E C O N O M I C S B U L L E T I N

Local content protection reconsidered: the case of domestic monopsonist

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Abstract

In this paper we examine how local content protection (LCP) affects the use of the domestic intermediates, the use of total intermediates and the domestic welfare when domestic intermediate−goods market is under monopsony. In the domestic intermediate−goods market under monopsony, the marginal expenditure cost (MEC) of using domestic intermediates has a discontinuous segment because the average expenditure cost (AEC) is a kinked curve. It is shown that there exists a case where because of the discontinuity of the marginal expenditure cost, LCP has no effect on the use of domestic intermediates and has a negative impact on the domestic final−goods producer. This paper provides a summary of the general effects of LCP on the domestic intermediate−goods market under monopsony in terms of resource allocations and the domestic welfare. Moreover, the effects of LCP under monopsony are compared with the case under perfect competition and under free trade.

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1 Introduction

For the last decades, the foreign direct investment has significantly emerged throughout the world. Some of the host countries imposed numerous restrictions on it to protect domestic industries. Some of these investment measures violate the National Treatment Agreement (Article III of GATT 1994) or the agreements on the quantitative restrictions (Article XI of GATT 1994). Therefore they are prohibited by the Agreement on Trade-Related Investment Measures (TRIMs Agreement) which contains statements prohibiting any TRIMs that are inconsistent with the provisions of the GATT Articles. An example of these restrictions is local content protection (LCP) or local content requirements, which violates the Article XI of GATT. Local content protection scheme, a widely spread form of intermediate-goods protection, is used most notably in the automobile industries of Canada, Australia and Latin America. LCP requires that a given percentage of domestic value-added (value-added content protection; VACP) or domestic components (physical content protection; PCP) be embodied in the specified final goods[1]. In the field of the free trade agreements (FTAs), the rules of origins (ROOs) have quite similar structures because the determination of the origin of the goods is often assessed by the content rate embodied in the production process and its effects can be often considered as LCP[2].

After some early analyses, Grossman (1981) developed a partial equilibrium model of a competitive firm that is subjected to LCP scheme and demonstrated the resource allocation effects of the two main types of the protection (PCP and VACP). He also considered how the analysis could be altered when the market of domestic intermediates is under monopoly. A number of papers have followed Grossman and extended the LCP scheme under several imperfectly competitive market structures. Monopoly in the market of intermediates was introduced by Mussa (1993), Vousden (1987), Beghin and Sumner (1992) and Hollander (1987). LCP in the oligopolistic market structure was discussed in Krishna and Itoh (1988) and Ishikawa (1999)[3]. But none of them have dealt with the effects of LCP under the domestic monopsony except Richardson (1991), despite of the fact that the large final-goods producers can have some monopsonic power and be likely to act as a monopsonist in the market of intermediates. Richardson (1991) showed the counter-intuitive effects of LCP on profits with a Cournot duopsony case. But he did not pay so much attentions to the effects of a monopsonic power on the resource allocations.

The main objective of this paper is to examine the resource allocation effects of LCP on the use of a domestically produced intermediates and on the domestic welfare in the monopsony market structure. It is considered that the monopsony arises in the domestic market where the single final-goods producer hires the intermediate factors of input. We are concerned with the case of the domestic monopsony in the market of intermediates in contrast to the case of perfect competition and free trade. We also show that, in a certain case, LCP might have no effect on the use of the domestic intermediates when the government sets LCP slightly higher than the free-trade level. This possibility arises because of the discontinuous property of the marginal expenditure cost and it never happens in another market structure.

The next section presents the basic model of LCP under domestic monopsony and shows comparisons among the several situations (free trade, perfect competition and domestic monopsony). It

[1] Munk (1969) dealt with the case of automobile industry in several Latin American countries and Johnson (1971) analyzed the case of the Canadian automobile industry before the Canada-US Auto Pact.

[2] There are slight differences between LCP and ROOs.While ROOs require that final goods (including imports) must be originated if they are eligible for zero tariffs in the member countries, LCP does not require the imports to meet the content rates.

[3] For other literature on LCP and FDI, see Nakanishi and Hara (1997), Lahiri and Ono (1998) and Qiu and Tao (2001), among others.

also presents an interesting result of LCP in a certain case. The final section concludes the analysis.

2 Monopsony in the intermediate-goods market

We develop a partial equilibrium model consisting of two industries: one producing intermediates, the other producing a final goods using the intermediates and primary labor (labor is assumed to be internationally immobile). Intermediates can be traded internationally without any transportation costs, and domestic and imported intermediates are assumed to be perfect substitutes. We analyze the effect of LCP scheme in the market structure where there is a monopsonist in the market of domestic intermediates. The domestic industry is assumed to be small in the world market, so that the world price of imported intermediates and final goods are regarded as exogenously given by domestic producers. We focus on the LCP scheme defined in the physical term (PCP), which protects domestic intermediate-goods industry by requiring that a certain fraction k $[0 \leq k \leq 1]$ of the total quantity of physical units of the intermediates embodied in the domestically produced final goods be of domestic origin. The final-goods producer is assumed to meet the LCP scheme and we do not consider the choice between acceptance and rejection of the LCP[4].

We describe the technology of the final-goods industry as a production function $F(L, M + M^*)$, where L is the amount of labor input, and M and M^* are the quantities of the domestic and imported intermediates, respectively. For mathematical conveniences, the function F is assumed to be continuous, twice differentiable and everywhere strictly concave.

The profit maximization problem for the final-goods producer is:

$$\max_{L,M,M^*} \Pi = pF(L, M + M^*) - q_m(M)M - q_m^* M^* - wL, \tag{1}$$

$$s.t. \quad M^* = (1 - k)(M + M^*), \tag{2}$$

where p is the domestic price of the final goods; q_m, q_m^* is domestic and foreign price of the intermediates respectively; w is the per-unit labor cost; and $q_m(M)$ is the marginal cost function of domestic intermediate-goods producers and hence the supply function of domestic intermediates. Since the domestic intermediate-goods producers are assumed to be price-takers, $q_m(M)$ is increasing in M[5]. Note that the supply function of domestic intermediates is equivalent to the *average expenditure cost (AEC)* function for the final-goods producer whenever q_m is higher than q_m^*[6]. Since the average expenditure cost of purchasing domestically produced intermediates has an upward slope, the final-goods producer must pay higher price for additional units of domestically produced intermediates.

[4] Grossman (1981) discusses the final-goods producer's acceptance problem of LCP. To avoid a complexity, as in Vousden (1987), we assume that either (1) the penalty ensures that the producer always choose to fulfill the LCP, or (2) the producer anticipates that violation of the protection would be met by some prohibitive tariffs.

[5] The profit function of the domestic intermediate-goods producers are:
$\pi(q_m) = q_m M - C_m(M), \quad C'_m > 0, \quad C''_m > 0$. From the first order conditions, $q_m = C'_m(M)$.

[6] In the standard model of monopsony, the supply curve of the input producer is the average expenditure cost curve for the buyer. When the average expenditure is upward sloping, then the marginal expenditure has a steeper slope in general. The equilibrium amount of input is determined by equalizing the marginal value product of input to the marginal expenditure cost.

The first-order conditions for the final-goods producer's profit maximization problem are:

$$\begin{aligned} pF_1 &= w, && (3)\\ pF_2 &= q_m'(M)M + q_m(M) - \lambda(1-k), && (4)\\ pF_2 &= q_m^* + \lambda k, && (5)\end{aligned}$$

where the subscript i of the function F denotes the partial derivative with respect to its i th argument and λ is a Lagrangian multiplier. Since $\lambda = q_m'(M)M + q_m - q_m^*$ at equilibrium, the total demand function for the intermediates $(M + M^*) \equiv Q$ must satisfy:

$$pF_2 = k[q_m'(M)M + q_m] + (1-k)q_m^* \equiv q, \tag{6}$$

where q is defined as the marginal factor cost of *total* intermediates weighted by k.

The equation (6) addresses important properties. In the first bracket $[q_m'(M)M + q_m]$ represents the marginal factor cost of using additional units of *domestic* intermediates, which is higher than the price q_m because of the domestic monopsonic distortion. We define the marginal factor cost of using domestic intermediates as the *marginal expenditure cost (MEC)* of using domestic intermediates for the final-goods producer. In the last term q_m^* is the marginal factor cost of using additional units of *imported* intermediates which is equal to its price. The final-goods producer chooses the amount of total intermediates Q so that marginal value product of total intermediates equals the weighted sum of the marginal factor costs of using domestic and imported intermediates. Thus, the derived demand for total intermediates is defined as a function of q,

$$Q \equiv M + M^* = Q(p, q, w) = -\Pi_q(p, q, w). \tag{7}$$

Accordingly, the derived demand for domestically produced intermediates is

$$M(p, q, w) = kQ(p, q, w) = -k\Pi_q(p, q, w), \tag{8}$$

which, combined with the definition of q and (6), yields the demand function for domestically produced intermediates M as a function of q_m (not of q). Formally, substituting q with (8), $M(q_m)$ satisfies the following equation

$$[q_m'(M)M + q_m] = \frac{-1}{k}\left[\Pi_q^{-1}(p, (M/k), w) + q_m^*(1-k)\right]. \tag{9}$$

Since the final-goods producer behaves as a price-taker in a final-goods market, the derived demand for domestically produced intermediates $M = M(p, q_m, w)$ is exactly the same as the marginal value product of domestic intermediates. Equilibrium amount of domestically produced intermediates is determined by equalizing the marginal value product of M to the marginal expenditure cost of M, while the actual price that the final-goods producer must pay for the domestic intermediates is determined on the average expenditure cost.

Figure 1 shows how the LCP affects the use of intermediates by the final-goods producer. To examine the effects of LCP with monopsony in the domestic intermediate-goods market, we take following three steps. First, we describe the free-trade equilibrium. Total demand curve of intermediates is given by (7) and described as DD' line, the supply curve of domestic intermediates is graphed as SS' line. In the free-trade equilibrium, given the world price of imported intermediates q_m^*, total use of intermediates is determined at point D^{FT} and the use of domestically produced intermediates is determined at point S^{FT}. Thus, the final-goods producer uses M^{FT} units of domestically produced intermediates and imports $(Q^{FT} - M^{FT})$ units of foreign intermediates. It should be noted that, with an assumption of a small country, the domestic supply point S^{FT} and total derived demand point D^{FT} is not changed in the free-trade equilibrium whether the domestic intermediate-goods market is perfectly competitive or not.

Second, we introduce LCP but assume that competition of domestic intermediate-goods market remains perfectly competitive. Suppose that the content rate is set by $(\overline{q_m^* H}/\overline{q_m^* D^{FT}})$ in the Figure 1. With a content requirement, the derived demand for the domestically produced intermediates M as a function of q is given by (8) and illustrated as DK line. Any points on the DK line satisfy the k fraction of total use of intermediates. HH' line also graphs M against price of *domestic* intermediates q_m which satisfies (9). Since the final-goods producer behaves competitively in the domestic intermediate-goods market, the use of domestic intermediates is determined at point I where HH' line intersects SS' line, and the total use of intermediates is determined at point D^{PC}. Thus, the final-goods producer uses M^{PC} units of domestically produced intermediates and imports $(Q^{PC} - M^{PC})$ units of foreign intermediates. Comparing with the free-trade equilibrium, the use of domestically produced intermediates increases triggered by the LCP. But the domestic intermediate-goods industry is protected at the expense of the final-goods producer. Decreasing use of the total intermediates implies the shrink of the final-goods industry, which was generated by the increased use of inefficient domestic intermediates and the rise in weighted sum of the marginal factor costs q [7]. Geometrically, the welfare loss from the free-trade equilibrium consists of the loss from the increased use of inefficient domestic intermediates (area $\triangle\,\mathrm{I}S^{FT}\mathrm{G}$) and the loss from the shrink of the final-goods industry (area $\triangle\,D^{PC}\mathrm{N}D^{FT}$).

Third, we consider LCP with monopsony in the market of domestic intermediate-goods market. The average expenditure cost of using domestically produced intermediates for the final-goods producer is illustrated as a kinked line $\mathrm{O}q_m^* S^{FT}\mathrm{S}'$, which has an upward slope within the range of $q_m > q_m^*$. Because of the kinked property of the average expenditure cost, the marginal expenditure cost of using domestic intermediates, which is graphed as a bold line, has a discontinuous segment $S^{FT}\mathrm{E}$ at $M = M^{FT}$. The final-goods producer chooses the amount of domestic intermediates M so that the marginal value product of domestic intermediates is equalized with the marginal expenditure cost of domestic intermediates. The equilibrium amount of domestically produced intermediates is determined at point A which is the intersection of HH' line and EE' line. The price of the domestic intermediates $q_m(M)$ is determined on the average expenditure cost curve at point C. Total use of the intermediates depends on the weighted sum of marginal factor costs q which is determined at point B on the DK line. Thus, the total use of intermediates is determined at point D^K. The final-goods producer uses M^K units of domestically produced intermediates and imports $(Q^K - M^K)$ units of foreign intermediates.

Comparing with the free-trade equilibrium, an introducing LCP under monopsony in the market of domestic intermediates results in an increase in the use of the domestically produced intermediates. But the amount of the M^K is smaller than that amount under the perfect competition M^{PC}. This is because the price of the domestic intermediates q_m is lowered by the monopsonic pressure of the final-goods producer, therefore the amount of the domestic intermediates is restricted more than under perfect competition. Moreover, the total use of intermediates under monopsony also gets smaller than under perfect competition by a decrease in the use of the domestic intermediates. The more the use of domestic intermediates decreases, the weighted sum of the marginal factor costs q becomes higher, which implies a decrease in Q. It should be noted that the degree of shrinkage of the final-goods industry is much larger under the monopsony than that under the

[7] In the competitive domestic intermediate-goods market, the weighted sum of the marginal factor costs can be regarded as the average price of the total intermediates, which is defined formally as: $q = kq_m + (1-k)q_m^*$.

perfect competition. The welfare cost comparing with the free-trade equilibrium is illustrated as the sum of the area $\triangle\, \mathrm{C}S^{FT}\mathrm{J}$ and the area $\triangle\, D^K\mathrm{L}D^{FT}$, which is larger than under the perfect competition. Comparing with the case under the perfect competition, the damage from a shrink of the final-goods industry under monopsony is enormous, no matter how the inefficiency of using domestic intermediates is lighten by a decrease in M. These comparisons of quantities and welfare costs are also summarized in Table 1.

	Free trade	LCP under perfect competition	LCP under monopsony
Q	Q^{FT}	Q^{PC}	Q^K
M	M^{FT}	M^{PC}	M^K
q	q_m^*	$kq_m + (1-k)q_m^*$	$k[q_m' M^K + q_m] + (1-k)q_m^*$
q_m	q_m^*	$C_m'(M^{PC})$	$C_m'(M^K)$
Welfare cost	$---$	$\triangle\, \mathrm{I}S^{FT}\mathrm{G} + \triangle\, D^{PC}\mathrm{N}D^{FT}$	$\triangle\, \mathrm{C}S^{FT}\mathrm{J} + \triangle\, D^K\mathrm{L}D^{FT}$

Table 1: Comparison of variables and welfare cost in general case

The above analysis in this section leads to the following proposition.

Proposition 1 *Suppose the final-goods producer behaves as a monopsonist in the market of domestic intermediates. Starting from the free-trade equilibrium, introducing LCP results in an increase in the use of the domestically produced intermediates and a decrease in the total use of the intermediates in general. The domestic intermediate-goods producers gain from LCP at the expense of the loss of the final-goods producer. The overall effect on welfare is negative.*

Finally we consider the special case in the Figure 2 which leads to an interesting result. Let the content rate evaluated at the free-trade levels of domestic intermediates be defined as $k^{FT} = \overline{q_m^* S^{FT}} / \overline{q_m^* D^{FT}}$. Suppose that the domestic government sets content rate which is slightly higher than k^{FT}. Then the point H is very close to the free-trade domestic production point S^{FT}. As we have seen, the marginal expenditure cost has a discontinuous segment under monopsony. Even if the content rate is slightly higher than k^{FT}, the use of domestic intermediates can not be expanded from M^{FT} as long as the HH' line intersects the marginal expenditure cost curve within the discontinuous segment $S^{FT}\mathrm{E}$. Thus, LCP does not affect the use of the domestically produced intermediates in this case. With respect to the welfare loss, the welfare cost of LCP in this case is not so large as in the previous case because q_m is lower (actually q_m is equal to q_m^* in this case) and the weighted sum of the marginal factor costs of intermediates q, is also lower than in Figure 1. The welfare cost of LCP under monopsony consists of the loss of the final-goods producer only (area $\triangle\, D^K\mathrm{LN}$). It should be noticed that the domestic intermediate-goods producers never gain nor lose by the LCP, while the final-goods producer necessarily gets worse off. Table 2 summarizes the comparisons with respect to quantities and welfare costs among the three situations (free trade, LCP under perfect competition, LCP under monopsony) in this special case.

	Free trade	LCP under perfect competition	LCP under monopsony
Q	Q^{FT}	Q^{PC}	Q^{K}
M	M^{FT}	M^{PC}	M^{FT}
q	q_m^*	$kq_m + (1-k)q_m^*$	$kq'_m M^{FT} + q_m^*$
q_m	q_m^*	$C'_m(M^{PC})$	q_m^*
Welfare cost	$---$	$\triangle \mathrm{I}S^{FT}\mathrm{G} + \triangle D^{PC}\mathrm{N}D^{FT}$	$\triangle D^{K}\mathrm{L}D^{FT}$

Table 2: Comparison of variables and welfare cost in a special case

The possibility of this special case is slim. However, if we consider effects of a small change in k from the free-trade level, it is considerable that LCP might not be effective to protect domestic intermediate-goods producers. The analysis in this special case leads to the following proposition.

Proposition 2 *Suppose the final-goods producer behaves as a monopsonist in the market of domestic intermediates. Then, the marginal expenditure cost of using a domestically produced intermediates has a discontinuous segment. A small increase in the rate of LCP from free-trade level necessarily shrinks total use of intermediates by the final-goods producer, but might neither expand nor contract the production of domestic intermediates as long as the marginal expenditure cost curve intersects the marginal value product curve of domestic intermediates within its discontinuous segment.*

3 Conclusions

This paper has shown how LCP affects the supply of the domestic intermediates, the use of total intermediates and the domestic welfare when domestic intermediate-goods market is under monopsony. We draw two main conclusions from this analysis.

First, we have examined general resource allocation effects of LCP under domestic monopsony. And then we compared effects of LCP under monopsony with those under other cases (under free trade, under perfect competition). Introducing LCP at the free-trade equilibrium increases the use of the domestically produced intermediates and decreases the use of the total intermediates. Comparing with the case under perfect competition, the degree of shrinkage in the final-goods industry is magnified when the domestic intermediate-goods market is under monopsony. Furthermore from the point of welfare, LCP has negative effects on the domestic welfare. In general, LCP increases the amount of domestic intermediates, hence raises the domestic intermediate-goods producers' payoffs. But the weighted sum of the marginal factor costs q gets higher, and domestic final-goods industry shrinks. The latter negative effect surpasses the former gain, thus the total effect on domestic welfare is negative.

Second, we have obtained an interesting result in a special case. When the content rate is close to the free trade level, the use of the domestic intermediates may not be expanded by LCP. This possibility stems from the property of the marginal expenditure cost curve which has a discontinuous segment, and it occurs only in the case of domestic monopsony. As long as the marginal expenditure cost intersects the value marginal product of domestic intermediates on its discontinuous segment, LCP has no effect on the use of the domestically produced intermediates. In this case, LCP not only fails to expand the use of domestic intermediates, but also leads to the welfare loss. The source of the welfare costs in this case is caused solely by the loss of the final-goods producer who is faced with a rise in the weighted sum of the marginal factor costs q.

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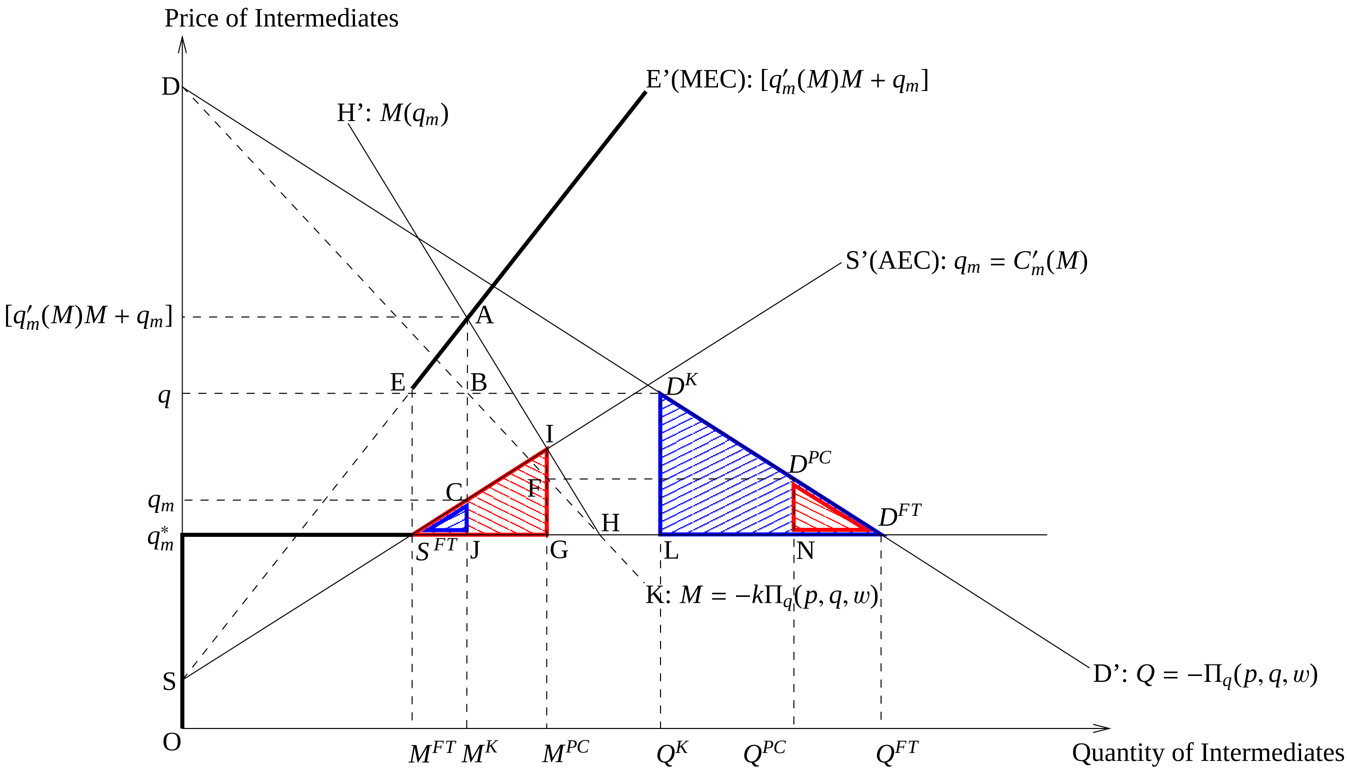

Figure 1: general case

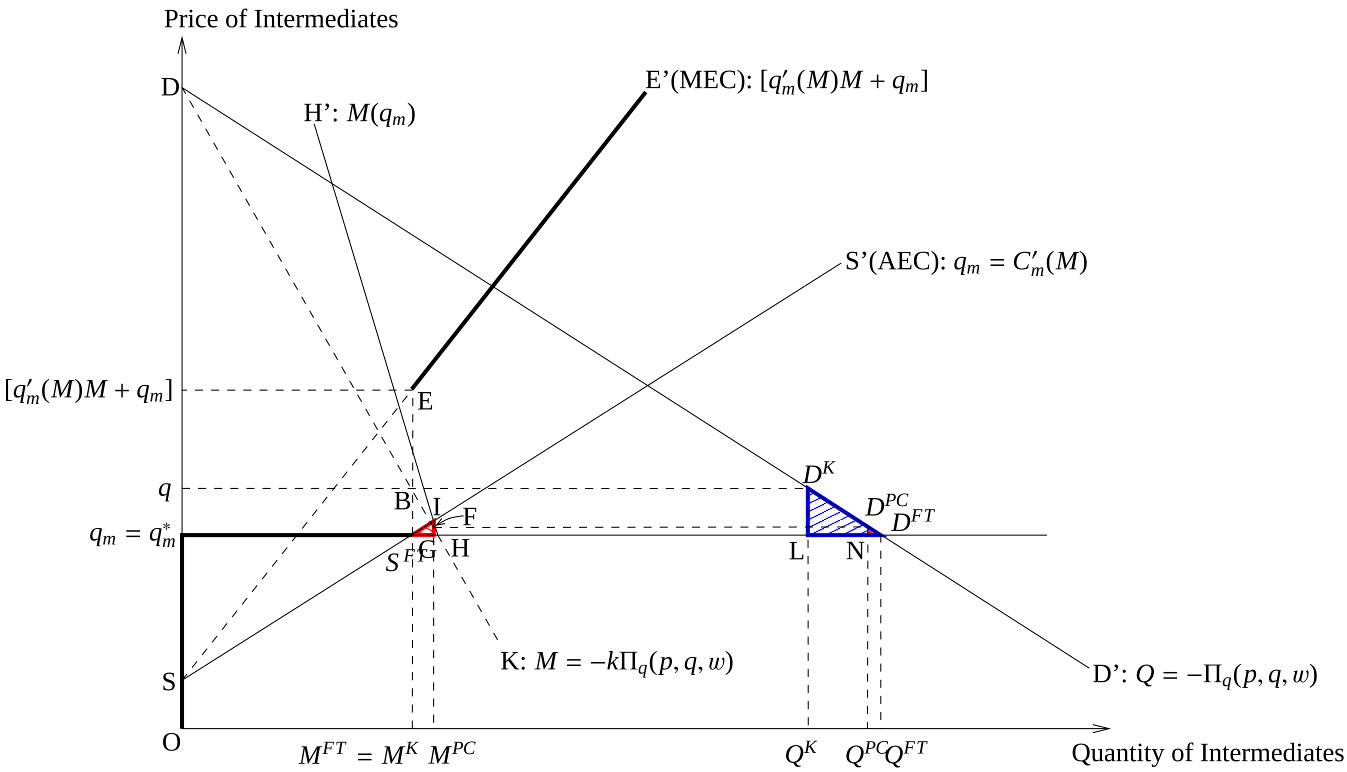

Figure 2: special case