Preliminary, comments welcome

INFLATION AND FINANCIAL SECTOR SIZE*

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ABSTRACT

Traditionally the cost of expected inflation has been seen as the "shoeleather cost" of going to the bank more often. This paper focuses on the other side of these transactions--i.e., on the increased production of financial services by financial firms. I construct a model in which households must make purchases either with cash or with costly transactions services produced by firms in the financial services sector. One can think of these services as being the use of a credit card or other method of paying without cash. In the model, a higher inflation rate leads households to substitute purchased transactions services for money balances. As a result, the financial services sector gets larger. A test of the model using cross-sectional data finds that the size of a nation's financial sector is strongly affected by its inflation rate. The empirical results provide an alternative way to measure the costs of inflation. These costs appear to be large.

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Introduction

Traditionally, the cost of expected inflation has been viewed primarily as the "shoeleather cost" of going to the bank more often, as in the familiar Baumol-Tobin parable (Baumol, 1952; Tobin, 1956). In this view, households reduce their average holdings of cash by making smaller withdrawals with greater frequency, and the cost of the inflation is the utility loss associated with trips to the bank, waiting in line, etc. This paper focuses on the banks' side of these transactions: in order to satisfy the increased customer activity, banks may need to hire additional tellers, build more and larger branches, or make other costly investments in automation or technology. Thus, the cost of inflation can be viewed, at least in part, as the result of resources transferred to the financial sector to accommodate the increased number of transactions chosen by households as they attempt to shift the cost of holding currency onto others. These resources are a social loss because if inflation were lower, the resources could be used directly to increase production of consumer goods.

This focus on the effects of inflation on the size of the financial sector is not new. Bresciani-Turroni, in his history of the German hyperinflation, notes that inflation caused a "hypertrophy of the banking system" in late 1922 and 1923 (Bresciani-Turroni, 1937, p. 215). For example he reports that more than 400 new banks were established in 1923, the peak year of the hyperinflation. This was more than four times the number established in 1922, and six times the number established in 1920 and 1921. At the same time, existing banks were extending their branch networks and greatly increasing their employment. There were 30,489 employees at the "D" banks (Deutsche

Bank, Diskonto-Gesellschaft, Darmstadter Bank, and Dresdner Bank) in 1920. By 1922 there were more than 45,000 employees, and by the fall of 1923, when the inflation was at its peak, almost 60,000. Bresciani-Turroni notes that the increase in banking activity reflected a higher volume of financial transactions rather than an increase in real activity. Indeed, the number of current accounts at the three largest "D" banks rose from less than 1.5 million at the end of 1920 to an estimated 2.5 million at the end of 1923.

The rapid expansion in the banking sector generated by the German hyperinflation reversed sharply following stabilization. The number of new banks established fell by more than 80 percent in 1924, to just 74. The number of employees at the four "D" banks declined by nearly a half by the end of 1924, and the number of current accounts at the three largest "D" banks fell by three-quarters over the same period. A similar pattern of decline in the size of the financial sector following stabilization was noted by Weber (1986) in his study of the ends of hyperinflations in Eastern Europe in the 1920s. He cites one estimate that 4,000 of 12,000 bank officials in Budapest became unemployed following the stabilization in Hungary, and he estimates that 10,000 bank employees lost their jobs following the Austrian stabilization.

In order to address this issue, I construct a model in which households can make purchases with cash or with purchased transactions services. A number of recent papers (e.g. Cole and Stockman, 1992; Schreft, 1992; Gillman, 1993; Dotsey and Ireland, 1993) present models in which households can transact without money at some cost in terms of labor. While these models allow for alternative methods of transacting, the focus on labor costs seems to capture primarily the cost of household "home production" of financial services. In

contrast, the approach taken here is to allow agents to make purchases with "transactions services" supplied by banks or other financial firms as in Fischer (1983), Prescott (1987), and Aiyagari et al. (1995). In the model, households are constrained to make purchases either with cash or with purchased transactions services.[1] One can think of these services as interest-bearing checking accounts, money market mutual funds, overdraft services, or credit cards. An increase in the inflation rate induces households to substitute transactions services for real balances. As a result, increases in the inflation rate increase the size of the financial sector.

I test this implication of the model using cross-sectional data on financial sector size and inflation rates. The results suggest that the effect of inflation on the size of the financial sector is significant both economically and statistically. The empirical model indicates that the effect of a 10 percent inflation in the United States would be to increase the share of GDP produced in the financial sector by almost 1-1/2 percentage points. This estimate of the cost of inflation is larger than those found in earlier studies, such as those of Fischer (1981) and Lucas (1981), although it is similar to that found in a recent study by Lucas (1994).

I. The Model

The economy contains a continuum of identical agents, indexed by $i \in [0,1]$, each with infinite horizons. Each period they supply a

1. One could also require <u>firms</u> to transact with cash or transactions services. This issue is discussed below. In practice, firms' purchases of cash management services are likely very important.

unit of labor inelastically and receive a wage, w.[2] They hold two assets: capital and money. Each period the capital is rented to firms at a rental rate r. Agents must purchase their consumption for the period using their start-of-period money balances or by purchasing transactions services. One could motivate this constraint by assuming that households include two individual agents, one of which works while the other shops (see, for example, Lucas and Stokey, 1987). At the end of the period, households receive their wage and a cash transfer from the government, and they pay for the purchases made with transactions services as well as for the services themselves. Then they choose their money and capital holdings for the start of the next period, and the period ends.

The economy has three types of firms. Firms in the consumption goods sector produce one of a continuum of consumption goods. The market for each of the goods is competitive. Firms in the capital goods sector produce capital. Firms in the transactions services sector produce transactions services. As discussed below, capital and transactions services can be purchased without cash or transactions services. Firms in all three sectors are competitive, and production in each sector requires both capital and labor.

A. The Transactions Technology

There is a continuum of goods in the economy indexed by j, $j \in [0,1]$. Each good is assumed to be purchased with a separate transaction. Agents can pay cash, or incur a fixed cost, q, to make the purchase without cash. Because the cost of making a purchase

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2. If labor supply were not inelastic, then inflation would affect labor supply. Since my focus here is on the effects of inflation on the size of the financial sector, I do not take account of this possible effect. See Aiyagari et al. (1995) for a related model that includes an effect of inflation on labor supply.

without money is independent of the size of the transaction, agents will make small transactions with cash and large ones with transactions services. This approach is similar to that taken by Whitesell (1989, 1992) in studies of the optimal use of alternatives to cash purchases, although Whitesell (1992) allows for more than one alternative to cash and both a fixed and a proportional cost of transacting without cash.

Other recent models take a variety of approaches to get a margin along which agents adjust to reduce cash transactions in the face of higher inflation. In Gillman (1993) and Aiyagari et al. (1995) the cost of making a purchase without cash is assumed to be proportional to the size of the transaction, and the size of the cost differs exogenously across goods. In Schreft (1992) and Dotsey and Ireland (1993), the cost is assumed to be larger for goods purchased farther from the agent's location on a unit circle.

The cost structure assumed here has the intuitively appealing implication that cash transactions tend to be smaller than check or credit purchases. Evidence on actual household transactions can be obtained from the preliminary results of the 1995 Survey of Consumer Transactions Accounts Usage, commissioned by the Board of Governors of the Federal Reserve System and conducted by the University of Michigan Survey Research Center. This survey, conducted in May 1995, showed that the mean size of household check transactions was $80, the mean size of credit card purchases was $54, and the mean size of debit card transactions was $24. By contrast, the mean cash purchase was $11. The pattern of transactions sizes is similar to the one prevailing in the mid-1980s, as reported by Whitesell (1992). The 1995 survey showed that on average households used checks to make 15 purchases a month, credit cards to make 4 purchases, debit cards to make 1

purchase, and cash to make 29 purchases. Thus, cash was used for nearly 60 percent of purchases, but those purchases accounted for less than 20 percent of the dollar volume of expenditures.

The nature of the cost of transacting without cash differs across the papers in this area. Gillman (1993), Dotsey and Ireland (1993), and Schreft (1992) all assume that the cost is a labor cost--perhaps focusing on the purchaser's nuisance costs of writing a check, keeping records, waiting while the store verifies the check, etc. By contrast, this paper, like Prescott (1987) and Aiyagari et al. (1995), focuses on the production of transactions services by financial firms. The model in Fischer (1983) allows for both household production of transactions services and purchases of transactions services from banks, with their marginal costs equalized in equilibrium. Whitesell (1989) suggests a number of types of costs, including nuisance costs, seller charges, and bank charges, but his model does not focus on the production of transactions services or their welfare implications. It would be straightforward to add to the model an additional nuisance cost of using transactions services. Doing so would clearly raise the welfare cost of inflation, but would not greatly change the results of the model.[3]

In the model presented here agents pay a fixed cost for transaction services. In practice, of course, the purchaser generally does not actually pay the fixed cost of the transaction. While some banks do have per-check fees on some accounts, and some sellers have different prices for cash and credit purchases, these direct payments

3. The nuisance costs could even be negative, especially for large transactions, owing to the possibility that large amounts of cash could be lost or stolen.

are the exception.[4] More commonly, the costs of transacting without cash are implicit--fees and lower interest rates paid on checkable accounts, for example. In addition, decisions made by retailers, who absorb a part of the transactions cost, likely generate effects much like those of a fixed cost. For example, some stores have a minimum size for credit card purchases. Alternatively, stores selling products that generally yield small transaction sizes (e.g., newsstands or coffee shops) are presumably less likely to accept checks or credit cards because the associated costs would require too large a percentage increase in prices.

The assumption that the cost of transacting without cash is independent of transaction size may not be strictly true for very large transactions, but it seems more reasonable than the assumption that the cost is proportional to the transaction size. The cost of clearing a personal check through the payments system, for example, is likely the same virtually regardless of the amount of the purchase. For example, the Federal Reserve System's functional cost analysis reports a fixed estimated cost for individual check transactions regardless of size (Federal Reserve System, 1995). The same should be true for credit card transactions. For retailers, the costs of verifying checks and credit card accounts as well as the subsequent paperwork should not depend on the size of the transaction (although retailers may be more likely to verify large transactions). As for purchasers, the nuisance costs of writing the check or waiting for the clerk to handle the transaction are likely very similar for widely different transaction sizes.

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4. Of course, a higher credit price would amount to a proportional, rather than a fixed, cost of transacting without cash (see Aiyagari et al., 1995, p. 9).

I assume that capital goods can be purchased without cash at no cost.[5] Not doing so would generate an investment distortion as in Stockman (1981). Aiyagari et al. (1995) assume that households augment their capital holdings by purchasing equal amounts of each consumption good. As a result, capital is purchased in part with cash and in part with transactions services. Purchases of capital are likely very large, however, compared to the average household purchase. For example, the average size of a check purchase, including purchases by businesses, is about $1150, while the average size for households, as noted above, is only $80 (Humphrey, et al., 1995). Thus the assumption in Aiyagari et al. may greatly overestimate the cash portion of capital purchases. One could model purchases of capital in a manner similar to that used for consumption goods here--allowing the size distribution of capital goods purchases to differ from that for consumption goods. Implicitly, I am assuming that capital goods purchases are so large that they can be made without cash at negligible cost.

B. The Household's Problem

The representative household gets utility in a given period based on consumption of the various consumption goods:

$$u = \int_0^1 \frac{\phi(j) c_j^{1-\gamma}}{1-\gamma} dj$$

where c_j is the consumption of good j, γ is the inverse of the intertemporal elasticity of substitution, and $\phi(j)$ is a weighting function. I assume that $\phi(j)$ is increasing in j, and that $\phi(1)$ is

5. I also assume that firms do not need to pay cash in advance for labor and capital services.

equal to 1.[6] I will also assume that ϕ is continuous and strictly increasing in j.

Given my assumptions about $\phi(j)$, and the fact that all goods have the same price in equilibrium, households will choose a cutoff value of j, j^*, and purchase goods 0 through j^* (i.e., those goods it consumes relatively little of) with cash. The remaining goods are purchased with transactions services, hence the household purchases $(1-j^*)$ units of transactions services.

Thus the household's maximization problem is:

$$(1) \qquad V(k,M) = \max_{c_j,k',M',j^*} \int_0^{j^*} \frac{\phi(j)c_j^{1-\gamma}}{1-\gamma}dj + \int_{j^*}^{1} \frac{\phi(j)c_j^{1-\gamma}}{1-\gamma}dj + \beta V(k',M')$$

Subject to a budget constraint:

$$(2) \qquad w + rk + k + \frac{M}{P} + \frac{X}{P} = k' + \frac{M'}{P} + \int_0^{j^*} c_j dj + \int_{j^*}^{1} c_j dj + q\tau$$

and two transactions constraints:

$$(3) \qquad \frac{M}{P} \geq \int_0^{j^*} c_j dj$$

$$(4) \qquad \tau = 1-j^*$$

where w is the wage, r is the rental rate for capital, k is this period's capital stock, M is nominal money holdings, X is a cash transfer from the government, P is the price of all of the consumption goods and capital, q is the relative price of transactions services, τ is the quantity of financial services bought, and a prime denotes the values of variables next period. The transactions services

6. The latter assumption is not simply a normalization. It has the plausible implication that consumption of good 1 is finite, but this means that sufficiently low positive nominal interest rates will eliminate the inefficient use of transactions services. See the discussion on this point at the end of Section II.

constraints require that a good either be purchased with cash, or with a transactions service costing q, as discussed above.

Assuming that that equation 3 holds with equality, the first-order-conditions for an interior solution to this problem are the three constraints and:

c_j: $\quad \phi(j)c_j^{-\gamma} = \lambda \qquad$ for $j > j^*$

$\quad \phi(j)c_j^{-\gamma} = \lambda + \mu$ for $j \leq j^*$

k': $\quad \beta(1+r')\lambda' = \lambda$

M': $\quad \beta(\lambda'+\mu')/P' = \lambda/P$

j^*: $\quad \left\{\frac{\phi(j^*)c_{j^*-}^{1-\gamma}}{1-\gamma} + \frac{\phi(j^*)c_{j^*+}^{1-\gamma}}{1-\gamma}\right\} = \lambda(c_{j^*-}^* - c_{j^*+}^* - q) + \mu c_{j^*-}^*$

where λ and μ are the multipliers on (2) and (3) respectively, $c_{j^*-}^*$ and $c_{j^*+}^*$ are the levels of consumption of good j* approaching from above and from below, and I have substituted out for the multiplier on (4).[7] The condition for j^* shows that the budget constraint and the transactions constraint are related. Using the conditions for k' and M', one can show that:

$$\mu' = \lambda' i'$$

where i is the nominal interest rate:

$$1+i' = (1+r')(1+\pi')$$

and π is the inflation rate:

$$1+\pi' = P'/P$$

Substitution into the conditions for consumption yields the intratemporal relationship between levels of consumption of each good:

(5a) $$c_j = \left\{\frac{1}{1+i}\right\}^{1/\gamma} \psi(j)c_1 \quad \text{for } j \leq j^*$$

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7. Note that it does not matter whether the household consumes $c_{j^*-}^*$ of good j^*, paying with cash, or $c_{j^*+}^*$ of good j^* paying with transactions services. I have arbitrarily assumed that good j^* is purchased with cash.

and

(5b) $$c_j = \psi(j)c_1 \quad \text{for } j > j^*$$

where

$$\psi(j) \equiv \phi(j)^{1/\gamma}$$

So the profile of consumption across goods looks like the that shown in Figure 1. Note that equations 5a and 5b imply that:

$$c_{j+}^* = (1+i)^{1/\gamma} c_{j-}^*$$

Eliminating c_{j-}^* and μ from the the condition for j^* yields,

(5) $$q = c_{j+}^* \left\{ \frac{\gamma}{\gamma-1} \right\} \left\{ (1+i)^{\frac{\gamma-1}{\gamma}} - 1 \right\}$$

To interpret this equation, note that the product of the terms in brackets on the right hand side is less than i (for small values of i it is approximately equal to i). The cost of purchasing an amount q/i of a consumption good using cash exactly equals the cost of purchasing it with a transactions service. Thus c_{j+}^* is just larger than this level. Similarly, one can show that c_{j-}^* is just below this level. Thus j^* is, roughly speaking, the index of the good that is consumed at a level equalizing the two types of transactions costs. For goods with $j>j^*$ it is cheaper to use transactions services, while for goods with $j<j^*$ it is cheaper to use cash.

The growth rate of consumption of good 1 can be derived from the condition for k':[8]

(7) $$c_1^{-\gamma} = \beta(1+r')c_1'^{-\gamma}$$

Equations (2)-(7) determine the optimal time paths for k, M, c_1, c_j $(j\neq1)$, j^*, and τ, given time paths for r, w, q, π, and X/P plus initial holdings of real money balances and capital.

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8. Note that the assumption of an interior solution for j^* implies that good one is purchased with transactions services. If this were not the case, then the economy would look like a simple cash-in-advance model.

C. The Firms' Problems

The firms in each sector maximize profits given the levels of wages and prices. All consumption-goods producers have identical production functions, $\theta F(k_j, l_j)$, as do capital-goods producers.

The first order conditions for producers of consumption goods are:

(8) $r = \theta f'(\kappa_j)$ for all j

(9) $w = \theta f(\kappa_j) - r\kappa_j$ for all j

where

$$\kappa_j = k_j/l_j \quad \text{for all } j$$

is the capital-labor ratio chosen by the firm. The first order conditions for capital-producing firms are the same:

(8') $r = \theta f'(\kappa_k)$

(9') $w = \theta f(\kappa_k) - r\kappa_k$

where

$$\kappa_k = k_k/l_k$$

Since consumption and capital producers have the same production functions and face identical factor prices, their prices will be the same, as was assumed above.

Firms producing transactions services have a production function $\theta(1/\xi)F(k_\tau, l_\tau)$, for some fixed ξ. Note that the production function differs from that of the goods producing sectors only by a constant. As a result, shifts in the size of the transaction-services sector have no effect on the relative returns to capital and labor. This is a convenient simplification. In addition, production of transactions services is assumed not to require the use of money. There is little effect on the results of the model if transaction services production does require money--as in Fischer (1983)--so long as the share of money in production is small. One measure of that

share would be the interest lost on bank holdings of (interest free) reserves as a fraction of GDP in the banking sector. Since total bank reserves (including vault cash) are only about $60 billion and short-term nominal interest rates are currently under 5-1/2 percent, the foregone interest amounts to roughly $3-1/2 billion a year, or less than two percent of banking sector GDP.

Given the assumed production function, the first order conditions for a transactions sector firm are:

(8") $r = q\theta(1/\xi)f'(\kappa_\tau)$

(9") $w = q\theta(1/\xi)f(\kappa_\tau) - r\kappa_\tau$

where

$$\kappa_\tau = k_\tau/l_\tau$$

Notice that (8)-(9") imply that:

(10) $q = \xi$

(11) $\kappa_\tau = \kappa_k = \kappa_j \equiv \kappa$ for all j

D. Government Policy

The government has a simple policy of increasing the money supply by a constant fraction, σ, each period. Hence:

(12) $X = \sigma M$

As noted above, these increases in the money supply are achieved via lump-sum cash transfers.

E. Equilibrium

An equilibrium for this economy consists of sequences for prices (r, w, q, and P) and quantities (c_j, τ, l_j, l_k, l_τ, k_j, k_k, k_τ, and M) such that: the households' first order conditions are satisfied, firms' first order conditions are satisfied, and the

markets for each of the consumption goods, money, transactions services, capital, and labor clear.

Market clearing in the consumption goods markets is:

(13) $c_j = \theta 1_j f(\kappa)$ for all j

Market clearing in the transactions sector is given by:

(14) $1-j^* = \theta(1/\xi)1_\tau f(\kappa)$

Market clearing in the money market is:

(15) $M' = (1+\sigma)M$

Market clearing in the rental market for capital is:

(16) $\int_0^1 k_j dj + k_k + k_\tau = k$

and market clearing in the purchase market for capital is:

(17) $k' - k = \theta 1_k f(\kappa)$

Market clearing in the labor market is:

(18) $\int_0^1 1_j dj + 1_k + 1_\tau = 1$

Because of Walras' law, one of the market clearing conditions will be redundant.

F. Steady-state Conditions

In the steady state equations (2)-(7), (8)-(12), and (13)-(18) will hold with constant values of c_j, j^*, τ, κ, M/P, 1_k, 1_τ, 1_j, k_k, k_τ, k_j, r, w, π, and q. Let these constant values be indicated by bars, $\bar{c}_j$, etc.

Market clearing in the money market, equation 15, implies that:

(19) $\bar{\pi} = \sigma$

The first-order condition for consumption of good 1, equation 7, implies that in steady state the marginal product of capital must equal the rate of time preference:

$$\theta f'(\bar{\kappa}) = \delta \tag{20}$$

where

$$\beta = \frac{1}{1+\delta}$$

and

$$\bar{\kappa} = \bar{k}/1$$

Equation (20) yields the steady-state capital stock. Note that it is not affected by the level of inflation. The economy is not super-neutral, however, because a change in σ will affect $\bar{c}_j$, $\bar{j}^*$, and $\bar{m}$.

Substitution into the household's budget constraint, equation 2, yields the feasibility condition:

$$\theta f(\bar{\kappa}) = \int_0^1 \bar{c}_j dj + \xi(1-\bar{j}^*) \tag{21}$$

which shows that total output must be equal to total consumption of the various consumption goods plus purchases of financial services.

In steady state, the relative consumptions of the various goods can be obtained from equations 5a and 5b:

$$\bar{c}_j = \left\{\frac{1}{(1+\delta)(1+\sigma)}\right\}^{1/\gamma} \psi(j)\bar{c}_1 \quad \text{for } j \leq j^* \tag{22a}$$

and

$$\bar{c}_j = \psi(j)\bar{c}_1 \quad \text{for } j > j^* \tag{22b}$$

The steady state condition for j^* is given by:

$$\bar{c}_{j^*}\left\{\frac{\gamma}{\gamma-1}\right\}\left\{((1+\delta)(1+\sigma))^{\frac{\gamma-1}{\gamma}}-1\right\} = \xi \tag{23}$$

The steady-state levels of $\bar{c}_1$ and $\bar{j}^*$ are jointly determined by (21) and (23), after substituting for the c_j's using (22a) and (22b). Then the steady-state levels of the c_j's can be obtained from (22a) and (22b).

Finally, the level of the steady-state real money stock is given by:

$$(24) \qquad \bar{m} = \int_0^{\bar{j}^*} \bar{c}_j dj$$

II. Graphical Analysis

Using equations (22a) and (22b), one can rewrite (21) and (23) as:

$$(21') \qquad \theta f(\bar{\kappa}) = \bar{c}_1 \left[\left\{ \frac{1}{(1+\delta)(1+\sigma)} \right\}^{1/\gamma} \int_0^{\bar{j}^*} \psi(j)dj + \int_{\bar{j}^*}^1 \psi(j)dj \right] + \xi(1-\bar{j}^*)$$

$$(23') \qquad \left\{ \frac{\gamma}{\gamma-1} \right\} \left\{ [(1+\delta)(1+\sigma)]^{\frac{\gamma-1}{\gamma}} - 1 \right\} \bar{c}_1 \psi(\bar{j}^*) = \xi$$

Equation (21') defines a locus in c_1-j^* space that is feasible given $\bar{\kappa}$ and ξ. This locus is upward-sloping because an increase in j^* reduces the production of transactions services and so allows an increase in c_1. I call this locus BB; it is shown in Figure 2. Equation (23') also defines a locus in c_1-j^* space along which the marginal cost of purchasing the j^{*th} good with cash is balanced against the cost of an additional financial service, for each value of c_1. This locus is downward sloping because an increase in c_1 raises the amount of each good purchased and so raises the cost of purchasing each good--including the j^{*th} good--with cash. Thus the marginal condition is satisfied at a lower j^*. This locus is also shown in Figure 2, and it is labeled FF. The intersection of these two loci provides the steady-state values of c_1 and j^*.

It is useful to define a third locus. Equation (24) can be rewritten as:

$$(24') \qquad \bar{m} = c_1 \left\{ \frac{1}{(1+\delta)(1+\sigma)} \right\}^{1/\gamma} \int_0^{\bar{j}^*} \psi(j)dj$$

Equation (24') defines a locus along which the steady-state level of real money balances are constant. This locus is downward sloping since an increase in c_1 would raise money holdings unless fewer goods were purchased with cash. In general, this line can be either steeper or flatter than than FF; it is labeled MM in Figure 2. Steady-state real money balances are higher above and to the right of MM.

This figure can be used to explore the effect on the steady state of this economy of changes in the technology and government policy parameters.

A. The Effect of an increase in θ

An increase in productivity in all industries, θ, raises output, thereby shifting the BB line up. It has no effect on the other curves. As a result, c_1 rises and j^* falls (see Figure 3). Not surprisingly, increased productivity raises consumption. It also increases the use of financial services because more goods are consumed in large enough quantities to make purchasing them with financial services preferable to paying the inflation tax. Note that if the MM locus is steeper than the FF locus, then real money balances decline. In fact, as long as $\phi(0)$ is strictly positive, a large enough increase in θ will make this economy cashless, since consumption of good 0 will eventually be sufficiently high than it will be optimal to purchase it with transactions services. Nonetheless, if $\Psi(j)$ is steep at j^*, then there would be little substitution of transactions services for cash transactions owing to a rise in θ, and the steady-state level of real balances would rise since the increased consumption of goods purchased with cash would outweigh the small reduction in the number of goods purchased with cash.

B. The Effect of a Decrease in ξ

An improvement in the transactions technology (which is a decline in ξ) shifts the BB line up since for a fixed j^*, fewer resources need to be employed in the financial services sector. The fall in ξ also shifts the FF line to the left because at the margin it is now cheaper to transact with financial services, thereby reducing j^* for each c_1. Thus the decrease in ξ causes a fall in j^*--i.e. a larger financial sector--and could cause a rise or fall in c_1 (see Figure 4). The change in ξ has no effect on the MM line, and so the steady state money stock likely falls.

If the shift in the FF locus is large enough, then the improvement in the transactions technology could reduce welfare. This result is not as surprising as it may seem. If ξ is very large, then no financial services are used. In this case, the economy is super-neutral, and the steady-state outcome is first best.[9] It is also the same steady-state outcome that would occur with ξ equal to zero--i.e., free financial services and no money holding. For ξ between the two extremes, the dead-weight cost of using the transactions services sector reduces welfare, and the effect on welfare of a change in ξ is ambiguous.

Indeed, the government in this model could raise welfare by eliminating the financial sector through regulation. Of course attempting to do so in a real economy would lead to the substitution of home-produced financial services or a foreign currency for financial services produced by the domestic financial services sector, with a likely loss in efficiency.

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9. This outcome would not be first best if inflation affected the labor supply and savings decisions. See Gillman (1993) and Aiyagri et al. (1995) for discussions.

C. The Effect of an Increase in σ

An increase in σ raises inflation and the nominal interest rate. The increase in the nominal interest rate raises the BB line because it cuts consumption on cash goods for a fixed c_1. An increase in the nominal interest rate shifts the FF line to the left because, with the higher inflation, transacting with cash is more costly, inducing households to purchase more financial services. As a result, an increase in σ reduces j^* (see Figure 5). It also reduces total consumption expenditure because output is divided between the production of consumption goods and transactions services and the latter rises. It could increase or decrease c_1 because with the higher inflation rate consumption will shift toward the goods purchased with transactions services. The increase in the nominal interest rate causes the consumption of cash goods to fall. The lower consumption of cash goods, coupled with the reduction in the number of goods purchased with money, causes a decline in the steady-state money stock.

The cost of higher inflation has two components in this model. The first, familiar from Lucas and Stokey (1987), is the distortion in the distribution of consumption across goods purchased with cash and those purchased with credit (see Figure 6). In this model, however, which goods fall into each category is endogenous. The cost of this distortion is likely small for low rates of inflation since the lower consumption of goods purchased with cash is partially compensated by increased consumption of goods purchased with transactions services. The second cost is the waste of resources resulting from the use of transactions services rather than money. This loss could be large because the resources shifted to the production of transactions services are completely lost.

The optimal monetary policy in this economy is clearly to set σ sufficiently low that all purchases are made with cash. If $\psi(j)$ is bounded, as assumed above, this policy will not correspond to a zero nominal interest rate, as in the Friedman rule. So long as the nominal interest rate is low enough that it is cheaper to buy good 1 with cash than with purchased transactions services, there will be no cost to the inflation. If one allowed $\psi(j)$ to go to infinity as j goes to 1, then the usual Friedman rule would obtain.[10]

III. Empirical Evidence

In the Introduction, I noted the evidence from the 1920s on the effect of hyperinflation on the size of the financial sector. A similar effect has been noted in the cases of Brazil and Israel in the 1980s. Dornbusch et al. (1990, p. 25) note that in Brazil "financial markets substantially adapted [to high inflation]. As a result, the velocity of M_1 rose more than in other countries, while that of M_4 increased less. The sharp rise in the velocity of M_1 reflects a well organized payment system by check (even for a lunch snack) drawn on overnight accounts." Presumably this "well-organized" payment system required increased capital and labor in the financial sector.

Marom (1988), presents an empirical study of the effects of inflation on the size of the banking sector in Israel in the early 1980s. He notes that while the share of banking in Israeli GDP in 1970 was smaller than in any of the six OECD countries for which

10. The Friedman rule would also obtain, regardless of the boundedness of ψ, if inflation affected the labor or savings decisions. Aiyagari et al. (1995) and Cooley and Hansen (1991) argue that these distortions could be important.

comparable data are available, it was larger than in all of the six OECD countries by 1982. Over the period 1970-82 inflation in Israel averaged 33.9 percent, more than three times the highest average rate among the OECD countries. Marom estimates a time series econometric model to assess the effect of inflation on the size of the Israeli banking sector. The effects are statistically significant and indicate that high inflation (defined by Marom as inflation over 10 percent per year) nearly doubled the share of banking in GDP in the early 1980s. Similar equations estimated using banking's share in total employment and total wages show smaller but statistically significant effects.

Work by Kleiman (1989) provides information on the effect of the 1984 stabilization program on employment in the banking sector. After expanding further in 1983, employment declined through 1987, by which time it had returned to its 1979 level. As noted by Kleiman, however, the immediate cause of the decline was a banking crisis that occurred in late 1983. The government intervened to provide assistance, but the banks were required to cut costs. Nonetheless, the pattern of banking sector expansion and contraction is broadly consistent with the model.

Aiyagari et al. (1995) present time series data on the size of the banking sector in Brazil, Israel, and Argentina, noting that high inflation has been reflected in the size of the financial sector in all three countries. The Argentine data, however, is somewhat problematical: The banking sector's share in employment peaked around 1980 and then declined, while the inflation rate spiked sharply in the mid-1980s, and then even more forcefully later in the decade. The decline in the relative size of the financial sector in the early 1980s likely reflected the effects of a financial crisis at that time,

which followed a period of financial liberalization in the late 1970s (Balino, 1991). As a result, when inflation picked up in the mid- and late-1980s Argentineans appear to have reacted, at least in part, by shifting to U.S. dollars rather than making greater use of domestic financial firms (Dornbusch et al., 1990, p. 25).[11] Currency substitution of this sort is, of course, another form of costly adjustment to high inflation--albeit one of a sort not contemplated in the model.

A. A Cross-Country Comparison

As an alternative test of the model, similar to Marom's (1988) comparison of Israel to six OECD countries, I consider a cross-country comparison of inflation rates and financial sector size. The model presented above suggests that the share of output devoted to the financial sector should be a function of the level of inflation, output per capita, and relative productivity in the financial sector. While higher inflation should cause the financial sector to expand, the effects of the other two variables are not clear on theoretical grounds. As noted in section II, above, higher productivity will raise consumption of all goods, causing an increase in the number of transactions that are made without cash. It is not clear, however, whether the proportional increase in the financial sector will be larger or smaller than that of GDP. Similarly, more transactions will be done with financial services if the financial

11. The resulting difference in the method of domestic payments is noted in a recent Economist survey of Latin American Finance (Dec. 9-15, 1995). Kamin and Ericsson (1993) present an empirical study of dollarization in Argentina. They conclude that holdings of U.S. dollar currency in Argentina were nearly as large as the total of dollar-denominated domestic deposits and all peso-denominated monetary assets by the early 1990s. They also note that the effect of inflation on the use of dollars appears to be long lived.

sector becomes more efficient, but the relative price of these services will fall. Thus, the net effect of the productivity increase on the financial sector's share is uncertain.

Because of the difficulty of obtaining comparable information on the relative size of the banking sector for a large number of countries. I focus on the broader sector including finance, insurance, and real estate. I use two measures of the size of the financial sector: its share in GDP and its share in employment (both in percent). These shares can be used to calculate the relative productivity of labor in the financial sector. Because data on capital inputs are not available, a more comprehensive measure of total factor productivity cannot be constructed. The GDP, employment, and labor productivity data are for 1985.[12] Wherever possible, I measure annual average percentage inflation using the GDP deflator. Where this is not available, the consumer price index has been substituted. Because the model presented above focused on steady states, I use the average annual inflation rate over the ten years from 1975 to 1985.[13] To account for differences in the level of income across countries, I use GNP per capita at world prices from the Penn World Table (Summers and Heston, 1991). For details on the data used, see the data appendix.

B. Empirical Results

The first column of table 1 shows the results of a regression of the share of the financial sector in GDP on per-capita real output, average inflation over the previous 10 years, and relative labor

12. In some cases the employment data were not available for 1985, and so data from 1984, 1986, or 1987 were substituted.

13. I experimented with the average inflation rate over 1980-85 and obtained similar results.

productivity in the financial sector. The results show that higher levels of per-capita income and average inflation are reflected in increased financial sector size. By contrast, there does not appear to be a significant effect of relative labor productivity on this measure of financial sector size. This result suggests that the two offsetting effects noted above cancel out. Dropping the productivity variable from the regression, as shown in the second column, does not greatly affect the other parameters.

The strong and statistically significant effect of real income per capita on the size of the financial sector should not come as a surprise. Kuznets (1971, p. 107) notes that "the share of banking, insurance and real estate shows a striking rise as we shift from low to higher income countries." The strong result found here suggests that either the effect of higher income on the share of goods purchased without cash is large, or the model fails to capture another effect of higher income that leads to increased use of the financial system. It is not hard to think of such effects. For example, if higher income households purchase a larger number of goods, as well as more of each good, higher incomes would lead to a larger number of transactions and likely to an increased need for financial services (as well as cash). Alternatively, if households do their own cash management, they may choose to do less of it as incomes rise, owing to the higher opportunity cost of household time. As a result, households would increase their purchases of transactions services produced by financial firms.

The effect of inflation on the size of the financial sector, as shown in columns 1 and 2, is economically as well as statistically significant. Given that countries with higher per-capita incomes generally have larger financial sectors, however, it seems likely that

the effect of inflation on financial sector size is larger in high income countries as well. To test this hypothesis I interact the inflation term with per capita income in the regression reported in column 3.[14] The use of the interaction term improves the fit of the regression fairly substantially, suggesting that the effect of inflation on the size of the financial sector is smaller for low-income than for high-income countries.

The results of an alternative test are shown in table 2. Here the countries are divided into three groups based on income per capita, and for each group a separate regression is run of financial sector size on income and average inflation.[15] The coefficient on the inflation rate is small and insignificant for the poorest countries, moderate and marginally significant for the middle-income countries, and large and significant for the high-income countries.

The theoretical model suggests that the effect of inflation on financial sector size should be nonlinear. In particular, if inflation gets sufficiently high, virtually all transactions are done without money. Further increases in inflation will then have no effect on the size of the financial sector. Experimentation with a number of nonlinear specifications, however, did not yield statistically significant nonlinearities.

The remaining columns in table 1 show regression results for the share of the financial sector in total employment. One difference between the GDP share and employment share results is the significance of the productivity variable in the employment regressions, especially

14. If the level of inflation is included as well as the interaction term, it is insignificant and does not affect the other parameters.

15. The income categories were defined, arbitrarily, as under $2000, between $2000 and $9000, and over $9000. The mean income level in the sample is about $4800. Modest changes in the cutoff levels of income do not affect the results appreciably so long as Israel (with a 1985 per capita income of $9293) remains in the high income group.

when it is interacted with the level of income (column 5). Given the insignificance of this variable in the GDP regression, the significance here may not be a surprise. Since countries with higher financial sector labor productivity do not generally have a larger share of GDP in the financial sector, they must have a smaller share of employment in the sector. The inflation interaction term is significant in the employment regressions, although the coefficient is less than 1/3 the size of the comparable term in the GDP regressions. The smaller parameter is not surprising because, on average, the share of the financial sector in employment is about 1/3 as large as its share in GDP, suggesting a similar proportional decline in the size of the parameter.

C. Caveats

There are two caveats to the empirical results shown above. First, it is possible that the relatively large effect of inflation on the GDP measure of financial sector size reflects inflation-induced measurement error. The measurement of output in the financial sector is difficult because output is often hard to quantify. (See Triplett, 1993, for a brief discussion of the difficulties in measuring banking sector output.) If, for example, high inflation led to an upward bias in the measurement of financial sector output, then the regression results would reflect, in part, the measurement problem rather than a real effect of inflation.

Such a bias should be apparent in the labor productivity measure used in the regressions, since the share of the financial sector in GDP would be boosted by the measurement error while the

share of the financial sector in employment would not be.[16] To test for this effect, I regress the productivity measure on per capita income, inflation, and inflation times per capita income. The results, shown in table 4, show no significant effect of either inflation variable on relative labor productivity in the financial sector. Table 5 shows the results of regressions like those in table 1 when the GDP measure of financial sector size is adjusted to remove the effects of inflation on relative financial sector productivity shown in table 4. These adjusted results differ very little from the baseline results in table 1.[17]

A second caveat is simply to point out the importance in the empirical results of a relatively small number of countries. Figure 7 shows a plot of the GDP measure of financial sector size versus inflation times per capita income. (A constant and per capita income have been partialed out of both variables.) The upward slope found in the regressions is clearly evident in the figure. It is also clear, however, that the result depends a great deal on a small number of countries with very high inflation rates. The five most inflationary countries in the sample--Israel, Argentina, Brazil, Bolivia, and Peru--comprise 5 of the 6 observations in the upper-right quadrant of

16. The relative labor productivity measure is:

$$\frac{\text{(Financial Sector GDP)/(Financial Sector Employment)}}{\text{(Total GDP)/(Total Employment)}}$$

which can be rewritten as:

$$\frac{\text{(Financial Sector GDP)/(Total GDP)}}{\text{(Financial Sector Employment)/(Total Employment)}}$$

which is the ratio of the financial sector share in GDP to the financial sector share in employment.

17. To do the adjustment, I started by adjusting the relative productivity variable by evaluating the two inflation terms in the regression and subtracting them from the relative productivity measure. Then I multiplied this adjusted productivity measure by the share of the financial sector in employment to get the adjusted measure of the financial sector in GDP.

the figure.[18] If they are excluded from the regressions, the inflation terms are no longer significant. However, excluding them is surely wrong, since high inflation countries are exactly the ones with the most information about the effects of inflation on financial sector size.

Nonetheless, it is unfortunate that the effect of inflation on financial sector size does not stand out in the lower inflation countries. Evidently, other factors contribute importantly to variation in the size of countries' financial sectors. In part, this variation likely reflects the effects of regulation and past financial sector difficulties. In addition, the regressions employ data on the production of financial services, while it is consumption of financial services that should be affected by inflation. Clearly, if a country purchases financial services from firms in a neighboring country, its financial sector will appear to be unexpectedly small, while that of its neighbor will appear to be large. The geographical pattern of the residuals suggests that this difference may be significant in some cases. For example, the residual for Belgium in the regression shown in column 3 of table 1 is -8.3 percent, the financial sector in Luxembourg is more than 9 percent larger than the equation would lead you to expect (because of its small population, Luxembourg was excluded from the regression). By contrast, the standard error of the regression is only 3.6 percent. Similarly, the residual for Ireland is -5.8 percent, while that for the United Kingdom is +3.6. In some cases there appear to be regional financial centers reflecting relative political or economic stability. In particular, Jordan and Kenya have unexpectedly large financial sectors (residuals of 6.2 and

18. The other one is Chile, which had the seventh highest inflation rate in the sample.

6.0 percent respectively), while some of their neighbors have unexpectedly small ones. Note that to the extent that low inflation allows a country to export financial services to its neighbors, low rather than high inflation would be associated with a large financial sector, biasing downward the estimated effect of inflation on the size of the financial sector.

D. Discussion

The regressions shown in table 1 suggest a larger cost of inflation than might have been expected. A 10 percent rise in the inflation rate in the U.S. (1985 real per-capita income, $16,779) would be expected to increase the share of the financial sector in GDP by about 1-1/2 percent, and its share in employment by about 1/2 percent. The 1-1/2 percent share of GDP is a measure of the resources lost owing to the inflation. Fischer (1981) and Lucas (1981) calculate that the welfare loss of a 10 percent inflation amounts to .3 to .45 percent of GNP, based on estimates of the area under a money demand curve. However, Lucas (1994) reports a welfare loss similar to that reported here, 1.3 percent, based on a different paramaterization of the money demand curve. It is straightforward to show that, in the model presented above, the area under the compensated money demand curve is approximately equal to the size of the financial sector.[19] Thus the results presented here do not differ conceptually from the measures employed by Fischer and Lucas.

To assess whether the large costs of inflation found here are credible, table 5 presents information on the two measures of financial sector size, inflation, and per-capita income for the five

19. The two are exactly equal if inflation is not allowed to distort the pattern of consumption across goods. For a proof of a similar result, see Aiyagari et al. (1995).

countries with the highest inflation rates over 1975-85. Also reported in the table are the average values of these variables for other countries with real per-capita incomes between 50 and 150 percent of each of the five countries. As shown in the table, both Brazil and Israel have financial sector shares in GDP more than 10 percentage points larger than other comparable countries. By the same measure, Argentina, Bolivia, and Peru have financial sectors that roughly 6, 3, and 1 percentage point larger than their peers. With the exception of Bolivia, there is a similar pattern to the employment shares of the financial sector, with financial sector employment 3 percentage points higher in Argentina, Brazil, and Israel, and 1 percentage point higher in Peru.

It is not surprising that the effects of inflation on financial sector size are largest for Brazil and Israel, and smaller in the other three countries. As noted above, a larger share of the adjustment to inflation in Argentina took the form of dollarization. The same appears to have been the case in Bolivia (Melvin, 1988; Melvin and Afcha, 1989) and Peru (Rojas-Suarez, 1992). The experience in these countries suggests that high inflation may not lead to as large an expansion in the financial sector if currency substitution takes place instead. Which method of adjustment predominates presumably depends on the regulatory environment as well as the quality of financial firms at the start of the inflation. In any case, the likely importance of dollarization in limiting the size of the financial sector in some of the high inflation countries suggests that the regression results reported above will provide underestimates of the effects of inflation on financial sector size for countries where growth in the financial sector is not constrained by regulation or financial crises.

The evident large effects of inflation shown in table 3 are consistent with the large costs of modest inflations implied by the regressions. For example, Israel, with 110 percentage points of "extra" inflation relative to its peers, had a financial sector share about 11 percentage points higher, implying a cost of about 1 percent of GDP for each 10 percent of inflation. For the U.S., with per capita income about half again as large, an increase of 1-1/2 percent for a 10 percent inflation seems plausible.

Aiyagari et al. (1995) report that the effects of inflation on the banking sector appear to be limited to a few percent of GDP. Thus the larger effects found here for the broader finance, insurance, and real estate sector likely reflect, in part, increases in other subsectors as well as in banking. This implication seems plausible: other intermediaries, such as insurance companies and securities dealers will have to handle more transactions as businesses and households increase their efforts to conserve on cash. Moreover, such firms will also be boosting their own efforts to limit cash holdings.

Of course institutional inertia or nonlinearities could limit the expansion of the financial sector in response to moderate inflations, reducing the cost of such inflations to levels below those implied by the estimated equations. There are other reasons, however, to believe that the increase in the size of the financial sector understates the total costs of inflation. For example, this measure does not take account of the unremunerated costs of increased "home production" of financial services--e.g. the traditional shoeleather costs of inflation--nor does it account for the production of financial services by nonfinancial firms. Bresciani-Turroni (1937) notes that during the German hyperinflation nonfinancial firms had to

greatly increase the amount of "unproductive" work time--i.e., work required to manage financial flows.

The increase in the size of the financial sector also does not take account of a variety of other inflation-related distortions. For example, the wedge driven between the marginal utility of cash and non-cash goods in consumption reduces welfare directly. Similar distortions in labor supply and investment decisions reduce welfare indirectly by reducing either current or future output. Even if consumption and investment would otherwise not be affected, if reserves pay no interest, inflation serves as a tax on intermediation, reducing the efficiency of resource allocation. Finally, there is some evidence (see Fischer, 1993) that inflation reduces the growth rate of total factor productivity, which would have a potentially large effect on welfare.

Data Appendix

The data on the size of the financial sector are taken from two United Nations sources. The data on GDP by sector are from the United Nations National Accounts: Main Aggregates and Detailed Tables volumes (table 1.11). The data for 1985 were not available for every country in the 1986 volume, and so later volumes were used in some cases. The employment data by sector are from the United Nations Statistical Yearbook. Because of lags in data availability, several volumes from the late 1980s were used. The numbering of the tables in the yearbooks changes from year to year. As noted in the text, employment data for 1985 were not always available, and data for 1984, 1986, or 1987 have been substituted where necessary. These data are used to calculate the shares of the finance, insurance, and real estate sector in GDP and employment, and relative labor productivity in that sector.

The inflation data is taken from the country tables in the International Monetary Fund's International Financial Statistics volume (1992). Where possible the GDP deflator (line 99bi) is used. Where this is not reported, consumer price index data (line 64) have been substituted. For a few high inflation countries, the deflator grew by so much that it cannot be reported in the country tables. In these cases, the inflation rates, as reported in the inflation tables (pp. 152-155 for the deflator, pp. 104-107 for the cpi) have been used instead.

The per capita income at world prices data is from the Penn World Table (Summers and Heston, 1991). Robert Summers kindly provided this data on diskette.

I exclude countries with populations below three million. These countries are very noisy since some are offshore or regional banking centers (e.g. Panama, Luxembourg, Hong Kong, and Singapore) while others are not.

The data used in the regressions is available from the author on request. Descriptive statistics are shown below:

Table A1

Variable	Number of Observations	Mean	Std. Dev.	Minimum	Maximum
Financial Sector Share in GDP (%)	73	10.38	5.11	2.26	24.22
Per-Capita Income ($1000s)	73	4.82	4.41	.33	16.78
Inflation (%)	73	22.80	39.88	3.23	252.95
Inflation•(Per-Capita Income)	73	91.41	178.73	2.13	1117.11
Share in Employment (%)	49	5.34	3.10	0.77	14.09
Relative Labor Productivity	49	2.99	2.02	0.40	8.82

Table 1

Regressions Explaining the Size of the Financial Sector

(t-statistics in parentheses)

Dependent Variable: Share of the Financial Sector	(1)	(2)	(3)	(4)	(5)
Share Measure:	GDP	GDP	GDP	Employment	Employment
Sample Size:	49	73	73	49	49
Explanatory Variable					
Constant	5.53 (3.71)	5.92 (8.21)	6.32 (9.86)	5.40 (8.17)	3.43 (7.89)
Per-Capita Income	0.76 (6.07)	0.77 (7.68)	0.67 (6.77)	0.32 (5.68)	0.78 (9.86)
Inflation	0.04 (2.78)	0.03 (2.88)			
(Inflation)•(Per Capita Income)			.009 (3.80)	.002 (1.80)	.003 (2.21)
Financial Sector Productivity	0.32 (1.10)			-0.75 (5.65)	
(Financial Sector Productivity)•(Per Capita Income)					-0.21 (6.07)
$\bar{R}^2$	0.44	0.46	0.50	0.67	0.69

Table 2

Regressions Explaining the Size of the Financial Sector

(By Level of Per-Capita Income)

(t-statistics in parentheses)

Dependent Variable:
Share of the Financial Sector in GDP

	(1)	(2)	(3)
Income Level:	Low	Medium	High
Sample Size:	27	28	18
Explanatory Variable			
Constant	5.90 (4.28)	6.85 (2.42)	1.90 (0.34)
Per Capita Income	1.32 (1.11)	0.50 (0.74)	1.04 (2.26)
Inflation	0.01 (0.42)	0.03 (1.86)	0.11 (3.17)
$\bar{R}^2$	-0.01	0.07	0.36

Table 3
Regression Explaining Relative Productivity in the Financial Sector

(t-statistics in parentheses)

Dependent Variable: Relative Labor Productivity in the Financial Sector	
Sample Size:	49
Explanatory Variable	
Constant	3.81 (6.92)
Per-Capita Income	-0.13 (1.79)
Inflation	.001 (0.03)
(Inflation)•(Per Capita Income)	-.001 (0.15)
$\bar{R}^2$	0.04

Table 4
Regressions Explaining the Size of the Financial Sector

(t-statistics in parentheses)

Dependent Variable:
Adjusted Share of the Financial Sector

	(1)	(2)	(3)
Share Measure:	GDP	GDP	GDP
Sample Size:	49	49	49
Explanatory Variable			
Constant	5.26 (3.35)	6.42 (6.20)	7.04 (7.77)
Per-Capita Income	0.81 (6.19)	0.77 (6.20)	0.64 (5.48)
Inflation	0.05 (3.61)	0.05 (3.58)	
(Inflation)•(Per Capita Income)			0.01 (4.56)
Financial Sector Productivity	0.30 (0.99)		
$\bar{R}^2$	0.48	0.48	0.54

Note: The GDP measure of the size of the financial sector has been adjusted to remove the effects of inflation on measured productivity in the financial sector.

Table 5

Financial Sector Size and Average Inflation Rates
for High Inflation Countries in 1985

	Financial Sector Share		Average Inflation 1975-1985	Per-Capita GDP
	GDP	Employment		
Argentina	14.7%	6.5%	252.9%	$3,982
Comparable Countries	9.0	3.6	17.6	3,742
Bolivia	10.6	--[a]	197.8	1,566
Comparable Countries	7.7	3.1	15.8	1,506
Brazil	20.0	5.7	98.4	3,995
Comparable Countries	9.0	3.6	17.6	3,742
Israel	24.2	9.6	120.2	9,293
Comparable Countries	12.9	6.7	10.6	9,264
Peru	9.8	4.5	77.6	2,730
Comparable Countries	8.8	3.6	16.1	2,468

[a] The United Nations data indicate that the share of the financial sector in Bolivian employment was 0.9 percent in 1987, the year closest to 1985 for which data are available. This is lower than all but three countries in the sample, and implies a very unlikely level of relative productivity in the sector. I have assumed that the number is an error and excluded it from the regressions. Including it does not greatly affect the results presented in the last two columns in table 1. In particular, the effect of inflation is still statistically significant.

Note: Comparable countries are selected separately for each country shown based on per capita income. "Comparable" is defined to be those countries with incomes between 50 and 150 percent of the country to which comparisons are being made. The comparable countries exclude the five countries shown and those with populations of 3 million or less. There are between 20 and 25 comparable countries in each case, although only about half generally have data on the share of employment.

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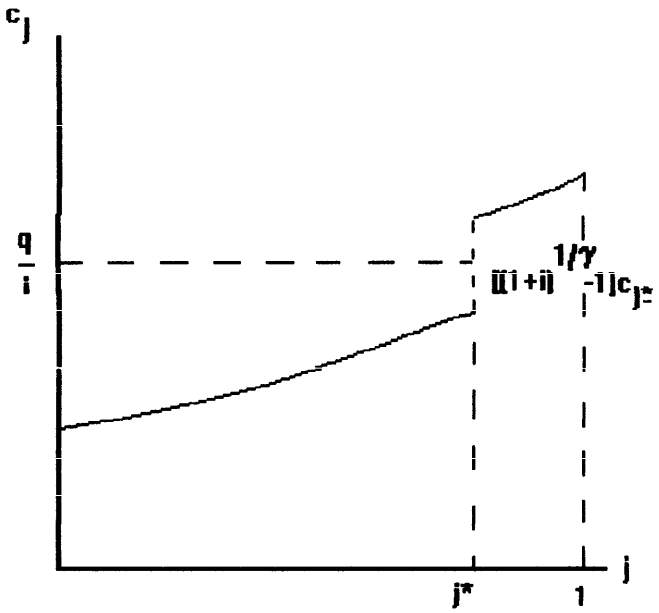


Fig. 1. Distribution of Consumption Across Goods

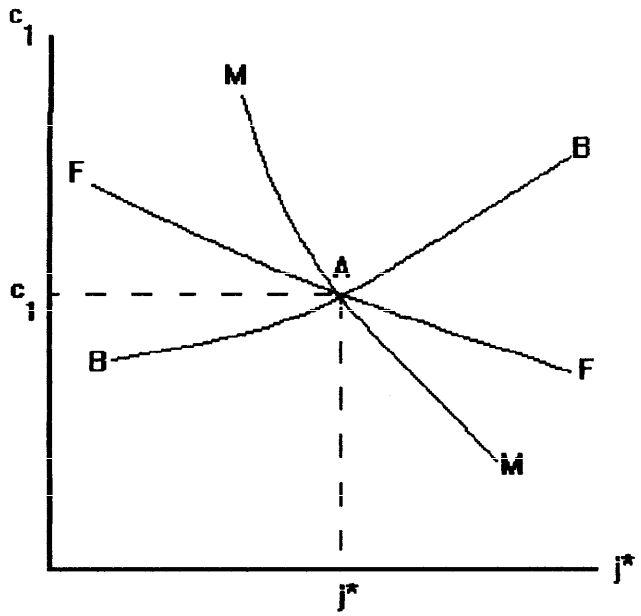


Fig 2. Steady-State c_1 and j*

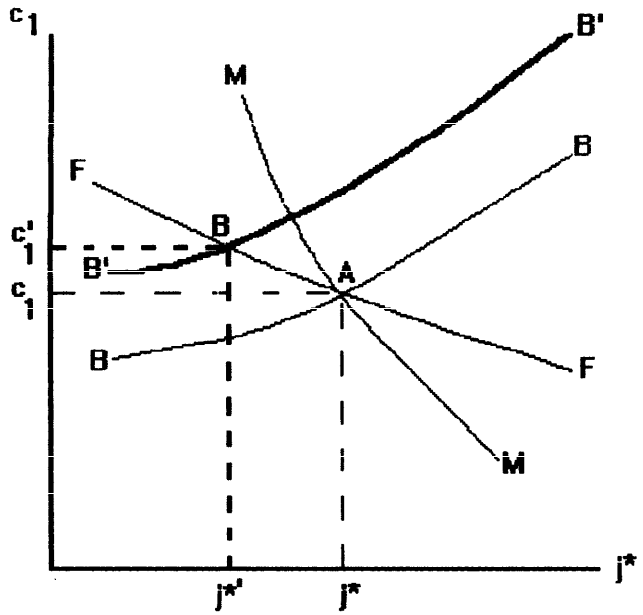


Fig. 3. Effect of an Increase in θ

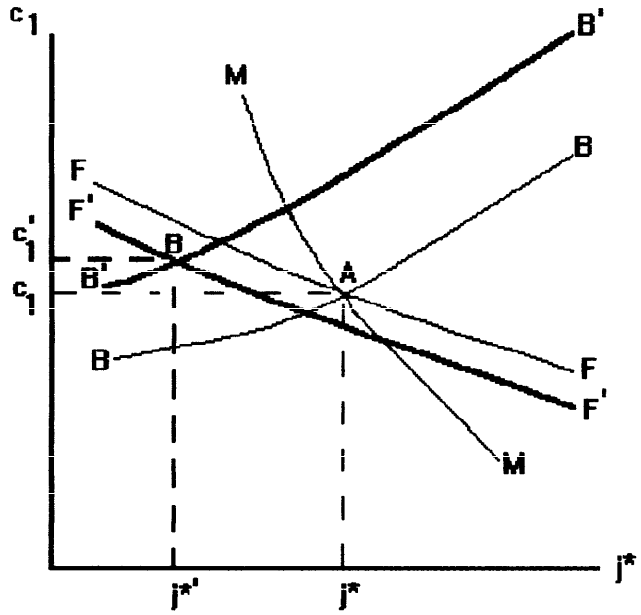


Fig. 4. Effect of an Increase in ξ

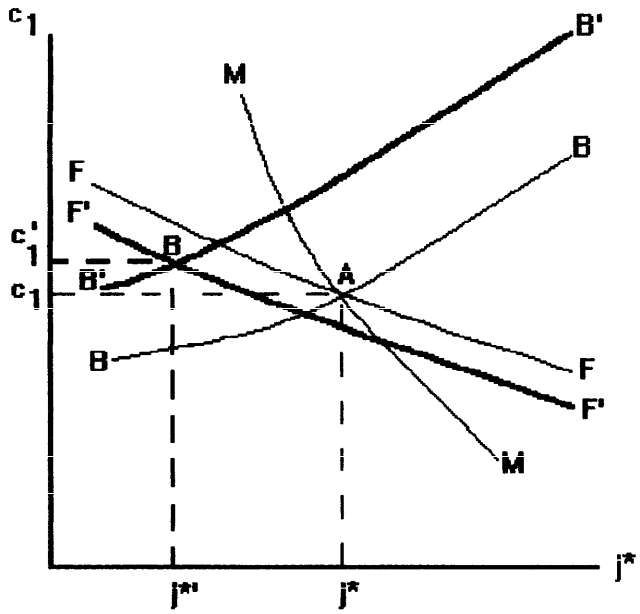


Fig. 5. Effect of an Increase in σ

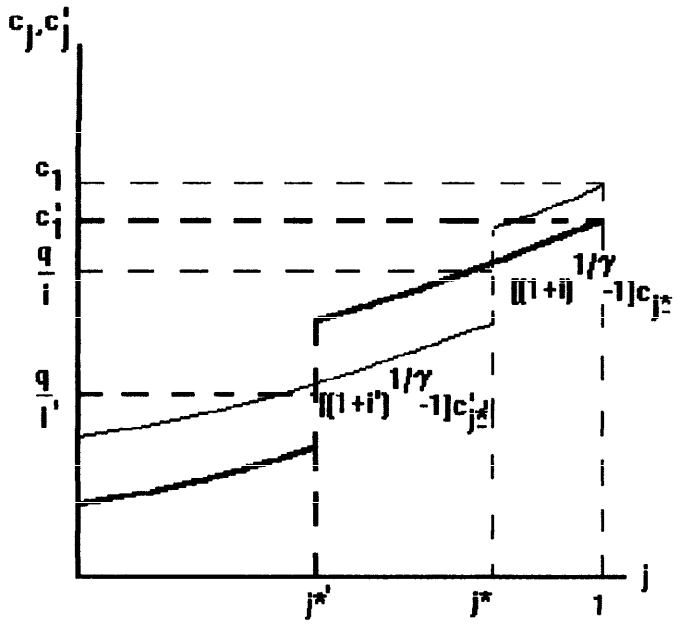
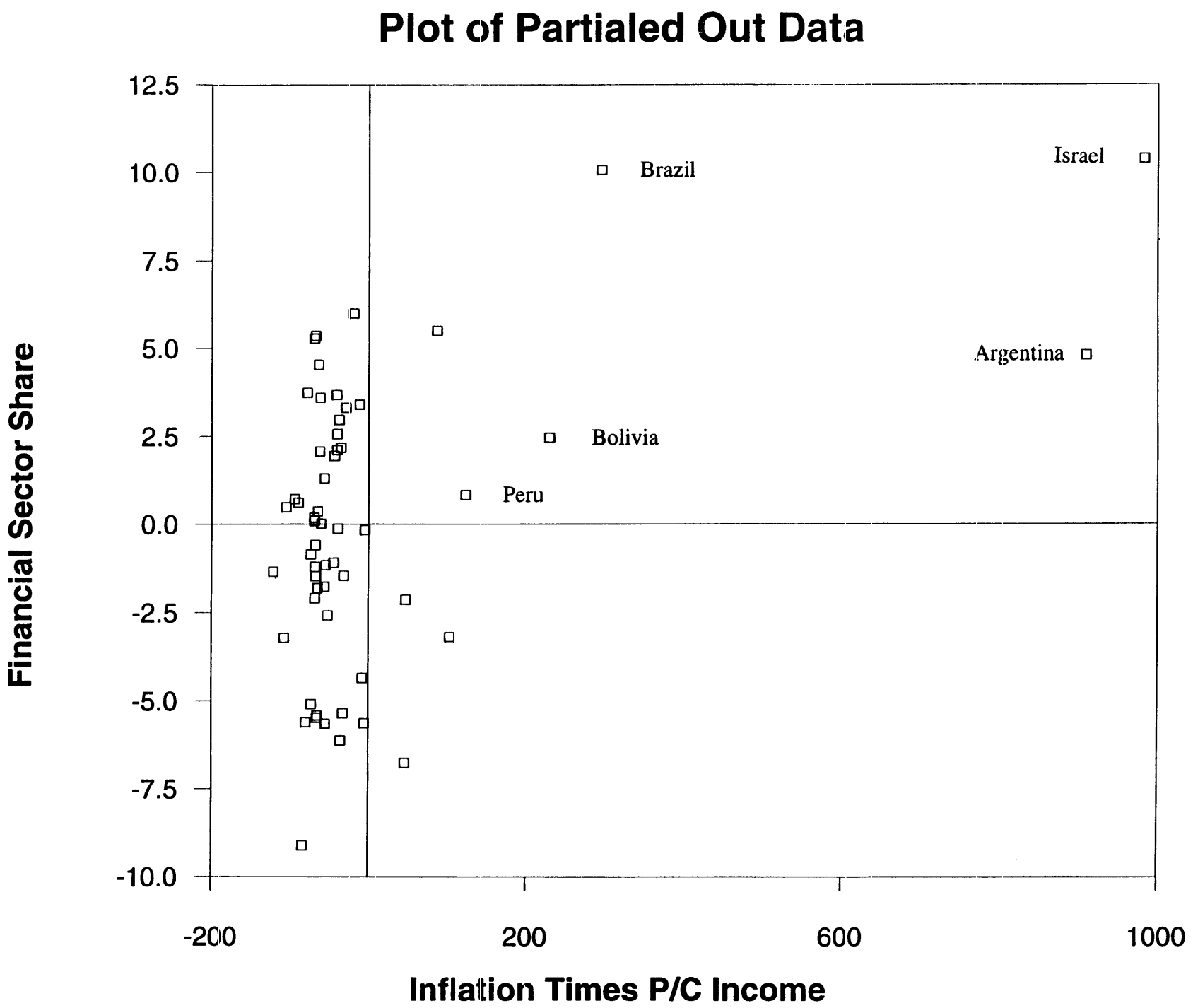


Fig. 6. Effect of an Increase in σ on the Pattern of Consumption

Figure 7


Plot of Partialed Out Data
Financial Sector Share
12.5
10.0
7.5
5.0
2.5
0.0
-2.5
-5.0
-7.5
-10.0
Brazil
Israel
Argentina
Bolivia
Peru
-200
200
600
1000
Inflation Times P/C Income