ACCESS TO BANKING AND INCOME INEQUALITY

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ABSTRACT

Using a simple model of banking services we consider how deposit-taking banks price for their services and choose the type of deposit customers that they target. In considering a banking model with a consumer population heterogeneous in income we go beyond previous theoretical work on consumer banking, allowing us to determine the role of household income in the access to deposit services. In addition we consider the usage and pricing for Alternative Financial Services (AFS) by households left out of the mainstream banking sector. We look to identify how the prices they pay for financial transactions differs from those in the mainstream sector. We show that, all other things equal, a higher rate of return on investments available to banks is an important factor in lowering financial exclusion, increasing the profitability of low-income consumers for deposit-taking institutions. This would suggest that the possibility of financial exclusion increases in periods of recession. In addition, if the bank's ability to invest is connected to financial exclusion, any regulation restricting the bank's ability to make investments should take this into account. Finally, by introducing specific income distributions to our model, we are able to demonstrate how an increase in income dispersion can lead to a greater proportion of consumers excluded from mainstream banking.

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1 Introduction

The importance of access to banking services for participation in the mainstream economy has made it increasingly costly for those households that are left out of the financial services sector. Over the last several decades financial services have become more sophisticated and prevalent in developed economies. Households rely on bank accounts to conduct basic financial transactions, build precautionary savings, and as a means for access to affordable credit. Most workers in advanced economies are no longer paid in cash, and require a way to cash checks or set up direct deposits in order "access" their wages. Households without a bank account not only end up paying more for basic financial services, but they may also be more vulnerable to loss or theft of their cash and asset holdings and often have difficulty building credit histories and achieving financial security.

The purpose of this paper is two fold. First, we go beyond previous theoretical work on consumer banking by considering a model of bank deposit services with a consumer population heterogeneous in income. This will allow us to focus specifically on what type of consumers are excluded from banking services. We look to identify how mainstream banks charge for deposit accounts and the customers they target. Second, we look at what happens to the consumers that are left out of the mainstream banking sector, and the costs they face when they are forced to turn to Alternative Financial Services. Finally we consider the role of AFS in the financial services market as well as what happens when we allow banks to participate in the AFS market. We show that the welfare impact of financial exclusion depends significantly on the extent to which consumers can participate in the economy without requiring the services of financial institutions.

A recent study in the U.S. by the Federal Deposit Insurance Corporation (FDIC) found that access to mainstream banking services such as deposit accounts, debit cards and checking services is lacking for a significant portion of the population, FDIC (2009). The 2009 survey found that over one quarter of households across the United States are either unbanked (7.7%, do not have a checking account) or underbanked (17.9%, have a checking account, but use Alternative Financial Services like check cashing services). Financial exclusion is also a problem in the United Kingdom where 5% of the population do not have access to a transaction account, FIT (2009)[2] , and an additional 20% are considered underbanked, Kempson and Whyley (1998)[3]. Lack of access was especially stark amongst low-income households, where in the U.S. 20% were categorised as unbanked (37% of low-income households did not have a current account

[2]This is excluding households that did not respond. Including those who did not state the account status would raise this number to 7%.

[3]This statistic might have decreased since the study by Kempson and Whyley (1998) and FSA (2000). The Financial Inclusion Taskforce (FIT) has observed a steady decline in the percentage of households without access to any transactional accounts, we would expect this decline to be reflected in the percentage of households considered on the margin of financial exclusion.

in the UK, Devlin (2005)), with even higher levels of exclusion amongst minority groups (54% of black households and 43.3% of Hispanic households are either unbanked or underbanked in the U.S.). It is interesting to note the similarities between the exclusion numbers in the U.S. and UK. Studies into access to financial services in poorer countries have found financial exclusion to be much more widespread (See Beck et al. (2007) and Beck et al. (2008)).

Part of the reason for the prevalence of unbanked households is thought to be a lack of information on the services available to these households, a problem that banks attempt to alleviate though providing educational material and conducting community outreach. But it is acknowledged by the banks themselves that the lack of access is partially driven by the fact that very low-income households are not profitable customers for the banks. The latter is the main focus of our paper. We use our model of banking services to more formally consider the profitability of low-income customers of banks, hoping to better understand the economic causes of financial exclusion.

We begin by more formally describing what banking services entail.

Banking Services

Most mainstream bank accounts provide a variety of services for depositors. The most obvious benefit is the convenience of transaction services featured in the Baumol-Tobin bank deposit model. Transaction services include internet/telephone banking, ATM access, direct debit and check cashing, automated payments and online and in person debit card transactions. Deposit accounts also provide security for account holders by providing theft and fraud protection. In addition, customers with deposit accounts are usually given preferential access to credit through overdraft services, credit cards and personal loans. Though we can take these perks for granted, they all play a significant role in our participation in the economy. Without a debit/credit account it is very difficult to participate in the e-retail market, cash checks, access cash locally or internationally, as well as rent accommodation or open mobile phone and utility accounts.

Banks charge for these services directly through fees and indirectly through foregone returns. Direct fees can be either in the form of periodic fees associated with holding a deposit account, or through charging fees for various bank services, like overdraft charges. Indirect fees are considered to be the difference between the consumer's so called outside option, the risk-free rate of return, and the interest paid on deposit accounts. These indirect fees make up a significant portion of revenues for deposit-taking institutions, and are a prominent aspect of the Baumol-Tobin model of transactions. From an accounting perspective, indirect fees are very difficult to measure, making it more difficult to quantify the contribution of the financial sector to GDP (See System of National Accounts 1993, 2008).

The direct fees tend to be a greater expense for low-income/low-balance account holders. Overdraft fees and fees associated with bounced checks only impact customers who have a low account balance and face the risk of triggering these charges. Most European and U.S. banks require a minimum balance and/or minimum periodic deposits in order for consumers to avoid fee payments, clearly a more difficult hurdle for low-income households. In addition, most banks have a tiered fee system where the higher the balance on customers accounts, the lower the fees. These penalties are cited as one reason why some households choose not to open up a bank account with a mainstream bank, resorting instead to Alternative Financial Services. High fees can also be seen as a way for banks to avoid less profitable customers, as we will discuss below. In times of financial distress, when bank profits and returns fall, banks tend to raise direct fees to replace lower revenues from indirect fees, Dash (2011). As we will demonstrate in our model below, higher direct fees are in effect a regressive pricing mechanism and are usually a higher financial burden to low-income households. Therefore it is likely that financial exclusion increases in periods of recession.

Consumers that do not have a bank account turn to Alternative Financial Services for their banking needs. These include check cashing services, pre-paid direct debit cards, pawn brokerage, money orders and transfers as well as many forms of short term credit provisions. These services do not require a formal account but usually charge high fees. For example a recent product geared towards consumers without bank accounts are pre-paid debit cards, which allow consumers to put cash on debit cards not associated with a bank account. These types of cards have various forms of charges, including an application charge, transaction charges, an ATM withdrawal charge, a contribution charge as well as monthly fees. Considering the typically low balance on these cards for most consumers, these charges can add up to a high percentage of the volume of transactions for these customers, as well as a larger share of their disposable income.

In addition to being an issue of economic opportunity, financial exclusion is also a public policy concern. For example, social security, unemployment benefits and other benefits payments made by government institutions usually come in the form of checks. To the extent that those receiving these benefits have to pay high fees to cash them at AFS providers this is a transfer of public assets to these financial institutions. The U.K. government has taken steps to mitigate this effect by allowing for check cashing services through the country's postal service, FIT (2009). But these solutions are by no means universally available and do not address the transaction service needs of consumers.

The convenience of mainstream banks, the apparent need for a bank account for economic inclusion as well as the high fees associated with Alternative Financial Services are at odds with the widespread use of these services as well as the significant growth in the industry over the last decade. AFS providers have been growing steadily across the U.S. and are growing at

a fast pace in Europe. Pre-paid debit cards are available on both sides of the atlantic and are provided by mainstream institutions such as Walmart in the U.S. and Virgin in the U.K. In the U.S. $218 billion was loaded onto prepaid debit cards in 2007, representing a 100% increase in volume over four years, FDIC (2009).

We would like to better understand: why it is that these Alternative Financial Service providers exist and are becoming more prevalent; why consumers that have access to mainstream banks still choose to use these seemingly expensive services; and whether or not the prices charged for these services are determined by a well-functioning market or are a sign of the existence of market frictions.

In the following section we develop a theoretical model of the market for banking services. We look to use our model to better understand the importance of financial services for consumers and how banks choose the type of deposit customers that they target. In addition we consider the usage and pricing for Alternative Financial Services (AFS) by households left out of the mainstream banking sector and how this increases the prices they pay for financial transactions.

2 The Model

There has been extensive work done on modeling the business of commercial banks. Baumol (1952) and Tobin (1956) use an inventory style model to explain the economics of bank deposits, and the tradeoff consumers face when deciding how much cash to hold relative to keeping their money in less liquid assets. Other papers consider a bank's role as intermediary between lenders and borrowers, helping perform the role of choosing and monitoring the right investments for the funds provided by depositors (see Stiglitz and Weiss (1981), Diamond (1984), Holmstrom and Tirole (1997) and Shleifer and Vishny (2010)). Though all of these papers make important contributions towards understanding outcomes in the financial sector none of them have explicitly considered the role of income distribution in financial markets. The purpose of our paper is to begin thinking about how the distribution of income of consumers can impact bank decisions, focusing specifically on income distribution and the supply of deposits in the banking sector. By introducing consumers heterogeneous in income we are able to focus on the causes and extent of financial exclusion in bank deposit services. We consider how banks price for deposit services and how they determine the type of consumers that they accept deposits from. We abstract away from the monitoring problem, taking the return banks earn on deposits as given, and focus on the cost benefit tradeoff of the banks and deposit customers. The general framework of our model and our method of telling the story of the bank deposit market follows that of Shaked and Sutton (1982), who consider entry and the choice of quality in a monopolistically competitive market, and Atkinson (1995), who considers the exclusion

of consumers from the market of a productive good. We have adjusted their assumptions about consumer preferences and firm strategy to reflect more closely the market for financial services. We begin with a simple model of consumers, Alternative Financial Service providers (AFS), and a mainstream bank.

Consumers

There is a unit mass of consumers that only differ in their income, w. Income is distributed according to a cumulative distribution function $G(w)$. The density, $g(w)$, is zero for values of w below the minimum wage, a and above the maximum wage, $a + h$, where h can take any positive value, $h > 0$. Consumers can choose to either keep their earnings at a mainstream bank providing all the deposit services described above, or to turn to an AFS that offers a minimum set of services (such as check cashing or pre-paid debit cards). More formally, banks provide consumers with full access to their earnings as well as an additional benefit of θw, where $\theta > 0$, to a customer earning w. Banks charge a fee, f_B, for these deposit services. AFS only provide consumers with access to their earnings (this is analogous to $\theta_A = 0$) and charge fee f_A.

We are inherently assuming an indirect fee by not providing a deposit interest rate to customers. This is based on the observation that most consumers that use AFS providers do not have access to a risk free rate, $r_f > 0$, as an outside option. Since most banks usually pay an interest rate very close to zero, and since it is hard to argue that the risk free rate is really an option for some customers, we will not include indirect fees in our analysis of the consumers' problem[4].

In this section, the model assumes that consumers do not have full access to their cash without going through a financial service provider. Otherwise AFS customers would choose to keep their income w and not pay a fee. This is based on the observation that in the modern economy most workers are paid through checks or direct deposits. In addition, many consumer transactions, from online purchases to sending money to family members, usually require bank/AFS services. There is a role for cash payments within a developed economy, but we assume this to be sufficiently small that even the poorest consumer would always prefer to pay the fee rather than solely rely on cash.

$$a - f_A \geq \lambda a \tag{2.1}$$

Where λ is the cash benefit of the consumer's wage, or equivalently the proportion of cash

[4]We are not saying that these fees do not exist, but only that since interest rates are zero on most checking accounts that these fees are not a real consideration when choosing between an AFS and a transaction account with a bank.

transactions. The above inequality requires that $\lambda < 1$. The condition above depends on the fee charged by AFS. We will consider the choice of f_A in our discussion below[5].

The consumer's binary choice is between:

$$u_B = (1+\theta)w - f_B \quad \text{s.t.} \quad \theta > 0 \qquad \text{and} \qquad u_A = w - f_A \tag{2.2}$$

We can compare the two utility functions above to determine the income level, w^*, such that consumers earning an income below w^* choose to use an AFS over a mainstream bank.

$$w^* = \frac{f_B - f_A}{\theta} \tag{2.3}$$

Consumers earning below w^* are considered excluded from mainstream banking services. We are particularly interested in looking at how the proportion of consumers that are excluded, $G(w^*)$, is determined within our model, as well as the costs to consumers that are excluded from mainstream banking.

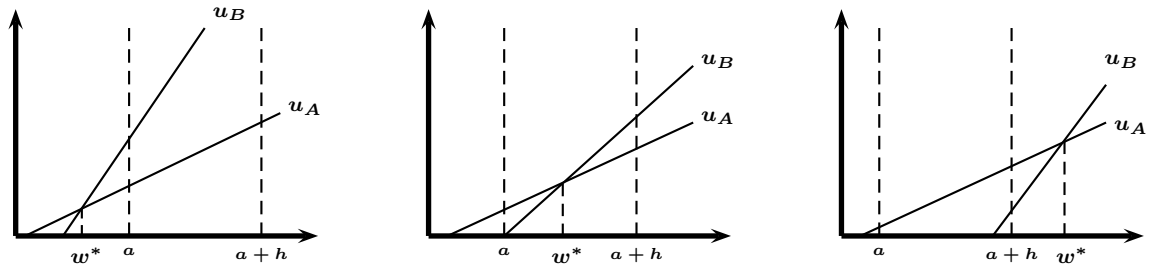

Figure 2.1: Cases of Financial Exclusion

Figure 2.1 demonstrates the three possible cases for the market for banking services. The figure on the left represents the case when no consumer is excluded from mainstream banking. In this case the cutoff wage for bank customers, w^*, falls bellow the poorest consumer earning a. The figure in the middle represents an interior solution where a portion of consumers are excluded. In the third figure the mainstream bank would not enter the market, leaving all consumers to resort to using AFS for their transaction needs.

[5]Note that λ is inherently included in our analysis of the consumers' problem. The bank and AFS provide access to the non-cash portion of consumer income, $(1-\lambda)w$. As we will show below, this means that λ, at least in our model, does not impact the level of financial exclusion. But as we would expect, λ does have an impact on overall consumer welfare. We will come back to the significance of λ to our results in the extension of our model below.

In the next section we will consider the bank side of the model to determine the conditions that would lead to each of the cases demonstrated above.

Banks

We use a basic deposit model where mainstream banks face fixed costs, k, such that only one bank enters, therefore we have a monopoly. Previous literature on the banking sector have used various levels of competition ranging from monopoly (see the Monti-Klein model described in Freixas and Rochet (2008)) to perfect competition. For the purpose of this paper we don't lose much generality by considering the strategy of a monopolist bank serving a consumer population with various forms of outside options. In fact the setup of our model is not too far away from the duopoly setup considered in Gabszewicz and Thisse (1979) and the monopolistically competitive model of Shaked and Sutton (1982)[6].

The bank takes in deposits and uses those deposits to invest in projects earning an assumed rate of return, r. The bank faces a fixed cost per deposit account associated with the administration and servicing of these account, c_B. Substituting for f_B from equation (2.3), the profit function for the bank is:

$$\pi_B = rD_B - (c_B - \theta w^* - f_A)N_B - k \tag{2.4}$$

$$\text{where} \quad D_B = \int_{w^*}^{a+h} wg(w)\,dw \quad \text{and} \quad N_B = 1 - G(w^*)$$

D_B is the total amount of deposits taken in by the bank and N_B is the number of bank accounts. In the integrals above, w^* is the level of income where consumers are indifferent between using the bank and an AFS provider, as defined in (2.3). In the general equilibrium models of bank deposits, such as Basu and Wang (2007), the rate of return available to banks, r, is determined by a corporate market. For our purposes we take that return as given.

We assume no fixed costs in the Alternative Financial Services sector, therefore we treat AFS as a competitive fringe. Studies into the profitability of AFS providers have found that their high fees tend to be offset with high marginal costs. Both studies found that relatively low fixed costs of entry lead to high level of competition in the AFS industry (see Flannery and Samolyk (2005) and Skiba and Tobacman (2007)).

[6]We acknowledge that endogenous choice of entry and its consequences on the results that follow is an interesting extension to our model, but our initial findings suggest that entry of additional qualities of banking services do not significantly impact our results. We will leave a more detailed consideration of the impact of entry for future work.

The bank takes the AFS fee, f_A, as given and equal to the constant marginal cost of providing AFS services, c_A[7]. The bank chooses its customers by choosing f_B, which in effect determines the cutoff level of income for bank customers, w^*. Differentiating (2.4) with respect to w^* we have:

$$\frac{1}{g(w^*)}\left[\frac{\partial \pi_B}{\partial w^*}\right] = -rw^* - (\theta w^* + c_A) + \theta\left[\frac{1-G(w^*)}{g(w^*)}\right] + c_B \tag{2.5}$$

The first and second terms on the right hand side are the loss in interest revenue and fees from the marginal consumer at w^*. The third term is the gain from higher fees charged to all remaining bank customers. The final term is the cost savings from not providing services to the marginal consumer. We can see from the cost and benefit terms that the interest available on the volume of deposits, r, makes it more costly for banks to raise their cutoff level of income. Therefore higher returns on bank assets makes it less likely that low-income consumers will be priced out of the mainstream banking market. Alternatively, the level of the bank's technology, or marginal cost of deposit services, c_B, increases the cost associated with low-income depositors and makes exclusion more likely.

From the equation above and the assumption that the density of our income distribution is zero below a, marginal profit is positive for any income below a. Therefore we have that the bank will not charge a fee below the point where the consumer earning the lowest wage will choose to use banking services[8]. Using equation (2.3) this gives us a lower bound for the fee charged by the bank:

$$f_B \geq \theta a + c_A \tag{2.6}$$

Lowering the fee below this level will not add any new consumers and will cost the monopolist revenues from existing customers. Raising fees above this level would only be profitable if the right side of equation (2.5) is positive for the lowest income level, a. In addition, whether or not a bank prices itself out of the market depends on the value of (2.5) at $w^* = a + h$. If the left hand partial derivative of the profit function is negative at that income level then the bank

[7]Note that if we had assumed no fixed costs in mainstream banking services, in other words a competitive banking market, f_B would be less than c_B in order to satisfy the zero profit condition. In addition to fees, banks earn revenues by investing consumer deposits. Therefore the zero profit condition for banks is a bit more complicated and is not unique since it depends on the number of banks that choose to enter the market. If banks only played the role of financial warehouses then the investment return portion of the profit function would disappear and we would be in a more typical Shaked and Sutton setting.

[8]In fact this is also true for cases where $g(a) = 0$, that is when the probability of earning the subsistence level of income is zero then marginal profit is positive at that income level. This result is significant for our condition for an interior solution below.

would have incentive to lower its price to at least attract the wealthiest consumer in the market. Evaluating the differential at these two points gives us conditions on our model parameters that would allow for a bank to operate in that market but only target a portion of the consumer population:

$$(r+\theta)a - \frac{\theta}{g(a)} \;<\; c_B - c_A \;<\; (r+\theta)(a+h) \tag{2.7}$$

The right hand side condition assures that it is worth it for a bank earning r and providing quality of service θ to enter a market where the wealthiest consumers earn $a+h$. The left hand side condition is when such a bank would not cater to the poorest consumers in the market, in other words it is the requirement for financial exclusion. Checking dimensions, all of the terms in the conditions above are in terms of income, we have monetary conditions as we would expect[9].

Interestingly, the condition for exclusion on the left hand side is a weaker condition on the level of a than the requirement for profitability of the poorest consumer, $(r+\theta)a+c_A > c_B$[10]. Therefore, it is not necessarily the profitability of the poorest consumer that might cause them to be left out of the mainstream banking sector, but rather the ability of the bank to price discriminate across consumers[11].

In practice it is very common for banks to price discriminate across consumers of different income levels. But the type of price discrimination we observe does not match the progressive form that the above results would predict. Price discrimination usually comes in two forms. The first form of price discrimination is through indirect fees, the theoretical foregone interest consumers could earn if they invested their funds in a risk free asset rather than depositing them in a bank. Banks tend to offer greater returns on savings accounts with higher average balances. Assuming that all consumers have the option to invest their funds in risk free assets, this is inherently a regressive cost to consumers. The extent to which poorer consumers do not have access to risk free returns mitigates this effect. It is possible that this form of price discrimination is directly related to the availability of a risk free rate of return to the consumer as an outside option. One can argue that higher income consumers tend to have access to higher rates of returns on their investments, requiring the bank to offer them a higher return on their savings in order to attract their business. The second form of price discrimination, which is much more common in mainstream banking in the U.K. and U.S., is in the direct fees

[9] $\frac{1}{g(a)}$ is a monetary number.

[10] This condition says that the poorest consumer is profitable if the bank sets fees such that $w^* = a$, that is such that the poorest consumer's participation constraint is binding.

[11] If the bank could price discriminate then it would set fees such that the participation constraint for all consumers are binding and no one is excluded.

charged by banks. These fees tend to be waived for high-volume deposit accounts and tend to target lower volume accounts[12], making them a regressive price discrimination. In both of these cases price discrimination would exacerbate financial exclusion. We do not allow for price discrimination in our banking model.

The rate of return available to the bank, r, is an important factor in the inequality in (2.7). A higher r makes deposit resources more profitable for the bank, and less likely that poor consumers will be excluded. To the extent that exclusion from the financial sector negatively impacts low-income households, a higher return available for banks could be seen as a positive social outcome. This result is a bit misleading since in our model we do not consider what drives r. Higher returns for banks can be due to greater risk and uncertainty in the bank's investment portfolio, which can be a negative for the overall consumer population. This is a tradeoff that became more clear in the 2008 financial crisis and has spurred a debate about the role of banks as deposit-taking institutions. It is not clear to what extent banks should focus purely on safeguarding consumer deposits versus on their rate of return on investments. As the above inequality makes clear, there is a tradeoff for banks between making deposit services cheaper for their customers by offsetting high fees with high returns, and the extent that banks expose customer assets to financial risk. This result would be an argument against the notion of limiting a bank to only serving as a money warehouse. If banks were not allowed to earn a return on customer deposits they would either respond by lowering the quality of deposit services, θ, or more likely by raising fees, and in effect increasing financial exclusion.

Another possible interpretation of r in the condition for exclusion above is in the context of economic recession. Zero or negative economic growth tend to coincide with periods of low returns on investments for financial institutions. To the extent that a low rate of return on the volume of deposits forces banks to increase their direct fees on deposit customers, as demonstrated in our results above, we can argue that financial exclusion is likely to increase in periods of slow to negative economic growth[13].

From the two conditions above we can see that as long as there is enough income in a community the bank will choose to enter the market. In addition, if there is significant difference between the technology of the two types of financial service providers, that is if $c_B - c_A$ is sufficiently large, relative to the income of the poorest consumer, then the left hand condition in (2.7) holds and we have an interior solution where the bank targets a portion of the consumer population. These preliminary results seem to match what we would expect. Banks that are

[12] In the sense that they tend to charge higher fees for accounts that have lower average balances and where customers do not regularly deposit funds into the account.

[13] In this instance, when considering the impact of a recession on exclusion we are ignoring any impact on the distribution of income. Clearly a recession might have redistributive effect or lead to a decrease in the standard of living, but here we are focusing only on the relation between periods of slow economic growth and the rate of return available to banks. We will consider the distributive impact on exclusion below.

targeting higher income consumers are more likely to provide better services in exchange for higher absolute fees, while financial companies targeting poorer neighborhoods are more likely to provide very basic services and charge lower fees. In the rest of this section we consider the pricing decision of a monopolist bank when facing a distribution of consumers that would result in a portion of the population being unbanked. We will also compare the fees paid by the "banked" and "unbanked" within this framework in order to determine if the unbanked end up paying a higher percentage of their transaction volume as financial fees.

The Distribution of Income

In the context of our banking model a and h are a measure of standard of living and are defined relative to the technology of the financial service providers, c_A and c_B. On its own h is not a sufficient summary statistic in our setting and only vaguely represents changes in dispersion. The impact of h on the dispersion of income will depend on the functional form of the distribution function $G(w)$ as well as the minimum level of income a. We will consider the impact of changes in these relative parameters, as well as changes in the income distribution of the overall population, when we introduce specific distribution functions below. Throughout our analysis, we are interested in how the relationship between the distributive and standard of living parameters from the consumer side and the technology parameters from the banking side interact to determine exclusion, as well as consumer welfare, within our model.

From (2.5) we have that if $g(a) = 0$ then $\frac{\partial \pi_B}{\partial w^*} = \theta > 0$ at a. Therefore, when the density at a is small enough our condition holds and a portion of the population will be excluded from banking services. If the overall standard of living, a, is sufficiently high, then the left hand side of the above inequality does not hold and everyone in the distribution uses mainstream banking. The right hand condition does not hold when the income of the richest consumer in the market is low relative to the difference in technology of the two types of firms. If this condition does not hold then the bank would not target any consumers and the entire population would have to resort to a lower θ (which in this case means an AFS, so they would be considered "unbanked"). This is not such an unrealistic possibility. There are neighborhoods in very poor urban and rural areas where branches of mainstream banks do not exist. These neighborhoods, depending on their income level, might be serviced by local banks that provide some level of deposit services, or they might rely fully on AFS providers.

All that is left to check is whether or not the second order condition for a maximum is satisfied. Similarly to Atkinson (1995), the second order condition for a local maximum is satisfied when the following condition holds:

$$\frac{(1-G)g'}{g^2} + \frac{r}{\theta} + 2 \geq 0$$

A non-decreasing hazard rate ($\frac{g}{(1-G)}$) is sufficient but not necessary to assure that this condition holds[14]. We can show that the second order condition for a local maximum is satisfied for the specific income distributions considered below[15]. The global condition on the second derivative that will assure us a unique solution requires that:

$$g(w^*)\,(r+2\theta) \;\geq\; g'(w^*)\,[c_B - c_A - (r+\theta)w^*]$$

We can show that the conditions for a global maximum hold for the two income distributions we consider below, therefore in both of these cases our solution for the profit maximising level of w^* is unique[15].

If the conditions for an interior solution are satisfied then there is a profit maximizing level of w^* such that:

$$r + \theta = \frac{\theta[1-G(w^*)]}{w^* g(w^*)} + \frac{c_B - c_A}{w^*} \tag{2.8}$$

Whether or not the cutoff wage for financial exclusion is decreasing with the rate of return available to the bank, r, depends on how the cumulative distribution function changes with w^*. If the first term on the right hand side of (2.8) is non-increasing with w^*, then we must have that an increase in the rate of return available to the bank leads to lower cutoff level of income. Our assumption of a non-decreasing hazard rate is again sufficient but not necessary for this condition to hold. As we argued above, this condition holds for the specific income distributions that we consider below. The cutoff level of exclusion is also increasing with the difference in technology between mainstream banks and Alternative Financial Service providers.

The proportion of consumers that get priced out of mainstream banking services, $G(w^*)$, depends on the distribution of income in a given market. We can illustrate possible outcomes by considering specific income distributions. For example, suppose that consumers are distributed uniformly from a to $a+h$, which gives us a density function $g(w) = 1/h$. Under this distribution the marginal profit of the mainstream bank is given by:

$$h\left[\frac{\partial \pi_B}{\partial w^*}\right] = -rw^* - (\theta w^* + c_A) + \theta(a + h - w^*) + c_B$$

Comparing the loss from raising the cutoff level of income (the first two terms) and the ben-

[14] since $\frac{r}{\theta} + 2 > 1$.
[15] See Appendix.

efits (the last two terms) determines the choice of w^* for the bank facing a uniform distribution of depositors. This is illustrated in the figure below:

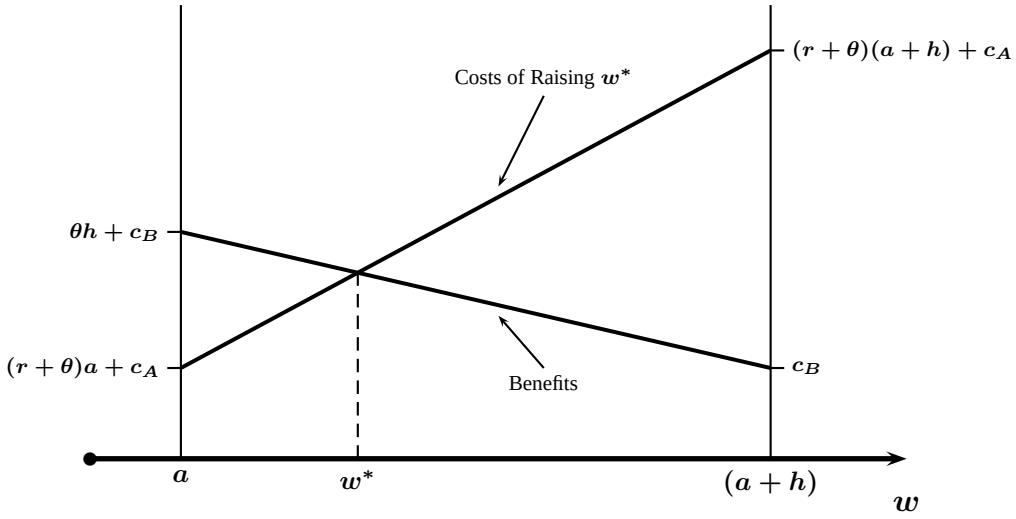

Figure 2.2: Costs and Benefits of Deposits

Evaluating the differential above at $w^* = a$ and $(a+h)$ we can derive the conditions for exclusion with a uniform distribution of income:

$$(r+\theta)a - \theta h \;<\; c_B - c_A \;<\; (r+\theta)(a+h) \tag{2.9}$$

As before the right condition is for a bank to enter this market, and the left is the condition for exclusion. The likelihood of a mainstream bank entering a market and there being consumers that are excluded increases with the difference between the richest and poorest consumers, h. We can see that from the left side of the inequality above, which is decreasing with h, and the right side, which is increasing with h. As we argued above, an increase in r reduces the possibility of exclusion and gives a bank greater incentive to enter a market.

Then w^* and the level of exclusion, $G(w^*)$, under a uniform distribution is:

$$w_U^* = \tfrac{\theta(a+h)+c_B-c_A}{r+2\theta} \;\Rightarrow\; G(w_U^*) = \tfrac{1}{r+2\theta}\left[\theta + \tfrac{c_B-c_A}{h} - a\left(\tfrac{r+\theta}{h}\right)\right] \tag{2.10}$$

The level of financial exclusion is decreasing with the lowest income in the market, a. As we discussed above, h on its own is not a sufficient summary statistic. Increasing h increases the difference in income between the poorest and wealthiest consumers, but it would also lead

to a higher average income when using a uniform distribution. To avoid this ambiguity in distributive effects we consider the impact of greater income dispersion by considering a mean preserving spread in the uniform distribution. A simultaneous and equal fall and rise in a and $a + h$ respectively[16].

A mean preserving spread of the distribution is demonstrated in figure 2.3 below, where $\bar{w}$ is mean income[17].

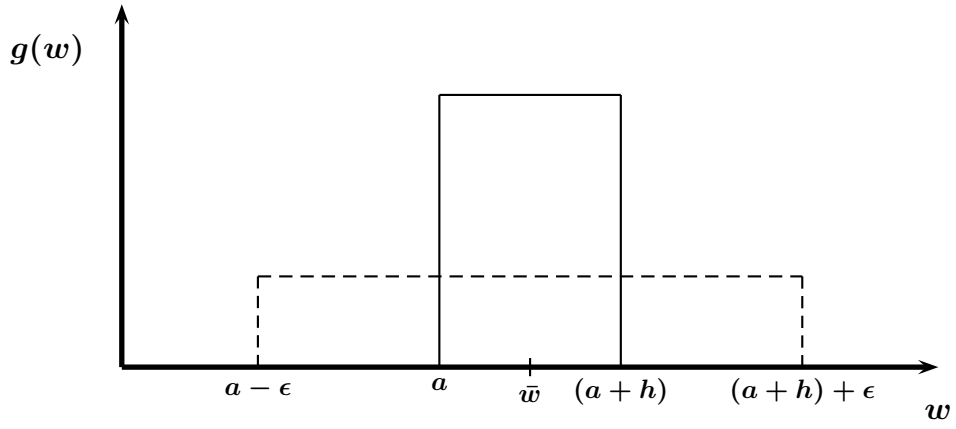

Figure 2.3: Uniform Distribution of Income

We can compare the proportion of consumers excluded from the mainstream financial sector by comparing the cumulative distribution function, $G(w)$, evaluated at the initial w^* with the extent of exclusion when our distribution is more spread out. Since $G(w)$ represents the proportion of consumers that fall below a particular level of income, an increase in $G(w^*)$ corresponds to a higher proportion of consumers excluded. The new w^{**} and proportion of exclusion, $G(w^{**})$, after a mean preserving spread becomes:

$$w_U^{**} = \frac{\theta(a+h)+\epsilon+c_B-c_A}{r+2\theta} \quad \Rightarrow \quad G(w_U^{**}) = \frac{1}{r+2\theta}\left[\theta + \frac{c_B-c_A}{h+2\epsilon} - (a-\epsilon)\left(\frac{r+\theta}{h+2\epsilon}\right)\right] \quad (2.11)$$

Comparing (2.10) with (2.11) we find that increasing the spread of our distribution leads to a greater proportion of consumer excluded if the following condition holds:

$$r\bar{w} + \theta\bar{w} + c_A \quad > \quad c_B \quad (2.12)$$

[16]Note that since we are lowering a by ϵ, in order to increase $a + h$ by ϵ we must increase h by 2ϵ.

[17]In a uniform distribution $\bar{w} = \frac{a+(a+h)}{2}$.

The left-hand side of the above inequality is the revenue to the bank from the average consumer if $w^* = \bar{w}$. This condition says that if the average person in the economy would be profitable for the bank then an increase in inequality would lead to greater exclusion. Based on the exclusion data discussed above, we would expect that the above condition tends to hold for the general population in the U.S. and U.K.[18]. The above condition might not hold in poorer regions within those countries where the average level of income is very low. In such areas an increase in inequality could lead to lower exclusion, but mainly in the upper tail of the income distribution.

Comparing the condition on exclusion from (2.7) with our condition for increasing exclusion in (2.12), it is clear that both conditions can hold for a range of values of $c_B - c_A$. As long as a is low enough relative to the cost differential between the bank and the AFS, exclusion can exist, and increase when income becomes more spread out.

Alternatively we could consider our results under a Pareto distribution, where income is greater than or equal to our lower bound a (this is equivalent to $h = \infty$). The cumulative distribution and density function are given by:

$$G(w) = 1 - \left(\tfrac{a}{w}\right)^{\alpha} \qquad g(w) = \tfrac{\alpha}{a}\left(\tfrac{a}{w}\right)^{\alpha+1} \qquad \text{s.t.} \quad \alpha > 1$$

Under this distribution $g(a) = \frac{\alpha}{a}$, where α is a shape parameter of the distribution. Therefore condition (2.7) becomes[19]:

$$(r+\theta)a - \tfrac{\theta a}{\alpha} \;<\; c_B - c_A \tag{2.13}$$

As α decreases income becomes less concentrated in the lower part of the distribution, and it becomes more likely that consumers will be excluded from mainstream financial services. Alternatively, as the standard of living for the lowest income households, a, increases, the condition for exclusion is less likely to hold.

w_P^* and the level of exclusion, $G(w_P^*)$, under a Pareto distribution are given by:

$$w_P^* = \tfrac{c_B - c_A}{r+\theta\left(1-\frac{1}{\alpha}\right)} \quad \Rightarrow \quad G(w_P^*) = 1 - \left(\frac{a\left[r+\theta\left(1-\frac{1}{\alpha}\right)\right]}{c_B - c_A}\right)^{\alpha} \tag{2.14}$$

[18]This is based on the observation that total exclusion from transaction accounts for the entire U.K. and U.S. population tends to be below 10% and concentrated mainly in the poorer segment of the population, FDIC (2009) and Devlin (2005).

[19]In this case we do not have an upper condition since our income distribution does not have a finite upper limit.

Where again we have that the percentage of the population excluded, $G(w_P^*)$, is decreasing with the rate of return, r, and the income of the poorest consumer (our standard of living parameter), a. We also have that both the cutoff level of exclusion and the proportion of those excluded are decreasing with α. The significance of α as a measure of inequality is not clear. An increase in α represents an increase in the density at the lower tail of the distribution, but it also represents a fall in the mean income[20]. Chipman (1974) has shown how under different conditions both α and its inverse can be used as an index of inequality. The interpretation of these results depend on whether or not we follow Pareto's own example and use α as a measure of inequality.

In the case of the U.S., α has decreased over the last 30 years, leading to an increase in overall mean income. But as Atkinson et al. (2011) argue, this rise in mean real income has been driven mainly by an increase in the right tail of the income distribution, while the standard of living of the lowest income households, a, has remained mostly unchanged[21]. This would suggest the opposite of how Pareto interprets α, meaning that a lower α can be associated with greater inequality. On the other hand, their study of real income in the U.K. found that although α has been decreasing, the standard of living for the lowest-income households, a, has increased[22].

Based on these results our model would predict that in the U.S. exclusion from mainstream banking must have increased over the last 30 years. From (2.14) we can see that, holding everything else constant, decreasing α without an increase in a would lead to greater exclusion. In the case of the U.K. the prediction of the model would be ambiguous. As we argued above, a decrease in α would increase exclusion, while an increase in a would cause it to decrease. Interestingly, the U.K. seems to have experienced a decrease in financial exclusion over the last decade. According to the Financial Inclusion Taskforce the proportion of the unbanked in the U.K. decreased steadily from 2000 to 2008, FIT (2009). This trend might suggest that in the U.K. the impact of a rise in a has outweighed a fall in α[23].

[20] Mean income under a Pareto distribution is equal to: $a\left(\frac{\alpha}{\alpha-1}\right)$.

[21] Atkinson et al. (2011) show that although over the previous 30 years real income had grown at an average annual rate of 1.2%, the majority of that growth had been due to the growth in income of the top 1% of the population.

[22] Their study found this to be true for most English speaking countries, as well as to a smaller extent some Nordic countries.

[23] Note that these results might also be due to a variety of other factors, such as changes in the rate of return available to banks, r, as well as efforts by the U.K. government to increase access to banking. In addition, we currently do not have historical data on exclusion in the U.S., and the FIT study only provides data on exclusion in the U.K. for the last ten years.

Financial Cost of Exclusion

Finally we would like to consider the costs of financial exclusion. Before we go into our analysis, there are two clarifications as to the purpose of this section. Firstly, in our model consumers choose their method of banking optimally. So from a utility perspective it is clear that excluded consumers would not prefer to use a mainstream bank. This result is driven partially from the fact that other than imposing a monopolist bank, we did not allow for any frictions. Our results would differ if something other than a bank's choice of fees led to the exclusion of the lower income class from banking services. These frictions can include information asymmetries, uncertain income flows coupled with risk aversion, or lack of spatial access, among others. Considering the welfare implications of these types of frictions is beyond the scope of our theoretical model. Alternatively, we can look at how the cost of transaction services as a percentage of income compares between the banked and unbanked, giving us a sense of the costs of being excluded from mainstream banking. This is the approach we will take here.

The second point of clarification is related to this approach. The direct fees charged by most deposit-taking institutions tend to be fixed fees, so by definition are regressive. That means that irrespective of the type of financial service provider households use (bank or AFS), low-income consumers pay a higher percentage of their transaction balances as fees than high-income consumers. We will discuss this issue in more depth below. In this section we look at the relative costs of the two types of service providers in order to determine the extent to which the unbanked pay higher prices, and the factors that can help mitigate these costs.

Let us consider our results when using the Pareto distribution. We have from equation (2.3) that the fee charged by the bank is given by:

$$f_B = \theta w^* + c_A \quad \Rightarrow \quad f_{P,B} = \frac{c_B + c_A\left(\frac{r}{\theta} - \frac{1}{\alpha}\right)}{1 + \frac{r}{\theta} - \frac{1}{\alpha}}$$

When using a Pareto distribution, consumers with income greater than w^* pay $f_{P,B}$ for banking services, while consumer with income less than w^* pay c_A. In determining who pays more as a percentage of income we consider the outcome for the poorest consumer relative to a consumer to the right of w^*. Choosing a number, $\bar{h}$, such that $a + \bar{h} > w^*$, we would like to determine under what condition the unbanked pay a higher percentage of their income than the banked for financial services, $\frac{f_{P,B}}{a+\bar{h}} < \frac{c_A}{a}$. Comparing these two ratios we have the following condition:

$$\frac{c_B - c_A}{c_A} \quad < \quad \frac{\bar{h}}{a}\left(\frac{r}{\theta} + \frac{\alpha - 1}{\alpha}\right)$$

If the above condition holds, then the unbanked pay a higher percentage of their income for transaction services. By comparing the two sides of the above inequality we can see that the higher the relative income of the banked consumers (higher $\frac{\bar{h}}{a}$) and the higher the α, the more likely that the unbanked pay a higher relative fee. In addition, a higher rate of return available to banks would make it more likely that those who are left out of the banking sector are worse off. Coupled with the result from above, where an increase in r or α makes exclusion less likely, this suggests that although the probability of being excluded goes down with these factors, the cost of being excluded increases.

One factor that we have not considered so far is the low level of cash transactions in the modern economy. It is important to determine whether unbanked consumers pay higher fees because of being excluded from mainstream banking, or because they do not have a good outside option. There is evidence to suggest that the lack of an outside option is a major factor in the high cost of banking services to low-income households. Research into the fees charged by major banks has found that bank consumers with low deposit balances pay comparable fees to those charged by AFS, CRL (2011). In addition, there are many cases where mainstream banks either directly or indirectly participate in the AFS market, Epstein and Grow (2007).

In the next section we consider what happens to our results when we allow the bank to participate in the AFS market, as well as how our results depend on the consumers' outside option, λ.

3 Alternative Financial Services

In the previous section we presented a very specific model of competition, a monopolist facing a competitive fringe. Now we consider some variations in the structure of our model to get a better sense of the policy implications of our results. We begin by allowing the bank to participate in the AFS market.

Bank as AFS Provider

Up to now we have assumed that the bank can only provide mainstream banking services and is not able to participate in the AFS market. But this does not have to be the case. Financial services involve some basic operations universal to banks and AFS. In most cases banks provide the same types of financial services to their deposit clients as AFS provide to their customers. It seems reasonable to expect that if banks face competition from AFS providers, they would consider the option of entering that market. In fact this observation seems to be true in practice. Mainstream banks have been shown to participate in the AFS market both directly, by providing AFS type services to clients with and without deposit accounts, and indirectly, by funding or owning AFS providers, Epstein and Grow (2007). We extend our model above to allow the

bank to enter the AFS market. We maintain our assumption of a monopolist bank facing a competitive fringe.

The bank's role in the AFS market will depend on the marginal cost faced by the bank for transaction services, c_T. If $c_T \geq c_A$ then the bank would not be able to compete in the AFS market and therefore would not enter. A lower marginal cost of providing transaction services for a mainstream bank seems a reasonable assumption, therefore we consider the alternative case, and for simplicity choose $c_T = 0$[24]. Similarly to our model above we assume that the fixed cost of entering the AFS market is zero, but this is not essential to our results. Since we have that the bank's marginal cost of transaction is lower than that of the AFS providers, the bank will choose a price, f_T, less than c_A and drive the rest of the AFS providers out of the market. We consider the choice of fees, and in turn w^* by the bank in this setting. The bank's profit function when providing both deposit and transaction services is given by:

$$\pi'_B = rD_B - (c_B - f_B)N_B + f_T T_B - k \tag{3.1}$$

$$\text{where} \quad D_B = \int_{w^*}^{a+h} wg(w)\,dw \quad \text{and} \quad N_B = 1 - G(w^*) \quad \text{and} \quad T_B = G(w^*)$$

We now have that $w^* = \frac{f_B - f_T}{\theta}$. D_B and N_B are as we defined them previously, and T_B are the banks transaction customers. These customer do not have deposit accounts, so their funds are not available to the bank to invest in the first term D_B. From w^* we have that the bank is competing with itself between deposit and transaction services. Changes in f_T impact w^* in an equal but opposite direction with changes in f_B. This property allows us to make the following proposition regarding the choice of fees by the bank.

Proposition 3.1: *If the bank chooses to enter the AFS market, the profit maximizing choice of f_T is equal to c_A (or more precisely a very small amount below c_A). While the profit maximizing level of deposit fees f_B is determined by the value of w^* that maximizes the profit function above, holding f_T constant at c_A. In other words, we only need to consider the bank's choice of the "excess price" for deposit accounts relative to a fixed level of transaction fees.*

Proof: It is clear that the bank must choose a fee for transaction services less than c_A,

[24]The actual value of the marginal cost of transactions for the bank is not as important as the assumption that the bank has a cost advantage to provide AFS services over AFS providers. In fact the value of c_T does not impact the choice of f_B, and ultimately the level of w^*, as we will show below. Where actual value of c_T is relevant is in the profitability for the bank of entering the AFS market. Given the studies that argue that banks find this sector profitable, we are comfortable making this assumption.

otherwise it would not be able to attract any AFS customers. In addition, given our assumption on the outside option for consumers from section 2 (where we have substituted in for f_A):

$$a - c_A \geq \lambda a$$

The bank has a captive AFS market for all choices of $f_T \leq c_A$. Finally, given that the absolute value of the changes in w^* are equal for changes in f_T and f_B, it is optimal for the bank to raise f_T to be the highest possible value (just below c_A), and then choose the value of w^* (by choosing f_B) that maximizes (3.1). Any lower value of f_T would lead to lower profits from fees for the bank, without increasing profits from deposit holdings.

Substituting in for $f_T = c_A$ in (3.1) and solving for the value of w^* that maximizes the monopolist's profits under a uniform income distribution, we have:

$$w_U^{'*} = \frac{\theta(a+h)+c_B}{r+2\theta}$$

Comparing this choice of w^* with the cutoff level of income when the bank did not participate in the AFS market, from equation (2.10), it is straightforward to show that the cutoff level of income has increased:

$$\Delta w_U^* = \frac{c_A}{r+2\theta}$$

If the bank chooses to enter the AFS market, the cost to the bank of losing non-banked customers decreases, leading it to price a higher proportion of consumers out of mainstream banking. From the difference in w^* above we can see that this impact is decreasing with the rate of return available to the bank, which is the cost of losing deposit customers, but increasing with the relative cost advantage of the bank in providing AFS services, $|c_A|$.

What remains to be checked is whether or not the bank would choose to enter the AFS market to begin with. By our inherent assumption of profit maximization, the bank would only choose to provide AFS sevices if the resulting level of profits, π'_B is greater than the level of profits in our original model π_B. Under a uniform distribution of income the difference in the two profit levels is given by:

$$(\pi'_B - \pi_B)h = -(r+2\theta)\left(\frac{w_U^{'*2}}{2} - \frac{w_U^{*2}}{2}\right) + \Delta w_U^* \left[c_B + \theta(a+h)\right] + c_A(w_U^* - a) \quad (3.2)$$

Which leads to the following condition for entry of the bank into the AFS market:

$$(r+\theta)a - \theta h < c_B - \tfrac{c_A}{2}$$

This is a weaker condition on the standard of living, a, than our condition for financial exclusion in (2.9) above. If a bank does not find low-income consumers profitable in its higher quality deposit-taking business, it would rather enter the AFS market and serve those excluded customers as a provider of lower quality transaction services. And as we showed above, when a bank chooses to enter the AFS market, the cutoff level of income for customers choosing to open a deposit account increases.

From a policy perspective this would suggest that allowing banks to enter the AFS market might lead to greater exclusion from mainstream banking. Large financial institutions have a cost advantage over small pawnbroker type AFS. At least in the case of our model, a bank with such a cost advantage is able to profit from non-banked customers. This might lead the bank to increase its fees for deposit services, increasing the proportion of the unbanked without reducing the fees for transaction services. The policy response to this result is not very clear. Regulating banks to keep them out of transaction services might not be feasible. An alternative to increased regulation would be to focus on the outside options available to consumers of financial services.

Now we consider the role of consumers' outside option in our results.

Role of Outside Option

In the introduction to our original model we presented the concept "proportion of cash transactions in the economy", λ. This parameter represents to what extent consumers can rely solely on cash without ever having to resort to a bank or AFS. From the perspective of access to income, this would be the proportion of people (including public and private employees) who are paid their wages and other form of earning in cash, rather than through check or direct deposit. While from a perspective of using their earnings, λ represents the extent to which consumers can purchase goods and services in cash, rather than through online and in store debit/credit services.

Here we look to identify the role of this outside option in the results we have presented above. To this point λ has only played an indirect role in our results because we have assumed that the poorest consumer would always choose to use AFS rather than rely on cash alone, $\lambda a < a - c_A$. Now we relax this assumption by considering the choice of w^* by the bank if the AFS market did not exist, and so the consumers' only outside option is to rely on the existence of a cash economy. This extension will allow us to consider both the impact of a

less cash dependent economy and the existence of an AFS market in our model. Using u_0 to represent the utility of a consumer that does not use financial services we can now represent the consumer's binary choice as between:

$$u_B = (1+\theta)w - f_B \qquad \text{and} \qquad u_0 = \lambda w \tag{3.3}$$

As before we compare the two utility functions above to determine the level of income, w^*, below which consumers depends solely on a cash economy.

$$w_0^* = \frac{f_B}{1+\theta-\lambda} \tag{3.4}$$

Therefore consumers earning below w_0^* are excluded from mainstream banking services. Using a uniform distribution of income, we substitute the above cutoff into the bank's profit function from (2.4) and maximize with respect to w_0^*. Solving for the bank's choice for the cutoff level of income when AFS are not an option for consumers we have:

$$w_0^* = \frac{(1-\lambda+\theta)(a+h)+c_B}{r+2(1-\lambda+\theta)} \qquad f_{U,B} = \frac{(1-\lambda+\theta)(a+h)+c_B}{\frac{r}{1-\lambda+\theta}+2} \tag{3.5}$$

As we would expect f_B is a decreasing function of λ, as consumers' outside option improves, the bank is forced to lower fees to keep its customers. Differentiating w_0^* with respect to λ we have that if the following condition holds the level of exclusion is decreasing with the proportion of cash transactions, λ.

$$c_B < \frac{r}{2}(a+h)$$

If the level of income in a market is high enough relative to the technology of the bank, then as consumers' outside option increases the bank would choose to lower fees aggressively, resulting in less exclusion. The intuition behind this result is based on the rate of return available to the bank on customer deposits. As we have noted above, the bank earns revenues from charging customers direct fees and by earning a return on customer deposits. As λ increases the bank must lower its fees, resulting in lower direct revenues from customer accounts. If the level of income in a population is high enough, the lower direct fees puts greater emphasis on the return on deposits as a factor in bank profits. Therefore as long as the condition above is satisfied, when the percentage of the cash economy increases the bank would be willing to

sacrifice the less profitable fees to attract more deposit customers.

The implication of this result is that an increase in consumers' outside option might not reduce financial exclusion if the bank is faced with a low-income consumer population. In such a case as the fees the bank charges decrease, the bank would not find returns on deposits high enough relative to the cost of administering accounts, therefore the bank would shrink its target market.

In order to see the impact of AFS on exclusion we can compare w_0^* with the cutoff level of income from our initial model. We can see by examination that (3.5) is greater than the cutoff level from our base case, w_U^*, regardless of the value of λ. This would suggest that despite their high fees, AFS do in some way improve the outcome for the consumer population by improving their outside option. The presence of AFS in the market forces the bank to lower its fees, lowering the costs of banking as well as financial exclusion.

Although it seems that λ has an ambiguous impact on the level of exclusion, it does have very important welfare implications. We can see by looking at the utility level of the two types of consumers in (3.3) the welfare of consumers left out of the financial services sector is very much dependent on λ. If we have a 100% cash economy the only difference between the banked and unbanked is the quality of service provided by the banking institution, θ.

This is a very important point. As we discussed above, the cost to consumers of being left out of the mainstream banking sector involves both a lack of access to the non-cash portion of the economy, as well as the inability to benefit from the security and convenience provided by deposit-taking institutions. Although both factors are very important issues facing households, they are very different from an overall welfare perspective. Security and convenience of consumer assets are similar to having a good security system or generous insurance on your home, they can be seen as goods bought in the market at a price.

But access to your earnings should be considered more as a right. To the extent that some consumers are priced out of full access to their earnings is a much more fundamental problem. A problem that should interest public economists as well as policy makers, since it can impact redistribution measures that are rarely paid out in cash.

A Captive Audience

As a final extension, we consider the possibility of there existing a captive audience for AFS providers. By captive audience we mean the possibility that a portion of the consumer population does not have the bank as an option (or does not know the bank is an option). These could be illegal immigrants, financially uneducated consumers, or those who live in neighborhoods without banks, so are spatially constrained.

The impact of such a group within our model depends significantly on our choice of income

distribution, as well as who the captive audience are, with respect to their level of income. To illustrate our point, consider a uniform distribution of income with density function $g(w) = 1/h$. If we assume that the captive audience is spread evenly across the income distribution, this is equivalent to a decrease in our density function, $g(w) = 1/h - \epsilon$. As we have shown in our analysis above, in a uniform distribution, h does not impact the choice of w^* by the bank, and therefore does not impact exclusion. Although a reduction in density would not impact the income level of inclusion, it would increase the percentage of consumers that resort to AFS providers.

Alternatively, if we assume that the captive audience is concentrated at the bottom of the income distribution, this is equivalent to cutting off a rectangle on the left hand side of the uniform cumulative distribution. In this case the captive audience would only impact our results if it extended beyond the bank's choice of w^*, meaning that the bank is not able to access as many customers as it would like. This seems to be a reasonable possibility in practice. According to the 2009 FDIC report on financial exclusion, some mainstream banks actively seek out unbanked consumers through community programs designed to improve understanding of the availability and benefits of deposit accounts. This would suggest that a portion of the exclusion data that we site in our introduction to this paper might be attributed to the lack of good information or understanding, rather than the kind of cost benefit analysis we have described in our model.

4 Conclusion

In this paper we have looked to more formally analyze the causes of exclusion from mainstream banking. We have used a stylized model of banking services to demonstrate how under certain circumstances it might be optimal for the bank to exclude the lower income portion of the population. In this setup, the existence of AFS in the market provides consumers with a better outside option relative to relying solely on cash for their day to day existence. In that sense the AFS market plays a positive role in our model, and forces the monopolist bank to price more competitively.

This result depends to some extent on our assumption of perfect competition in the AFS market, as well as our inherent assumption of perfect information and access for all consumers. Uninformed or segregated consumers may not have access to the mainstream banking sector, even if they would prefer to have a bank account rather than rely on AFS. To the extent that these frictions exist, consumers might be susceptible to predatory pricing. Skiba and Tobacman (2007) and others have shown that AFS is not a highly profitable business, therefore marginal cost pricing might not be very farfetched. On the other hand, the volume of transactions in the AFS market is growing very quickly, an indication that there are positive profits in this sector.

More work needs to be done to understand the role of AFS and the consequences for consumers that are forced to rely on AFS for their financial needs.

We have also shown that the rate of return available to the bank, r, can play a positive role in reducing exclusion from mainstream banking. This result suggests that allowing banks to invest customer deposits has a positive impact on the consumer population by reducing the direct fees they have to pay for banking services. To the extent that consumers do not have access to a risk free rate of return for their assets, these direct fees make up a big chunk of the costs of banking. By allowing the bank to reduce direct fees, a higher rate of return on deposits reduces exclusion from banking services, as well as increasing consumer surplus. But the positive impact of r depends on what drives the increase in returns for the bank. If an increase in r is associated with economic growth and better investment opportunities, then it can be seen as a win win outcome for consumers and the overall economy. On the other hand, if increases in r are driven by higher risk in the bank's investment portfolio, the positive impact on consumers can be short lived; a phenomenon that we observed directly in the 2008 financial crisis. Future work on this topic should consider the tradeoff a bank faces when it chooses r, and how its choice of risk in its investment portfolio depends on the consumer population and the economic environment.

We believe that our results in this paper are a good demonstration of how introducing a heterogeneous consumer population adds greater depth to economic analysis. As far as we know, models of banking services have mainly ignored the role of income distribution in considering the strategic decisions of financial institutions. As we have shown above, how income is distributed can significantly impact firm strategy. In addition, changes in the income distribution can have important implications for outcomes for individual consumers. As we show in this paper, under certain circumstances, an increase in the dispersion of income can lead to the bank charging higher fees, and excluding a greater portion of consumers. Over the last several decades we have observed a trend towards greater income dispersion, our results would suggest a greater need for understanding the impact of this phenomenon on the workings of the modern economy, and the financial sector.

5 Mathematical Appendix

Proof for local maximum

In case of a uniform distribution we have that $g(w) = 1/h$ and $1 - G(w) = \frac{a+h-w}{h}$. Therefore we have that:

$$\frac{g}{1-G} = \frac{1}{a+h-w}$$

Which is clearly an increasing function of w. Therefore we have a non-decreasing hazard rate, and the condition for a local maximum is satisfied.

In the case of a Pareto distribution we do not have a non-decreasing hazard rate. We need to show that the following condition for a local maximum holds:

$$\frac{(1-G)g'}{g^2} + \frac{r}{\theta} + 2 \geq 0$$

Using the Pareto distribution we can show that:

$$\frac{(1-G)g'}{g^2} = -\frac{\alpha+1}{\alpha} > -2$$

Where the relation at the end comes from the condition that $\alpha > 1$. Therefore our condition for a local maximum holds for any non-negative values of r and θ.

Proof for global maximum

The condition for a global maximum holds trivially for a Uniform distribution since the density function is constant with respect to w, that is $g'(w) = 0$.

To see that the local maximum under a Pareto distribution is also a global maximum we consider the derivative of our profit function.

$$\frac{\partial \pi_B}{\partial w^*} = -[\alpha r + (\alpha - 1)\theta] \left(\frac{a}{w^*}\right)^{\alpha} + \frac{\alpha}{a}(c_B - c_A)\left(\frac{a}{w^*}\right)^{\alpha+1}$$

We have already shown that the above function reaches a local peak at $w^* = w_P^*$ (where

w_P^* is defined as in equation (2.14)). It is also straightforward to show that this function is positive for all values of w^* below the w_P^* and negative for all values of w^* above w_P^*. Therefore the profit function is single peaked and we must have that w_P^* is the unique value of w^* that maximizes the bank's profit function.

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