# Lange and Hayek Revisited:

# Lessons from Czech Voucher Privatization

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Abstract:

A fundamental question in economics since the 1930s has been whether an administrative price system could simulate the results of perfect competition even without a true market for the means of production. The theoretical possibility of such a system has been known since the introduction of market socialism by Oskar Lange. We have used the artificial bidding market involved in the Czech voucher privatization process to test whether a sequential process of trial-and-error can set administrative prices close to equilibrium. It would appear from this natural experiment that Robbins and Hayek were correct in doubting the real-world feasibility of market socialism.

Keywords: bidding scheme, Oskar Lange's model, privatization, price setting, voucher scheme

JEL classification: P00, P22

## I. Introduction and Motivation

Since the sudden demise of Communism in the late 1980s economists have regarded the transition from command to market economies in Central and Eastern Europe with intense interest. In addition to studying the transition per se, they have begun using the region as a testing ground to investigate the validity of classic propositions. Recently vouchers were used to privatize substantial portions of the economy in several transition countries in Central and Eastern Europe. The core of these voucher schemes was use of artificial money (vouchers) to purchase shares of privatized companies in several waves of closed auctions. Since policy makers in these countries were typically afraid to employ open financial markets (which frequently did not yet exist), most countries used administrative price committees to set the prices of shares in these auctions.

Voucher privatizations, therefore quite unintentionally, provided an empirical test of one of the key issues in a now almost forgotten, but once very famous, controversy in the economic theory of socialism. The key issue in this controversy was whether a socialist economy (whose *differentia specifica* was the public ownership of the capital and natural resources) could allocate its resources to replicate the perfectly competitive outcome. Put very simple, the question was whether a system of government price administration could "get the prices right" in comparison with the competitive market?

Oscar Lange, a central figure from that mid-thirties controversy, strongly argued in favour of the feasibility of a "non-market" solution. In his extensive debate with economists of his time (including L. Robbins and F. Hayek), Lange(1993, originally published (1936) and (1937)), referring to Wicksteed and Schumpeter, pointed to the so called "generalised meaning" of price as being not only exchange ratio between two commodities on the market but also (at a more fundamental level) the "terms on which alternatives are offered." He claimed that an actual market was unnecessary in order to find out these "indices of alternatives." Since this argument was

irrefutable, the focus of the controversy shifted to whether, in practice, a "non-market" solution could be operationalized. Robbins and Hayek claimed that practical application of the concept would require the price setting authority to possess a great deal of information as well as solve hundreds of thousands of simultaneous equations which, once solved, would be obsolete. Lange, however, rejected these claims by invoking a "trial-and-error" principle as the algorithm on the bases of which a competitive market operates in practice. Moreover, Lange went even further and claimed that by the trial-and-error not only could the efficient outcome be obtained but also that the convergence would be faster due to the superior information content at the disposal of the planning authorities as opposed to the information available to the private entrepreneur.

These predictions by Lange about the required informational content and a speed of convergence of such a "non-market" (or simulated market) approach represents the motivation for the current paper. Elsewhere (Filer and Hanousek, 2000), we have demonstrated that Czech voucher privatization was able to incorporate all information about future equity market prices into the administrative voucher prices and that, therefore, these prices were "efficient" in the sense usually used with respect to financial markets. We now turn our attention to the more fundamental question in the Lange/Hayek debate - was the administrative authority able to establish an equilibrium set of prices in the sense that they were able to clear the relevant markets without significant excess demand or supply?

The paper is structured as follows. The next section contains a brief description of the Czech voucher privatization, especially its rules and type of agents involved. The third section contains a simple test of whether the pricing authorities were able to establish an equilibrium set of prices while the results while the last section concludes the paper.

## II. Voucher Privatization Scheme

We present here only a brief summary of the Czech voucher privatization mechanism. For a more detailed discussion see Filer and Hanousek (2000). There were 1,664 companies that had some or all of their equity included in voucher privatization. Voucher privatization took place in two waves. The first wave involved shares in 988 firms. The second included shares in an additional 676 firms plus unsold shares in 185 firms carried over from the first wave. The total book value of the equity privatized through vouchers was more than $14 billion, about 10 per cent of the Czech Republic's national wealth.

All Czech citizens over the age of 18 were eligible to acquire 1000 voucher points, the artificial currency used in the process.[1] Approximately 75 percent of eligible Czechs participated in each wave, making the book value of the shares available slightly more than $1,400 per participant in the first wave and $1,000 in the second wave.

Participants could bid for shares themselves or assign their voucher points to an investment privatization fund (IPF) in return for a share in the fund.[2] In the first wave 72.2 percent of participants turned their points over to one of 265 IPFs. In the second wave a somewhat smaller 63.5 percent of participants assigned their points to one of 349 funds. In addition to those who assigned their points to the funds, between 1.5 and 2 million individuals bid their points themselves. Each wave involved several rounds of bidding (five in the first wave and six in the second). Share prices were announced by the administrative authorities and participants submitted bids for the number of shares desired at the announced price. If the bids for a firm did

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[1] There was a nominal charge of 1000 crowns (about $35 or one week's wages for the average worker) to cover administrative costs.

[2] Any fraction of an individual's points (in multiples of 100 points) could be turned over to a fund but this transaction had to be done prior to the start of the first round of bidding. See Allen and Smidkova (1998) for a discussion of households' optimal behavior.

not exceed its supply of available shares, these demands were satisfied and the remaining shares were deferred to the next round. If the demand for a firm's shares exceeded supply by less than 25% and the market could be cleared by prorating of the IPFs' demand, then individual investors had their demand met while IPFs were rationed proportionally to their bids.[3] In such a case, all shares were sold and the firm was not available in the succeeding rounds. If demand exceeded supply by more than 25%, then no bids were accepted and all shares were deferred to the next round.

The price, expressed as voucher points per share, was set by the Price Committee according to an unknown algorithm based on the ratio of demand to supply in the previous round and some other variables. According to official statements, the algorithm involved up about 20 factors, with additional ad hoc changes done manually (Kuponova privatizace [Voucher Privatization], Privatization Newsletter of Czech and Slovak Republics) although the price committee announced that they adjusted prices mainly on the basis of the ratio of demand to supply in the previous round. Several observers remarked that the privatization authority appeared to use the rule of a thumb of unitary price elasticity as a key for price setting (see Sefik (1995) and Svejnar and Singer (1994) among others).

For the first round share prices were set uniformly across firms at 3 shares per 100 points in Wave 1 and 2 shares per 100 points in Wave 2 according to the accounting value of the firm, so that each share represented the same book value (about 1200 crowns for both waves) for every enterprise. Clearly these prices were far from equilibrium, so that in the first wave the ratio of demand to available supply in round 1 ranged from less than 1 percent to 14,540 percent. After

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[3] In the first wave, IPF participation could be prorated only if their demand did not have to be reduced by more than 20%. For the second wave, this condition was removed.

the first round there were substantial price changes. By the third round of the first wave, for example, the lowest price was 1.03 points per share while the highest price had reached 1000 points per share.[4]

## III.    A Test of Price Convergence

As pointed out in the previous section, the bidding scheme was a way to establish market prices where there was no market by using sequential market responses to adjust/administer the prices using an excess demand rule. Because of the high number of individuals involved as well as the relatively high number of products (firms) on offer, voucher privatization can be considered a simulation of a small closed economy in which the pricing authority set the prices of goods (shares) using "consumer reactions." This provides a unique opportunity to test the ability of such a pricing authority to engender convergence to equilibrium prices. At the same time, we must recognize that voucher privatization as implemented in the Czech Republic was an inherently simpler process in which to establish equilibrium than a full economy with many thousands of products. Among these are:

1)    The supply was exogenously determined. Thus, the pricing authority needed only to worry about the responses of demanders.

2)    For profit maximising investors all goods (shares) were perfectly substitutes.

3)    The pricing authorities appeared to have been willing to tolerate aggregate excess supply, leaving some shares unsold at the end of the process. This may have been due to a desire to retain assets that the state could sell for income at a later date or it may have been because the administrators wanted to increase the probability that participants were not

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[4] The detailed structure of the price by industrial sectors, and rounds is available from authors upon a request (See also http://home.cerge.cuni.cz/hanousek/lange).

left with unspent and, therefore, "worthless" points at the end of the process in order to avoid any political repercussions (see Hillion and Young, 1996).

The excess aggregate supply embodied in the system can be seen in Table 1 which shows the total number of points available for bidding in each round as well as the total number of points that would be required to purchase all of the shares available at their announced prices. This systemic excess supply is especially critical since it gave the pricing authority a great deal of flexibility to misprice goods and still achieve a "quasi-equilibrium" price structure in the sense that all demands were satisfied. In other words, given the lack of a true supply side, price administrators in the voucher privatization scheme had the luxury of knowing that there should have been a large number of vectors of equilibrium prices that met the goal of eliminating excess demand for individual goods.

Note that the question here is fundamentally different from that addressed in Filer and Hanousek (2000) which asked whether the prices resulting from the multi-round adjustment process were efficient in the sense of incorporating all relevant information about future values. Here we are concerned with whether these prices are equilibria in the sense of eliminating excess demands. Excess demand may exist even if prices are informationally efficient if there are uninformed or "noisy" traders in the market.

Table 2 shows that even under these very favorable conditions, the pricing authorities were not able to achieve an equilibrium price vector during the five to six rounds of bidding in voucher privatization. The final round is especially interesting given that the authorities attempted to manipulate demand in order to *ensure* that there was no unsatisfied demand. Prior to this round the authorities announced that prices would be set such that if all investors rebid for exactly the shares they were not able to obtain in the previous round (and all unbid points were bid for these shares in a ratio equal to their fraction of unsatisfied demand in the previous round), then

there would be no shares in excess demand in the final round.

As can be seen in Table 2, even in a world where the authorities were willing to tolerate excess supply and where they tried to explicitly manipulate demand, it proved impossible to set a price vector that eliminated excess demand. In the final round in each wave some 12 to 17 percent of demand was unsatisfied. Translated to a real economy, this implies significant queues as frustrated customers found that they were not able to have their demands satisfied. The situation in earlier rounds is even less favorable. After three price adjustments (i.e. in round four) between half and two-thirds of demand was *unsatisfied*. Thus, these prices were a long way from equilibria even in this much simplified economy.

## V. Conclusions

A fundamental question in economics for the sixty years between the 1930s and the 1990s has been whether there might exist an administrative price system that could simulate the results of perfect competition even without a true market for the means of production. The theoretical possibility of such a system has been known since the introduction of market socialism by Oskar Lange in the 1930s (See Lange (1930), or Neuberger (1973) and Kowalik (1993) for the entire body of Lange's related essays).

The theoretical assumptions of Lange's model have been heavily criticized by Hayek (1940), arguing that Lange's model is, in terms of information flows, equivalent to a perfect competition.[5] This claim reflects the position of a Central Planning Board (CPB) setting all prices primarily on changes of consumer demands and production costs. The CPB therefore mimic the market behaviour and set the prices similarly as in competitive market environment. One can

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[5] Probably, underlying motivation structure of Lange's model of market socialism is major problem. We refer to Neuberger (1973) for more details.

translate a part of his critique into a practical question whether or not CPB can get sufficient information to be able to set a price for each commodity, especially in a changing environment.

In other words, the question is whether a sequential process of trial-and-error can set administrative prices close to equilibrium.

We have used the artificial bidding market involved in the Czech voucher privatization process to test whether such equilibrium prices can be achieved a *de nova* market. We find that at the conclusion of this process prices were still far from equilibrium in the sense that there were still significant excess demands despite the lack of a true supply side of the market and the willingness of the pricing authorities to tolerate significant excess supply. If the Czech pricing authorities were unable to find even one out of the set of price vectors that would eliminate excess demand in four or five adjustments of an economy with less than 1,000 products, there seems little chance that socialist planning authorities could hope to achieve market clearing prices in a far more complex real economy with several thousand products and a real supply side. Thus, it would appear from this natural experiment that Robbins and Hayek were correct in doubting the real-world feasibility of market socialism. Interestingly, the results presented here in combination with those in Filer and Hanousek (2000) suggest that the fundamental problem may lie less in the inability of the authorities to utilize relevant information than in their ability to incorporate the demands of nuisance or noisy traders into their prices.

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## Table 1.

### Extent of Excess Supply

| ROUND | Wave 1 | | Wave 2 | |
|---|---|---|---|---|
| | Available Points | Points Required to Exhaust Supply | Available Points | Points Required to Exhaust Supply |
| 1 | 6,835,627,000 | 7,083,043,000 | 6,158,720,000 | 7,750,000,000 |
| 2 | 4,580,293,800 | 4,965,459,000 | 5,112,295,600 | 5,709,697,300 |
| 3 | 1,642,654,700 | 2,026,129,800 | 2,990,576,700 | 3,518,736,600 |
| 4 | 821,769,000 | 1,155,213,300 | 1,967,929,000 | 2,543,364,300 |
| 5 | 438,743,000 | 753,791,900 | 713,641,200 | 924,719,200 |
| 6 | | | 202,590,300 | 320,450,200 |
| Unspent points | 75,405,100 | | 39,338,600 | |

## Table 2.

### Fraction of Demanded Satisfied by Rounds

| ROUND | Wave 1 | | Wave 2 | |
|---|---|---|---|---|
| | IPFs | Individuals | IPFs | Individuals |
| 1 | 39.0 | 26.4 | 20.0 | 15.8 |
| 2 | 53.9 | 46.9 | 17.9 | 8.7 |
| 3 | 17.2 | 7.8 | 17.0 | 14.3 |
| 4 | 37.4 | 39.7 | 53.5 | 54.0 |
| 5 | 87.9 | 84.0 | 80.0 | 76.7 |
| 6 | | | 83.8 | 82.6 |