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MATERIALS HANDLING ECONOMICS AND COSTS: THEORY AND APPLICATIONS FROM THE INDUSTRIAL LIFE

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Abstract

The layout is the right arrangement of the machines within the industrial plant representing anatomically the skeleton of a human being. Material handling represents in general all the internal movements of any type of material within the industrial plant representing anatomically the muscular system of a human being. As aforesaid, it is obvious, that in facilities design priority has to be given in the design of the plant layout which is considered to be the skeleton of the facilities design. Upon its completion the material (s) handling system has to be introduced in order to complete the production process. It has to be indicated that any time of malfunction in the right arrangement of the machine is not allowed, because of any movement or changing of the position of any machine is not considered as to be as an easy task at all. The relation between Plant Layout and Material Handling is analyzed thoroughly below as following:

There is a close relationship between plant layout and material handling. The material handling technique to be used definitely effects the plant layout and the factory building. A sound low cost method can be designed and installed only if material handling is considered an integral part of plant layout.

A well-considered arrangement of production equipment, the proper location of different departments, a logical sequence of operation within the department and convenient location of store areas, tool cribs and similar activity centers is required for a good material handling arrangement. The efficient and economical material handling system can be designed and selected for installations only after the floor plan has been adequately organized.

In all types of plant layout provisions for the receiving and shipping of materials by various possible means (like trucks or train etc.) should be made. If it is required to move the materials by hand operated or power operated trucks, sufficient passage should be provided.

If the building is multi storied, lift, elevators and conveyors of different types must be utilized to enable efficient material handling. The location of items in the store room should provide for minimum handling of materials to the point of issue, accessibility and efficient space utilization. (https://www.yourarticlelibrary.com/ergonomics/material-handling/relation-between-plant-layout-and-material-handling/34671)

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1. Introduction

This chapter deals generally with the economies which can be derived from imaginative yet sound application of materials handling techniques and mechanical handling equipment. Traditionally a Board of Directors exists to safeguard and develop the assets and the earning power of a company in the interests of its shareholders, its employees and its management. It will therefore tend naturally to assess the value to the company of any project in terms of what the project will cost and of the anticipated return in terms of economies and increased earning power. Each board will have its own views as to the return which is acceptable for any particular outlay. Frequently it may be thought that a board is parsimonious in its outlook, expecting equipment to pay for itself in an unreasonably short time, often only a small fraction of its estimated life. But when it is realized that mechanical handling equipment may be competing in the allocation of funds with other projects which may achieve an even quicker return, one may have some sympathy with a board's point of view. (K.E. Booth and C.G. Chantrill, 1962).

Obviously the board is more likely to authorize a proposal having the greatest advantage and offering the quickest return for capital expenditure.

Materials handling is the key to the attainment of very substantial economies, not merely in the form of simple savings, which are easy to calculate and generally concern labour costs, but particularly in reducing the incidence of fixed expense through more efficient employment of a company's resources.

It is always possible and most important to assess savings and advantages in advance to justify investment in equipment for mechanization. This method of approach will ensure that no detailed and local improvements can be put in hand without previously obtaining full knowledge of their effects and repercussions on the economy and performance of the whole organization. In many cases it will be found that these repercussions increase the advantages and make the proposal more attractive.

The Materials Handling Engineer is strongly advised to ensure that all the economic factors have been properly appreciated before submitting his proposals. It is hoped that this chapter has indicated that there are numerous instances where economic factors are not only complementary but sometimes, in fact, are conflicting. It is vitally important that the true resultant should be calculated in support of any proposals.

2. A general overview of the topic

2.1. Operating economy

Because of the general preoccupation in industry and commerce with the cost of *manpower,* there is a tendency to ignore many of the opportunities which can be secured through good materials handling applications. If materials handling engineers only look for savings in actual labour cost, direct or indirect, to justify the purchase of handling equipment, it is small wonder that a large number of schemes are either turned down or relegated to a low priority.

The materials handling engineer must "raise his sights" and understand thoroughly exactly how materials handling affects the operating economy of his particular company. He will then find that many of the proposals, which at first were considered to be doubtful or borderline cases, will become highly satisfactory. If he is content to look for piecemeal savings, significant though these might be, he will only achieve piecemeal development which, in the end, runs the risk of becoming unbalanced.

2.2. Scope

The keynote of materials handling is *opportunity.* Opportunity to regroup the resources of an organization so that in their modified form they can be re-employed to create greater productivity, greater earning power and greater wealth. It has already been stated earlier in this book that development is not something which is undertaken once and for all but rather that it is a continuous cycle which, in a progressive company, never ceases. A thorough understanding of the possibilities afforded by sound materials handling will immeasurably accelerate this cycle.

Materials handling is everybody's business. It is involved in the procurement of basic materials from the earth; in the production of food; in civil engineering projects – for building, for opening up communications, and for bringing to the remoter parts of the world the refinements of civilization; in transportation in all its forms and in transshipment from one form of load carrying vehicle to another; in storage and in warehousing and distribution; and, certainly in its most intensive degree, in manufacturing. In fact, there is no activity where it is not present.

In the United States of America, the most highly mechanized country in the world, it is calculated that materials handling in one form or another accounts for 50% of the net cost of production. In the U.K., its cost has been assessed as upwards of €1,000,000,000 a year – probably an understatement.

2.3. Materials handling and costs

It is not sufficient to assess the actual cost of handling in terms of labour and of the cost of operating handling equipment, including depreciation and maintenance. It is necessary to assess the hidden losses which are incurred, as well as the missed opportunities, when the potential advantages of efficient handling are not taken. For example, every unnecessary handling operation or element not only bears its own cost but, which is more important, it often prevents a useful operation from being done; thus losing saleable output and diminishing the recovery of overhead cost.

In addition, poor flow through inadequate handling tends to inflate inventory, freezing working capital in. excess stock and work-in-progress, and taking up valuable space which otherwise could have been employed on productive work. Poor handling will affect the loading and unloading of production plant, vehicles, etc. Production plant and vehicles are not earning when being loaded and, as is well known, "turn round" time affects their operating economy drastically.

The effect of handling on the cost of supplies can be very significant. Given a material or component specification, a buyer will often place a contract with the suppliers who quote the lowest price. The margin may be as little as 1% less than other suppliers. Yet handling costs incurred because no thought has been given to method of delivery, inspection costs (because of supplier's unreliability) and inventory costs because of storage necessary to offset failure to maintain delivery promises, may together account for as much as 5-10% of the cost of the material or component. This shows how necessary it is to consider movement and handling *beyond* the confines of one's own organization.

On the other hand, every time an unnecessary effort or movement can be eliminated, and the resources thereby released to do useful, saleable work, such additional work is carried on without any increase in fixed expense. This is reflected in an increased profit margin.

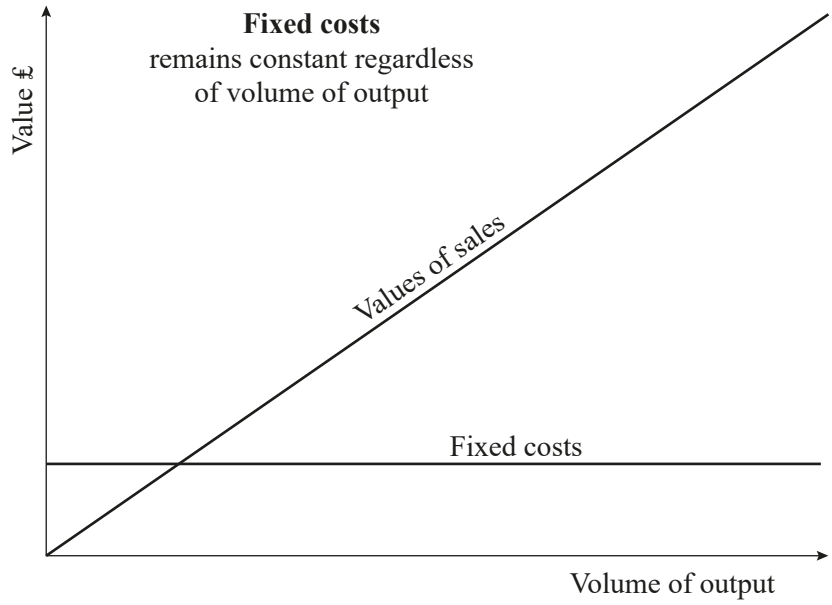
The national cost of materials handling and the savings which are possible tend to be of little but general interest to the industrial engineer or materials handling engineer. What he wants to know is how to establish reliably the potential economies present in specific situations in his particular firm, where to seek these and how to present a case to his Board which, being aware of its policy, he knows will receive favourable consideration. He needs to be able to assess the return on expenditure and the factors which will govern this. He needs to know the economic characteristics of the equipment which he will recommend in substitution of the former method.

2.4. The effect of activity volume on the elements of cost

The elements of cost relating to any activity or process are:

The Fixed Costs: those costs *which remain the same* regardless of the volume of activity (see Fig. 1).

Figure 1: Fixed costs graph (K.E. Booth and C.G. Chantrill, 1962)



Within the normal limits of volume fluctuation within a business, these are covered by such items as:

Rent and Rates

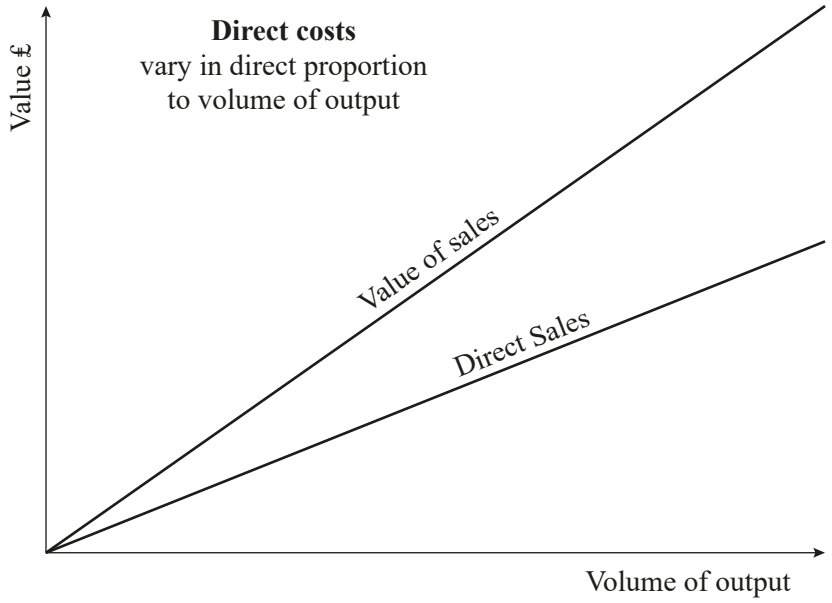
Depreciation of buildings and plant (although whether these are treated as fixed expense in a Company's accounts will depend upon the accounting method)

Certain general overhead costs such as Higher Management.

The Direct Costs: those costs *which vary in direct proportion to the volume of activity* concerned (see Fig. 2). Examples are the materials of manufacture, in the case of manufacturing concerns, the direct labour cost when this can

be expressed as directly attributable to the saleable product or service and is directly proportional to the volume of activity or output.

Figure 2: Direct costs graph (K.E. Booth and C.G. Chantrill, 1962)



The Variable On-costs: elements of cost which are influenced by increases or decreases in the volume of activity or output, but do not vary in *direct* proportion to these. For instance, supervision will not necessarily be doubled if the volume of activity should be doubled; it might only increase by say, 50%; heating and lighting may only be increased by say 5% or 10% in such a case; power and fuel may be increased by 80-90%; and so forth. The elements usually concerned as variable on-costs are:

- Indirect labour
- Supervision
- National Insurance and holiday pay
- Cost of inventory
- Indirect materials

- Services – fuel, electricity, gas
- Plant and buildings maintenance
- Factory administration
- Cost of selling and marketing
- General administration.

In any particular company, it is possible accurately to assess the extent to which a variable on-cost will react to the volume of activity.

If, for instance, it increases at half the rate, i.e. 50% for an activity increase of 100%, this would be the same as saying that it was 50% direct expense and 50% fixed expense. If the increase were 80%, it could be expressed as being 80% direct and 20% fixed.

The total variable on-cost can therefore be expressed as the sum of all the fixed elements plus the sum of all the directly variable elements (see Figs. 3 and 4).

Figure 3: Total variable on-costs graph (K.E. Booth and C.G. Chantrill, 1962)

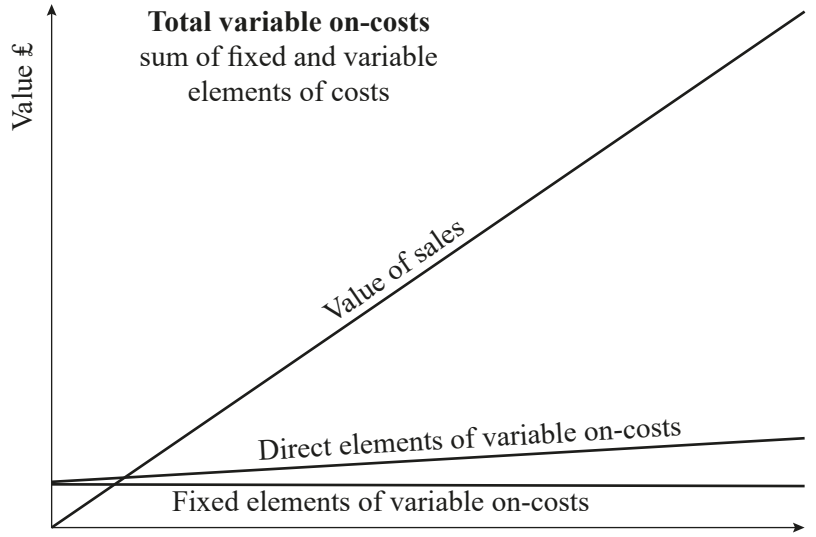
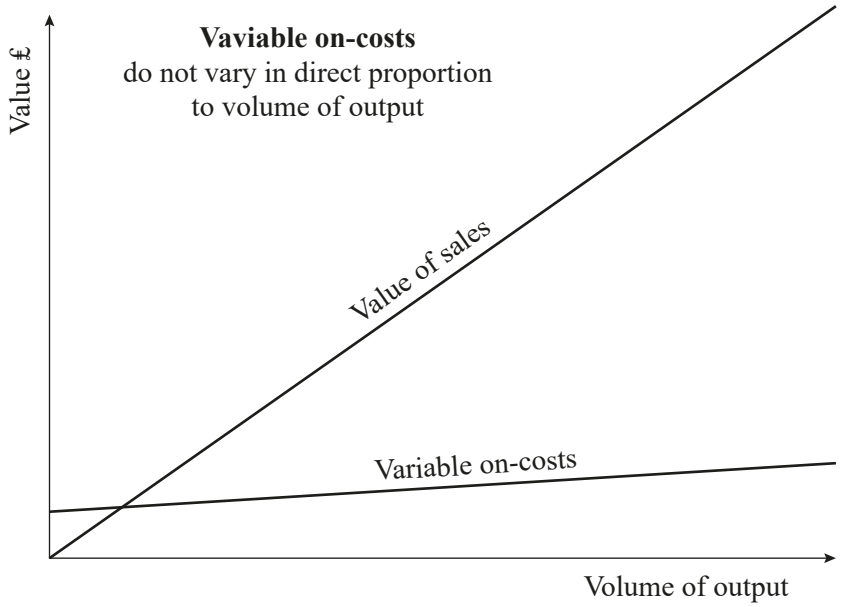


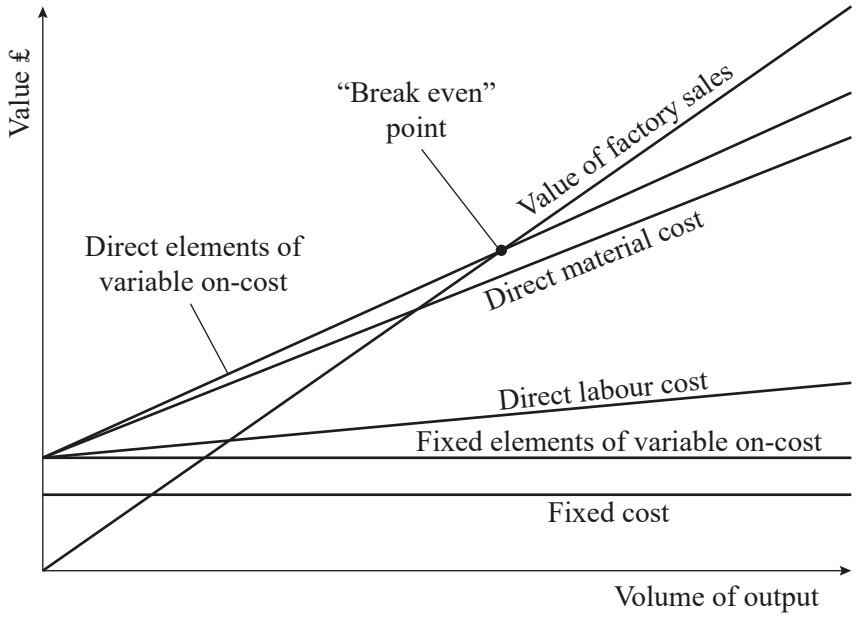
Figure 4: Variable on-costs graph
(K.E. Booth and C.G. Chantrill, 1962)



From the foregoing, it is possible to build up the total cost of the activity (or total operating cost) in relation to any particular volume (see Fig. 5). If the activity is a service and not manufacture, there will be no direct materials element present but the other elements will be as shown. Fig. 7 also shows the income to be derived from selling the product or service.

Excluding such complications as quantity discounts, which would occasionally be introduced in practice, it will be seen that the income derived from the sales will be directly proportional to the volume.

Figure 5: Build-up of total activity cost (K.E. Booth and C.G. Chantrill, 1962)



2.5. Break-even point

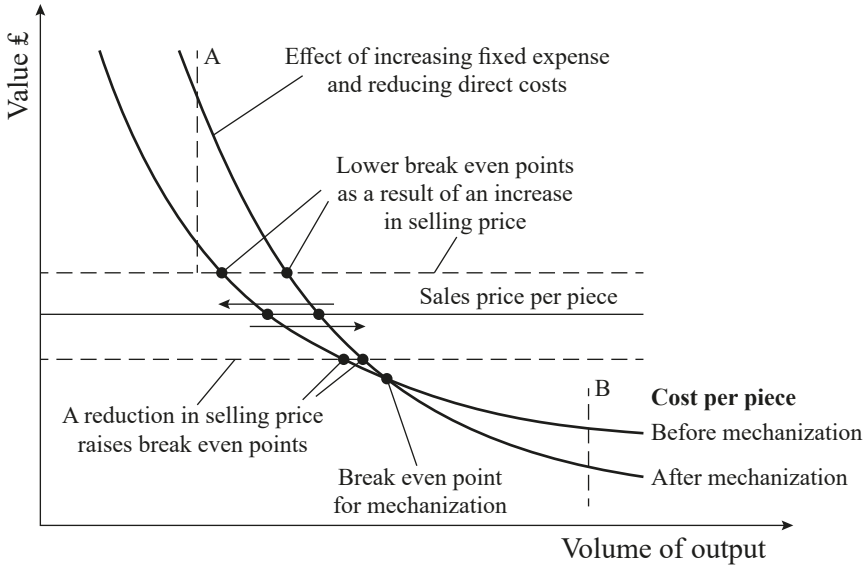
It will be noted that at low volume of activity the income from sales is less than the total operating cost but as the volume increases the difference becomes less until sales income exactly equals the total operating cost. This is generally known as the break-even point in respect of the operation or activity. Thereafter, as volume increases up to full capacity, the sales income becomes increasingly greater than the total operating cost and the difference may be called the profit margin or operating advantage.

It is vital that the break-even point should be determined before applying a new method. There obviously cannot be much purpose in recommending a method unless there is reasonable certainty that the volume of activity required will always be well in excess of the break-even point.

The cost per "unit of activity" (in manufacture, this may be "cost per

product piece" or "cost per unit weight or volume of material," while, in a service operation, it may be "cost per service hour" or some such convenient unit of measurement), as may be seen from Fig. 6, will be as follows for any volume of activity:

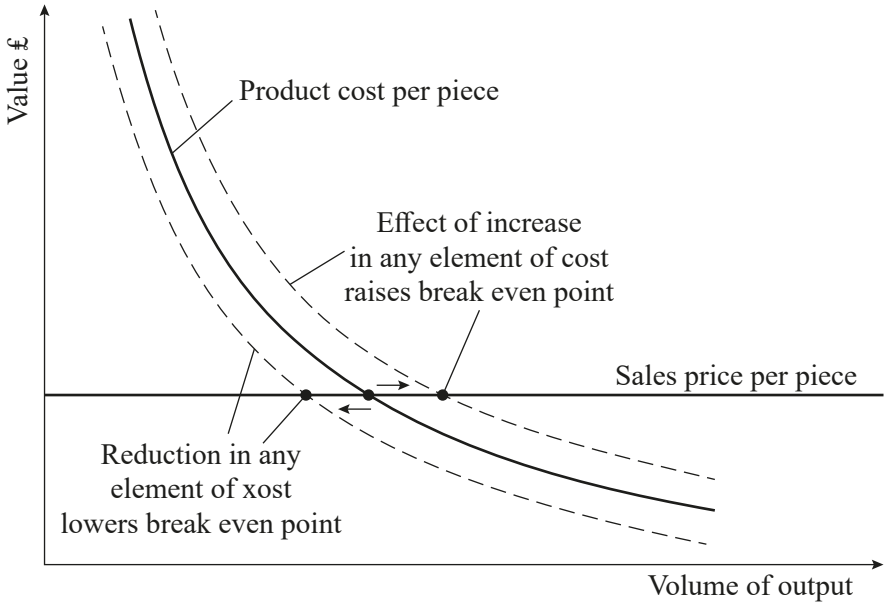
Figure 6: Cost per unit of activity graph (K.E. Booth and C.G. Chantrill, 1962)



Direct cost per unit + total fixed cost / number of units
Thus, when the volume is nil, the cost per unit is
Direct cost per unit + total fixed cost / 0 = infinity
For 100 units, it would be:
Direct cost per unit + Total fixed cost / 100
and so on.

This is illustrated in Fig. 7 which shows how the cost per unit varies in relation to activity volume on account of the incidence of fixed expense. This also shows the selling price per unit as being fixed and hence as a horizontal line.

Figure 7: Cost per unit of activity graph (K.E. Booth and C.G. Chantrill, 1962)



The break-even point occurs at the point where the cost/unit curve (which is hyperbolic) crosses the selling price. When any element of cost is increased, a new curve is generated above the cost/unit curve, so raising the break-even point. When an element of cost is reduced, a new curve is generated below the cost/unit curve and the break-even point occurs at a lower volume of activity.

2.6. Effect of mechanization

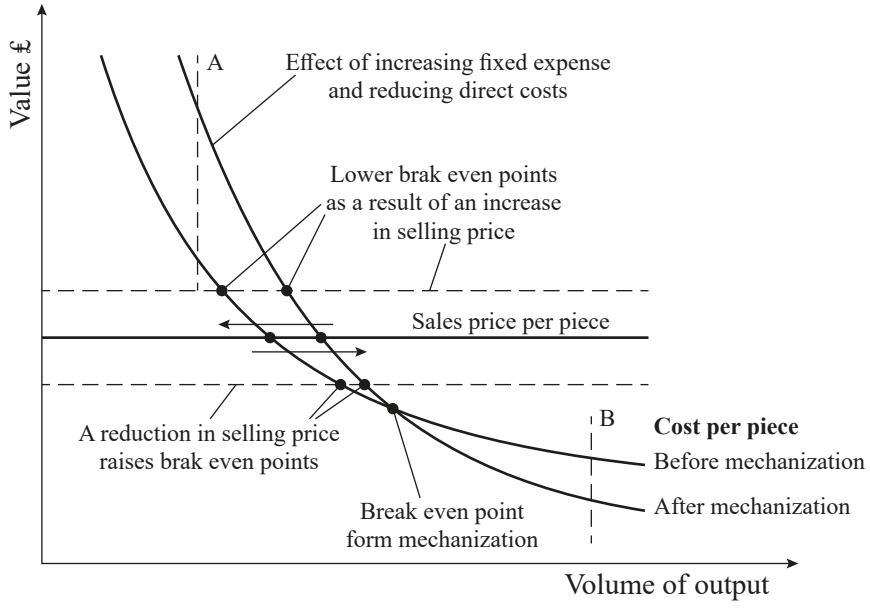
The effect of substituting equipment for labour is, firstly, to increase the fixed expense by the addition of a number of indirect elements of cost such as depreciation on the new equipment, maintenance, power, fuel, etc. Greater reductions, however, are made possible in direct expense under the heading of labour cost. The net result is that operating costs are higher at a low volume of activity and lower at a high volume of activity, as shown at A and B in Fig. 8.

The common characteristic effect of mechanization is to tend to raise the

break-even point. In fact, one must take into account the break-even point between the two methods as shown in Fig. 8.

Fig. 8 shows a comparison of two situations, the first being an organization with low investment in capital equipment and the second showing the same factory after intensive mechanization. It will be seen that the high investment is recovered by substantial reductions in direct expenses. The characteristic increase in volume at which the organization breaks even can be seen, as also can the effect of raising or lowering prices. Thus an increase in cost *raises* the break-even point and vice versa (Fig. 7). An increase in selling price *lowers* the break-even point and vice versa (Fig. 8).

Figure 8: Cost per piece graph before and after mechanization (K.E. Booth and C.G. Chantrill, 1962)



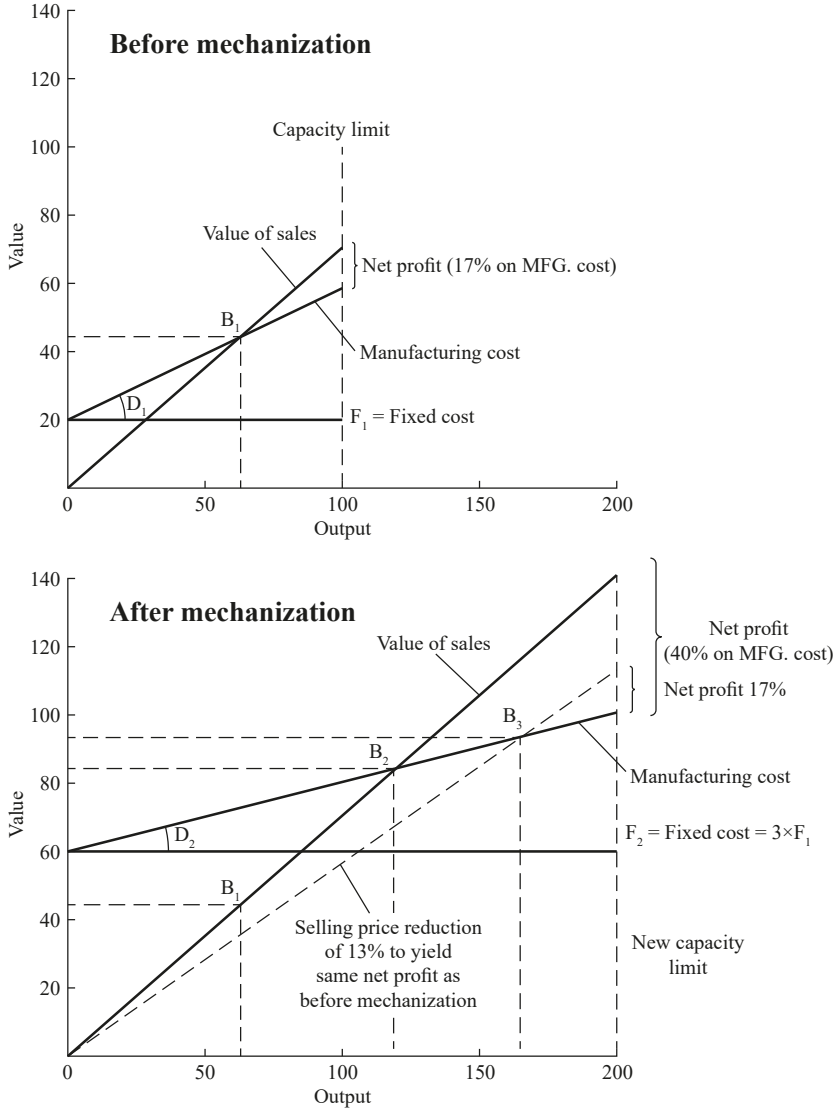
2.7. Savings and advantages

For purposes of definition, “savings” are actual reductions in any element of cost.

“Advantages” are obtained in addition to savings when the resources released as the result of savings can be productively reemployed to increase sales income.

Savings and advantages can be found in direct labour, indirect labour, space, reduction of work-in-progress, supervision, administration and in yield by reducing damage as a result of rough handling.

Figure 9: Before and after mechanization graph (K.E. Booth and C.G. Chantrill, 1962)



Key: D_1 Direct expense before mechanization
D_2 Direct expense aftermechanization
} $D_1 = 2 \times D_2$
B_1 Break even point before mechanization
B_2 Break even point after mechanization
B_3 Break even point after mechanization and after price reduction

The following examples may be helpful in order to illustrate the potential economies:

2.8. Direct labour

Let us assume that a 20% saving in direct labour can be achieved in a company whose annual trading figures are broadly as follows:

		Sales turnover
Direct labour	125,000 €	1,000,000 €
Direct materials	400,000 €	
Variable overheads	200,000 €	
Fixed overheads	175,000 €	
Total manufacturing cost	900,000 €	1,000,000 €
Net profit margin	100,000 €	
	1,000,000 €	1,000,000 €

(K.E. Booth and C.G. Chantrill, 1962)

If output is not increased, the saving is 20% of €125,000, or €25,000 per annum. If, however, the 20% labour so released can be productively re-employed, the sales turnover can be increased by 25%, to €1,250,000 per annum.

Saving in direct labour from 25% increase in ouput without increase in direct labour costs is then

(€125,000 / 4 + €125,000) − €125,000 = 31,250
advantage in incidence of overheads €175,000 / 4 = 43,750
increase in net profit on the increased turnover
€100,000 / 4 = 25,000
Total potential savings and advantages 100,000

This is four times as great as the saving in direct labour if output had not been increased. The comparable figures would then be:

		Sales turnover
Direct labour	125,000	1,250.000
Direct materials	500,000	
Variable overheads	250,000	
Fixed overheads	175,000	
Total manufacturing cost	1,050,000	
Net profit margin	200,000	
	1,250,000	1,250,000

2.9. Indirect labour

Better handling equipment usually enables indirect labour to be reduced. With the output unchanged the amount of reduction will represent the whole saving.

But if balance and flow is improved and the capacity so released can be used for greater output, then advantages similar to those in the above examples would be obtained.

2.10. Space and work-in-progress

Working capital is required to pay for materials, wages and services while products are being made, and until such time as payment has been received for the finished products.

Reverting to the hypothetical firm in the example above, the annual cost of production was €900,000 per annum or approximately €18,000 per week. If the flow of work was so fast that the value of work-in-progress materials and stores were no more than one week's production, working capital requirements for production would be €18,000 plus a contingency totaling approximately €25,000 to €30,000. But if no proper flow of work exists, these items may total six to nine months production and the working capital would need to be €500,000 to €700,000, the interest charges on which could be €35,000 to €49,000 per annum at 7%. Productively used, this capital could earn at least 10% for the company. A little thought will soon indicate the enormous hidden advantages available through reducing inventory by accelerating throughput with improved materials handling.

In addition, if the space saved by reduced work-in-progress can be made

productive, advantages can be calculated which indicate the profit which could be earned from the release of increased productive space.

2.11. Supervision and administration

These are ancillary to production and exist to obtain the most effective production that conditions will allow. Good flow with simple means of controlling the balance of activity are ideal conditions for ensuring low supervision and administration costs.

2.12. Damage as a result of rough handling

The loss to a company, in terms of products damaged through rough handling during the production cycle, is not simply the value of the raw materials. To this must be added both the labour and overhead cost of all operations performed before the product was damaged together with the loss of profit as a result of a reduction in output. Finally, sales turnover may be affected through a deterioration of goodwill following a failure to meet delivery dates.

The operating cost of equipment may be divided into two categories: the running cost and the overhead or standing cost. The running cost includes labour, direct and indirect, both for operating the machine and for the cost of fuel and power. Operating costs vary directly with the throughput. The standing overhead costs are made up of depreciation, interest on capital and the cost of maintenance and these are incurred whether the plant is working or idle.

When standby equipment is installed to offset the effect of stoppages due to breakdowns it represents an additional standing charge. This is justified when the standing cost can be shown to be less than that of the breakdowns that are likely to be expected. Standby equipment is usually installed in the case of relatively inexpensive plant which may, if inoperative, halt a production line or even a whole factory. It is seldom justifiable to install major items of plant as standby.

2.13. Costs of projects

The cost to be incurred in implementing a project fall under two headings.

2.14. Installation costs

These include the cost of designing the equipment and developing the

layout and also the cost of purchasing and installing the plant, as well as the cost of any trials which may be necessary before the plant is handed over to the production department for operational purposes.

2.15. Initiation costs

These include production losses due to the changeover and during the acclimatization period until full output has been reached under the new arrangements. The cost of recruiting and training labour and any losses due to initial scrap and bad workmanship also come under this heading.

2.16. Operating costs

The scope for securing savings and advantages as the result of the reorganization of layouts, method and handling has been discussed earlier in this chapter. It is now necessary to show what operating advantage can be obtained to justify the cost of a proposed scheme. The operating advantage is expressed as the present total cost per hour (or per piece) less proposed total cost per hour (or per piece).

This can then be extended on an annual basis based on past and proposed activity and performance.

2.17. Factors in assessing amortization periods

Having calculated firstly the combined installation and initiation costs and secondly the operating advantage, it is then possible to assess how long it will take to repay the total cost of the investment thus

Amortization period in years = Installation cost plus initiation cost/Annual operating advantage

In what time must such expenditure be recovered? Obviously the shorter the period the more acceptable the project will be to the board. In determining the amortization period to be allowed, consideration must be given to the cost of interest and to the following:

(i) *Anticipated Life of the Plant*: the amortization period should never exceed the anticipated life of the plant or equipment.

(ii) *Obsolescence of Product*: clearly the amortization period must be less than the anticipated time during which the product will have a sales appeal.

(iii) *Obsolescence of Plant*: in rapidly developing industries there is a risk of new plant becoming obsolete well within its anticipated life. In such a case

the amortization must be within the limit of its anticipated useful life before it becomes superseded by further development.

(iv) *Alternative Uses*: for equipment which may readily be used for other purposes, the period over which the cost should be recovered may be extended.

(v) *Contingencies*: ample allowances should be made for unforeseen factors. If the project still yields a satisfactory return when, say, only 60% of the expectations are realized, then it will be well worth pursuing. If, however, the project can only be justified at 95% realization it is probably best left alone. The economic advantages which can be obtained from well-applied materials handling schemes are usually outstanding. Therefore it is safe to say that when advantages are only marginal it is probable that the wrong course is being followed and that the project should be examined afresh from a different standpoint.

Contingencies are particularly applicable in respect of time. It is often fairly easy to obtain accurate estimates of cost of equipment. Many suppliers, however, fail to meet delivery dates and a delay in the completion of a project may have a serious effect on a company's economic structure particularly if the provision of capital is geared to an annual budget of expenditure and savings. (K.E. Booth and C.G. Chantrill, 1962)

2.18. Comparative relationships

So far this chapter has dealt with the simple basic principles underlying the calculation of operating costs and the assessment of savings and advantages in justifying investment in equipment. In practice, however, the materials handling engineer is often confronted with entirely conflicting factors, and it is important to assess which of these is predominant in the particular situation under review. If the predominant factor is not clearly recognized it is very probable that the wrong application will be adopted. The following are examples of such conflicting conditions and it is hoped that from these it may be possible to stimulate in the reader the correct reasoning for application to his problems.

2.19. Stacking height, space and equipment

Elsewhere in this book the practical uses of space, both in horizontal and vertical planes, has been discussed in some detail together with types of equipment and layouts suitable for handling materials into and out of storage. From

an economic aspect there are some important relationships between the cost of space, equipment and the use of "air rights" or stacking at height.

The first, and usually the most important, is the use of space in relationship to the height of stacks. Fig. 10 shows the floor space required to store 10,000 cubic feet of material in 27 cubic feet unit loads for varying tier heights. In order to simplify the example the gangways are assumed to take 40% of the storage floor space irrespective of the height of stacking.

The second, shown in Fig. 11 indicates the relationship between the cost of equipment and the height at which it is to operate. It has already been stated that for stacking at heights greater than, say, 12 ft it is necessary to employ heavier and more costly equipment which requires more floor space in which to operate.

Thirdly, as it is necessary to increase the capacity of the equipment –in order to compensate for the derating effect of working at heights– wider gangways are required, leaving less room for storage purposes. This relationship is similar to that shown in Fig. 11. The loss of space taken up by additional gangway requirements increases in steps as greater capacity equipment is required.

There must, therefore, be an optimum height at which material should be stacked which reflects the minimum cost of space using the least costly equipment with minimum gangway widths. This varies depending on the cubic storage space required and its cost, the size, weight and shape of the material being handled and the type of equipment being used. Because of these variables a hard and fast formula cannot be developed which will suit all conditions absolutely. However it is not difficult to analyze the costs and to present the information in such a manner that the optimum stacking height may be determined for any set of conditions.

This can be simply done by plotting on the same graph (a) the cost of storage space and (b) the cost of equipment and gangway space to a common "height of stack" scale (Fig. 12 (a)). The costs, which increase with increases in height (e.g. equipment, gangway space) should be added and plotted as one curve. The point on the height scale at which these curves cut will represent the optimum height for minimum costs.

In cases where space is extremely expensive or the cost of equipment relatively low, the graph may indicate the conditions illustrated in Fig. 12 (b). In this case the cost of space is the predominant factor and materials should be stacked as high as possible.

Figure 10: Floor space and number of tiers graph for stacking unit loads (K.E. Booth and C.G. Chantrill, 1962)

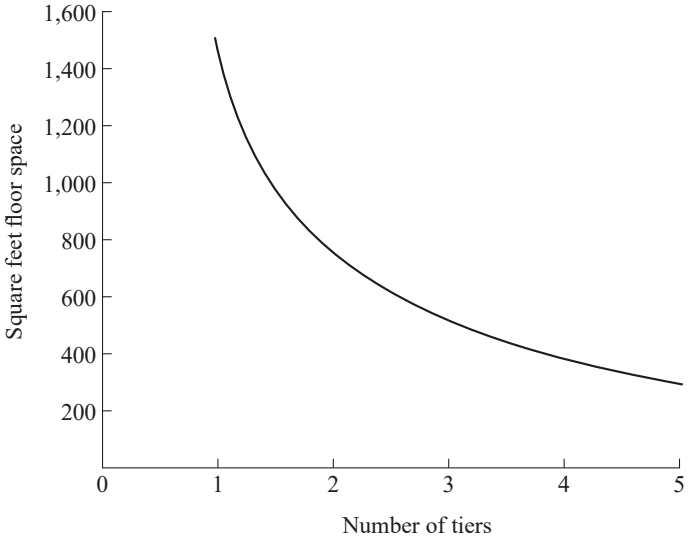
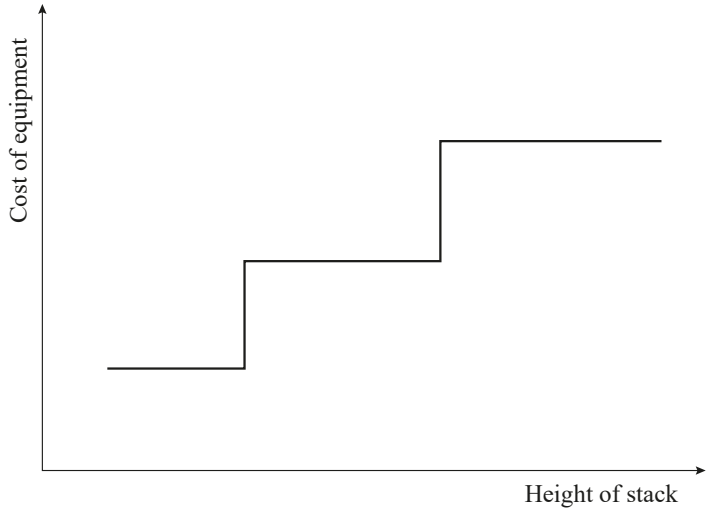


Figure 11: Cost of equipment and height of stack graph (K.E. Booth and C.G. Chantrill, 1962)



2.20. Storage space and stock turnover

For a given volume of throughput, storage space requirements are inversely proportional to the rate of turnover. This is shown graphically in Fig. 13 and should be constantly borne in mind.

One frequently encounters stores which have been established for many years and which still occupy the same space today, although the annual volume of throughput has increased enormously. This condition is only possible when the rate of stock turnover has also increased correspondingly, and the stock variety factor has remained reasonably constant. Otherwise conditions of congestion limiting the capacity of the store will soon be experienced.

The graphs in Fig. 13 give an indication of the difference in operating cost at different levels of stock turnover for the following methods of storage and stock handling:

(a) Block stacking light goods, imposing limited access.

(b) Free access on the basis of each pallet stack containing the same commodity.

(c) Fully random access with pallet rack storage.

These curves are based on the cost of handling by fork-lift truck and the cost of space and storage equipment. They reflect the fact that more gangway space is required for free and random access than under block stacking conditions.

2.21. Vehicle turn round and loss of payload

A further relationship to be considered is that of the speed of turn round compared with lost pay load. Fig. 14 shows the number of loads which a vehicle can be expected to handle traveling at an average speed of 27 miles an hour for varying return journey distances up to 100 miles and for varying turn round times of from 20 minutes to two hours. It is evident from these curves that the effect of turn round time for journeys over 70 miles is limited, whilst for short distances the effect is considerable.

Fig. 15 shows the percentage increase in the number of journeys as a result of reducing turn round time from two hours over return journeys of 10, 30 and 70 miles. From this graph it will be seen that an increase of 250% in pay loads can be obtained if the turn round time were reduced from two hours to 20 minutes for a return journey of 10 miles. Where volume predominates over weight in assessing the shipping space required, palletization will reduce the effective pay load by rather more than 10% due to the space taken over by the pallets. Where weight is the predominant factor a smaller allowance will suffice.

Figure 12 (a): Optimum stacking height in relation to costs (K.E. Booth and C.G. Chantrill, 1962)

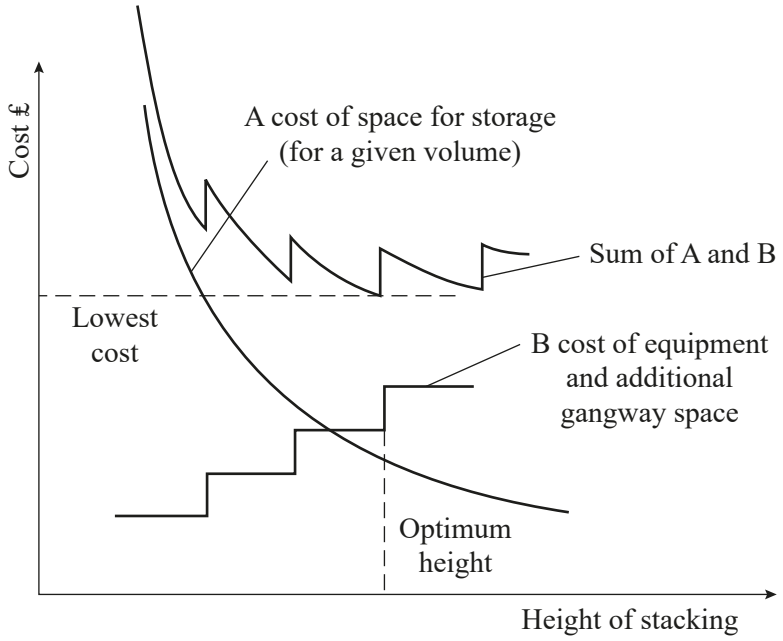


Figure 12 (b): Optimum stacking height in relation to costs (K.E. Booth and C.G. Chantrill, 1962)

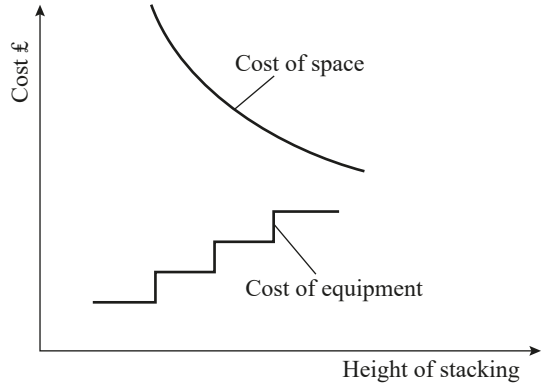
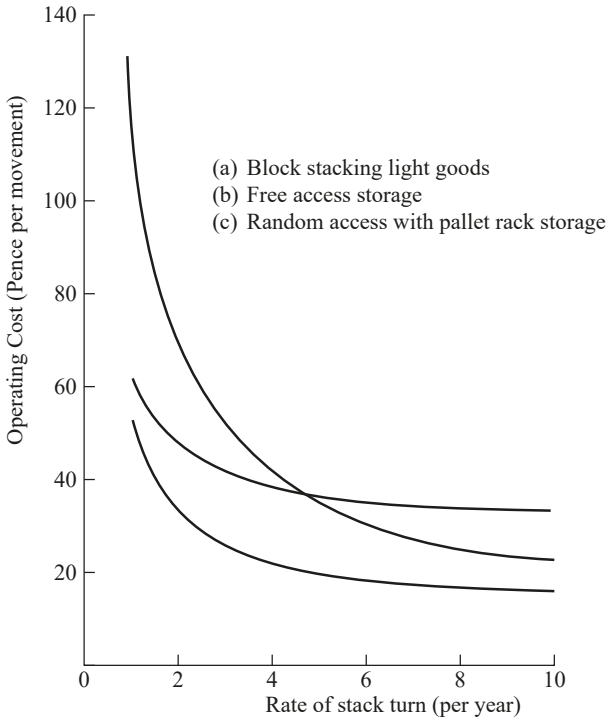


Figure 13: Storage space requirements related to rate of turnover (K.E. Booth and C.G. Chantrill, 1962)



The foregoing only relates to the effect which mechanical handling can have in speeding the turn round of vehicles. It should not be assumed that mechanical handling at terminals is not justified when journeys are in excess of 70 miles. It simply means that handling equipment must be justified in terms of savings in space, manpower and cost at the terminals and that lorry utilization should not be taken into account as a factor where long distances are travelled.

2.22. Cost of pallets in unit load handling schemes

In many handling schemes involving the use of fork-lift trucks in conjunction with pallets, sufficient weight is not given to the operating costs of the pallets themselves. Sometimes the initial cost of pallets can be several times greater than

the fork-lift truck itself while the operating costs themselves will vary according to the number of times the pallet is loaded afresh in a given period.

Figure 14: Number of loads a vehicle can be expected to handle (K.E. Booth and C.G. Chantrill, 1962)

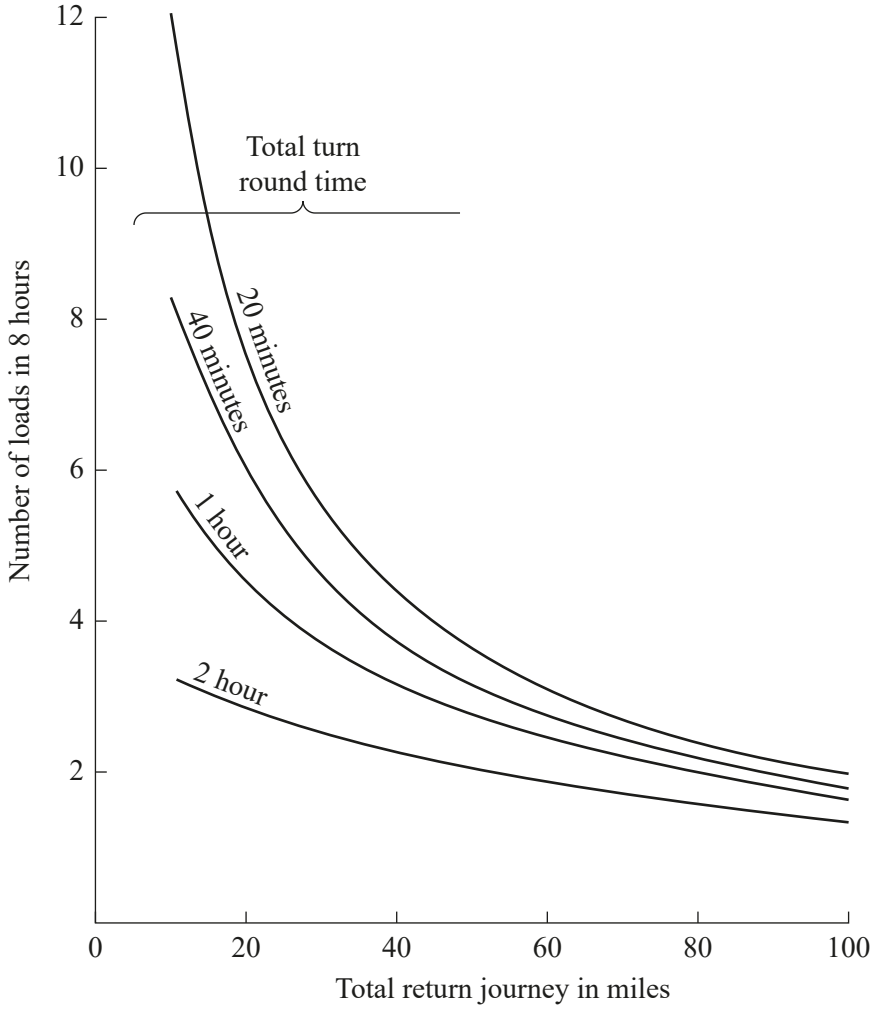


Fig. 16 shows the cost per load in respect of wooden pallets and steel box pallets at various frequencies of loading through the year. These figures are based on an initial cost in the case of wooden pallets of 30s. written off in three years, and of steel box pallets of €10, written off in 10 years, and include amortization, interest on capital and maintenance.

Figure 15: Percentage increase of journeys as a result of reducing turn round time (K.E. Booth and C.G. Chantrill, 1962)

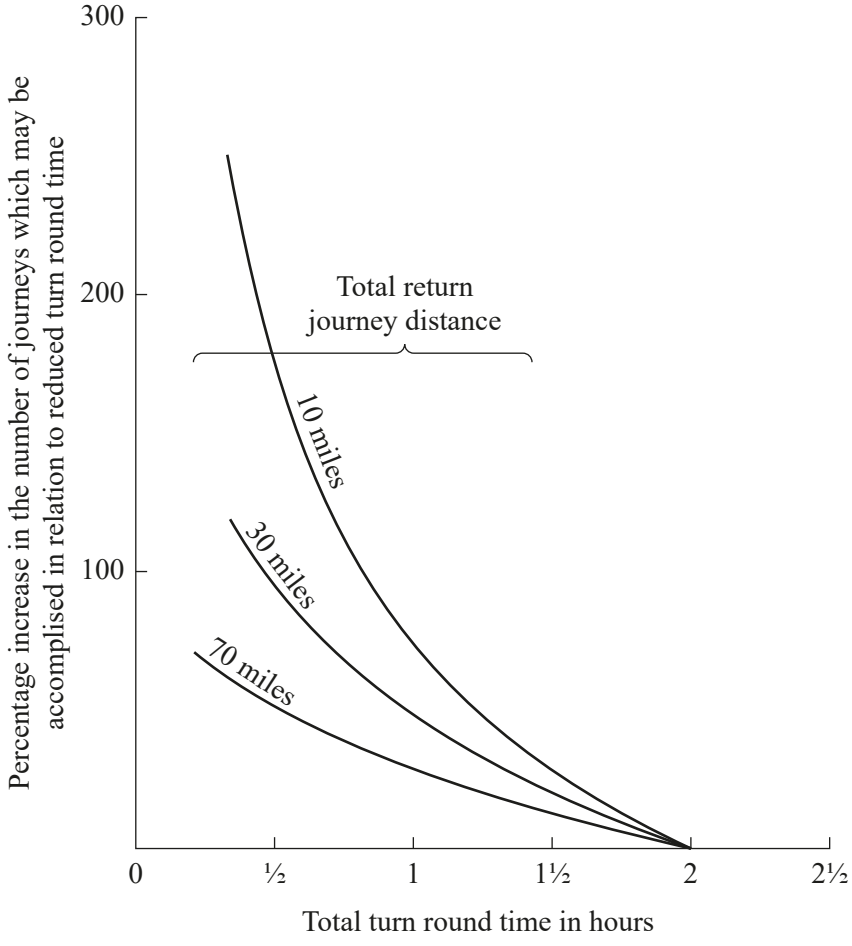
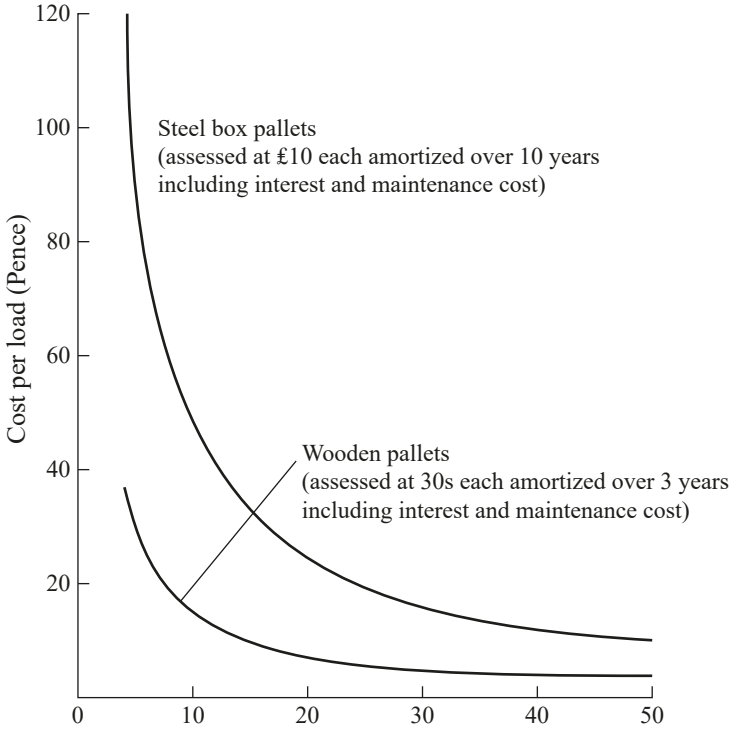


Figure 16: Cost per load of wooden pallets and steel box pallets at various frequencies of loading throughout the year (K.E. Booth and C.G. Chantrill, 1962)



3. Economics and advantages of good material handling systems[1]

Then American Society of Mechanical Engineers (ASME) had developed certain formulas for estimating the economies that are possible with the application of certain equipment to a material handling problem. The following factors in the handling costs are taken into account are indicated by letters:

1) A = Percentage allowance on investment

1 https://www.citeman.com/6672-economics-and-advantages-of-good-material-handling-systems.html

2) B = Percentage allowance for insurance, taxes etc
3) C = Percentage allowance for maintenance
4) D = Percentage allowance for depreciation and obsolescence
5) E = Yearly cost of power, supplies and other items in dollars
6) S = Yearly saving in direct labor cost in dollars
7) T = Yearly saving in fixed charges, operating charges or burden in dollars.
8) U = Yearly saving or earning through increased production in dollars
9) X = Percentage of year during which equipment is used.
10) I = Initial cost of the equipment.

Formula: The relations between these factors are expressed in following formulae:

Maximum justifiable investment in dollars (i.e. Z);

$Z = (S + T + U – E) X / A + B + C + D$

Yearly cost of maintaining the equipment (i.e. Y)

$Y = 1 (A + B+ C + D)$

Yearly profit from the operation of the equipment, above simple interest (i.e. V);

$V = [(S + T + U – E) X] – Y$

The estimated rate of profit (i.e. P);

$P = V / I + A$

Number of years required for amortization of investment out of earnings (i.e. H);

$H = 100 / P + D$

Advantages of a good Material Handling System:

The following advantages are availed from an efficient material handling systems:

1) A good material handling system minimizes the movement of material, moves them continuously and at maximum rate which is advantageous as under:

a) Shorter operating cycle
b) Reduction in handling cost

2) It eliminates unproductive handling of materials like back tracking, re-handling etc.

3) It reduces idle machine capacity thus ensuring better turnover of investment.

4) It reduces the idle time of labor. Workers are required to keep pace with the production processes supported by a good handling system. Moreover, they are freed from the physical work of moving and positioning materials.

5) It eliminates the factory hazards and thus increases the safety of the operators.

6) The quality of the materials is maintained through minimum human touches, elimination of breakages etc.

7) The factory area is used most effectively, unproductive overhead an floor areas are used most productively.

8) It avails of greater economy in store room and facilitates material issues.

9) It helps in maintaining effective production control.

10) It helps in providing better customer services due to

i) Reduced operating cost.

ii) Better quality of products and

iii) Timely production.

Container Revolution:

The cargo movement has been revolutionized with the arrival of a container. Containers permit unit lo-ads and are fit for inter-modal transport by road, rail, sea and air. ISO Container has the following dimensions.

Length: 5, 10, 20, 30, 40 feet:

35 feet Sealand containers and 45 feet containers are becoming popular. 20 feet unit is popular in shipping.

Width: Common

Height: 8 feet – 9.6 feet

Details: Floor, walls and roof

Opened at the end

Some units permit entry from the side or top

Insulated walls

Refrigeration units

Made of steel, aluminium or fire board

Cargo shifted manually or by fork lifts.

Containers are put on ship by container handling systems like counter-balanced trucks or reach stackers. There are straddle carriers and mobile lifting frames. These equipment operate in unrestricted area. Some equipments are operated in restricted area, gantry cranes and ship-to-shore cranes.

If there is one area which can increase industrial productivity almost overnight, it is material handling. The term material handling relates to the art of sorting, packaging and moving materials from one place or form to another. A wise choice of techniques and equipments for material handling can bring about considerable saving of time and money.

Source: (Economics and Advantages of Good Material Handling systems August 15, 2009Sree Rama Rao Operations Management)

4. An application of design of materials handling cost at dashen beer manufacturing plant

4.1. Determination of cost[2]

The first task in preparing an economic evaluation of a project is to obtain capital cost estimate.

Total cost investment (TCI) = Fixed capital cost (FCC) + production cost (pc)

4.2. Cost for malt

Malt feeding / day = 90.425 ton
Malt feeding / month becomes = 2,712.76 ton / month
Malt feeding / year = 32,553.3 ton
1 ton = 4923.79 birr
32,553.3 ton = X?
X = **160,285,063.7 birr / year**

2 https://www.academia.edu/5371324/INSTITUTE_OF_TECHNOLOGY_SCHOOL_OF_MECHANICAL_AND_INDUSTRIAL_ENGINEERING_DEPARTMENT_OF_INDUSTRIAL_ENGINEERING_Project_Tittle_Design_of_Dashen_Beer_Manufacturing_Plant_Group_members

4.3. Machine cost and equipment

Table 1:

No	Equipment / machine	Quantity	Average unit cost	Total cost
1	EBI (empty bottle inspection)	1	5,884,800	5,884,800
2	Guideline	3	490,400	1,471,200
3	Filler	1	22,068,000	22,068,000
4	Pasteurizer	1	18,512,600	18,512,600
5	Labeler	1	7,797,360	7,797,360
6	EBI	1	931,760	931,760
7	Caser	1	3,040,480	3,040,480
8	Un-caser	1	3,040,480	3,040,480
9	Conveyor		24,520,000	24,520,000
10	Data display	1	735,600	735,600
11	Boiler	2	210,000	420,000
Total				**385,381,800**

4.4. Raw material cost

Table 2:

No	Raw material	Quality	Average unit cost	Total cost
1	Malt	32,553.2 ton/year	4923.79birr/ton	160,285,063.7 birr/year
2	Hope	85,489.2 kg/year	64.12 birr/kg	5,481,567.5 birr/year
3	Yeast		140 birr/kg	90,826,421.6 birr/year
Total				**256,593,052.8**

4.5. Other equipment costs

Table 3:

No	Equipment (machine)	Quantity	Average unit cost	Total cost
1	Millstar	1	16,000	
2	Mushtunkettle	1	94,915	
3	Lauter tank	1	94,915	
4	Wortpre-runtank	1	94,915	
5	Wortkettle	1	94,915	
6	Wort boil	1	94,915	
7	Whirl pool	1	94,915	
8	Wort cooling (heat exchanger)	1	10,500	
9	Yeast propagation tank	1	54,915	
10	Filteration	1	61,000	
11	Fermentation& BBT	23	13,188,000	302,634,000
12	Buck etelevator		325,800	
13	Pre-cleaner		5,000	
14	Dry-destoner		5,000	
15	Malt weigher	1	2,000	
16	Chain conveyor		24,520,000	
17	Cyclone	1	4000	
Total cost				**338,699,905 birr**

4.6. Man power requirement and annual labor cost

Table 4:

No	Description	Quantity	Monthly salary	Annual salary
1	Plant general manager	1	15,000	15000
2	Deputy manager	1	10000	10000
2	Executive secretary	1	1800	1800
3	Legal service head	1	4000	4000
4	Planning & programming and service head	1	4500	4500
5	Quality control service head	1	4700	4700
6	Audit service head	1	4200	4200
7	Telephone operator	1	1000	3000
8	Administration department	3	4100	4100
9	Finance department	1	4000	4000
10	Technical department	1	3900	3900
11	Production department	1	4800	4800
12	Workshop department	1	4000	4000
13	Secretary	3	2000	6000
14	Chemical engineer	3	5000	15000
15	Mechanical engineer	3	5000	15000
16	Electrical engineer	3	5000	15000
17	Chemists	12	3500	42000
18	Administration personnel	1	3500	35000
19	Sales head	1	2800	2800
20	Purchase head	1	2500	2500

No	Description	Quantity	Monthly salary	Annual salary
21	Market research & promotion division head	1	3000	3000
22	Nurse	2	2500	5000
23	Sanitation worker	5	1000	5000
24	Production operator	99	2500	247500
25	Lab technician	15	2000	30000
26	Welder	10	1700	17000
27	Power plant operators	6	3500	21000
28	Drivers	18	2000	36000
29	Guards	30	1200	36000
30	Cleaners	20	1200	24000
31	Daily manual laborers	50	1200	60000
Total cost				**635,800 birr**

4.7. Component cost

Table 5:

No	List of component	Quantity / year	Average unit cost	Total cost / birr
1	Crown	606,051,187.2	0.159	96,362,138.8
2	Labeler paper	606,051,187.2	0.020976	12,713,014.5
3	Glue	107,182,050 kg	116	12,433,118.34
4	Bottle	20,000,000 units	3.50	70,000,000
Total cost				**191,508,271.64**

4.8. Transport cost

Table 6:

No	Vehicle type	Quantity	Average unit cost	Total cost
1	Bus	3	600,000	1,800,000
2	Lorry	5	1,000,000	5,000,000
3	Forklift	4	1,000,000	4,000,000
4	Emergency car	1	800,000	800,000
Total				**11,600,000**

4.9. Estimated variable costs

Table 7:

Variable cost	Cost per year	Unit variable cost
Rawmaterial	256,593,052.8	
Maintenance	1,500,000	
Utility	5,000,000	
Total	**263,093,052.8**	

4.10. Estimated building cost

Table 8:

Building cost	Area (m^2)	Average cost	Total cost
Production room	1931.4	4500	4,992,300
Administration offices	104.7	4500	471,037.5
Café & entertainment	432.8	4500	1,947,600

Building cost	Area (m^2)	Average cost	Total cost
Raw material	803	4500	3,613,500
Clinic	18	4500	81,000
Utility room	450	4500	2,025,000
Warehouse	300	4500	1,350,000
Workshop	150	4500	675,000
Power generator	100	4500	450,000
Parking area	498.5	4500	2,243,250
Library	104.25	4500	469,125
Guesthouse	27	4500	121,500
Raw water store	88.2	4500	396,900
Fuel store tank	44.1	4500	198,450
Total	5051.9		**180,134,662.5**

4.11. Total fixed costs

Table 9:

Initial cost	Cost (birr)
Machine and equipment	338,699,905 + 385,381,800 = 724,081,705
Building cost	180,134,662
Land cost	20160
Vehicle cost	11,600,000
Labor cost	635,800
Other costs	400,000,000
Total	**1,316,472,327**

4.12. Total revenue and profit calculation

Profit = Revenue − cost
Revenue = selling price × quantity sold
From previous calculations we can see that we assumed the total number of bottles we planned to sell per year is about 606,051,087 bottles. And the selling price of one bottle of our beer will be 10 birr. So,
Revenue = 606,051,087 × 10 birr
R = 6,060,510,870 birr/year
Calculation of Break-even point
Break-even point (B.E.P) = fixed cost (Fc) / (selling price (P) − unit variable cost (Vc)
Therefore, first we need to calculate unit variable cost.
Unit variable cost (Vc) = (Revenue (R) − Fixed cost (Fc)) / Quantity sold (Q)
Vc = (6,060,510,870 − l,316,472,327) / (606,057,087)
Vc = **7.8278 birr**
Then, the break-even point can be found as:
B.E.P = Fc / P-Vc
= 1,316,472,327 / (10-7.8278)
= **606,051,087 bottles**
Pay-back period calculation
Profit = Revenue - Total cost
= R − (Fc+Vc+other costs)
= 6,060,510,870 − (2,944,118,871)
= **3,116,391,999 Birr/year**
Therefore, the pay-back period can be calculated as:
Payback period = Revenue/Total cost
= 6,060,510,870/2,944,118,871
= **2 years**
Therefore, the length of time required to recover the initial investment is **2 years**.

5. Conclusions

This paper dealt generally with the economies which can be derived from imaginative yet sound application of materials handling techniques and mechanical handling equipment. Traditionally a Board of Directors exists to safeguard and develop the assets and the earning power of a company in the interests of its shareholders, its employees and its management. It will

therefore tend naturally to assess the value to the company of any project in terms of what the project will cost and of the anticipated return in terms of economies and increased earning power. Each board will have its own views as to the return which is acceptable for any particular outlay. Frequently it may be thought that a board is parsimonious in its outlook, expecting equipment to pay for itself in an unreasonably short time, often only a small fraction of its estimated life. But when it is realized that mechanical handling equipment may be competing in the allocation of funds with other projects which may achieve an even quicker return, one may have some sympathy with a board's point of view. (K.E. Booth and C.G. Chantrill, 1962)

Obviously the board is more likely to authorize a proposal having the greatest advantage and offering the quickest return for capital expenditure.

Materials handling is the key to the attainment of very substantial economies, not merely in the form of simple savings, which are easy to calculate and generally concern labour costs, but particularly in reducing the incidence of fixed expense through more efficient employment of a company's resources.

It is always possible and most important to assess savings and advantages in advance to justify investment in equipment for mechanization. This method of approach will ensure that no detailed and local improvements can be put in hand without previously obtaining full knowledge of their effects and repercussions on the economy and performance of the whole organization. In many cases it will be found that these repercussions increase the advantages and make the proposal more attractive.

The Materials Handling Engineer is strongly advised to ensure that all the economic factors have been properly appreciated before submitting his proposals. It is hoped that this chapter has indicated that there are numerous instances where economic factors are not only complementary but sometimes, in fact, are conflicting. It is vitally important that the true resultant should be calculated in support of any proposals.

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HEALTH CRISES AND STOCK MARKETS: THE IMPACT OF COVID-19 AND POLICY INTERVENTIONS ON STOCK PRICES ACROSS EU COUNTRIES AND GREEK SECTORS

I. FOUNTOUKIDIS* P. KYRMIZOGLOU**

Abstract

The present study aims to examine stock markets' performance during the health crise triggered by Covid-19. More specifically, we calculate the abnormal returns and apply panel data analysis techniques to explore EU markets' reactions during the evolution of this crise as well as to draw conclusions about the factors that drive these reactions. Furthermore, we examine how pandemic and related policies (lockdowns) affect Greek stocks across different sectors. Our findings reveal the negative response of EU markets to the beginning of virus spread in EU countries. Pandemic outbreak, market sentiment and containment policy constitute the key factors that drive stocks' devaluation while expansionary monetary policy can minimize their negative effect. However,their impact depends on sector and market characteristics.

JEL Classification: G01, G1, G4

Keywords: Covid-19, stock markets, sectoral stock indices, abnormal returns, economic policies, social distancing policies.

1. Introduction

The outbreak of Covid-19 has caused dramatic changes in everyday life with unpresented impact on all spheres of society. Since the outbreak of virus in China and more specifically in the city of Wuhan, the rapid spread worldwide has caused millions of hospitalisations and deaths. WHO declared the Covid-19 outbreak a public health emergency of international concern on January 30 and upgraded to a pandemic on March 11 after the detection of Covid-19 cases in almost every country.

In economic literature, health crises are considered as exogenous shocks, black swans, that disrupt economic activity. As Schoenfeld (2020) mentions

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from a macroeconomic point of view, shocks like these can have an impact on both aggregate demand and aggregate supply. Pandemic's caused uncertainty may affect investment and consumer expenditure due to declining expectations. Moreover, virus spread and its transmission to individuals causing deaths and hospitalizations can disrupt business activity having a negative impact on the supply of economies. In addition, economic agents' fear of exposure to Covid-19 makes them avoid social contacts to reduce the possibility of being infected, which may cause a fall in demand for products or services that require physical presence as well as a reduction in labour supply. The latter can also happen if the reduction of social contacts comes from mandatory government interventions against virus spread such as social distancing policies, gathering restrictions, lockdowns, business closures, etc. Based on what has been mentioned so far, it is easily understood that industries associated with increased social contacts between individuals, increasing the likelihood of virus spread, will be more affected than others. In contrast, some other industries will benefit in such a crisis. A typical example of this, are the large losses of tourism sector in contrast to the increased profitability of pharmaceutical firms (Tsoulfidis & Tsaliki, 2021).

Apart from pandemic's impact on real economy, another aspect that is essential to be discussed is its impact on stock markets. March 2020 has been one of the worst months in stock markets' history with major country indexes losing a big part of their value. Due to the forward-looking nature of stock markets, it is logical to assume that the economic consequences of the pandemic are reflected to stock prices sooner than in the rest of economic variables. From a theoretical perspective, fundamental stock prices, which are equal to the present value of firms' future dividends or cash flows, regulate the fluctuations of actual stock prices. As so, a shock which causes a fall in both aggregate demand and aggregate supply is assumed to have a direct impact on them.

If this theoretical explanation is sufficient, we should expect that pandemic outbreak and its containment policies, which both cause a significant fall in the gross domestic product, will lead to changing expectations about future dividends or cash flows resulting into declining stock prices. Moreover, the differentiation of their impact on various sectors will be reflected on the stock prices as well. Furthermore, there are also other channels through them the movements of stock markets can be explained. The role of investors' sentiment and irrational pessimism during exogenous shocks is well documented in the existing literature. Economic policy implemented during this crise, fiscal and monetary, can also trigger changes in both expected dividends and discount rates impacting stock prices' movements.

Taking into account the above considerations, the present study aims to

provide empirical evidence and answer several questions relative to stock market performance during the evolution of the health crise triggered by Covid-19. Using data of 27 EU stock market indices, we explore the movements of EU markets during this health crise. More specifically, we calculate the abnormal returns to examine how markets react during different periods and events. Moreover, we explore the impact of virus spread, investors' sentiment, social distancing and economic policies on abnormal returns by using panel data analysis techniques. In further analysis, we test if there are any differences between developed and other markets. Finally, we examine the performance of Greek stocks across different sectors by using data of Greek sectoral indices and calculate abnormal returns to capture pandemic's and containment policies' impact on them as well as to testify if the differentiation of their impact is reflected to stock performance.

This study attempts to contribute to the existing literature in several ways. Firstly, it is the first study to our knowledge that explores EU markets and Greek sectoral stock performance during the pandemic era. Secondly, unlikely typical event studies which explore the impact of individual events or announcements (e.g. Heyden & Heyden, 2021 and Pandey & Kumari, 2021), we explore markets' reactions in different periods and events during the evolution of this crise. Thirdly, we provide explanations about what triggers the abnormal returns found by decomposing them into those occurred by virus spread, investors' sentiment, social distancing policy and economic policy measures. Fourthly, we find the net impact of policies implemented on markets. Although social distancing and economic policies impact has been highlighted by other studies (e.g. Ashraf, 2020b), their findings are contradictive. Finally, we provide evidence concerning differences in the impact of pandemic, sentiment and policies implemented between developed and other markets.

The rest of the paper is structured in the following way. Section 2 examines the existing literature related to the topic. Section 3 introduces the data collection procedure and the selected methodology while section 4 presents and discusses the results of empirical analysis. Finally, section 5 summarizes the main conclusions.

2. Review of literature

2.1. Health crises and stock markets

Research on the impact of contagious diseases on stock markets is not something new. Several empirical studies have been conducted in the past to find how stock markets react in such crises. In this framework, Nippani and Washer

(2004) investigate the impact of SARS on the affected countries' stock markets. Comparing daily returns between different periods (before and after the outbreak) and performing parametric and non-parametric tests (heteroscedastic t-tests and Mann Whitney tests) they find no impact on the affected countries except from China and Vietnam. Chen et al. (2007) explore SARS' imprint on Taiwanese hotel stock prices finding significant negative cumulative abnormal returns (CARs) of hotel stocks while Kim et al (2020) show the negative impact of several epidemic outbreaks on restaurant stocks' performance.

Pandemic outbreak draws again researchers' attention on the relation between health crises and stock markets' performance. David et al. (2021) explore the relation between epidemics and stock market indices. They show that epidemic outbreaks had an impact on indices but in contrast to Covid-19 outbreak, markets recovered quickly. Nquyen et al. (2021) examine the impact of a series of disease outbreaks on Chinese's stocks returns following event study methodology. They find the negative impact of disease outbreaks on stock returns, with Covid-19 having the most serious effects especially in the phase of worldwide spread.

Baker, Bloom, Davis, Kost et al. (2020) explore US stock market returns from 1900 to the end of April 2020 to draw conclusions about market's reactions during health crises. As they show no other disease outbreak included the Spanish flu has affected US market in such a way as Covid-19. From February 24 to the end of April, pandemic and related policy news are the main drivers of market performance. Researchers argue that this difference is due to government restrictions on commercial activity, voluntary social distancing and the current structure of the economy, elements that differ from previous pandemics such as the Spanish flu and the flu pandemics of 1957-1958 and 1968 respectively, both in terms of the stringency of policies or the structure of the economy. Although the study of Baker, Bloom, Davis, Kost et al. (2020) refers to the US stock market, the same conclusions emerge from the study of Davis et al. (2020) for the stock market of the second largest economy in the world, namely China, at least for the last 30 years to which this study refers. Given the importance of the two markets and especially US market's which plays an important role in the movements of international stock markets (Baker, Bloom, Davis and Sammon, 2020), the difference in the impact of the current health crisis compared to previous ones is well perceived.

2.2. Stock markets in the Covid-19 era

Regarding Covid-19 outbreak and its consequences on stock markets, plenty of empirical studies emerge. Following the methodology of Nippani

and Washer (2004), Khan et al (2020) show pandemic's negative impact on stock markets after the announcement of human-to-human transmissibility. They argue that investors react both to the initial hearing of the news andto the next period. The only exception is China where although negative returns are observed in the beginning, Chinese market recovers in the long period due to the containment of the pandemic by Chinese State. Pandey and Kumari (2021) explore the impact of WHO's declaration of public health emergency of international concern on stock markets worldwide. Following event study methodology, they found the declaration's negative impact on stock markets especially on Asian ones. Nevertheless, Heyden and Heyden (2021) find the negative impact of death announcements on European and US stocks.

Virus spread and changes in the severity of this crise seem to be linked with stock markets' performance. Alfaro et al. (2020) using simple epidemiological models (exponential and logistic growth models) show that unexpected innovations in predicted cases are related with negative or positive stock market jumps. Shanaev et al. (2020) using a SIR model to capture daily forecasts of the maximum percentage of simultaneous infections, show the negative impact of pandemic spread on markets. Ashraf (2020a) shows the negative relation between stock market returns and the growth rate of daily infections.

The role of investors sentiment on stock prices decline during Pandemic outbreak has been also highlighted by literature. Shanaev et al. (2020) using a Google search volume index show the negative impact of investors sentiment on stock markets which ranges between -5,6% to -8,2%. Lyosca et al. (2020) conclude that part of stock prices decline is caused due to the low market sentiment and Covid-19 crise related pessimism.

2.3. The impact of social distancing and economic policies

Government policies during pandemic outbreak have been extensively discussed. However, their impact on stock markets is still unknown. Even though one would assume that policies like social distancing measures will affect stock prices negatively, the findings of empirical studies don't converge on the same conclusion. Some studies conclude that social distancing policies such as lockdowns have a negative impact on returns (Alexakiset al., 2021) while others conclude the opposite (Narayan et al., 2021; Huynh et al., 2021).

The logic behind these contradictive results relies on the question whether the positive impact of these policies, that comes from pandemic containment, outweighs or not the negative impact on economy. As Ashraf (2020b) finds social distancing policies have a direct negative impact on markets because of the

disruption of economic activity as well as an indirect positive effect due to the containment of virus spread. The question is what's their net impact on markets?

The same contradiction is observed concerning the impact of economic policy measures during pandemic outbreak. While some studies conclude that economic support measures boost stock markets (Ashraf, 2020b), others argue that expansionary fiscal policies enhance uncertainty and expansionary monetary policies calm markets (Heyden & Heyden, 2021) and others find that both policies have a negative impact on them (Shanaev et al., 2020).

2.4. The impact across different sectors

Research on the impact of Covid-19 outbreak on stock prices of various sectors is also conducted in the framework of this crise. The differentiation of the impact that pandemic and related policies have on various sectors as well as changes in the preferences and total demand for a series of products and services in a health crise situation, arises the question if these developments are reflected on stock prices as well.

Regarding Chinese market, Al-Awadhi et al. (2020) report significantly higher than market's daily stock returns for IT and pharmaceutical firms in contrast to beverage and transports during the first months of Covid-19 related crise, while He et al. (2020) find that the news related to the closure of Wuhan on January 23 have negative impact on stock prices of transportation, mining, environment. electricity and heating firms in contrast to those of manufacturing, information technology, education and health-care. Mazur et al. (2021) examine US stock market during March 2020 finding high returns for stocks of gas, food, healthcare and software firms in contrast to petroleum, real estate, entertainment and hospitality stocks.

3. Methodology and data collection

To explore the impact of Covid-19 and policy interventions on EU stock markets we apply a two-step methodology. In the first step, we calculate the abnormal returns to explore how EU markets react during the emergence and spread of Covid-19. In the second step, we apply panel data analysis techniques to find how several factors affect them during this period. This methodology allows us to examine the movements of EU stock markets comparatively to the evolution of this crise as well as to provide evidence concerning those movements.

To start with, we compute daily logarithmic returns for every index used in

this study. Country market indexes constitute a weighted portfolio of national stocks of every country and as so their returns can be seen as the returns of a national portfolio. Missing values of index prices are excluded as well as returns of the days that correspond to the day of the missing value and the next day. Secondly, we compute abnormal returns (ARs) following the market model for the period 20/1/2020-3/4/2020. This time window starts on the day of confirmation of human-to-human transmissibility of Covid-19 by China national health commission and ends on the beginning of April when the virus had been spread across all EU countries. As market index we use the MSCI ACWI index. To compute parameters, we use 240 observations before 20/1/2020. The market model is specified as

$$R_{i,t} = a_i + b_i * R_{M,t} + e_{i,t} \quad (1)$$

with $R_{i,t}$ being index i returns on day t, a_i and b_i being the parameters, $R_{M,t}$ the market returns and $e_{i,t}$ the residual while expected and abnormal returns are calculated as shown in equations 2 and 3 respectively. In equation 2, the parameters with the hat over them represent the estimated values of market model's parameters.

$$E\left(R_{i,t}\middle|R_{M,t}\right) = \widehat{a_i} + \widehat{b_i} * R_{M,t} \quad (2)$$

$$AR_{i,t} = R_{i,t} - E\left(R_{i,t}\middle|R_{M,t}\right) \quad (3)$$

Then, we compute average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) to capture the net impact on EU markets. Finally, we compute CAARs for different sub-periods and events and perform statistical significance's tests like t-test and adjusted Patell test to explore if CAARs are statistically different from zero. The first subperiod starts on the day of confirmation of human-to-human transmissibility of Covid-19 and ends before the regional lockdown in Italy while the second starts the first day after this event and ends ten days after the declaration of pandemic. The initial period corresponds to the emergence of Covid-19 in EU countries while the second period to the virus spread phase inside and among EU countries. CAARs and AARs are calculated as

$$AAR_t = \frac{1}{N} * \sum_{i=1}^{N} AR_{i,t} \quad (4)$$

$$CAAR(t_0, t_1) = \sum_{t=t_0}^{t_1} AAR_t \quad (5)$$

with N representing the number of indexes, while t-value for the statistical significance's test of CAARs is calculated as

$$t_{CAAR} = \frac{CAAR(t_0, t_1)}{\sigma_{AAR} * \sqrt{t_1 - t_0 + 1}} \tag{6}$$

where σ_{AAR} is the standard deviation of AARs. To calculate the adjusted Patell statistic as introduced by Kolari and Pynnönen (2005), we calculate the forecast error corrected standard deviation ($\sigma_{i,t}$), the standardized ARs (SARs), the average standardized ARs (ASARs) and the cumulative average standardized ARs (CASARs) based on the following equations

$$\sigma_{i,t}^2 = \sigma_i^2 * \left(1 + \frac{1}{n} + \frac{\left(Rm_t - E(Rm_t)\right)^2}{\sum_{t=-n}^{-1}\left(Rm_t - E(Rm_t)\right)^2}\right) \tag{7}$$

$$SAR_{i,t} = \frac{AR_{i,t}}{\sigma_{i,t}} \tag{8}$$

$$ASAR_t = \frac{\sum_{i=1}^{N} SAR_{i,t}}{N} \tag{9}$$

$$CASAR(t_0, t_1) = \sum_{t=t_0}^{t_1} ASAR_t \tag{10}$$

$$\text{Adjusted } Z_{PATELL} = \frac{CASAR(t_0, t_1)}{\sqrt{\frac{t_1 - t_0 + 1}{N}} * \sqrt{\frac{n-2}{n-4}}} * \left(\frac{1}{1 + (N-1) * \bar{r}}\right) \tag{11}$$

with n representing the number of observations used to estimate the parameters of the market model and r-bar the mean correlation between the abnormal returns of the indexes.

To explore the impact of virus spread, market sentiment, social distancing and economic policy, we use the estimated ARs as dependent variable and specify the following model:

$$AR_{i,t} = a_0 + a_1 * GR1_{i,t-1} + a_2 * GR2_{i,t-1} + a_3 * dGS_{i,t} + \sum_{j=-1}^{2} a_{4j} * dES_{i,t-j}$$
$$+ \sum_{j=-1}^{2} a_{5j} * dSTR_{i,t-j} + \sum_{j=-1}^{2} a_{6j} * MON_{i,t-j} + \sum_{j=0}^{1} a_{7j} * EM_{t-j} \quad (12)$$
$$+ \sum_{j=0}^{1} a_{8j} * PAN_{t-j} + e_{i,t}$$

where $AR_{i,t}$ represents the abnormal returns of country i in time t, $GR1_{i,t-1}$ and $GR2_{i,t-1}$ the daily growth rate of Covid-19 infections in country i and in the rest EU respectively, $dGS_{i,t}$ daily changes in google search volume for Covid-19 related terms (first differences of a google search volume index which values vary from 0 to 100), $dES_{i,t}$ daily changes in fiscal policy while $dSTR_{i,t}$ daily changes in social distancing policy (first differences of Economic support index and Stringency index, indexes provided by Oxford Coronavirus Government Response Tracker database and vary from 0 to 100 with 0 meaning absence of measures), $MON_{i,t}$ is a dummy variable which is equal to 1 the day when expansionary monetary policy measures are announced and 0 otherwise, EM_t and PAN_t are dummy variables which are equal to 1 the day of WHO's announcements (declaration of public health emergency and pandemic respectively) and 0 otherwise. The sum of parameters of WHO's announcements dummy variables represents the CARs triggered by the announcements while the sum of parameters of every policy variable represents the CARs triggered by the implemented policy. $dGS_{i,t}$, $dES_{i,t}$ and $dSTR_{i,t}$ are divided by 100 in order their parameters to represent the maximum ARs that may be triggered by a change in these variables (a change equal to 100).

To capture differences between developed and other markets we use the dummy variable DEV_i which is equal to 1 for developed markets and 0 otherwise. Then, we add to the initial model the explanatory variables multiplied by DEV_i and calculate the parameters. The parameters of both models are estimated using the pooled ordinary least square (OLS) method and heteroscedastic robust errors Beck and Katz.

To examine the impact of Covid-19 outbreak on Greek stocks across different sectors, we follow the same procedure as we did for EU markets. We use sectoral stock indices which represent a portfolio of stocks of every sector. As market index used in the market model, we use the FTSE Athex Market index which is a weighted all share index. Instead of calculating AARs and CAARs, we compute CARs for the same sub-periods for every sector and perform t-tests and Patell tests. To capture lockdown's impact on different sectors,

we perform the same statistical significance tests on ARs of the day after the announcement. CARs and t-statistic are calculated as

$$CAR_i(t_0, t_1) = \sum_{t=t_0}^{t_1} AR_{i,t} \tag{13}$$

$$\mathrm{t_{CAR}} = \frac{\mathrm{CAR_i}}{\sigma_i * \sqrt{t_1 - t_0 + 1}} \tag{14}$$

while the standardized CARs (CSARs) and Patell statistic (see Chen et al, 2007) are calculated as

$$\mathrm{CSAR_i}(t_0, t_1) = \sum_{t=t_0}^{t_1} \mathrm{SAR_{i,t}} \tag{15}$$

$$\mathrm{Z_{PATELL}} = \frac{\mathrm{CSAR_i}(t_0, t_1)}{\sqrt{t_1 - t_0 + 1} * \sqrt{\frac{n-2}{n-4}}} \tag{16}$$

EU country market indexes data were selected from various sources such as investing.com, seekingalpha.com and nasdaqbaltic.com. The data of MSCI ACWI index were collected from msci.com. Market indexes of countries outside the Eurozone which value is expressed in their local currencies were converted to Euros. Daily Covid-19 cases data were obtained from ourworldindata.org while the stringency policy index and economic support index from covidtracker.bsg.ox.ac.uk. Data of search volume for Covid-19 related terms were collected from trends.google.com. Dummy variables used in this studywere constructed based on information from various sources such as imf.org, ecb.europa.eu, who.int and other institutions' websites (e.g., national central banks' announcements). The categorization of markets in developed or not is based on msci classification. Sectoral stock indices and FTSE Athex Market index data were collected from investing.com and naftemporiki.gr. Sectors are classified according to the Industry Classification Benchmark (ICB).

4. Results & discussion

4.1. EU markets in the pandemic era

Graph 1 shows daily total infections, AARs and CAARs for the period 20/1-3/4 while Table 1 reports the CAARs of different subperiods and events.

As depicted in the graph, AARs and CAARs are nearly equal to 0 until 24/2. More specifically, the CAARs of the first subperiod are equal to -0,05% and are not statistically significant. The emergence of Covid-19 seems not to have an impact on EU markets during this initial period. Investors do not assume virus outbreak as a major threat for EU economies. This is something logical assuming that only 36 infection cases occurred in EU until 21/2.

Examining individual events during this period, negative abnormal returns are found after the first reported Covid-19 cases on France and Germany. CAARs are statistically significant at 5% level according to both tests. However, EU markets recover relatively quickly in the next days, possibly due to the limited virus spread across EU. Furthermore, we find that the declaration of public health emergency does not have an impact on EU markets. CAARs are not statistically significant. As David et al (2020) argue similar declarations have been made in the past for various epidemic outbreaks with none of them ending in a worldwide health crise. Based on that, it is logical to assume that the declaration cannot be evaluated as an indication of a serious possibility of a pandemic outbreak. Therefore, the non-reaction result is not a paradox.

As depicted in the graph, from 24/2 CAARs start to fall while total cases increase exponentially. As shown in Table 1, the CAARs of subperiod 2 are equal to -16,1% and statistically significant at level 1% according to both tests. Starting from 21/2, 226 cases were recorded in only three days, over 6 times more than the total cases recorded since the first case occurred on 24/1. This increase is due to the rapid virus spread in Italy (cases increased from 3 to 229) which led Italian government to put 50000 people in quarantine on 23/2 (Ramelli & Wagner, 2020). Therefore, EU markets react negatively in the first trading day after all these events which indicate an increased possibility of virus spread all over Europe. CAARs are equal to -1,9% and statistically significant at level 1% according both tests.

From this point on, it becomes clear that the virus is beginning to spread across Europe, which is confirmed by the exponential virus spread to other countries of the Union in the next days. This situation is combined with negative CAARs for the total period equal to -8,59% until 10/3. After the worldwide virus spread, WHO declares a pandemic on 11/3 which comes as a shock for EU markets. The CAARs related to the announcement are equal to -6,42% and statistically significant at level 1% according to both tests. The markets' fall continues in the following days with CAARs reaching -20% and then recover, being equal to -16.1% on 20/3. From this point on and until the beginning of April, markets stabilize with CAARs ranging around -16%.

These results show the way investors respond to the information available

at each period. Investors revaluate stock prices based on their new beliefs about the upcoming situation. The emergence of Covid-19 is not evaluated as a sign of an upcoming health crise with serious consequences in economic activity. However, when Covid-19 cases increase exponentially and the first signs that indicate an increased possibility of a generalized crise emerge, this changes. In this uncertain situation, investors seem to form their beliefs based on developments related to this crise and revaluate stock prices accordingly.

Table 1: CAARs of different subperiods and events

PERIODS	**CAAR**	**T−Value**	**Z−Patell**
Subperiod 1	−0,05%	−0,038	0,152
Subperiod 2	−16,10%	−13,447***	−11,641***
EVENTS	**CAAR (0, 1)**	**T−Value**	**Z−Patell**
First cases in Europe (France, Germany)	−0,83%	−2,129**	−2,156**
Declaration of public health emergency	0,28%	0,718	0,795
Exponential spread in Italy and regional lockdown	−1,90%	−4,889***	−5,386***
Declaration of pandemic	−6,42%	−16,535***	−14,295***

Note: ***, **, * indicate statistical significance at level 1%, 5% and 10% respectively

Graph 1: Daily total cases, AARs and CAARs from 20/1/2020 to 3/4/2020

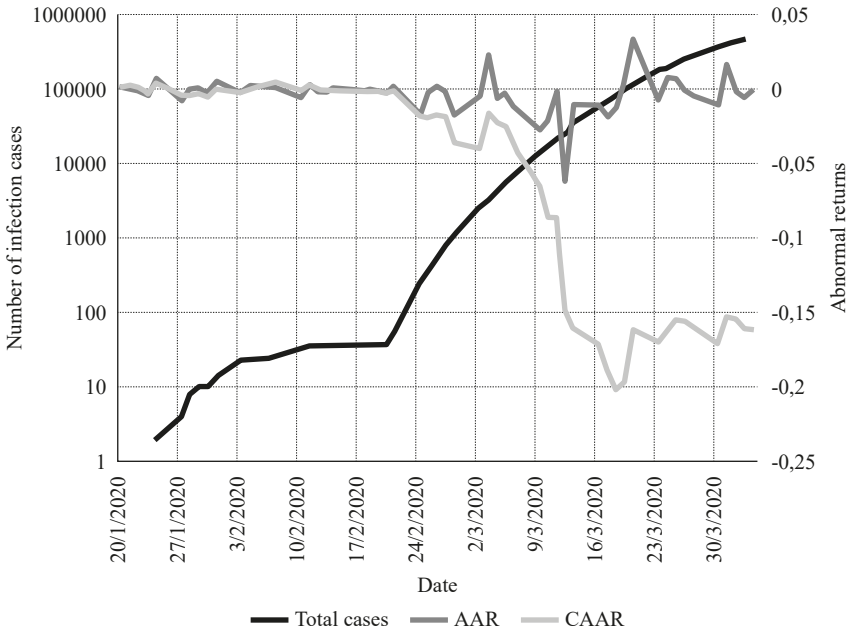

Table 2 reports the estimated parameters of equation 12 model and its expanded form. In model 1, both national and EU growth of infections enter negative and significant. Domestic virus spread shows changes in the severity of the health crise reflecting future economic fallout while virus spread in other EU countries reflects both expected virus spread domestically and economic fallout due to the disruption of trade between countries. Daily changes of the google search volume index also enter negative and significant revealing the adverse impact of investors' sentiment on markets. The parameter of $dGS_{i,t}$ is equal to -0,016 suggesting that the maximum effect of sentiment can reach to -1,6%. Both results confirm the findings of previous studies about the negative effect of virus spread and sentiment on stock returns.

With respect to social distancing policy, the sum of $dSTR_{i,t}$ parameters for the time window (-1, 2) is equal to -0,108 and significant revealing its adverse net impact on markets. In contrast to studies that argue that the net impact of those policies is positive, our results suggest that the negative impact of

them can reach to -10,8% in the case of implementation the strictest social distancing measures (when stringency index is equal to 100). Based on the stringency of measures taken in EU countries, this is translated into CARs that range between -6,1% and -10%. The sum of $dES_{i,t}$ parameters for the same time window is not statistically different from zero meaning that fiscal policy measures implemented don't have any impact on EU stock markets. On the other hand, the sum of $MON_{i,t}$ parameters is positive and statistically significant. More specifically, the sum is equal to 3% meaning that expansionary monetary policy measures (conventional such as rate cuts or unconventional such as quantitative easing) have a positive impact on stock markets leading to positive abnormal returns. This result can be attributed to the relation between interest rates and discount rates. Lower interest rates mean lower discount rates and vice versa. As so, policies that aim to lower real interest rates have a direct impact on discount rates, resulting in higher stock prices.

The same conclusions arise also from model's 2 estimated parameters. Domestic virus spread, EU virus spread and market sentiment enter negative and significant. Regarding policies implemented, the sign and the statistical significance of the sum of parameters for every policy does not change. Concerning differences between developed and other markets, the parameters of policy variables multiplied with the dummy variable DEV_i are not statistically significant, meaning that policies' impact on markets does not differ. On the other hand, domestic growth of infections as well as market sentiment multiplied both with the dummy variable are significant and positive. This means that the impact of these variables is smaller on developed markets. Developed markets seem to react mainly to the increase of cases in the rest EU. Free movement of people between EU countries is translated into easier virus spread among them. Therefore, developed markets seem to discount the virus spread within their country so they do not react in the same degree when this happens. Moreover, advanced health systems which are established in countries with developed markets have better capability to cope with a health crise and changes in its severity. As a result, the more efficient crise management leads to smaller economic fallout which turns out to smaller negative abnormal returns. Finally, developed markets seem to be more resilient to investors sentiment. This is compatible to Corredor et al. (2015) who argue that sentiment's impact is stronger on emerging markets than in developed ones.

Table 2: The results of the estimation of models' parameters

Variable	$AR_{i,t}$	
	1	**2**
constant	0,002 (0,26)	0,002 (0,22)
$GR1_{i,t-1}$	−0,009** (0,04)	−0,021*** (<0,01)
$GR2_{i,t-1}$	−0,009** (0,03)	−0,013** (0,01)
$dGS_{i,t}$	−0,016*** (<0,01)	−0,023*** (<0,01)
$\sum_{j=-1}^{2} dSTR_{i,t-j}$	−0,108*** (<0,01)	−0,113*** (<0,01)
$\sum_{j=-1}^{2} dES_{i,t-j}$	−0,026 (0,11)	−0,02 (0,38)
$\sum_{j=-1}^{2} MON_{i,t-j}$	0,03** (0,01)	0,023* (0,07)
DEV_i^* $GR1_{i,t-1}$		0,02*** (<0,01)
DEV_i^* $GR2_{i,t-1}$		0,006 (0,17)
DEV_i^* $dGS_{i,t}$		0,017* (0,09)
$\sum_{j=-1}^{2} DEV_i * dSTR_{i,t-j}$		0,031 (0,51)
$\sum_{j=-1}^{2} DEV_i * dES_{i,t-j}$		−0,018 (0,54)
$\sum_{j=-1}^{2} DEV_i * MON_{i,t-j}$		0,016 (0,37)
$\sum_{j=0}^{1} EM_{t-j}$	0,003 (0,78)	0,003 (0,80)
$\sum_{j=0}^{1} PAN_{t-j}$	−0,044*** (<0,01)	−0,042*** (<0,01)
R^2	0,225	0,296

Note: ***, **, * indicate statistical significance at level 1%, 5% and 10% respectively. P-values are reported in the parentheses.

4.2. Abnormal returns of Greek stocks across different sectors

Table 3 reports the CARs of stocks of various sectors of Greek stock market for different subperiods and their statistical significance. Concerning subperiod 1, CARs are not statistically significant according to both tests, confirming the results of previous section that Covid-19 outbreak does not have any impact on markets in this initial period. This changes in subperiod 2 with stocks of various sectors facing a differentiated impact during the virus spread phase. Although the pandemic affects the market with all stocks losing much of their value, stock prices of specific sectors show a larger than expected decline while others the opposite.

More specifically, the CARs of food and beverage, construction and materials, retail, travel and leisure stocks are negative and statistically significant at 1% level according to both tests. On the other hand, utilities and industrial products and services stocks are resilient to the pandemic, with their CARs being positive and statistically significant at 1% level according to both tests.

Table 3: CARs of different sectors and their statistical significance

Sectors	Subperiod 1			Subperiod 2		
	Car	T-Value	Z-Patell	Car	T-Value	Z-Patell
Food and Beverage	5,22%	0,85	0,84	−24,09%	−4,62***	−3,83***
Financial Services	2,81%	0,44	0,43	9,43%	1,67*	1,46
Construction and Materials	−1,13%	−0,26	−0,52	−14,58%	−3,71***	−2,76***
Banks	−6,15%	−1,24	−1,23	0,35%	0,08	−0,64
Basic Resources	−2,28%	−0,13	−0,13	−24,32%	−1,64	−1,48
Utilities	2,74%	0,49	0,48	12,81%	2,62***	2,60***
Industrial goods and services	−7,69%	−1,60	−1,59	13,04%	3,21***	2,95***
Oil and Gas	−4,37%	−0,83	−0,82	−4,23%	−0,91	−0,74
Consumer goods and services	−2,37%	−0,38	−0,37	10,14%	1,87*	1,31
Real estate	1,64%	0,21	0,21	−10,23%	−1,60	−1,09
Retail	−5,01%	−0,51	−0,47	−26,81%	−3,15***	−3,00***
Technology	3,49%	0,64	0,63	−8,48%	−1,73*	−1,29
Telecommu-nications	2,65%	0,52	0,52	6,49%	1,46	1,77*
Travel and Leisure	6,05%	1,05	1,04	−24,98%	−4,90***	−3,95***
Insurance	1,06%	0,08	0,08	−11,94%	−1,09	−0,87
Healthcare	−0,75%	−0,10	−0,10	−7,42%	−1,17	−0,81

Note: ***, **, * indicate statistical significance at level 1%, 5% and 10% respectively

The CARs of banks, basic resources, oil and gas, real estate, insurance and healthcare stocks are not significant according to both tests. Moreover, although the CARs of financial services, consumer goods and services,

telecommunications and technology stocks are significant at 10% level based on one of the two tests, they are not significant according to the other. Stock returns of the above sectors do not diverge from their expected returns given the market performance, meaning that the pandemic has not special effects on their performance.

Table 4 shows the abnormal returns of Greek sectors in the first trading day after the announcement of the lockdown by the Prime Minister on March 22. As expected, social distancing policies like lockdowns have differentiated impact on various sectors. As reported in Table 4, the ARs of food and beverage, construction and materials, energy and retail stocks are negative and significant. In contrast to those sectors, the ARs of financial services stocks are positive and significant while the ARs of other sectors are not significant.

Table 4: The ARs after the announcement of Lockdown

Sectors	AR	T-Test	Z-Patell
Food and Beverage	−3,76%	−3,14***	−2,91***
Financial services	4,07%	3,15***	2,90***
Construction and Materials	−2,85%	−3,17***	−2,91***
Banks	−1,28%	−1,36	−1,25
Basic resources	1,47%	0,43	0,40
Utilities	0,19%	0,17	0,16
Industrial goods and services	0,12%	0,13	0,12
Oil and Gas	−2,70%	−2,52***	−2,32***
Consumer goods and services	−1,16%	−0,93	−0,86
Real estate	0,44%	0,30	0,27
Retail	−3,34%	−1,71*	−1,57
Technology	0,33%	0,30	0,27
Telecommunications	1,05%	1,03	0,95
Travel and Leisure	-0,01%	−0,01	−0,01
Insurances	1,10%	0,44	0,40
Healthcare	—	—	—

Note:***, **, * indicate statistical significance at level 1%, 5% and 10% respectively

5. Conclusion

This study provides empirical evidence concerning stock markets' reactions during the evolution of the health crise triggered by Covid-19 and highlights the factors that drive stock market movements. Our results reveal the negative response of EU markets to the virus spread across EU. While the emergence of Covid-19 has no impact on EU markets, this changes after the exponential

growth of infection cases in Italy. The initial outbreak does not trigger any movements of markets while the exponential virus spread seems to be related with investors' realization of the upcoming crise. Therefore, we show that after this realization, investors revaluate stock prices resulting in negative abnormal returns. This revaluation is consistent with pandemic related developments, shifts in the severity of the health crise and its generalization across EU countries.

Our results suggest that stock prices' decline is a result of both pandemic outbreak's and social distancing policy's impact on fundamentals while low sentiment does also play role. The expected decline in gross domestic product, triggered by the upcoming health crise and its containment policy, is related with expectations for declining dividends resulting in stock prices decline. Furthermore, pandemic related pessimism and uncertainty about future returns constitute another factor that drives stocks' devaluation during this crise.

Our findings indicate that these factors are the main components of Covid-19 related stock markets' fall. However, their impact is not uniform and depends on sector or market characteristics. As we show concerning the Greek market, the differentiation in the way pandemic and containment policies impact various sectors is also reflected on stock prices with the impact of both components varying between stocks of different sectors. Moreover, it is found that developed markets are more resilient to domestic virus spread and investors sentiment.

Regarding the impact of economic policy measures implemented during the evolution of this crise, we show that while fiscal policy measures do not impact stock markets, the implementation of expansionary monetary policy measures, such as rate cuts or quantitative easing programs, has a positive effect on them. The lowering of interest rates has a direct impact on discount rates, resulting in positive abnormal returns and in a minimization of pandemic's adverse effects on asset prices.

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CULTURAL AND SAILING TOURISM WITHIN A COUNTRY'S PORT SYSTEM: A WELL EXPECTED COMBINATION FOR GREECE

G. ZOGRAFOS*

Abstract

Cruising as a concept is a complex one and it combines much of the well-known "tourism chain": transportation, catering, tourism, entertainment and travel. Today's organized cruise combines product markets, education and sports activities and it is a unique destination. Cruise tourism is defined as any leisure travel by ferry, with the primary purpose of accommodating passengers aboard and the visiting of a variety of destinations. A key point of the definition is that the purpose is not solely to carry passengers to their destinations but to stay on board.

Greece and its topography are ideal for the development of sailing tourism. Cruises product in Greece is largely based on underpinning visits in cosmopolitan islands such as Mykonos and Santorini providing the chance to passengers to visit various places for a short daily visits. 42 ports however, are available for cruise ships to be moored. All of those ports, are located in various parts of the country which due to isolation conditions throughout centuries have developed their own identities, distinct in architectural features, urban plot configuration, customs, traditions etc.. New cruising products could easily derive, pushing ahead in this way, local cruising industry and that is really a goal to be achieved.

Themed cruises around Greek ports are not a so new approach in sailing tourism narrative in Greece. Due to trading routes of the past, common conquerors etc, distant places irrelevant at first glance can be matched under a certain prism as it can be filtered through history, gastronomy, art, architecture, wine making etc. Certain marketing techniques can be easily applied.

Due to the significant development of tourism in Greece during the last decade, there is place for the offering of specialized products focused on nieces of the global tourism market. In recent years, culinary tourism as well as wine tourism has attracted millions of tourists around the world who seek to combine the travel experience with the pursuit of culinary tastes and delights. The search for traditional dishes and local products and their combination with the local customs and its folklore, its history and mythology are now a major motivation for many tourists and that is why many countries are investing in promoting their local cuisine and products.

Results of this paper could be the proposal of new cruise products for the Greek cruising industry. Tremendous potential for development of cultural developed can be combined with tremendous potential for development of sailing tourism. Themes can vary and they could range from culinary adventures contrasting cuisine of the mainland to that of islands, to the visit of battlegrounds of ancient battles such as Salamis, Platee, Marathon and Thermopiles.

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Consequently in this paper, themes of cruises will be presented along the ports and activities selected for each destination. For example a seven-day thematic cruise on the Greek Islands, with a theme "A Look at Antiquity" is going to take us back through the centuries. Through guided tours visitors would experience lots of archaeological sites and museums as well as various videos and a glimpse into the life of ancient Greeks. Conclusions of the paper are going to be focused on how easy could be the formation of new cruising products if culture in all its forms is stimulated. Greek seas and their ports are an ideal background for the formation of new cruising products which can be applied in other countries too.

JEL Classification: R580

Keywords: Sailing Tourism, Cultural Tourism, Yachting, Cruises.

1. Introduction

The last decade has seen the emergence of a new example, a different trend, which refers to both travel and destination selection. This new trend is called alternative tourism and can occasionally have fans as well as persistent critics (Kozak & Martin, 2012). In Greece, the emergence of the phenomenon marks a new era, an era of maturity for tourism, which is very different from the prevalence of mass tourism.

The tourism market and the tourism industry are driven by many factors which affect demand, e.g. the number of visitors, the destination and the distribution of flows, as well as the income from domestic and international tourism. The tourism market includes all transactions whose object is based on tourism products (Badulescu & Rusu, 2009). At the same time, the tourism market can be represented by those groups of consumers involved in tourism travel. It can also be defined as a set of commercial activities that produce tourist goods and services. Due to the fact that the tourist offer consists of goods and services, in other words tangible and intangible elements, the tourist market is characterized by complexity. Dynamism and resilience, along with mobility, are some of the special features of the tourism market, which displays a variety of tourism products and diversity in consumer needs.

It is a fact, that there have been changes in the wishes of a growing number of tourists who were not satisfied with conventional tourism and were looking for something different from their vacation. On the supply side, alternative forms of tourism lead to the least possible impact on the natural and structured environment without significantly reducing the positive economic results (Andriotis, 2008).

The consumer seems to be interested in gaining new experiences related to other people's history, habits and traditions and their way of life. The tourist not only wants a place for recreation, but he/she also wants to satisfy his/hers

curiosity, to discover, see and understand other cultures. In addition, the needs and preferences of consumers around the world are now universal and more specialized. International tourism companies have started to create products and services that will meet those new needs. In terms of consumer preferences, the paradox of homogeneity and variety allows for greater differences and at the same time greater uniqueness together (Moutinho, 2000).

In recent years, culinary tourism as well as wine tourism, have attracted millions of tourists around the world who seek to combine the travel experience with the pursuit of culinary tastes and delights. The search for traditional dishes and local products and their combination with local customs and its folklore, its history and mythology are now a major motivation for many tourists and that is why many countries are investing in promoting their local cuisine and products.

Nowadays, cruises are a way of fun and a way of getting to know distant places that we are not able to visit daily. Main destinations for cruises are the Caribbean islands, the Mediterranean Sea and the fjords as well. Concerning the context of this paper it begins with the definition of maritime tourism and therefore the cruise and then goes on with how it is presented in Greece, as well as a brief historical overview of how it has evolved over the years and how much it has developed to date.

When conclusion are drawn, then themes of cruises will be presented along the ports and activities selected for each destination. A seven-day thematic cruise on the Greek Islands, with a theme "A Look at Antiquity" aims to take us back through the centuries and show us through guided tours lots of archaeological sites and museums as well as various videos and a glimpse into the life of ancient Greeks.

2. The notion of cruises

Many European Union countries support alternative tourism. Areas characterized by intense and rich natural, cultural and cultural wealth, are the most common tourist destinations. The term "alternative tourism" describes all the concepts and elements of mass tourism. The most basic characteristics that describe alternative tourism are the following (Andriotis, 2003):

- A need to develop sustainable tourism investments aimed at favoring tourist destinations and their inhabitants
- Creating investments, but without abusing the natural environment
- Maintaining the traditional character of a destination and strengthening economic activities

- Utilization of the cultural and environmental characteristics of the tourist areas
- Benefits for people related to tourism and creation of long-term plans for the tourist destination

Many authors consider maritime tourism as an explicit form of alternative tourism.

Maritime tourism is defined as any maritime activity selected by people in their spare time and it also includes the concept of travel (Diakomichalis, 2010).

Cruising as a concept is a complex one and it combines much of the well-known "tourism chain": transportation, catering, tourism, entertainment and travel. Today's organized cruise combines product markets, education and sports activities and it is a unique destination. Cruise tourism is defined as any leisure travel by ferry, with the primary purpose of accommodating passengers aboard and the visiting of a variety of destinations. A key point of the definition is that the purpose is not solely to carry passengers to their destinations but to stay on board (Diakomichalis, 2010).

Cruises are separated into the individual ones and the massive ones. They are organized by tour operators and tourist agencies that tailor the general needs and interests of the customers as a whole, thus forming a tourism activity and a journey that meets the highest percentage of customers expectations.

The first cruise liner to be recorded in the maritime history, which was the start of the cruise, was made by the Black Ball Line, based in New York. In 1844 was the year that the cruise industry came to prominence when the first leisure voyage took place. In the coming decades, travel conditions were continuously improving as well as the services offered to passengers, leading to the substantial development of cruise ships by then (Diakomichalis, 2010).

Cruises called tour cruises began in the 1950s with small tonnage ships of mostly old companies that they do not exist today. The inspiration for cruise ships dates back to 1835 and to Peninsula & Oriental Company. Their first destination was the Mediterranean Sea, but it continues to be one of the main cruise lines in the Caribbean and the Baltic Seas. Globally, the cruise lines industry is a relatively young one. Modern cruise is a distinctive product of maritime tourism which consists of a mixture of tourist elements, since in addition to the tourist ports approach and the stay of the tourist on board, it includes various leisure activities aboard, such as watching and participating in events, theatrical performances, cinema, music events, sports, conferences, as well as activities in nearby ports, as sports and, excursions, tours (Diakomichalis, 2010).

3. Visitor experience design in cruises

"Visitor Experience Design" can be an excellent marketing tool that will bring immediate profits to any tourism business and the place itself. A visitor nowadays is actually looking for something more than just visiting a tourist destination. He/She seeks to be able to experience the destination through various experiences that will help him/her, by participating in local activities, in the history but also in the cultural and natural heritage of the place, to know completely the place he/she has visited (Adamopoulos & Thalassinos, 2020). In order to prevail in the competition, companies seek to provide the consumer with the experience that the market demands. Approaches to what creates the experiences vary. (Pine & Gilmore, 1999)

According to Pine & Gilmore (1999), "experiences are events that involve the individual in a personal way". They themselves divide the experiences into four dimensions based on two specific axes: The first is the visitor's connection with the environment and the second is the level of his/hers participation in the experience. The first axis of experience concerns, as we have said, the connection of the visitor with the environment. The two ends of this axis are absorption and immersion. The first indicates the distance of the visitor from the experience, such as in the cinema, while the second, that the visitor "deepens" on it.

The participation to which they refer can be substantially differentiated into active or passive. The first is perfectly harmonized with the visitor, who is the one who can create and enjoy this experience. In cases such as amusement parks, rafting, etc., the production of experiences will depend on the active participation of the visitor. In the other case, that of the passive participation of the visitor, his/hers presence is mainly spiritual and thus does not in fact affect at all the performance of the experience, for example, in a museum, or in the cinema. In other words, the distinction is the same as that of the visitor's connection with the environment.

There is a clear separation of "experiences" and "substantive experience". Specifically, they claim that, through our senses, we collect impressions of the world, which in turn cause us various emotions such as sadness or anger. So, when this sequence of emotions occurs, a "substantial experience" is created. The "substantial experience" is superior to an experience that we would characterize as "unforgettable" and this is because the "substantial experience" is related to the sum of our interactions with the environment and to what the experience itself teaches us during its evolution. The term "unforgettable" is also a key factor in shaping and creating an experience of Pine & Gilmore (1999).

This point, at which the visitor experiences an "essential experience", is the "sweet spot" - (Pine & Gilmore, 1999), which activates all the senses of the visitor. When it comes to destinations, it is important to be able to offer experiences that cover all four dimensions. The issue is to integrate the tourist in this smooth adaptation to the tourist destination, but also to manage to meet a satisfactory variety of needs and desires. (Stamboulis & Skayannis, 2003).

Promoting the tourist destination through social media (eg Facebook, Twitter) or service rating sites (eg Tripadvisor), since these forms are the most prevalent nowadays, can take off a business-tourist destination, as it has already completed its website and can provide the consumer-visitor, a complete experience through the selected social network. Tourist experiences, being intangible, cannot be evaluated before their consumption, which is why personal recommendations are a great influence. Users are not consumed in using only one social media, but tend to use a range of communication tools. This trend shows us that not only does each medium not replace the other, but that with a remarkable design; they can all be integrated into a social media package that includes online forms of communication (Baym, Zhang & Lin, 2004).

Therefore, social networking sites have a great influence on the modern tourist in terms of the composition and consumption of the tourist experience, while providing a variety of tools to those responsible for marketing tourism products and tourist destinations. Equally influential are Tour Operators, who are sources of information and distribution channels with a great impact on the impressions and images that tourists form for a tourist destination. The goal of tour operators is a stable clientele. They have the ability, after watching the entire course of the tourism industry, to set quality standards and in some cases, they can appreciate the satisfaction that some tourists receive after their trip. In addition, they are able to extend the tourist season of a destination with promotional packages, advertisements and educational trips

The necessity for quality experience design in cruises can lead to the formation of interesting themes. Experience design in cruising products would focus on the narration of a certain theme. Organizers should handle this issue holistically interpreting heritage for example. Themes that are related to historical periods could encompass passive and active visitor experience. Passive would be the experiences being acquired when visiting archeological sites and museums, while active will be the visitor experience design on board when travelling for port to pot. At that time, several events could be organized and handled such as exhibitions, festivities, lectures, culinary and wine tasting.

4. Greece and cruises

Although Greece is relatively a small country compared to the other Mediterranean ones, the complexity of its perimeter combined with the abundance of its islands, ranks it first in the list of the countries with the largest coastline among the Mediterranean countries (and it is on the planet's top list), with its coastline reaching 13,676 kilometers.

Greece is divided into its mainland and its island part. In the mainland are located two large mountain ranges, Pindos and Rodopi and several plains, with the largest in Thessaly. The country is characterized as mountainous due to the fact that 70% of its territory consists of mountains. In addition, several lakes and several rivers are located between its mountains and plains. This diversity of the continental part results in great climatic variation throughout the country. The island part of the country consists of five island groups (the Dodecanese, the Ionian Islands, the Cyclades, the North Aegean and the Sporades), Crete and Evia. There are about 6,000 islands, islets and rocky islets across the country, of which only 227 are habitable. In Greece there are 42 ports for cruise ships to be moored.

Greece is located in the eastern side of the Mediterranean and its climate is characterized as temperate Mediterranean, with mild and wet winters and long, hot and dry summers. Extreme temperatures are generally not found, especially in island areas. Combined with its geographical diversity, the climate has played an important role in the development of summer tourism in the country, a fact that for many years ranks it in the top ten tourist destinations in the world for the summer season and even in the years not in the top ten does not fall never below the second ten (Zografos, 2020). The changing and ever-increasing needs and requirements of the country's visitors, in combination with the over-tourism and the effects of mass tourism, lead to the need for transformation and change of the promoted tourist product (Zografos, 2019). Greece fought for many years and managed to relate to the triptych 3S: Sun-Sea-Sand (sun-sea-beach), taking advantage of its island part in combination with its climate, as much as it could (Zografos & Deffner, 2009). The excessive increase in the number of tourists in this type of tourism began to have a negative impact on the experience of many visitors, resulting in many being led to other types of tourism (Zografos & Deffner, 2007).

Greece's initial goal was to become known for tourism that concerns its islands and beaches. Then, the types of tourism appeared, which were related to the sea and mainly during the summer season, such as maritime tourism and all the subspecies and activities that complement it. Maritime tourism began

to grow relatively quickly in relation to the beginning of the development of tourism in the country. The first cruises had already appeared in 1954, with the first being the royal cruise, while in the 1960s other marine activities were developed, such as sailing, diving, thalassotherapy, etc.

Development of cruises in Greece began in 1930. Greek cruise ships appeared when the first Greek companies offered cruises to the Aegean and the Mediterranean Sea. One of the first Greek cruise companies was AKTEL, which offered cruises in the Mediterranean Sea from 1935 until World War II. ELMES originated from AKTEL and continued its activity in coastal ferries and cruise shipping (Diakomichalis, 2010).

Initially, foreign travel agencies were chartering Greek ships for tours across the Eastern Mediterranean. Specifically in 1954, five vessels, the Agamemnon, Mediterranean, Dolphini, Miaoulis and Kolokotronis, were chartered by foreign travel agencies for short day trips along the Greek seas. The following year (1955), the National Tourism Organization, in order to promote the Greek islands in particular, chartered the Semiramis of the Continental by establishing regular cruises for the first time (Diakomichalis, 2010).

It should be noted that until 1999 Greek cruise ships operated under the privileged status of cabotage. The EU's policy was to create markets free from state interference and protectionism, while strengthening the conditions of free competition so that all businesses could enter the market. In 2003, there were 9 vessels registered under the Greek flag, while around 25 vessels were Greek-speaking. Changes that have taken place in the Greek cruise market in recent years have created a negative climate for the development of Greek cruises.According to Diakomichalis, (2010) cruises on offer all fall into the category of international cruises, specifically in the area of the Mediterranean Sea. For a large number of cruise programs, Greek ports are the main destination, with additional destinations some of the neighboring ports in Italy, Turkey, Cyprus and Egypt. In other programs Greece is a complementary destination, with little or even an one port approach.

5. Conclusions

Globalization is an extremely important factor that seems to affect tourism in many ways. The homogenization of consumer needs and lifestyles, the nature of modern international tourism, as well as the development of the computer and telecommunications network, have all led to an ever-expanding international tourism market.

In Greece, tourism development as a footprint of the global tourism market

in the context of the country is one of the main factors affecting the economic development of the country. Revenues of the tourism industry reach almost 1/3 of the National Gross Product of the country. The development and transformation of the tourism model and consequently the tourism product is of the outmost importance for the country's economy and for this reason special attention should be given to the development of alternative tourism and perhaps to the creation of new ideas, services and products of its various kinds.

Greece has always been known for its rich history and for its countless monuments, around which modern civilization has been built. But in addition to historical tourism, which is the first to be developed immediately after the end of the civil war in the 20th century, other kinds are now developing, such as religious tourism, cultural tourism, agro tourism, wine tourism and others. Global travelers seek in Greece authenticity. In the past five to ten years, until today there has been a shift towards the traditional and the genuine. Many tourists seek from the country what no other country can offer them.

As a conclusion of all mentioned above it is time for Greece to start providing new types of cruises, which will focus on Greece's unique heritage.. Themes can vary and they could range from culinary adventures contrasting cuisine of the mainland to that of islands, to the visit of battlegrounds of ancient battles such as Salamis, Platee, Marathon and Thermopile

Three identical cruises are given below. The one is related to the abundance of maritime museums in the Aegean Islands, which reflect the supreme naval heritage of the region, the other one of its culinary heritage of it. The third cruise which is given in more detail is about the combination of ports with adjacent archeological sites of global importance. It is clear that all these themed products will target specific groups which are interested in those themes. The organizers have to design experiences for the travelers offering interpretation of the themes even on board. The main feature of all those themed proposals will be the effort for the gaining of experiences. Passive experiences will be gained mainly on archeological sites, museums and active experiences will be gained mainly on board with talks, film watching and festivities. At the same time, wherever is possible as in the case of Gastronomical cruise, passengers will obtain active experiences on the ports visiting. Those would be wine tasting, culinary adventures etc.

At the end, it is clear, that social media are ideal for the promotion of themed cruises. Images of all those peculiar experiences will be transferred globally through social media, reassuring success of the themed cruises as well developed product.

Examples of themed cruises

Maritime museums cruise

The main theme of the cruise is the maritime museums of the Aegean islands, and in general on the eastern side of the country. The main and major tourist spots in each place were selected in order to attract older people who are fond of maritime history and culture. The title of our cruise is "Historical Exploration of the Aegean Sea".

Ports to be visisterd will be Chios, Tinos, Mytilene, Santorini, Chania and Samos. In each port there will be a stop and two overnight stays. Lush maritime history of posts visited will be reflected on board where passengers will take place in various activities obtaining active experiences.

Gastronomical cruise

It is all about a seven-day cruise on Greek ports focusing on gastronomical tourism.

Port of departure will be Piraeus. The first port to visit is Mykonos where the first overnight stay will take place. Next visit will the at port of Milos and then an overnight stay in Santorini. The next day the ship will sail for the port of Chania, Crete. The trip will continue to Kusadasi, and finally back to the port of Piraeus where it started. There will be various activities mainly focused on discovering the culinary diversity of the Aegean islands.

Undoubtedly the originality of the interpretation, the authenticity of flavors and tastes is a key factor in achieving a well established result of tourism experience. Gastronomical tourists are actually cultural tourists who look for new experiences as far as sensing the place is concerned (Zografos, 2018).

A look at the antiquity cruise

The theme Greece had already developed since the prehistoric years of the Cycladic civilization, the Minoan civilization and the Mycenaean civilization. Then there was the Geometric Age, the Archaic Age, the Classical Age, and finally the Hellenistic Age. During all those centuries, Greece went through periods of war, such as the multi-year Persian Wars and the Peloponnesian War. Philosophy, literature and theater, music and dance, science and technology as well as religion and mythology flourished in all periods no matter of the wars in Ancient Greece.

The name of the proposed cruise is "A Look at the Antiquity". It is all about the ports which are close to archaeological sites and museums, according to the theme of the cruise. The main activity of the cruise will be visits to

archaeological sites and museums as mentioned above. Passengers will be transported from ports to archaeological sites by bus. There will be free time for passengers to do their shopping in each port.

- Nafplion: Guided tour of the ancient tombs of Mycenae and later a (theatrical) performance in the ancient theater of Epidaurus
- Katakolon: Guided Tour in Ancient Olympia
- Itea: Guided Tour in Delphi
- Kusadasi: Guided Tour in Ephessu
- Heraklion: Guided Tour in Knossos

Ancient Greek history related to places visited will be reflected on board where passengers will take place in various activities obtaining active experiences.

It is for sure; that all examples given above make clear that new products can easily derive from the combination of cultural and sailing tourism. Greek seas and their ports are an ideal background for the formation of new cruising products which can be applied in other countries too.

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