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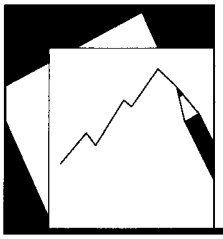

IMF Working Paper

Using Credit Subsidies to Counteract a Credit Bust: Evidence from Serbia

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Using Credit Subsidies to Counteract a Credit Bust: Evidence from Serbia[1]

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Abstract

Emerging markets are particularly vulnerable to boom-bust credit cycles, due to excessive capital flows, shallow equity markets, and companies' high leverage and open FX positions. While the policy debate on how to respond to boom-bust credit cycles remains unsettled, it has been conjectured that credit subsidies may provide a particularly effective policy tool to counter a credit bust. This paper reports on a rare policy experiment where credit subsidies were used to buffer the impact of the global financial crisis on Serbia in 2009. Model simulations suggest that credit subsidies in Serbia helped to mitigate the slump in output.

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I. INTRODUCTION

The right policy response to boom-bust credit cycles in emerging markets remains controversial. In a review of how emerging markets coped with the recent global financial crisis, IMF (2010) found that countries that managed to keep external pre-crisis vulnerabilities relatively low tended to recover faster from the crisis. In particular, prudential and capital control policies are the conventional tools to counter boom-bust cycles, but their design, effectiveness, and effects remain subjects of debate (see for instance, Ostry et al., 2010, and Stiglitz, 2003). Once a bust takes place, Calvo (2010) has argued that there is a strong case to attenuate credit conditions, particularly for small- and medium-sized enterprises, and he conjectured that credit subsidies could provide a potentially effective tool.

This paper provides evidence on the effectiveness of countercyclical credit subsidies, drawing on a rare policy experiment in Serbia. Credit subsidies have been standard policy fare for addressing market imperfections in advanced countries, notwithstanding questions about adverse allocation and other effects (see Buttari, 1995; Rapisarda and Patacchini, 2003). On aggregate level, excessive optimism followed by sudden corrections, which produce boom-bust cycles, can be also viewed as consequence of market imperfections. Therefore credit subsidies could be a potentially effective tool to address these imperfections during a bust, see Calvo (2010). However, there seems to be no direct evidence available on the effectiveness of such credit subsidies. Largely due to unusual local circumstances, the Serbian government had at the beginning of 2009 the scope to launch a package of credit subsidies to counteract the spillovers from the global financial crisis. Serbia's experience with these credit subsidies is explored in this paper, and can offer some preliminary evidence on Calvo's policy conjecture.

The paper uses a simple, calibrated model with a financial accelerator to gauge the effects of credit subsidies. The model focuses on the non-financial sector. An adverse shock (demand, interest rate, exchange rate depreciation on unhedged FX credit, or credit standards) impacts companies' cash flows and weakens their credit worthiness for credit renewal. The exit of companies that do not get renewed credit aggravates the initial adverse shock and deepens the economic downturn (see Bernanke et al. 1996). In this setting, credit subsidies improve cash flow either directly (enterprise credit subsidies via reducing interest payments) or indirectly (consumer credit subsidies via increasing in demand for companies' products). Thus, credit subsidies can mitigate a severe economic downturn.

The paper concludes that Serbia's credit subsidy scheme apparently helped to buffer the economy against deeper recession during a bust but it is too early to assess whether it was socially optimal. The model-based estimates suggest that without credit subsidies the economy could have experienced a deeper recession (by about 1–2 percentage points of GDP growth). This may help to explain why Serbia experienced a relatively mild output recession in 2009, taking into account that Serbia was one of the most vulnerable and exposed countries in the region.[2] Nevertheless, social optimality of such countercyclical credit subsidies is beyond the

[2] This is based on the first revision of GDP data, published in 2011.

scope of this paper as it involves longer-term intertemporal consideration of growth and redistribution effects.

The specific circumstances surrounding Serbia's credit subsidy experiment also suggest that it may be difficult to replicate. First, at the beginning of 2009, the Serbian government had unexpectedly fiscal resources available for this purpose (reallocated from other already budgeted spending that was unlikely to be spent given the crisis). Second, an energetic Ministry of Economy moved quickly to put the scheme in place. Third, account blockages of delinquent debtors—a Serbian specific feature—posed an important threat to corporate system liquidity, potentially causing widespread insolvency. Fourth, a key incentive to make the scheme work was provided by the central bank, which allowed deducting subsidized credit from the reserve requirement base. Fifth, prudent supervisory policies, prior the crisis, made banks particularly well liquid and solvent. And sixth, the success in promoting subsidized lending was in part facilitated by strong competition in the banking sector (with the Hirsch-Herfindahl index of 626, the Serbian banking sector is the least concentrated banking sector in Europe). For the sake of keeping their clients, banks were inclined to grant subsidized loans, even though the return from such loans was minimal or negative.

The rest of the paper is organized as follows: The next section introduces the main vehicle for simulating effects of credit subsidies in the non-financial sector, while the third section describes an approximation used for the rest of the economy. Section four is devoted to the Serbian case, including the model calibration and policy simulations. Section five concludes.

II. The Model of a Non-Financial Sector

This section introduces a partial equilibrium model of monopolistic competition with Dixit-Stiglitz technology. The model describes the behavior of small, medium, and large companies in a non-financial sector. There is a finite number of companies holding own capital, which is distributed normally. Companies need working capital to produce and banks provide credit only to companies with a certain minimum level of own capital; therefore not all companies produce in all times. Individual companies are price takers in the sector's labor market. The non-financial sector's budget constraint is partially exogenous, since it depends on government's and households' decisions, which are not modeled endogenously.

A. Households

Homogenous households work and consume. A finite number of households[3] supply homogenous labor to the sector and receive an equal wage. The wage is determined by the sector's aggregate labor demand and supply. The aggregate labor supply is elastic (parameter ρ) in the number of employees. In consumption of goods, households like variety – they prefer a

[3] A representative household setup would be equivalent in modeling and simulations; nevertheless, in order to match the actual data on number of employees, the normalization to a representative household is not introduced.

mix of products to an equal amount of a single good q_i. Therefore, their utility can be represented by a Constant Elasticity of Substitution (CES) function and the aggregate sector's utility-demand Q is defined as follows:

$$Q = (\sum_{i=1,\dots,n} q_i^{(\theta-1)/\theta})^{\theta/(\theta-1)}, \quad (1)$$

where θ is the elasticity of substitution; and there are n goods. Since each company produces one close substitute good q_i, there are n companies.

Households maximize utility (1) respecting the budget constraint. Households' utility increases with the amount of goods q_i; however, purchases of goods are constrained by household's budgets. The budget (PQ) for sector's output is a share (κ) of the aggregate budget in the economy (AD), which is the sum of all wages, profits of companies and banks, changes in savings, and government expenditures (including subsidies). Since the rest of the economy is not modeled here, the size of the sector's budget is semi-exogenous to the model.

The utility-consistent price index assures model consistency. The theoretically-consistent price index assures that the product of aggregate utility-based quantity and the aggregate price index will be consistent with the aggregate budget constraint. Thus, the aggregate price index P reads:

$$P = (\sum_{i=1,\dots,n} p_i^{(1-\theta)})^{1/(1-\theta)}, \quad (2)$$

where p_i is the price of the good q_i.

Households' preferences determine the sector's market structure. From the utility maximization with respect to the budget constraint, it follows that there is a residual demand for each product q_i – a characteristic of imperfectly competitive markets. Using the aggregate values as numeraire, the residual demand functions are defined as follows:

$$p_i = (q_i/Q)^{(-1/\theta)}P. \quad (3)$$

B. Companies

Companies differ in the amount of own capital. They hire labor l_i and produce close substitute products q_i according to a linear production function $q_i = A\ l_i$. The parameter A is the labor productivity factor. Companies need working capital to produce. They have own capital (k_i) in local currency, which covers a portion of the needed working capital and the rest they need to borrow from banks in domestic or foreign currency (FX).

They are homogenous in the optimal choice of output but their free cash flows differ. Companies maximize profit by choosing an optimal q_i, with respect to the residual demand

function (3), the production function, and other exogenously given variables and parameters. In particular, they solve the following program:

$$Max_{qi} \{(1- i -\alpha\Delta s)p_i q_i - wl_i + (i +\alpha\Delta s)k_i\} \quad (4)$$

$$S.t. \quad p_i = (q_i/Q)^{(-1/\theta)}P \text{ and } q_i = A\, l_i ,$$

where i is the interest rate on bank loans, α is the unhedged share of bank loans, and Δs is a percentage change in the nominal exchange rate. The first derivative of the expression (4) defines the price of good q_i:

$$p_i = w/[A(1-1/\theta)(1- i -\alpha\Delta s)]. \quad (5)$$

The optimal quantity q_i is related to the rearranged expression for residual demand (3),

$$q_i = (p_i/P)^{(-\theta)}Q ,$$

but it remains undetermined due to unknown number of companies n, which is needed to evaluate the aggregate price index $P = n^{1/(1-\theta)}p_i$. Once n is determined, we can compute Q from the semi-exogenous aggregate budget constraint and evaluate q_i. The optimal choice of output and prices are common to all companies (also because the share of unhedged loans is assumed equal across companies), but since some need to borrow more working capital from banks than others, free cash flows differ across companies.

C. Banks

Banks determine the number of companies on the margin. Given the distribution of own capital and banks' lending standards for free cash flows, banks determine the number of companies that receive credit. Companies that need to borrow a larger amount of working capital will have a lower free cash flow. There is a threshold for the free cash flow that banks require for lending. Companies that do not satisfy this threshold do not receive credit (i.e., the extensive margin; there is no intensive margin in the model). During distress, highly leveraged companies will be the first to not get renewed credit and close down.

The distribution of free cash flows is primarily determined by the distribution of own capital– $k_i \sim G(\mu, \sigma)$. There are two other variables that affect the distribution of free cash flows: (1) exchange rate changes; and (2) interest rate changes. The free cash flow π of a company i is given by the following relation:

$$\pi_i = p_i q_i\, (1- (i +\alpha\Delta s)v_i) - wl_i , \quad (6)$$

where the leverage $v_i = 1- k_i/p_i q_i$. Companies that have free cash flow lower than π^t (a threshold profit) do not qualify for credit. There are M companies that possess positive own capital and could generate profits, but profits of $G(\pi^t)M$ companies are not sufficiently high to warrant credit. Thus, there are $n = [1- G(\pi^t)]M$ companies operating in the economy.

D. Equilibrium

The equilibrium is derived by iterating over sector's wage, number of companies, and demand. Given the wage, aggregate budget constraint, number of companies with positive own capital, profit threshold for receiving credit, mean and standard deviation of own capital, share of unhedged FX credit, interest rate, exchange rate change, labor productivity factor, elasticity of labor supply, and the elasticity of substitution, endogenous variables are determined according to the following relations by iterating over the wage, number of companies, and the sector's demand as follows:

Guess: $[w, n, PQ]$

Evaluate:

$$p_i = w/[A(1-1/\theta)(1- i -\alpha\Delta s)] ; \quad (7)$$

$$q_i = PQ/(n\, p_i) ; \quad (8)$$

$$l_i = q_i/A ; \quad (9)$$

$$\pi_i = p_i q_i - w l_i - (i +\alpha\Delta s)(p_i q_i - k_i) ; \quad (10)$$

$$n^* = [1- G(\pi^t)]M ; \quad (11)$$

$$L^* = n\, l_i ; \quad (12)$$

$$w^* = \rho L ; [4] \quad (13)$$

$$PQ^* = \kappa[AD + n^* p_i\, q_i - PQ]. \quad (14)$$

Letters AD stand for the aggregate demand of the economy in the previous equilibrium.

Verify $[w^*, n^*, PQ^*]$ against the guess and if different use their average as a new guess. The model is in equilibrium, once the guess and the outcome converge.

Counterparts to the actual GDP deflator, real GDP, and employment in the model are: p^* (since all companies charge the same price, which equals the weighted average price—the GDP deflator), $n^* q^*$ (this follows from the fact that all companies produce the same quantity and that the real output is a sum of companies' real outputs), and $n^* l^*$, respectively.

[4] Such formulation helps finding the labor market equilibrium by searching along the supply curve. The equilibrium is consistent with the competitive labor market, i.e., wage equals the value of the marginal product of labor after payments for working capital.

E. The Role of the Exchange Rate

The exchange rate plays an important role in business cycle amplitudes of emerging markets. Emerging markets need foreign borrowing since domestic capital is scarce. Growth prospects attract foreign capital inflows (both direct and short-term investment), which balance the trade balance deficit, such that the exchange rate remains rather stable. Companies often borrow in FX—motivated by lower interest rate on FX loans—and carry significant open positions in foreign currency.

- If capital inflows are excessive, the exchange rate appreciates and boosts the real economic activity. In particular, the exchange rate appreciation lowers prices[5]—via (equations 7 and 10), increasing quantities produced and employment (equations 8, 9, and 12), increasing profits (10), wages (13), and the number of producing companies (11).

- Reversely, during a crisis, the capital outflow weakens the exchange rate (and increases both the debt service of unhedged FX borrowings) and forces companies to increase prices, banks close less profitable companies, and the real economic activity falls.

Therefore, the exchange rate fluctuations during optimistic and pessimistic outlooks aggravate business cycle amplitudes.

F. The Effects of Credit Subsidies

Interest rate credit subsidies lower borrowing costs for companies and stimulate consumers demand. During a crisis, free cash flows of companies suffer from exchange rate depreciation on unhedged FX borrowings and weakening demand. The interest rate subsidy lowers borrowing costs for companies, thereby increases free cash flows and eases the access to credit renewal.[6] Consumer credit subsidies increase demand, which also increases companies' cash flows.

The effectiveness of credit interest rate subsidies for companies varies with the size of the exchange rate shock. The distribution of free cash flows changes with exchange rate and interest rate changes (equation 6). Exchange rate depreciation affects free cash flows and several companies fall below the profitability threshold, which is required by banks for a credit renewal. Since the distribution of free cash flows is not uniform but bell-shaped and often rather narrow,[7] the marginal exchange rate depreciation has increasing marginal effect on the number

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[5] Such situation can appear also under fixed exchange rate regime, particularly if there is market perception of negligible exchange rate risk during a boom.

[6] The adverse selection problem in granting credit is less of an issue since credit subsidies do not change credit risk but improve cash flows.

[7] Margins tend to cluster around a market average. For instance, in the Czech Republic in 1993–2003, exporting companies charged price-cost margin 15 percent on average with a standard deviation of 4 percent (based on data

(continued…)

of companies close-down due to credit disapprovals by banks. In practical terms, a percentage point interest rate credit subsidy (measured on the stock of loans) will have a small effect if introduced when the exchange rate depreciation accelerates from one to two percent per annum, but it will have a significant effect if introduced when the exchange rate depreciation accelerates from 10 to 11 percent (provided that the distribution of mark-ups has a mean of 12 percent and a standard deviation of 4 percent).

III. The Rest of the Economy

The rest of the economy comprises micro businesses, banks, and the government sector, which all depend on the non-financial sector to various degrees. The micro businesses operate at the margin and thus follow development in the non-financial sector and banks are dependent on the non-financial sector via revenues. The government sector operates somewhat more independently from the non-financial sector.

The impact of changes in the non-financial sector on the rest of the economy is evaluated only roughly. The rest of the economy is likely less cyclical due to a lower leverage of micro businesses and banking and specifics of the government sector. Since the rest of the economy is not modeled explicitly, the impact on the rest of the economy from shocks to the non-financial sector is evaluated only roughly. Namely, by applying the relative procyclicality of the non-financial sector relative to the rest of the economy, as observed in 2008 and 2009, to simulations of new equilibrium in the non-financial sector.

IV. Calibration and Simulation for Serbia

In late-2008, as the global financial crisis spilled over, the loan market in Serbia suddenly switched from an over-optimistic to over-pessimistic state. Until October 2008, the Serbian Dinar (RSD)/Euro exchange rate, in which more than 90 percent of bank credit was granted, remained stable. During the last quarter of 2008, it depreciated by 9 percent year-on-year and during 2009 it lost 15 percent year-on-year. In reaction, at the beginning of 2009, the government introduced credit subsidies as part of its economic program.

A. Credit Subsidy Schemes

In February 2009, the government announced a credit subsidy program, which aimed at easing the impact of the global financial crisis on Serbia. The programs aimed at stimulating both supply and demand sides of the economy with a focus on Serbian non-financial corporate sector. On the supply side, participating companies received interest rate subsidies on credit for liquidity, working assets, export deals, and investment projects, but beneficiary companies must not lay off employees. On the demand side, consumers were incentivized by subsidized

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from Podpiera and Rakova, 2008). During 1974–86, Dutch manufacturing companies reported an average price-cost margin of 18 percent, which varied with a standard deviation of 2 percent (see Prince and Thurik, 1992).

consumer loans for locally produced goods and mortgage loans. The key details of the schemes are summarized below.

Limited amounts of liquidity-type loans per company became available at a beneficially low interest rate with repayment schedule of 12 months. The interest rate credit subsidy amounted to five percentage points from a capped interest rate of 10.5 percent or flexible Euribor 1M plus eight percent p.a. on FX-denominated loans. In May, the cap was unified to eight percent on all FX-denominated loans (with the exception for reprogramming loans having a cap of 9.9 percent). RSD-denominated loans were introduced with the interest rate cap set at the level of the reference rate of the National Bank of Serbia (NBS) less 3.5 percentage points. The NBS allowed banks to reduce the base for calculating the Required Reserves (RR) for loans extended under the program, provided that banks do not deleverage. From the start of the program, ceilings were set, ranging from 20 thousand euro or 2 million dinars for entrepreneurs to 2 million euro or 200 million dinars for large companies, while the export loans ceilings were double. If a company used up the maximum amount for any of these two subcategories of liquidity loans it could no longer apply for new subsidized loans.

Limited amounts, per borrower, of subsidized three-year-repayment consumer loans and lump-sum subsidies were designed for purchasing durable consumer goods produced in Serbia. The program, subsequently extended to legal entities, covered purchases of cars, trucks, busses, tractors, construction machines, construction material, agricultural machines, furniture, white goods, software, computers, monitors, speakers, and tourist arrangements. Interest rates were fixed, i.e., 9.5 percent on cars and 11 percent on the rest of Serbian products. The interest rate subsidy was five percent. The repayment period was three years, with a one-year grace period. Buyers were further incentivized by: (1) rebate of one thousand euro trade-in cars used for purchasing locally produced new FIAT Punto cars; (2) subsidy in the amount of two thousand euro for purchasing locally produced tractors; and (3) subsidy in the amount of 20 percent for purchasing locally produced trucks with an additional 10 percent subsidy for the trade-in car as well as 20 percent subsidy for purchasing construction machines.

The objective of the subsidized housing loans (mortgages) was to boost the construction sector. Subsidized loans had a limit of euro 100 thousand. The program was limited to first-time home buyers, not older than 45 years.

B. Model Calibration

The model is calibrated for a rather homogenous group of Serbian small, medium, and large companies in 2008. Small, medium, and large companies share three features, which make them a rather homogenous production entity (Table 1). First, even though the size of companies differs, the physical output per worker in each company is roughly equal across companies. Second, the gross markup (gross value added over turnover) does not vary substantially across the three size-categories of companies. And third, during a downturn, the exit of companies took place rather uniformly across differently sized companies.

The similar physical output per worker across companies justifies a linear production function in labor. The gross value added (constant prices of 2002) divided by the number of employees in 2008 and 2009 turns out to be similar across companies (Table 1). Therefore, a

linear production function with a single production factor—labor—and a labor productivity parameter, A = 0.57, well approximates the physical output produced by every company in the Serbian non-financial sector.[8]

Table 1. Descriptive Statistics

	2008				2009			
	Small	Medium	Large	Total	Small	Medium	Large	Total
Prices								
GDP deflator (Index, 100 = 2002)				**2.01**				**2.15**
Output								
Country's GDP (million RSD, current prices)				**2,722,461**				**2,815,000**
Share of sectors' GDP in total (percent)				**40**				**39**
Number of enterprises	10,415	2,675	568	**13,658**	9,873	2,470	529	**12,872**
Number of employees	214,136	281,865	458,562	**954,563**	200,954	259,129	435,751	**895,834**
Average number of employees per company	21	105	807	**69.9**	20	105	824	**69.6**
Gross value added (million RSD, prices of 2002)	115,773	134,495	288,239	**538,506**	104,524	125,105	283,159	**512,787**
Physical output per employee	0.54	0.48	0.63	**0.57**	0.52	0.48	0.65	**0.57**
Sector's nominal GDP growth rate (percent)					-3.6	-0.7	4.9	1.6
Sector's real GDP growth rate (percent)					-9.7	-7.0	-1.8	-4.8
Number of closed companies					542	205	39	786
Share of closed companies (percent)					5.2	7.7	6.9	5.8
Product market structure								
Turnover (billion RSD)	1,393	1,312	2,342	**5,048**	1,229	1,291	2,078	**4,599**
Gross value added (million RSD)	233,054	270,742	580,234	**1,084,030**	224,576	268,796	608,384	**1,101,756**
Gross markup (percent)	16.7	20.6	24.8	21.5	18.3	20.8	29.3	24.0
Labor market								
Average gross monthly wage (RSD)				**45,674**				**44,147**
Average net monthly wage (RSD)				**32,746**				**31,733**
Labor supply parameter				**0.58**				**0.59**
Credit market								
Leverage (population of companies, percent) [1/]				**49.4**				
Standard deviation of leverage (percent) [2/]				**27**				
Cost of credit (percent)				**14.9**				**12.4**
out of which: Interest rate (percent)								**13.3**
Interest rate subsidy (percent)								**-0.9**

Sources: Serbian Statistical Office, Ministry of the Economy and Regional Development, National Bank of Serbia, National Mortgage Insurance Corporation, and the IMF.

[1/] Weighted average of equity/debt by company's size, divided by the credit approval rate.

[2/] Standard deviation of equity/debt, divided by the credit approval rate.

[8] The non-financial sector in Serbia comprises the entire non-financial institutional sector according to the SNA methodology (i.e., from A to Q) and the statistics are reported based on financial statements of companies. See Burzanovic and Popovic (2010).

Companies operate in the condition of an imperfect competition with similar markups. They produce close substitute goods and charge similar markups (see gross markups in Table 1). Therefore, the market structure can be approximated by an imperfect competition with equal markups across companies, which is derived from a constant elasticity of substitution between products ($\theta = 2.28$). Such calibration implies the gross markup of 22 percent, which corresponds to the actual average of 21.5 percent in 2008.

There is a similar portion of overleveraged companies in each size-category of companies. This can be indirectly inferred from the proportion of exiting companies during the downturn in 2009. Although large companies charge on average slightly higher markups than the other size-groups, the proportion of closed large companies in large companies during the 2009 downturn is very comparable to similar proportions for the other two size-groups of companies. This observation indicates that all size-categories of companies have a similar distribution of companies according to leverage.

The leverage is distributed normally across all companies. The distribution is modeled as continuous rather than discrete,[9] since the exact shape is unknown and a sample of random drawings would not be stationary due to the relatively small number of companies. The mean and standard deviation (49.5 and 27 percent, respectively) are calibrated from the available data (see Table 1).

The threshold for receiving credit is based on loan rejection rates in the region. Based on a survey from 2004 and 05, Brown et al. (2011) report loan rejection rates in Europe. The rate in Eastern Europe is 7.6 percent (an average of the rates for discouraged and non-discouraged applicants). It follows that companies need free cash flows in the amount exceeding 38 percent of the value added to qualify for bank credit. This threshold for free cash flows was assumed unchanged also for 2009; according to reporting banks, credit standards remained in 2009 rather unchanged.[10] The distribution of free cash flows is derived using equation (6) and the calibrated distribution of leverage.

Number of all companies (potential and actual) follows from the rejection rate and the actual number of companies in 2008. The number of actual and potential companies is derived by dividing the actual number of companies in 2008 by the credit approval rate. If banks had granted loans to all companies that apply, there would have been 14,686 companies in 2008.

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[9] A particular choice of a discrete distribution is important for the effect of the credit subsidy. In order to calibrate an average benchmark effect we use the continuous approximation.

[10] A sample of banks, which accounted for 37.2 percent of total banking assets in 2008 and represent large and middle sized banks in Serbia, reported the following: Alpha bank, Piraeus, and EFG Eurobank tightened credit standards already in 2007–08 and did not change them in 2009. Banca Intesa did not change credit standards during 2009. Vojvodjanska tightened credit standards and procedures during 2009 and Hypo Alpe Adria only since July 2009.

The sector exhibits large, unhedged, and primarily euro denominated borrowings. Based on NBS statistics of *bank claims on corporate sector*, 75 percent of loans to the corporate sector were FX loans. We assume that all FX loans were unhedged against the FX risk. The use of hedging was very limited mainly due to illegality of hedging FX-indexed RSD loans, which dominated the corporate lending. In 2009, RSD depreciated year-on-year against euro from 81.3 to 93.1, i.e., 14.5 percent.

Reported interest rates declined in 2009, but the cost of servicing FX borrowing increased due to RSD depreciation. The average borrowing costs of the corporate sector have been constructed by the NBS from statistics on *total fresh lending* from the NBS, the *set of measures aimed for mitigating negative effects of the global economic crisis* from the Ministry of the Economy and Regional Development, and on *housing loans* from National Mortgage Insurance Corporation. The data on total banking exposure to the non-financial sector were also used. The weighted average interest rate (on RSD and FX) on the stock of loans to non-financial sector amounted to 14.3 percent in 2008, while in 2009 it was down to 12.4 percent (including interest rate subsidy for companies in the amount of 0.9 percentage points). Nevertheless, the RSD depreciation of 14.5 percent y-o-y in 2009 increased the cost for servicing debt.

Sector's labor supply is elastic in the number of employees. A decreasing employment in the non-financial sector puts a downward pressure on the wage along the labor supply curve. The parameter of the labor supply (0.59) is calibrated according to the ratio of the wage to the number of employees in 2008 and verified against the same ratio in 2009.

The rest of the economy is less procyclical than the non-financial sector. Overall, Serbia's GDP fell by 3½ percent in 2009. The rest of the economy contributed to the 2009 recession by 1 percentage point, while the non-financial sector's contribution was 2 percent. The relative procyclicality of the rest of the economy (80 percent of that in the non-financial sector) is employed in simulations of the impact of changes in the non-financial sector on the rest of the economy (see Subsection D).

C. Model's Fit

Table 2 contains simulations of the calibrated model from the previous subsection along with the actual data. It succeeds to match structural characteristics of the production sector and shows how the shocks (the exchange rate depreciation on unhedged FX positions and interest rate subsidies) influenced the economy in 2009. The calibrated model fits the data very well.

The simulated model's equilibrium for 2008 well describes the characteristics of the sector. It matches the actual companies' data in the number of companies (exact match), physical output per company (39 versus 40 in the data), average number of employees (69 versus 70), and markup (exact match). On aggregate, the model also closely mimics the sector's wage bill (517900 versus 523185), cash flow (566130 versus 560845), number of employees (940903 versus 954563), wage (45869 versus 45674), physical output (536315 versus 538506), and the price level (2.02 versus 2.01). See columns Model and Data for 2008 in Table 2.

Table 2. Model's Fit

	Data		Model	
	2008	2009	2008	2009
Companies				
Number of companies (receiving credit)	13,658	12,872	13,658	12,871
Share of companies that did not qualify for credit (percent)			7.0	12.3
Real output per enterprise	40	40	39	40
Individual product price (index, 100=2000)			2.02	2.16
Number of employees	954,563	895,834	940,903	894,726
Average number of employees per enterprise	70	70	69	70
Nominal gross value added (million RSD)	1,084,030	1,101,756	1,084,030	1,101,756
Price-cost margin (profit margin, percent)	51.7	56.9	52.2	57.1
Average actual profit margin (after debt service, percent)			44.0	44.6
Standard deviation of actual profit margins (percent)			4.00	6.00
Elasticity of substitution			**2.28**	**2.28**
Annual wage bill (million RSD)	523,185	474,581	517,900	472,315
Annual cash flow (million RSD)	560,845	627,175	566,130	629,441
Credit extended by banks (claims on the sector)	534,128	622,199		
Interest rate (weighted average RSD & FX, percent)	**14.9**	**12.4**	**14.9**	**12.4**
Share of unhedged FX loans (percent)	**75**	**75**	**75**	**75**
Households				
Labor productivity	**0.57**	**0.57**	**0.57**	**0.57**
Parameter of labor supply	**0.59**	**0.59**	**0.59**	**0.59**
Average gross monthly wage (RSD)	45,674	44,147	45,869	43,991
Aggregates				
Exchange rate change (y-o-y, percent, RSD/Euro)	**0.0**	**15.0**	**0.0**	**15.0**
Price level (GDP deflator, 100 = 2002)	2.01	2.15	2.02	2.16
Price level change (y-o-y inflation, percent)		6.7		6.9
Sector's GDP (const. prices 2002, million RSD)	538,506	512,787	536,315	509,994
Sectors' GDP growth rate (percent)		-4.8		-4.9
Country's GDP (current prices, million RSD)	2,722,461	2,815,000		
Share of sectors' GDP in country's nominal GDP (percent)	**40**	**39**	**40**	**39**
Sector's contribution to country's real GDP growth (percent)		-1.9		-1.9

Sources: Statistical Office of the Republic of Serbia; FSAP Update 2010; National Bank of Serbia; and IMF calculations..

Note: Nominal values are in million dinars, if not stated otherwise; bold numbers are exogenous entries into the model.

The models' simulation for 2009 reveals sector's adjustments due to changes in the exchange rate, interest rate, and sector's demand. Compared to 2008, in 2009, the RSD depreciated against euro by approximately 15 percent and the customer lending interest rate decreased by nearly two and half percentage points (see Table 1). The sector's nominal demand increased by 1.6 percent mainly due to consumer credit subsidy schemes. These are the only three changes that have been used to simulate the model's 2009 equilibrium. The equilibrium again closely matches the actual 2009 data (see Table 2, columns Model and Data for 2009).

The 2009 shocks caused banks to close several companies; operating companies reprised the cost of borrowing to clients; and the physical output declined. In year-on-year perspective, the share of companies that did not get credit increased from seven to 12 percent.

Operating companies raised prices by seven percent and benefited from lower wage costs due to a decreasing sector's employment (the price cost margin increased to 57 percent). Declining employment was mostly due to laying off employees from closing companies[11]. As a result, the sector's physical output declined by five percent.

D. Subsidy Scheme Simulations

The calibrated model, which has been shown to reasonably accurately simulate the change from equilibrium in 2008 to the one in 2009 in the previous subsection, is used for policy simulations. There are three model simulations: (1) without interest rate subsidy for companies, (2) without any subsidies, and (3) with government spending in the amount of actual costs of subsidies (spending is directed to the non-financial sector). The results are summarized in Table 3. These simulations yield the impact for the non-financial sector of the economy. For the impact on the overall economy, we need to derive the real growth in the rest of the economy, which is done using a simple approximation, described in Section III.

First, if the interest rate subsidies for companies has not been introduced, the country's real output would have declined by 4.2 percent. The absence of interest rate subsidies for companies would imply closing down additional one percent of companies, declining wage and physical output, and rising inflation. The subsidy programs reduced effective borrowing costs by about one percentage point (see Table 1) and thus a new equilibrium is simulated with a higher cost of credit by 0.9 percentage points. As reported in Table 3, in this situation, additional one percent of companies would not qualify for credit and would be closed. The average number of employees and the physical output per employee would not change, compared to the simulation with subsidies, but the number of employees and the wage in the non-financial sector would both decline by 0.6 percent. Inflation would accelerate by 0.7 percentage points and the sector's physical output would additionally decline by one percentage point. The non-financial sector' contribution to the decline in Serbian real output would increase by 0.4 percent to 2.3 percent. Using the approximate spillover from this sector to the rest of the economy (see Table 3, and Sections III and IV. B), the rest of the economy would contribute to the fall in output by 1.9 percent.

[11] This is in line with the credit subsidy program requirement of maintaining employment on the subsidized-loan-receiving companies.

Table 3. Policy Simulations, the year 2009

	Consumer and corporate subsidies	Only corporate subsidies	No subsidies	Government spending
Companies				
Number of companies (receiving credit)	12,871	12,724	12,724	12,724
Share of companies that did not qualify for credit (percent)	12.3	13.3	13.3	13.3
Real output per enterprise	40	40	39	39
Individual product price (index, 100=2000)	2.16	2.17	2.13	2.14
Number of employees	894,726	888,848	870,432	875,817
Average number of employees per enterprise	70	70	68	69
Nominal gross value added (million RSD)	1,101,756	1,101,756	1,056,574	1,069,689
Price-cost margin (profit margin, percent)	57.1	57.7	57.7	57.7
Average actual profit margin (after debt service, percent)	44.6	44.7	44.7	44.7
Standard deviation of actual profit margins (percent)	6.0	6.0	6.5	6.5
Elasticity of substitution	**2.28**	**2.28**	**2.28**	**2.28**
Annual wage bill (million RSD)	472,315	466,130	447,015	452,563
Annual cash flow (million RSD)	629,441	635,626	609,559	617,126
Interest rate (weighted average RSD & FX, percent)	**12.4**	**13.4**	**13.4**	**13.4**
Share of unhedged FX loans (percent)	**75**	**75**	**75**	**75**
Households				
Labor productivity	**0.57**	**0.57**	**0.57**	**0.57**
Parameter of labor supply	**0.59**	**0.59**	**0.59**	**0.59**
Average gross monthly wage (RSD)	43,991	43,702	42,796	43,061
Aggregates				
Exchange rate change (y-o-y, percent, RSD/Euro)	**15.0**	**15.0**	**15.0**	**15.0**
Price level (GDP deflator, 100 = 2002)	2.16	2.17	2.13	2.14
Price level change (y-o-y inflation, percent)	6.9	7.6	5.4	6.0
Sector's GDP (const. prices 2002, million RSD)	509,994	506,643	496,146	499,216
Sector's GDP growth rate (percent)	-4.9	-5.9	-7.9	-7.3
Country's GDP (current prices, million RSD)				
Share of sector's GDP in country's nominal GDP (percent)	**39**	**39**	**39**	**39**
Sector's contribution to country's real GDP growth (percent)	-1.9	-2.3	-3.1	-2.8
Country's GDP growth (percent)	-3.5	-4.2	-5.6	-5.2

Sources: Statistical Office of the Republic of Serbia; FSAP Update 2010; National Bank of Serbia; and own calculations.

Note: Nominal values are in million dinars, if not stated otherwise; bold numbers are exogenous entries into the model.

Second, the 2009 recession would deepen to 5.6 percent if the effects of credit subsidies for companies and individuals on sector's demand were removed. Subsidized loans in 2009 amounted to euro 1.1 billion[12], accounting for 10 percent of newly granted loans. Assuming the efficiency of 25 percent for such programs[13], the sector's demand was reduced by 2.5 percent as an initial shock (25 percent from approximately RSD 100 billion) for simulating the equilibrium without credit subsidy schemes. The model's equilibrium, simulated under no credit subsidy, showed a further deepening recession, a decline in inflation, employment, and wage. Compared to the simulation without interest rate subsidies for companies, the negative shock into the demand led to a decline in the nominal demand by four percent with sector's physical output (as well as employment and wage) falling by additional two percent and inflation by 2.2 percentage points (see Table 3). Adding the spillover from non-financial sector to the rest of the economy, it follows that the economy would experience in 2009 a deeper recession (by 2.1 percent) than actually observed.

And third, if the fiscal stimulus would have been used directly for purchases of goods by the government, the economic recession would have been slightly milder compared to the case without any subsidies. The last column in Table 3 represents a simulated equilibrium, in which the government spends the amount of money, which it paid for the subsidy programs directly for purchases of goods from the non-financial sector. This shows the effectiveness of the credit subsidy schemes relative to a benchmark of a simple government spending. Compared to the no-subsidy case, the output of the sector declines less, by 0.6 percentage points, inflation speeds up by 0.6 percentage points and both the monthly wage and employment increase by 0.6 percentage points. In this policy simulation, the physical output of the entire economy would fall by 5.2 percent, which is only by 0.4 percentage points less than in the case of no subsidies. It seems that the credit subsidies reach a higher effectiveness than simple government spending.

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[12] In 2009, subsidized liquidity loans accounted for the major share (euro 936.1 million). Subsidized consumer loans were also popular (euro 169.4 million), while demand for investment loans remained negligible (euro 2.4 million). More than 93 percent of the total subsidized loans were denominated in euro, the remainder in RSD. Subsidized housing loans amounted to euro 21 million.

[13] In terms of how many new loans the program marginally generates. It is assumed that banks would grant loans to 75 percent of clients under the credit subsidy program anyway. This is based on combined evidence from the EU25 on car scrapping subsidies and survey evidence on investment loans in Italy. The efficiency of car scrapping programs in the EU25 in 2009 reached 17 percent (see Global Insight, 2010). According to Adda and Cooper (1997), the efficiency of car subsidy programs depends on the average age of cars in the economy. The average age of cars and trucks in Serbia (15.3 years; all traffic; as of 2005; see Solujic, 2010) is higher than the EU25 (staying rather constant at 10.8 years during last 15 years; see European Environment Agency, 2010), and therefore the efficiency in Serbia might be somewhat higher. For a higher efficiency in Serbia might also speak a slightly higher incentive value in Serbia, compared to the average EU25. Regarding the efficiency in loans, based on a 2005 survey, Cannari et al (2006) found 25 percent efficiency of subsidized investment loans in Italy.

V. CONCLUDING REMARKS

Serbia introduced credit subsidy programs during the current financial crisis as a countercyclical policy measure. In late 2008, the economic climate in Serbia significantly worsened and in February 2009, the government announced a credit subsidy program. The programs aimed at stimulating both supply and demand of the economy with a focus on the Serbian non-financial corporate sector. On the supply side, participating companies received interest rate subsidies on credit for liquidity, working assets, export deals, and investment projects, but beneficiary companies were not allowed to lay off employees. On the demand side, consumers were incentivized by subsidized consumer loans for locally produced goods and mortgage loans.

The subsidy schemes had a countercyclical effect, reducing the 2009 recession by estimated 1–2 percentage points but it is too early to assess whether it was socially optimal. Based on the perfomed simulations, the real GDP of the entire economy would have fallen by 5.6 percent instead of the observed 3.5 percent, have not been subsidy schemes implemented. The non-financial sector would contribute to economy's recession by an additional 1.2 percentage points, while the rest of the economy would add 0.9 percentage points. Nearly 150 additional companies would have been closed and the employment rate in the non-financial sector would have fallen by additional 2.7 percent. Besides growth, subsidies set on several non-trivial itertemporal and distributional effects, which are yet to be realized and assessed from a social optimum point of view.

Serbian-specific circumstances increased the effectiveness of subsidy schemes, which was much higher than a direct spending by the government. The Serbian government had incidently available resources and shaped the subsidy schemes several times in response to the developments; but the success in promoting subsidized lending was facilitated by the high competition in the banking sector and ample banks liquidity. The credit subsidy schemes increased the aggregate demand much more than a direct government spending would have done and the credit subsidy for companies reduced the loan rejection rate by one percent. Thus, a less depleted corporate sector made the country better positioned for an economic upturn.

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