C | E | D | L | A | S

Centro de Estudios
Distributivos, Laborales y Sociales

Maestría en Economía
Facultad de Ciencias Económicas

UNIVERSIDAD NACIONAL DE LA PLATA

Comparing Downpayment and Interest Rate Mortgage Subsidies: An Analytical Approach

Ricardo Bebczuk y Edgardo Demaestri

Documento de Trabajo Nro. 162
Junio, 2014

ISSN 1853-0168

Comparing Downpayment and Interest Rate Mortgage Subsidies: An Analytical Approach

Abstract

Our paper sets up a simple model to assess, to the best of our knowledge for the first time, the relative pros and cons of housing downpayment and interest rate subsidies on the access to and the stability of the mortgage market. Our analysis unveils a number of relevant policy lessons for the design of housing subsidy programs, namely: (a) Under fiscal neutrality (same government outlay), both subsidies have the same positive effect on the ability and willingness to repay. But, for such neutrality to hold, the percentage interest rate subsidy must be larger than the downpayment subsidy, which is rare to happen in practice; (b) The interest rate subsidy raises the loan size a bank is willing to grant, but the downpayment subsidy does not, the reason being that the latter actually diminishes the need for bank financing for a given property value; (c) When targeting lower income households, the downpayment subsidy is superior to the interest rate subsidy, as the former increases the loan-to-value and debt-to-income ratios, two key criteria for mortgage borrower eligibility. By the same token, the downpayment subsidy is more likely to have a stronger effect on low and medium value housing units; (d) Such progressivity comes at the cost of a higher probability of default, meaning that some trade-off between equity and financial stability may emerge; (e) Subsidies are likely to put upward pressure on housing prices. The downpayment subsidy has a direct effect (by injecting fiscal resources to cover part of the property price) and an indirect effect (by easing the access to the mortgage market); (f) The interest rate subsidy only has the latter effect; and (g) Compared to the interest rate subsidy, the downpayment support promotes a less aggressive competition in the real estate market.

Ricardo Bebczuk (Universidad Nacional de La Plata, Argentina)

Edgardo Demaestri (Interamerican Development Bank)

This version: May 12, 2014

Introduction

Economic and social reasons justify the apparent concern of governments around the globe to support access to housing. In the Latin American context, two subsidy alternatives that have gained increasing momentum are the Chilean-style downpayment subsidy and the Colombian interest rate subsidy. Details on design, implementation and outcomes are provided in Alarcon, Demaestri and Piedrabuena (2013) and Bebczuk and Demaestri (2014).

As with any subsidy, the flip side is the potentially deleterious impact on the fiscal budget and on the allocation and quality of bank loan portfolios. Disappointingly, despite these latent vulnerabilities, there exists a conspicuous lack of analytical work in this area. In particular, to the best of our knowledge, no research whatsoever has tackled the relative pros and cons of both types of subsidy from a fiscal, banking and real estate market perspective. Such analysis should be of utmost interest for countries running or planning on putting in place a housing subsidy program.

To fill this void, this article presents a model of banking intermediation centered around subsidized mortgage loans.[1] Despite its simplicity, the model is well-suited to lay out the main features and explore the fiscal and financial implications of downpayment and interest rate subsidies.

The paper has three sections, devoted to setting up the model foundations (Section 1) and to exploring the impact on mortgage loan size and risk (Section 2) and on home prices (Section 3). Some conclusions and policy lessons close.

[1] As customary in the banking literature, the model will rely on financial frictions stemming from asymmetric information (see Bebczuk, 2003).

1. Model Setup

In what follows we spell out the details of the model, which just intends to be a stylized representation about the behavior of banks and borrowers in the presence of mortgage subsidies. Loan contracts take place in two periods, one in which the bank selects the borrower and disburses the funds, and a second and final in which the loan is due and is either repaid or defaulted. There are two possible states of nature: in the successful scenario, with probability a_s, the borrower obtains an income high enough to repay, while in the case of failure, occurring with probability a_f, the borrower's income is assumed to be nil. Three equations are the backbone of the model, namely, the bank's participation constraint (henceforth, BPC), the borrower's ability to repay condition (BARC) and the borrower's willingness to repay condition (BWRC).

The BPC displays the break-even point beyond which the bank decides to stop lending, that is, ceases to willingly participate in the contract:

$$(1+r)Dep + g \leq \alpha_s[1 + (1 - s_i)r_P]P + s_i r_P P + \alpha_f(V_1 - E) \qquad (1)$$

According to equation (1), the bank aims to achieve an expected income greater or equal to the expenses involved in the intermediation process. The left-hand side highlights two costs: the cost of loanable funds –equal to the volume of deposits (*Dep*) times the gross required return on such deposits (*1+r*)- and other lending-related expenses, labeled as *g*. The right-hand side, in turn, describes the expected income sources. In the good scenario, the bank gets principal and interest in full, whereas in the negative scenario, the bank recovers part of the money owed, by liquidating the property in period 1 at an expected market value V_1 net of mortgage foreclosure expenses *E* (covering legal and administrative outlays and the opportunity costs for judicial delays).

Expected loan-related revenues comprise the payment made directly by the borrower as well as the interest rate subsidy, equal to the total interest payment due (the loan *P* times the loan interest rate r_p). A few assumptions are implicit in the analysis: (i) While there is a borrower risk, the subsidy is paid to the bank with certainty; (ii) To avoid the trivial case of a risk-free loan, the net revenue from repossession is lower than the total outstanding debt, which means in turn that the loan interest rate will always be above the deposit interest rate; (iii) The bank is risk neutral, which means that expected values

are taken as certain. Perfect competition will happen when equation (1) becomes an equality; and (iv) No other costs or revenues enter the bank's income statement. Though some of these assumptions are more realistic than others, none of them is critical for our conclusions and are adopted only for the purpose of simplifying the presentation.

The value of the property being purchased in the first period, V_0, is linked to the loan value P by the following equation:

$$P = V_0(1 - d_s - d_{ns}) \qquad (2)$$

donde d_s and d_{ns} are, respectively, the subsidized and non-subsidized fractions of total downpayment in terms of V_0. The expression (1 - d_s - d_{ns}), o P/V_0, represents the initial loan-to-value, or LTV.

For equation (1) to be fulfilled, two conditions must be met as well. For one, the borrower must receive in the good state an income high enough that, in conjunction to the government subsidy, covers the amount due. Thus, borrowers will be *able* to repay when:

$$\theta Y_1 + s_i r_P P \geq (1 + r_p)P \qquad (3)$$

The coefficient θ is the maximum percentage of period 1's income allowed by regulation or the own bank's policy to be applied to loan repayment. The third and last condition is that, provided he/she is able, the borrower is *willing* to repay. For this incentive compatibility constraint to be satisfied, it is required that the cost of declaring default (the loss of the house with value V_1 in period 1) be higher than or equal to the benefit of repudiating the debt (economizing on principal and interest):

$$V_1 \geq [1 + (1 - s_i)r_P]P - V_0 d_{ns} - C \qquad (4)$$

Two additional factors may help defuse this moral hazard behavior. First, the decision hinges on the borrower's initial self-financed investment sunk in the property in the

form of downpayment ($V_0 \times d_{ns}$), as this sum will be lost for good upon the default event. Secondly, there might be a cost C associated to default, manifesting itself in a credit downgrade, the costs of relocation, and the psychological stress from failing to meet the moral obligation towards the creditor. It is worth noting that the downpayment subsidy ($V_0 \times d_s$), despite improving the ability to repay, does nothing in relation to the willingness to repay, as it is not borrower's money at stake.

2. The Impact of Subsidies on Loan Size and Risk

This section will examine how these two subsidies affect the maximum loan size a borrower can take on and the default risk for these subsidized mortgages. Before proceeding, it is useful to solve for the loan interest rate r_p in the bank's participation constraint (BPC, equation (1′)), the borrower's ability to repay condition (BARC, equation (3′)) and the borrower's willingness to repay condition (BWRC, equation (4′)):

$$r_P \geq \frac{(1+r)P + g - \alpha_s P - \alpha_f (V_1 - E)}{[\alpha_s + s_i(1-\alpha_s)]P} \qquad (1')$$

$$r_P \leq \frac{-\alpha_s \theta Y_1 + P}{P(s_i - 1)} \qquad (3')$$

$$r_P \leq \frac{V_1 + V_0 d_{ns} + C - P}{(1-s_i)P} \qquad (4')$$

In the plane (P, r_p), the BPC function displays a non-linear, positive slope, as for a larger loan balance and a given net liquidation value (V_1-E), the loan interest rate must rise so as to reach in expected value the minimum depositors' required return (r). For the BARC function the relationship is negative because, for a given borrower's income, a larger loan must be offset with a lower interest rate in order to maintain the ability to repay. Similar consideration explains the negative slope of the BWRC function: for a given V_1, the incentive to default on the debt would increase unless the interest rate falls.

Graphs 1-4 below depict the above functions under four possible configurations. A mortgage contract will be written as long as the three conditions are simultaneously met, a situation that will take place whenever r_p lies on or above the BPC function and on or below the BARC and the BWRC functions. In Graph 1, no loan is made since no interest rate jointly satisfies the above conditions. The opposite is observed in Graph 2, where there is no maximum loan amount. These two cases are of course trivial and irrelevant in light of the questions at hand.

Of greater interest is the case presented in Graph 3, where the ability to repay becomes a binding constraint and defines an upper loan limit, denoted as $P_{max,\ barc}$. From equating (1′) and (3′), after some algebra we obtain:

$$P_{max,barc} = \left(\frac{1 - s_i}{1 + r(1 - s_i)}\right)\left\{-g + \alpha_f(V_1 - E) + \left[\alpha_s + \frac{s_i}{(1 - s_i)}\right]\theta Y_1\right\} \quad (5)$$

The willingness to repay is the binding constraint in Graph 4, with the following equation defining the maximum loan size:

$$P_{max,bwrc} = \frac{1}{1 + r}\left\{-g + \alpha_f(V_1 - E) + (V_1 + V_0 d_{ns} + C)\frac{[\alpha_s + s_i(1 - \alpha_s)]}{(1 - s_i)}\right\} \quad (6)$$

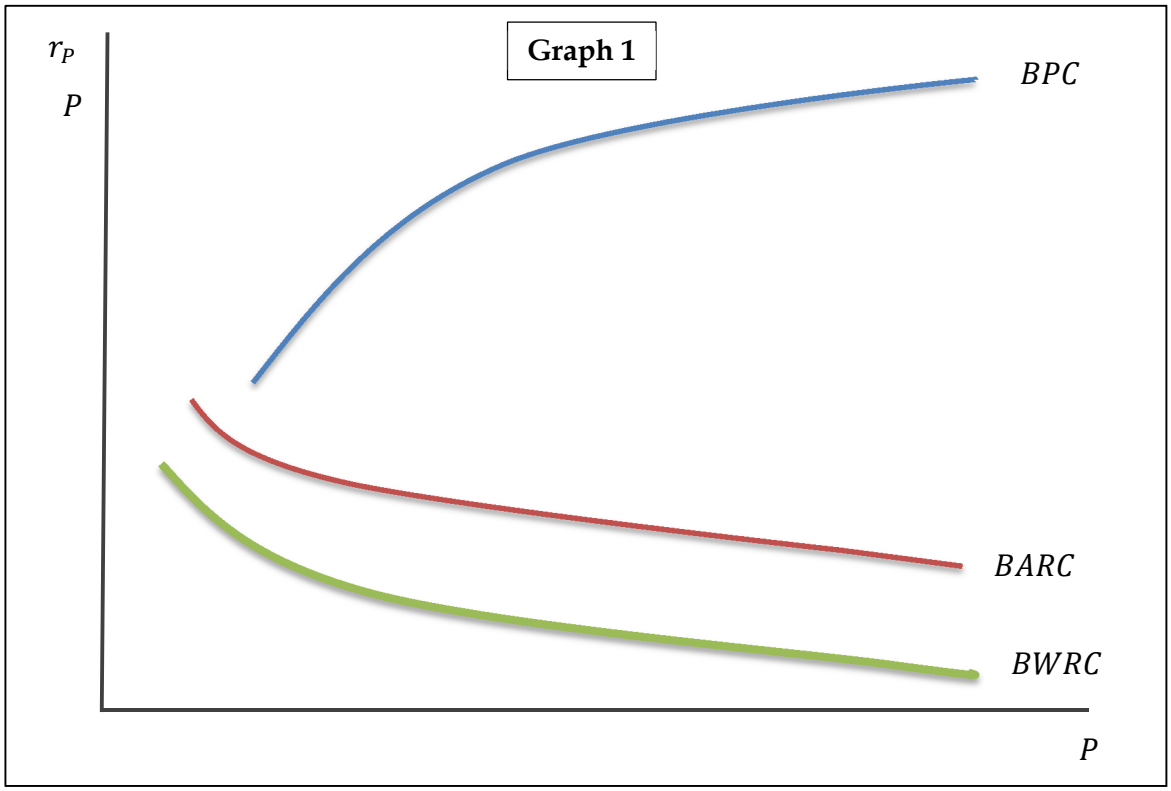
As expected, in both equations (5) and (6) the maximum loan size grows with V_1 and diminishes with g and E. Y_1 exerts a positive impact in equation (5), as does C and d_{ns} in equation (6).

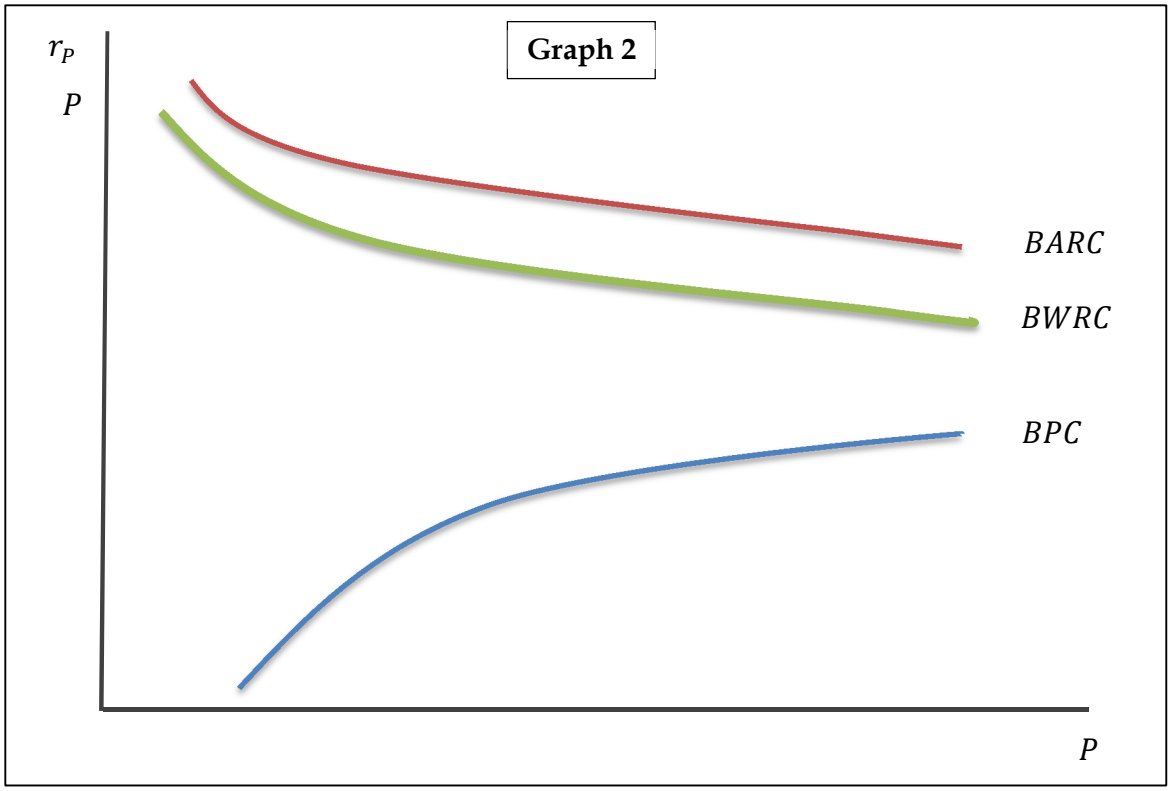
More importantly, the interest rate subsidy s_i, by improving both the ability and the willingness to repay, favors a higher loan level. Conversely, the downpayment subsidy at rate d_s has no incidence on the amount lent. This may look odd in view of the facilitating role a subsidy is supposed to play, but it must be recalled that this sort of subsidy, rather than operating through the banking system, embodies a transfer to the house seller. In fact, a larger subsidy implies, via equation (2), a smaller loan for a given V_0 –or, alternatively, a larger V_0 for a given P. This point can be made even clearer by looking at the extreme case in which s_i=d_s=100%. If s_i=100%, the borrower is responsible for repaying only the principal, while the interest is covered (with probability 1) by the government, all of this induces the bank to offer a larger loan. On the other hand, if d_s=100%, then there would be no loan at all, as the borrower can now manage without bank financing.

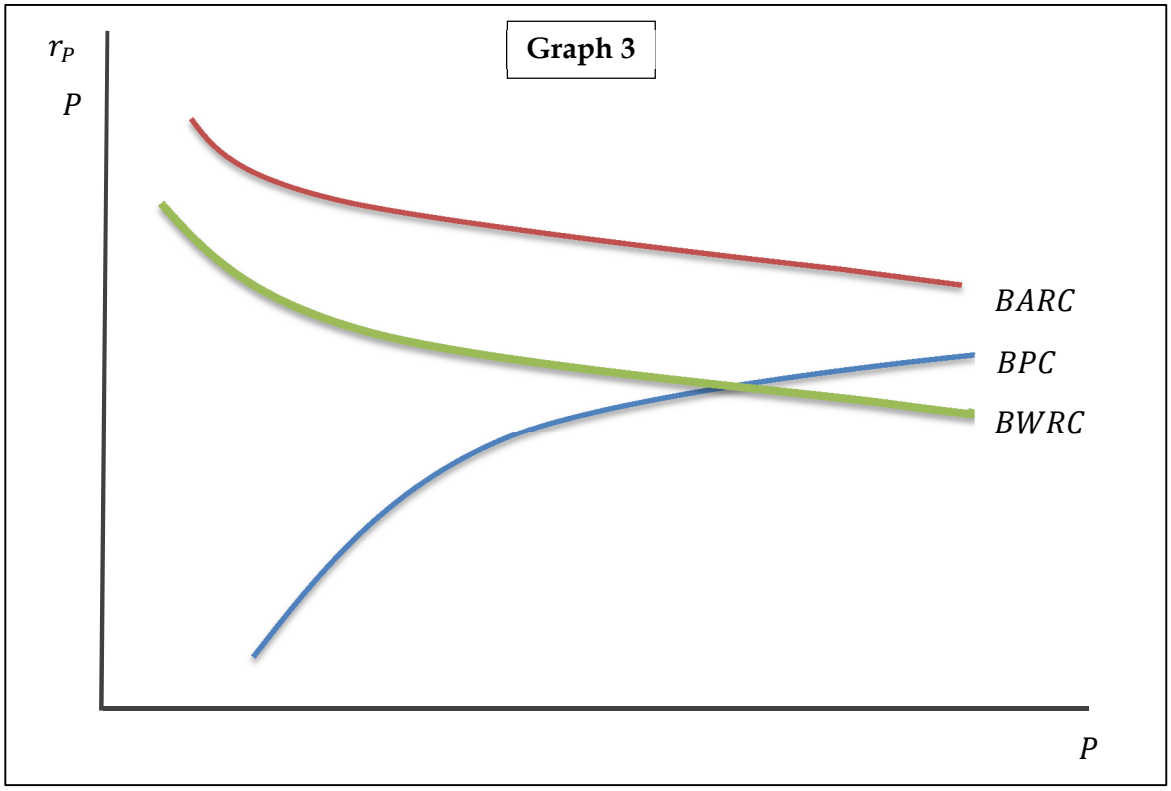
Naturally, the very same argument also explains the absence of d_s in equations (5) and (6). The parameter d_{ns} appears in equation (6) solely through its effect as a commitment device on the willingness to repay. One possible pitfall of the downpayment subsidy would then be the strategic substitution between d_s and d_{ns}: if opportunistic households

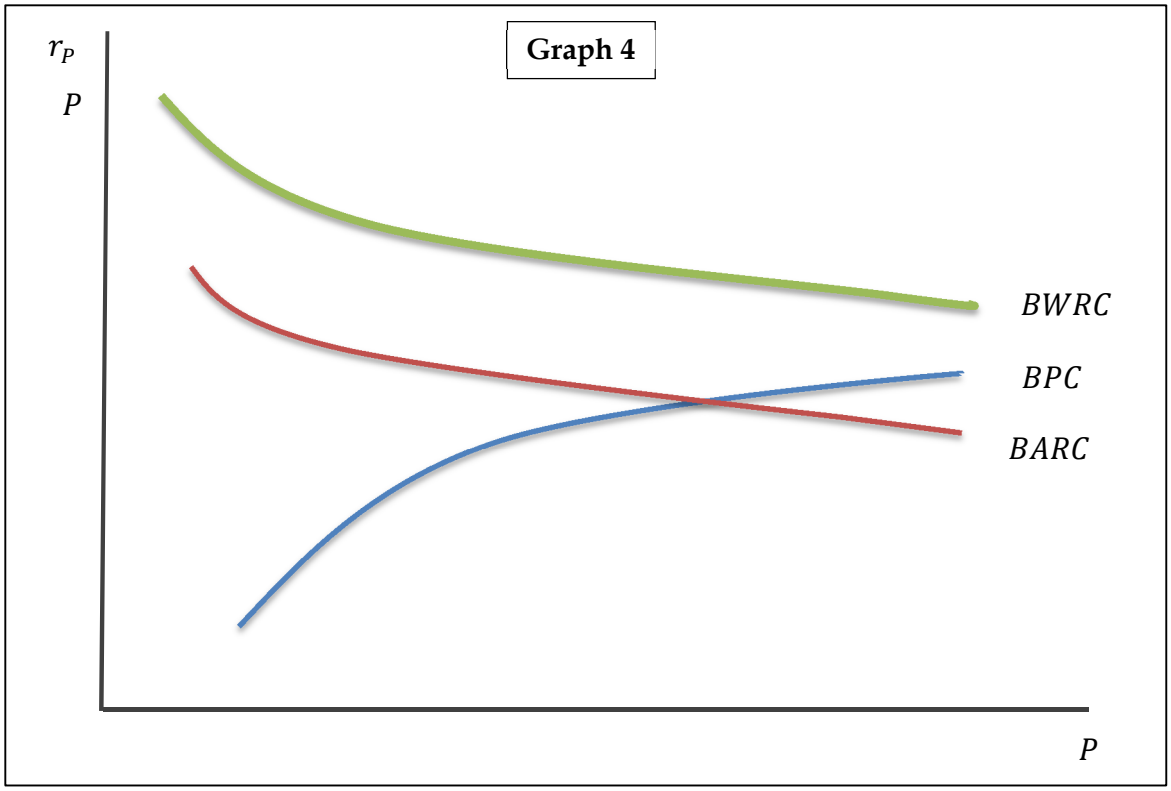
with capacity to save and make a downpayment hide these funds to take full advantage of the subsidy, their incentive to repay will weaken. Proper ex ante screening is needed to discourage such behavior.

Going back to the positive effect of the interest rate subsidy on loan size, this may be read as good or not-so-good news depending on the circumstances. For house buyers without capacity to pledge downpayment, a bigger loan can certainly be a solution. However, higher indebtedness turns borrowers more vulnerable to negative shocks and thus a default scenario, a risk that intensifies during economic downturns. Along similar lines, since any feasible solution will lie along the positively-slopping BPC function, larger loans are accompanied by a higher interest rate, which heightens the above-mentioned risk.




Graph 2
r_P
P
$BARC$
$BWRC$
BPC
P


Graph 3
r_P
P
$BARC$
BPC
$BWRC$
P



In spite of this differential effect on loan size, the model underscores the fact that both subsidies promote a higher financial inclusion by turning eligible for a loan some applicants that would have been otherwise rejected, should they depend exclusively on their own resources. To see this point, let us insert equation (2) into equations (3) and (4) to get:

$$Y_1 \geq \frac{1}{\theta}\left[\left(1 + r_p\right) - s_i r_P\right] V_0 (1 - d_s - d_{ns}) \qquad (7)$$

$$V_1 \geq [1 + (1 - s_i) r_P] V_0 (1 - d_s - d_{ns}) - V_0 d_{ns} - C \qquad (8)$$

All else equal, higher values of s_i and d_s go hand-in-hand with an enhanced ability and willingness to repay. Equations (7) and (8) reinforce the claim that the downpayment subsidy fosters mortgage penetration by reducing, for a given V_0, the loan amount and thus the prospective debt burden for the borrower. From the bank's participation constraint (equation (1)), this is also associated to a lower mortgage interest rate.

To perform a more strict comparison between subsidies, it is sensible to assume fiscal neutrality, that is, that the total outlays are the same under either scheme. In present value, the fiscal cost for the downpayment subsidy [$FC\ (d_s)$] and for the interest rate subsidy [$FC\ (s_i)$] equal:

$$FC\ (d_s) = d_s \times V_0 \tag{9}$$

$$FC\ (s_i) = (s_i \times r_p \times P)/(1+r) = [s_i \times r_p \times (1- d_s - d_{ns}) \times V_0]/(1+r) \tag{10}$$

Equating both expressions, we obtain the interest rate equivalent subsidy ($s_{i,eq}$) with the same fiscal cost in present value as a given downpayment subsidy:

$$s_{i,eq} = \frac{d_s\,(1+r)}{(1-d_s-d_{ns})r_p} \tag{11}$$

For the same percentage subsidy ($d_s = s_i$), the downpayment subsidy is more expensive from a budgetary standpoint. For example, if r_p = 15%, d_{ns} = 0% and d_s = 10%, assuming $r=0$, then $s_{i,eq}$ = 74%. Intuitively, this follows from the fact that the downpayment subsidy finances the principal, which usually exceeds the interest component, even more so in a two-period model such as the present one.

A key lesson here is that, under fiscal neutrality, the choice of one subsidy regime or the other is immaterial in regard to the ability to repay, as for construction both subsidies will strengthen it to the same extent, in one case by liberating the borrower from part of the interest payments and in the other by cutting down the required indebtedness –see equation (7). The same goes, as apparent from equation (8), for the willingness to repay, provided the borrower puts up the same downpayment of his/her own ($d_{ns} \times V_0$). [2]

More profound differences can be pinpointed, though, in terms of focalization once we introduce certain typical eligibility requirements imposed by banks and regulators, as well as some usual design features of mortgage subsidy programs. In turn, such

[2] The subsidy type is also inconsequential as to the bank capital requirements, since the risk weight for mortgage loans under the Basel guidelines is 35% regardless of the loan-to-value ratio.

differences are likely to affect the average quality of the mortgage loan portfolio, as shown next.

The first feature to factor in is that banks make credit decisions not only based on expectations of future variables but primarily on observable variables that are thought to be good predictors of payment behavior. Two crucial indicators in this regard are the loan-to-value (LTV) ratio and the debt-to-income (DTI) ratio, which are formalized in equations (12) and (13):[3]

$$LTV = \frac{P}{V_0} = \frac{V_0(1 - d_s - d_{ns})}{V_0} = (1 - d_s - d_{ns}) \leq \overline{LTV} \qquad (12)$$

$$DTI = \frac{P}{Y_0} = \frac{V_0(1 - d_s - d_{ns})}{Y_0} = \frac{V_0}{Y_0}(1 - d_s - d_{ns}) \leq \overline{DTI} \qquad (13)$$

As shown in the equations, by regulation or their internal credit policies, banks set maximum cutoff values for both parameters, $\overline{LTV}$ and $\overline{DTI}$.

For its part, housing programs, in line with their social and redistributive goals, tend to adopt eligibility rules biased towards pro-poor and middle income families. Popular clauses are that beneficiaries must not have an income above a stated limit (equation (14)) and that the percentage subsidy must decrease with the property value (equation (15) and (16)):

$$Y_0 \leq \bar{Y}_0 \qquad (14)$$

$$d_s = z(V_0) \qquad (15)$$

$$s_i = y(V_0) \qquad (16)$$

with z(.) and y(.) ranging between *[0, 1]* and $z' < 0$ and $y' < 0$.

[3] Notice that formulae include the observable variables V_0 and Y_0, not the future values V_1 and Y_1.

Now a major difference arises between both subsidies, as the downpayment subsidy diminishes both the LTV and DTI ratios (see equations (12) and (13)), but the interest rate subsidy affects neither of them. This is so because the latter alleviates the financial burden once the loan has been granted while the former shrinks in advance both ratios by reducing the need for debt at the time of applying for the loan.

Since lower income family have a limited capacity to save and hence accumulate enough wealth to provide the downpayment by themselves, the downpayment subsidy is especially critical for this population segment. By capping the income level to be admitted to the program (equation (14)) and setting a subsidy decreasing in property value (equations (15) and (16)), these subsidies reinforce their progressive effect. Still, the interest rate subsidy may fall short of reaching out to some poorer families unable to make the downpayment, so the government support may not be sufficient for these borrowers to qualify in the eyes of the bank.

Targeting low and middle income customers is likely to have some impact on the quality of the mortgage loan portfolio. This clientele has a priori a higher probability of default –the parameter a_f in equation (1)-, owing to their higher risk of unemployment (especially among less skilled and informal workers) and, in the case of small entrepreneurs, their limited capital and product diversification, which turn them particularly vulnerable to negative shocks. Compounding this problem, a lower probability of success implies a higher interest rate (via equation (1)), leading to a heavier future financial burden that compromises even further, as a second round effect, the ability and willingness to repay. As evident from this discussion, a trade-off between loan delinquency and income distribution equity may ensue.

3. Housing Subsidies and Home Prices

In assisting households to buy a house, subsidy schemes may fuel the demand and thus inflate the market price for residential real estate. By how much prices change depends on several factors: (a) The volume of additional demand made possible by the program; (b) The characteristics and location of the houses in higher demand; (c) The supply response in the face of such new demand; and (d) The influence of the program on price-setting behavior and competition in the real estate market.

In regard to the first factor, although both subsidies create additional demand, only the downpayment subsidy does that directly, by providing the household with fresh money to complete the transaction. The interest rate subsidy helps the household in a more indirect fashion, by making it more likely to successfully apply for a loan. That being said, it should be kept in mind that the flow of new demand infused into the market is normally is well above total subsidy outlays.[4] As reflected in equation (9) for the downpayment subsidy, the government takes upon itself just a fraction d_s of total house value V_0, with the remaining part being covered by the buyer and the creditor.[5]

As for the second factor on the list, it is important to recall that the additional demand will not spread uniformly across all available units in the market, but it will rather concentrate on those segments that are targeted by the program. Building on previous discussion in the paper, governments seek to support lower income families, which as a rule tend to look for equally lower value housing located in less expensive neighborhoods, and this is the market most likely to experience price inflation. Since this targeting is clearer under a downpayment vis-à-vis an interest rate subsidy, this effect will be more pronounced in the first case.

An obvious argument to be considered, and one largely independent of the subsidy design to be adopted, is the responsiveness of supply to a larger demand. In general, this reaction will be stronger in the long- than in the short-term, and will as well depend on other variables, including the availability of land and financing for construction projects, the building regulations at the municipal level, and the perception within the construction industry about the government commitment toward the subsidy program as a long-term policy or a temporary fix.

---

[4] On the other hand, subsidy expenses may overestimate the net effect of the subsidy whenever some beneficiaries that were planning on purchasing the house without government assistance now enroll in the program. The pure effect consists of the houses being bought only by virtue of the subsidy.

[5] Also those equations are written for one representative loan, not for the whole number of subsidies provided, which is the relevant figure to measure total additional demand.

The subsidy scheme may not be innocuous either for the degree of competition in the real estate market. In particular, the buyer pays the full price under an interest rate subsidy but only a share of it under a downpayment subsidy.[6] This may lead the household to overpay for a given property, as a result of a less active search or less aggressive price negotiation, or to look for a unit for a more expensive than without the subsidy. This distortion will amplify with the generosity of the subsidy (i.e., higher d_s).

To close, it must be noted that not only subsidies affect housing prices, but developments in the latter may have some influence on the program outcomes. For one, sustained housing price inflation will create a negative externality on households entering the market in the future by making units less affordable for subsidy beneficiaries and even more so for non-beneficiaries. Secondly, on a more positive note, higher housing prices in the future strengthen the willingness to repay, by making the default strategy more costly, as clear from the role of V_1 in equation (8).

[6] As a matter of fact, a lower price will benefit the buyer also under an interest rate subsidy by diminishing future interest and principal payments, and with fiscal neutrality both subsidies should be equivalent on this front as well. However, unlike the interest rate subsidy, the downpayment subsidy may be viewed by an upfront discount by some myopic households.

Conclusions and Policy Lessons

This work has investigated, to our best knowledge for the best time, the relative merits and pitfalls of downpayment and interest rate subsidies on the access to and the stability of the mortgage market, as well as their repercussions on the functioning of the real estate market.

The main conclusions from the analysis are:

(a) By improving the ability and willingness to repay, both subsidies enhance the probability of being eligible for a mortgage;
(b) Under fiscal neutrality, both subsidies have the same effect on the ability and willingness to repay;
(c) In practice, for fiscal neutrality to hold, it would be necessary the percentage interest rate subsidy to be much larger than the downpayment subsidy, which is rare to happen;
(d) When it comes to the willingness to repay, the interest rate subsidy may however be superior in the case that the latter might induce opportunistic borrowers to substitute downpayment of their own for subsidized downpayment;
(e) The interest rate subsidy raises the loan size a bank is willing to grant, but the downpayment subsidy does not, the reason being that the latter actually diminishes the need for bank financing for a given property value;
(f) The higher loan size under an interest rate subsidy may help borrowers gain access to a larger value property, but at the same time gives rise to higher default risk, as the rising leverage and interest rate make borrowers more vulnerable to negative shocks;
(g) When targeting lower income households, the downpayment subsidy is superior to the interest rate subsidy, as the former increases the loan-to-value and debt-to-income ratios, two key criteria for mortgage borrower eligibility;
(h) Such progressivity comes at the cost of a higher probability of default, meaning that some trade-off between equity and financial stability may emerge;
(i) Subsidies are likely to put upward pressure on housing prices. The downpayment subsidy has a direct effect (by injecting fiscal resources to cover part of the property price) and an indirect effect (by easing the access to the mortgage market). The interest rate subsidy only has the latter effect;
(j) The downpayment subsidy is more likely to have a stronger effect on low and medium value housing units;
(k) Compared to the interest rate subsidy, the downpayment support promotes a less aggressive competition in the real estate market; and

(l) Regardless of the subsidy type, housing price inflation will also be driven by the supply reaction and other factors. In turn, housing revaluation over time may have one positive side effect (enhanced willingness to repay) and a negative side effect (externality on future buyers, both within and outside the subsidy program).

References

Alarcón A., E. Demaestri and B. Piedrabuena (2013), "Financiamiento de vivienda en Chile", mimeo, IDB, March.

Bebczuk R. and E. Demaestri (2014), "Instrumentos estatales para la promoción del financiamiento de la vivienda en América Latina", IDB, March.

Bebczuk R. (2003), *Asymmetric Information in Financial Markets: Introduction and Applications*, Cambridge University Press, Cambridge, UK.