<tr>
<td>( EI(P) )</td>
<td>2.5</td>
<td>1.7</td>
<td>n.a.</td>
</tr>
<tr>
<td>( EI(Q) )</td>
<td>1.2</td>
<td>1.5</td>
<td>27.0</td>
</tr>
</tbody>
</table>

Note: See the explanatory notes to Table 1.

The importance of the data in Tables 1 and 2 follows from the circumstance that a comparatively weak test (reflecting comparatively non-constraining assumptions) is applied to demanding data involving second time differences. It is useful in our judgment to supplement the nonparametric test even after further applications and some technical refinement, with appropriate parametric procedures.

Table 3 reports some regressions from the preliminary work. The regressions involve
either relative changes or accelerations. The results obtained for the Netherlands is indicative of the general pattern. The first regression contains only the four impulses introduced above. The monetary and the external price impulse clearly emerge with leading significance for Dutch inflation. The second regression replaces the domestic monetary growth with a measure of the growth rate of the world money stock. It also includes a measure of "autonomous price changes," i.e., changes in state controlled prices, and an (inverse) index, \( q \), of capacity utilization. The two additional elements have the expected signs and substantial significance, whereas the insertion of the world monetary change lowers understandably the importance of \( EI(P) \).

The coefficient of determination \( R^2 \) seems quite satisfactory, but the intercept (statistically significant at standard levels) poses a problem requiring attention in further work.

### Table 3—Some Regression Patterns Obtained for Inflation and Output for Several Countries

**1. The Netherlands**

**a. Inflation**

\[
\hat{p}_{cp} = 2.51 - 0.13 EI(Q) + 0.27 EI(P) \\
\text{(2.12)} \quad \text{(1.11)} \quad \text{(2.02)} \\
-0.01 FI + 0.35 \Delta M_{t-1} \\
\text{(-0.04)} \quad \text{(3.35)} \\
\tilde{R}^2 = 0.59, DW = 1.92
\]

\[
\hat{p}_{cp} = 2.95 + 0.01 EI(Q) + 0.18 EI(P) \\
\text{(3.79)} \quad \text{(1.30)} \quad \text{(1.81)} \\
+0.03 FI + 0.23 WM_{t-1} + 1.26 \hat{p}_{an} \\
\text{(2.22)} \quad \text{(2.66)} \quad \text{(3.38)} \\
-0.44 q_{t-1} \\
\text{(-2.77)} \\
\tilde{R}^2 = 0.84, DW = 3.41
\]

**b. Output**

\[
\hat{y} = -1.78 + 0.76 EI(Q) + 0.20 EI(P) \\
\text{(1.23)} \quad \text{(5.56)} \quad \text{(1.07)} \\
-0.07 FI + 0.05 \Delta M_{t-1} + 0.53 q_{t-1} \\
\text{(-0.30)} \quad \text{(0.53)} \quad \text{(2.32)} \\
\tilde{R}^2 = 0.80, DW = 2.53
\]

**2. The United States**

**a. Inflation**

\[
\hat{p}_{cp} = 1.15 - 0.09 FI + 0.24 EI(P) + 0.31 \hat{M}_{t-1} \\
\text{(1.69)} \quad \text{(-0.54)} \quad \text{(1.75)} \quad \text{(2.07)} \\
\tilde{R}^2 = 0.37, DW = 0.91
\]

\[
\hat{p}_{cp} = 0.76 + 0.20 EI(P) + 0.36 \hat{M}_{t-1} + 0.04 \hat{y}_{t-1} \\
\text{(1.21)} \quad \text{(6.88)} \quad \text{(2.87)} \quad \text{(0.40)} \\
\tilde{R}^2 = 0.80, DW = 1.04
\]

**b. Output**

The dependent variable is \( \Delta y \), i.e., an acceleration measure of real GNP.

\[
\Delta \hat{y} = -0.17 + 0.48 \Delta FI - 0.09 \Delta EI(P) \\
\text{(-0.31)} \quad \text{(3.04)} \quad \text{(-1.31)} \\
+ 1.33 EI(Q) + 1.18 \Delta M \\
\text{(1.76)} \quad \text{(5.05)} \\
\tilde{R}^2 = 0.65, DW = 1.91
\]

\[
\Delta \hat{y} = 2.34 + 0.24 \Delta FI - 0.06 \Delta EI(P) \\
\text{(2.83)} \quad \text{(1.73)} \quad \text{(-1.08)} \\
+ 0.92 EI(Q) + 0.88 \Delta M - 0.68 \hat{y}_{t-1} \\
\text{(1.53)} \quad \text{(4.43)} \quad \text{(-3.50)} \\
\tilde{R}^2 = 0.79, DW = 1.93
\]

Notes:

- Variables with a hat sign describe percentage changes.
- Regressions are based on annual data.
- For inflation 1955–73
- For output 1956–73
- Industrial production is used as output measure.
- \( EI(Q) \): measure of external quantity impulse
- \( EI(P) \): measure of external price impulse
- \( WM \): measure of world money stock
- \( q \): index of capacity utilization (larger utilization means lower values of \( q \)).
- \( \hat{p}_{an} \): an index of consumer prices
- \( p_{an} \): an index of prices contained in the consumer price.
- (index administered autonomously by the government)
- Numbers in parenthesis below regression coefficients refer to t-values.
\[ \Delta y = 25.27 + .35 \Delta F + 1.02 \Delta \dot{M} - .30 \text{cu} \]
\[ R^2 = .65, \text{DW} = 1.72 \]

Notes: cu: index of capacity utilization
The other variables are explained under the regressions describing the Dutch experience.

3. Italy
\[ \dot{p} = -1.67 + .69 (\dot{M} - \dot{y}) + .18 \dot{\pi} \]
\[ (-1.90) (6.98) (5.52) \]
\[ R^2 = .76, \text{DW} = 2.39 \]
\[ \dot{p} = -.06 + .52 \dot{M} - .54 \dot{y} + .54 (\dot{p}_{-1} - \ddot{p}_{-2}) \]
\[ (-.02) (3.29) (1.95) (2.25) \]
\[ R^2 = .46, \text{DW} = 1.72 \]
\[ \dot{p} = .59 (\dot{W} - \dot{P}) + .04 \dot{M} \]
\[ (7.05) (7.49) \]
\[ R^2 = .13, \text{DW} = .90 \]
\[ \dot{p} = 2.63 + .32 (\dot{W} - \dot{P}) + .12 \dot{M} \]
\[ (9.70) (3.16) \]
\[ R^2 = .85, D = 1.77 \]

sample mean of dependent variable: 4.2
\[ \dot{p} = -.05 \dot{s} + .51 L(\dot{M}) - .06 \text{cu} + .55 \pi \]
\[ (-.59) (2.40) (.03) (4.52) \]
\[ R^2 = .51, \text{DW} = 1.91 \]

Note: The first two regressions are based on annual data
1954–73.
The last two regressions are based on annual data
1952–73.
\[ \pi: \text{anticipated inflation rate based on adaptive scheme} \]
\[ \dot{\pi}: \text{measure of real growth outside Italy.} \]
The term L(\dot{M}) in the last regression represents
a linear combination of lagged values of monetary
growth reaching a lag of five.

4. Germany
\[ \Delta \dot{p} = -.39 + .16 \Delta \dot{M} + .09 \Delta F \dot{-1} \]
\[ (-1.13) (3.09) (3.71) \]
\[ + .21 E(P) + .13 \dot{\pi} \]
\[ (4.11) (2.11) \]
\[ R^2 = .78, \text{DW} = 1.48 \]

Note: This regression is based on annual data covering the
period 1958–74.
\[ \Delta \dot{y} = -.36 + .48 \Delta \dot{M} + .00 \Delta F + .65 \Delta E(P) \]
\[ (-.59) (2.40) (0.03) (4.52) \]
\[ R^2 = .51, \text{DW} = 1.91 \]

Note: This regression is based on annual data covering the
period 1956–74.

4. France
\[ \dot{p} = .20 \dot{M} + .06 F + .17 E(P) + .10 E(Q) \]
\[ (8.88) (1.12) (4.44) (3.69) \]
\[ R^2 = .35, \text{DW} = 1.2 \]

Note: Sample period 1960–IV 1973; quarterly data.

There seems to be no problem about the intercept for the United States. The intercept is
small relative to the mean value of the dependent variable and the associated significance
level is quite high. The monetary and the external price impulse dominate the fiscal
impulse. A remarkable improvement of the fit is achieved by including an implicit capacity
effect in the form of a lagged value of the relative change in output. The capacity effect occurs
with the expected sign but with low significance.
The German regressions consider the relation
between accelerations, i.e., second time differences. Fiscal acceleration, monetary
acceleration and acceleration of external prices all appear to have substantial significance. The
regression pattern supports the results of the Vp tests. The German data also suggest that
the monetary impulse is subject to the longest lag.
We note furthermore the significant occurrence of the capacity effect on the rate of inflation.
The intercept is quite low and insignificant in the German case.
The "French regression" exhibits the same long monetary lag already noted in the German
case. All impulses with the exception of the fiscal impulse appear with highly significant
coefficients. But the fit of the regression is comparatively poor (i.e., \( R^2 = .35 \)), and the
\(DW\) statistic poses a question bearing on the interpretation of the positive serial correlation
of residuals.

We consider, lastly, the Italian results. The
first two regressions exemplify some versions
of a quantity theory with nonconstant velocity expressed via the interest change effect \(i\). The
second regression is obtained by replacing \(i\) with \(r + \pi\) (real rate + anticipated rate of inflation).
It is further assumed under the circumstances that \(r\) is constant and \(\pi = \dot{p}_{t-1}\).
It is interesting to note in the second regression
that the coefficients for $\dot{M}$ and $\dot{y}$ are essentially equal in magnitude with opposite signs. We also note an adequate value of the $DW$ statistic and a low and nonsignificant intercept. The circumstance is particularly interesting in comparison with the next two regressions representing a "wage-push" mechanism. A regression of the inflation rate on wage changes corrected for productivity changes and import price changes shows very little systematic relation when the regression is forced through the origin. The fit is spectacularly improved when the intercept is estimated freely. But the intercept explains more than 60 percent of the dependent variable's sample mean under the circumstances. The "quantity theory" exhibits on the other hand an essentially vanishing intercept. The "wage-push" formulation clearly obtains no support in comparison with a monetary explanation. The last regression for Italian inflation uses an extended lag pattern for the monetary impulse. This impulse is significantly supplemented with the operation of an external price impulse and the anticipated rate of inflation based on an adaptive process. The fit and the intercept are clearly supportive, but the astonishingly low (compared to the quantity theory regressions) $DW$ statistic poses some questions for future examination. The regressions executed for output yield some complementary results. All three countries examined produce strong patterns with respect to the monetary impulse and the external quantity impulse. It is noteworthy in this respect that in the case of the Netherlands monetary acceleration (i.e., "unanticipated" monetary movements) operate with substantially larger significance on output changes than monetary growth. The acceleration effect of the real variable $EI(Q)$ vanishes in comparison to the direct effect of $EI(Q)$. The external price effect and the fiscal impulse are not significant either directly or as accelerations.

The German data exhibit similar results. The monetary impulse and the external quantity impulse $EI(Q)$ dominate the regression. The fiscal impulse vanishes in significance with respect to output (in contrast to inflation). The reader should note, when judging the coefficient of determination, that the regressions involve accelerations of the underlying variables. The $DW$ statistic is also adequate and the intercept is small and not significantly different from zero.

The U.S. regressions use acceleration of the impulses and output. A somewhat different pattern emerges in this case, however. The coefficient of determination is high for the kind of variables used, the $DW$ statistic adequate, and the intercept of the first regression (on impulse variables only) small and not significant. But the fiscal impulse dominates the external quantity impulse and joins the monetary impulse as a significant force operating on output. The other regressions for U.S. output insert additional capacity effects. This insertion substantially modifies the position of the intercept and lowers the coefficient and significance of the fiscal impulse. The smallest change is in the response to monetary acceleration.

### III. Conclusion

The results obtained to date from the group's empirical investigation yield a strong case for the operation of financial impulses, and particularly for the operation of monetary impulses. There is also some evidence, occasionally strong, of the operation of external impulses on inflation and output changes (or accelerations).

The sustained and accelerating inflation emerging since the middle 1960's evidently results from gradual shifts in budgetary and monetary policies of Western countries. The reason for this development lies beyond the scope of this limited report. An exploration of the causes at work moves us into an analysis of "political and sociological facts" which offer a fruitful and exciting area for extension of economic analysis.