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CHATGPT'S PERFORMANCE ON CASE DISCUSSION QUESTIONS

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This paper reports the results of ChatGPT's performance on business case discussion questions. As ChatGPT becomes more broadly deployed in higher education, its capabilities and limitations have become better understood. ChatGPT fares quite well in certain activities and with some success in qualitative business work. ChatGPT fares less well in its management of quantitative information and tabulated or data-visualized information. ChatGPT has well-documented issues with so-called "*hallucinations*" where the AI creates a cogent, but false, answer to a question.

We provided ChatGPT-3.5 and ChatGPT-4 with access to three recently published business cases and the discussion questions associated with each case. We provided ChatGPT responses and the instruction manual rubric for the discussion questions to pairs of independent faculty reviewers. This paper reports on the ChatGPT responses, the independent faculty review, and our observations from the outcomes of these activities.

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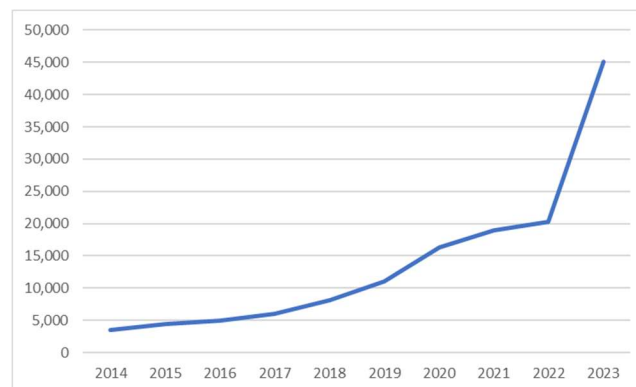
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Introduction

This paper reports the results of ChatGPT’s performance answering business case discussion questions. Our interest in this topic corresponds to a rapid increase in academic interest in generative artificial intelligence following the public release of ChatGPT. In Exhibit 1 below, we chart the number of Google Scholar references, by year, for the query “*artificial intelligence higher education*.” Two observations emerge from this search, one apparent in the figure and the other more apparent in the review of the search results themselves. First, academic interest in artificial intelligence and its relationship to higher education increased notably in the period between 2019 and 2022, and that interest doubled in one year from 2022 to 2023. Second, we observe from a scan of the literature in each year that articles appeared primarily in computing and science journals in the period of 2014-2019 then transitioned to the remainder of higher education journals beginning in 2020.

Exhibit 1. Peer-reviewed Journal Publications about AI in Higher Education, 2014-2023

Source: Google Scholar (February 2024)



The awareness of artificial intelligence and its emerging capabilities has become a significant discussion topic in higher education. Our research extends the discussion on the appropriate place of artificial intelligence in higher education to an examination of its most well-known application, ChatGPT, on a common higher education activity: business case analysis.

This article is organized in five parts. First, we briefly review ChatGPT and identify emerging perspectives of students, employers, and educators as they pertain to the technology. Second, we offer a perspective on teaching in an AI-mediated world. Third, we discuss ChatGPT's performance in higher education activities. Fourth, we describe the methods and results of our inquiry into ChatGPT's performance when answering teaching case questions. Finally, we conclude with a discussion of our observations from our study, and our perspective on the implications for the broader discussion of artificial intelligence in higher education.

ChatGPT

ChatGPT is the most widely known of an emerging suite of natural language processing artificial intelligence applications. For those interested in a discussion of the evolution of the technology which underlies these applications, we recommend Wecel *et al.* (2023, p. 46), who stated that *"GPT is a generative model and is designed for tasks such as text generation and language modelling..."* and that *"GPT-3 (Generative Pre-trained Transformer) is a third-generation, autoregressive model developed by OpenAI that uses deep learning to produce human-like text (sequence of words, code, or other data) starting from a source input (prompt) provided by a user."* While the output of generative AI can be music, video, imagery, or computer code, for purposes of this article, we focus on ChatGPT's ability to generate text (an answer) following a prompt (a question from the instructor's manual of a teaching case).

It took Instagram two years and 6 months to reach 100 million users worldwide. It took Tik Tok 9 months to achieve the same reach. But it only took ChatGPT two months to reach the 100 million user milestone, making it *"the fastest growing consumer application in history"* (Hu 2023, para. 1). Launched in November 2022, ChatGPT, a chatbot owned by Open AI, a private company backed by Microsoft Corp, continued to grow rapidly, surpassing the 180.5 million user mark by the end of August 2023 (Nerdynav 2023). Two versions of ChatGPT are available to the public, ChatGPT-3.5 is freely available and ChatGPT-4 is available with a subscription.

In March 2023, Open AI released GPT-4 as a subscription-based service, priced at \$20 per month. The 4th version's enhanced features included the ability to analyze images of objects, handwritten text and drawings, graphs, and file uploads (OpenAI 2023). With access to the Internet, subscribers can use ChatGPT prompts to obtain current information. As an example, the authors of this paper asked ChatGPT who had won the Alabama versus LSU football game in 2023. Exhibit 2 presents the responses provided by GPT-3.5 and GPT-4 to the football prompt (OpenAI 2023b).

OpenAI's testing of GPT-4's performance indicated it could generate more precise and relevant answers to prompts and had better mathematical and language skills than GPT-3.5 could. With such improved accuracy, OpenAI has been able to reduce the level of "hallucinations" (bogus or made-up information) and reasoning errors (OpenAI 2023).

Exhibit 2. Who Won the Alabama versus LSU in 2023?

Source: OpenAI (2023b)

GPT-3.5	GPT-4
I'm sorry, but I don't have access to real-time or future information, including the results of specific events like the Alabama versus LSU football game in 2023. My knowledge only goes up until January 2022, and I cannot provide updates on events or scores that have occurred since then. To find out the result of that game, I recommend checking a reliable sports news website, a sports app, or the official website of the teams or organizations involved.	In the 2023 football game between Alabama and LSU, Alabama emerged victorious, defeating LSU with a score of 42-28. This victory was achieved at Bryant-Denny Stadium and contributed to Alabama's season record, advancing them to 8-1 overall and maintaining an undefeated status of 6-0 in SEC play.

ChatGPT: The Student Perspective

In March 2023, Bestcolleges.com published the results of AI usage by college students. Exhibit 3 summarizes the results of 1000 students surveyed. While 57% of the students did not plan to use AI for their college work, 61% of those surveyed believed that AI tool usage will become the norm (Welding 2023).

Exhibit 3. Summary of Best Colleges Student Survey Regarding AI UsageSource: from <https://www.bestcolleges.com/research/college-students-ai-tools-survey/>

43% of college students have used ChatGPT or a similar AI application.
Of those who have used AI tools, 50% say they have used them to help complete assignments or exams. That's 22% of all college students in our survey.
However, most college students (57%) do <i>not</i> intend to use or continue using AI to complete their schoolwork.
31% say their instructors, course materials, or school honor codes have explicitly prohibited AI tools.
Over half of college students (54%) say their instructors have not openly discussed the use of AI tools like ChatGPT.
6 in 10 college students (60%) report that their instructors or schools haven't specified how to use AI tools ethically or responsibly.
61% of college students think AI tools like ChatGPT will become the new normal.

The Best Colleges survey indicates that students are already using ChatGPT and other generative AI solutions to assist in their college-level work. Duong and Tran (2023) studied the motivations of undergraduate students and found that the ease of using ChatGPT (effort expectancy) and the perceived benefits and advantages of using it (performance expectancy), influenced the intention to use and the actual usage of ChatGPT. Recent research, therefore, suggests that the utility and accessibility of ChatGPT influences student propensity to use the technology.

ChatGPT: The Employer Perspective

With ChatGPT available in the labor market for less than two years, it would be a conjecture to make claims about the long-term implications of the technology on the workforce. However, early evidence suggests that employers are adopting the technology in ways which may ultimately prove transformational.

In an NBER working paper, Brynjolfsson *et al.* (2023) described findings from the adoption of a ChatGPT model into a business-to-business customer service call center. They noted improvements in productivity, increased customer satisfaction, and decreased employee turnover in clusters where employees utilized a specially tuned ChatGPT. The company specifically tuned ChatGPT by training it on the knowledge management information stored in the company along with guidance on empathetic language outputs. Further evidence of employer interest in generative AI skilled workers appeared in an April 2023 *Time* magazine

which described AI jobs with six-figure incomes for employees who were skilled at prompt engineering (Popli 2023).

ChatGPT: The Instructor Perspective

Given the fast pace of usage and rapid improvements in the quality of output from ChatGPT, academics became concerned about the impact ChatGPT would have on academic integrity. In their 2023 paper, Adilov *et al.* detailed a vulnerability index for use of ChatGPT to cheat on college exams. Their model presumed that student access to ChatGPT will be greater in fully online classes and less - but not fully eliminated - in face-to-face classes. The model assigned an increased likelihood of ChatGPT utility in easier to access environments. Further, the accuracy of ChatGPT in answering exam questions, and the relative weight of an exam to the total class grade each increased the likelihood that a student will use ChatGPT to cheat. Their examination of course designs at a midwestern business school concluded that fully online courses were slightly more vulnerable than face-to-face courses. They concluded that multiple-choice-based exams were equally vulnerable to written, essay-type exams. They also observed that ChatGPT performed less well on quantitative assessment and better on logical and textual reasoning assessments.

The *Chronicle of Higher Education* invited readers to share their experiences teaching during the Fall 2023 semester. The responses of about 100 faculty members who shared their experiences indicate that approaches to dealing with ChatGPT varied. Some faculty members treated the use of ChatGPT as academic dishonesty, others redesigned their assignments to reduce the potential of cheating, and others incorporated the use of ChatGPT into assignments in their courses. Faculty comments suggest that concerns of academic dishonesty had diminished. While faculty recognized that they may not have been aware of students cheating in their classes, they indicated that the steps they took to minimize cheating appear to be working (McMurtrie & Supiano 2023).

In January 2023, a survey of 100 educators conducted by Study.com indicated that while there was concern about the cheating potential of the tool, only 34% of those surveyed supported a ban of ChatGPT usage in an educational setting. The survey results suggested that educators perceived the tool's benefits outweighed the cheating risk (Productive teaching tools 2023). Bearman and Ajjawi (2023) take this a step further, arguing that “*higher education clearly can play a role in preparing students to live and work in an AI-mediated world*” (pg. 1161). Markauskaite *et al.* (2022) suggest that the proliferation of AI increases the need for higher education to develop learner capabilities in AI literacy, authentic learning, critical thinking and reflective practices, epistemic practice, and AI-mediated learning.

Grajeda *et al.* (2023) provided evidence of factors which influence the utilization of and satisfaction with ChatGPT at a university with artificial intelligence embedded in its curriculum. They found that the effectiveness of AI tools to assist with assignments, the student's proficiency with AI tools, and the instructor's proficiency with AI tools each positively correlated with student AI technology adoption. They noted that advanced AI skills, such as prompt engineering, influence adoption, therefore “*this necessitates targeted training strategies to improve AI integration*” (pg. 21).

Teaching in an AI Mediated World

AI literacy is emerging as an important soft skill for students to acquire and therefore, academics need to train students in their use. Peres *et al.* (2023, pg.272) stated that the “*effective use of GenAI tools*” required students to learn about “*effectively crafting prompts, on how to evaluate the output in terms of its impact and metrics, and the inherit limitations of relying upon GenAI.*” They echoed the *Time* magazine article (Popli 2023), noting that prompt engineering (crafting prompts) has emerged as a job skill sought by agencies and brands in the marketing field.

Prompt engineering can be thought of as a form of natural language programming. It involves crafting queries for a generative AI tool which extends beyond simply asking the AI for an answer, but instead provides structure and constraints on the artificial intelligence alongside the question. Using prompt engineering, Mollick and Mollick (2023b) developed seven approaches that can be used to enhance the students' learning experience and help students build AI literacy skills. By creating prompts for students to use in assignments, AI can be used as a mentor, tutor, coach, teammate, student, simulator, or tool. Confabulation, also referred to as "hallucination," is a pedagogical risk associated with GenAI. Hallucination occurs when the AI generates information, data, or interpretations of data which are not factual (Maleki *et al.* 2024). Hallucination risk is the highest when AI acts as a tutor and lowest when AI acts as a student (Mollick & Mollick 2023b).

Exhibit 4. Summary of Seven Approaches to Enhance Learning Using AI

Source: Recreated from Mollick & Mollick (2023) p. 4, <https://arxiv.org/abs/2306.10052>

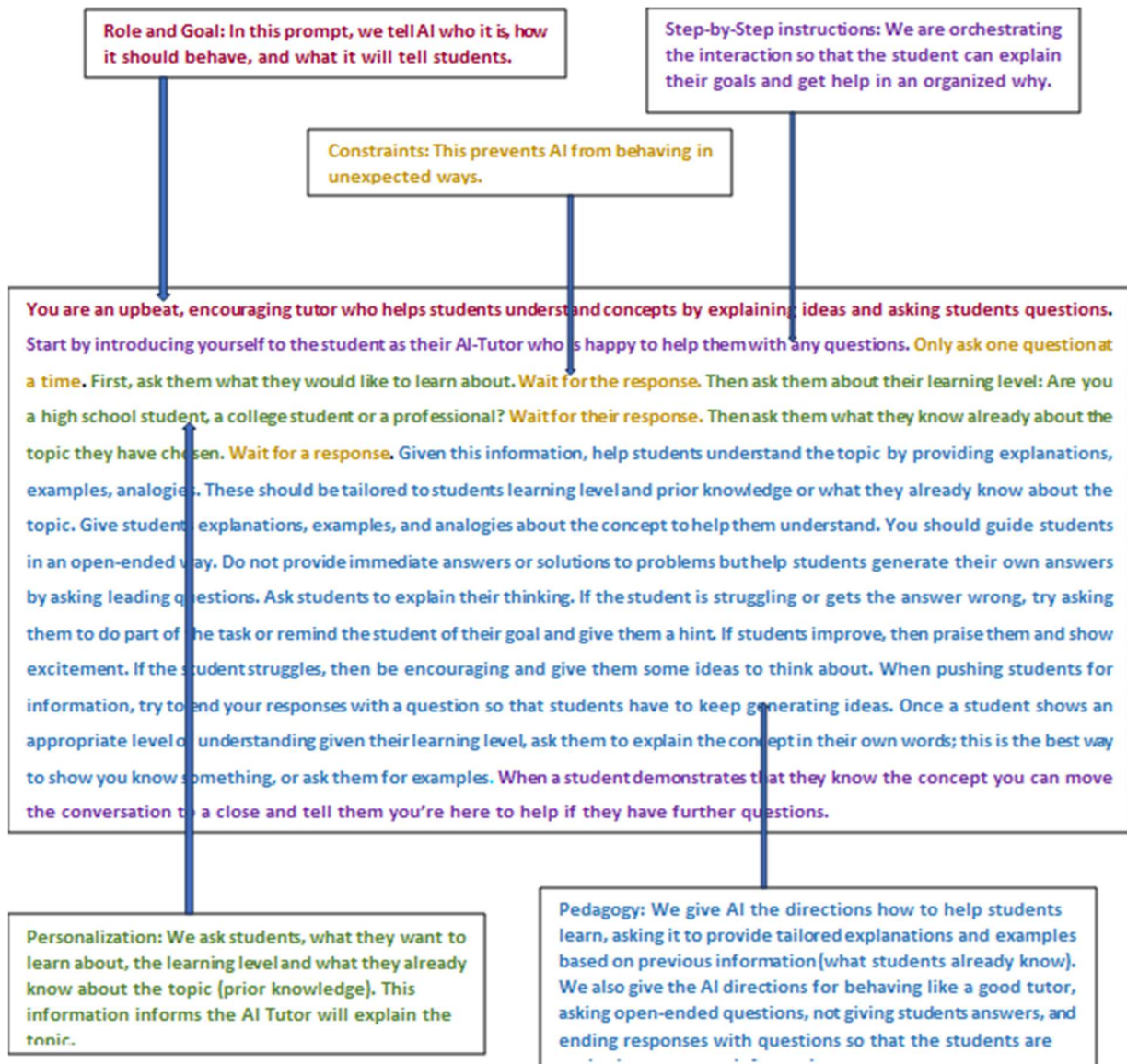
AI USE	ROLE	PEDAGOGICAL BENEFIT	PEDAGOGICAL RISK
MENTOR	Providing feedback	Frequent feedback improves learning outcomes, even if all advice is not taken.	Not critically examining feedback, which may contain errors.
TUTOR	Direct instruction	Personalized direct instruction is very effective.	Uneven knowledge base of AI. Serious confabulations risks.
COACH	Prompt metacognition	Opportunities for reflection and regulation, which improve learning outcomes	The tone or style of coaching may not match student. Risk of incorrect advice.
TEAMMATE	Increase team performance	Provide alternative viewpoints, help learning teams function better.	Confabulation and error. "Personality" conflicts with other team members.
STUDENT	Receive explanations	Teaching others is a powerful learning tool.	Confabulation and argumentation may derail the benefits of teaching.
SIMULATOR	Deliberate practice	Practicing and applying knowledge aids transfer.	Inappropriate fidelity.
TOOL	Accomplish Tasks	Helps students accomplish more within the same time frame.	Outsourcing thinking rather than work.

Mollick & Mollick (2023b) found that prompt engineering including certain elements improved the quality of AI generated responses, such as telling AI "who it is (role)," telling AI "what you

want it to do (goal),” “providing step-by-step instructions,” and “adding personalization” to allow it to be tailored to the audience of the output, and placing constraints that allow it to control the output provided by the AI tool used. Exhibit 5 contains an example of a prompt construction using AI as a tutor and the instructions given to students.

Exhibit 5. Prompt Example for AI acting as a Tutor.

Source: Recreated from <https://arxiv.org/abs/2306.10052> p.13



Implementing Teaching Strategies Using AI Tools

AI can be utilized to implement teaching strategies that otherwise would not be employed by faculty due to time constraints and the effort required to implement them. Mollick and Mollick (2023a) identified five strategies that can be deployed with AI's assistance. The first strategy involves providing diverse examples so students can grasp the key concepts and apply them to different scenarios. The second strategy is providing multiple explanations for a concept, building from *"simple to complex,"* so that students can *"eventually explain the concept to others in their own words."* Creating low stake tests is the third strategy. This strategy provides students with feedback allowing them to identify and address areas where their understanding is lacking while allowing faculty members to adjust their lectures accordingly. The fourth strategy is to assess student learning by having an AI tool summarizing responses to questions of what they thought was the main takeaways of the class and what where the areas of confusion (referred to as *"muddiest points"*) so faculty can address them in future classes. The fifth strategy is distributed practice of important ideas. Distributed practice requires faculty members to identify the most important topics in the course, the most important links between topics that are considered critical for students to understand and therefore how frequently they should be practiced.

Before deployment of any teaching strategy, Mollick and Mollick recommend evaluating the prompt with different AI tools, as the output will differ. The AI output will also differ using the same tool over multiple iterations. Once the AI output is produced, faculty must critically analyze the output to determine its usefulness and ensure that the materials produced do not include hallucinations. Exhibit 6 provides an example of a prompt and the response from Bing and ChatGPT. Bing provided only three examples compared to the four requested in the prompt.

Exhibit 6. Bing’s and ChatGPT’s Output to a Request for Examples

Source: Adapted from Mollick & Mollick (2023a) pp. 5-6

<p>The prompt: I would like you to act as an example generator for students. When confronted with new and complex concepts, adding many and varied examples helps students better understand those concepts, you will look up the concept, and then provide me with four different and varied examples of the concept in action.</p>	
<p>Bing’s List of Four Examples</p>	<p>ChatGPT’s List of Four Examples</p>
<p>The request: I would like examples of opportunity cost for high school students.</p>	<p>The request: I would like examples of opportunity cost for college students</p>
<ul style="list-style-type: none"> • If you spend \$50 on a pair of shoes, you cannot spend that money on something else. The opportunity cost is what you could have bought instead of shoes. • If you choose to volunteer for a non-profit instead of working as a financial advisor, you give up the income you could have earned. The opportunity cost is the money you would have made working. • If you plant wheat on your farm, you cannot plant another crop or use your land for something else. The opportunity cost is the value of planting a different crop or using your land differently. 	<ul style="list-style-type: none"> • Choosing a major: A college student is deciding between majoring in economics and computer science. By choosing to major in economics, the opportunity cost is the potential knowledge, skills, and careers opportunities they would have gained from majoring in computer science. • Studying vs. Socializing: A student has a big exam coming up next week but is invited to a party the night before. If the student decides to attend the party, the opportunity cost is the additional study time and potential improvement in their exam performance they could have achieved by staying home and studying. • Part-time job versus internship: A college student has an option to work a part-time job that pays \$15 per hour or take an unpaid internship in their field of interest. If the student chooses the part-time job, the opportunity cost is the valuable work experience and networking opportunities they could have gained from the unpaid internships. • Taking a gap year: A high school graduate is considering taking a gap year to travel and explore their interest before attending college. If they decided to take the gap year, the opportunity cost is the potential income and professional development they could have earned by starting college right away and graduating a year earlier.

Turning to a teaching topic directly relevant to our research, Weiss (2023) identified five ways ChatGPT or other AI tools can enhance case preparation. First, AI tools can assist in generating questions to consider for class discussion based on the case synopsis provided. Second, if necessary, follow-up prompts can be used to refine the questions to align them with the instructor’s case goals. Third, the AI tool can be asked to suggest academic concepts or

frameworks that can be linked to each of the questions previously generated. Fourth, the AI tool can be asked to provide a select number of real companies which used a concept to enhance the class discussion with examples. Fifth, the AI tool can *"simulate a live class discussion."* The simulation can provide insights on the potential responses that students might provide in an in-classroom discussion. Exhibit 7 provides the prompt used for the simulation.

Exhibit 7. Prompt for a Simulation of a Class Case Discussion Using ChatGPT

Source: Copied from Weiss (2023) p. 4

"I'd like you to help me practice teaching this session on TraceTogether. I am going to ask you a question. Please create three student personas: Worm Deck, Garden Deck, and Sky Deck. Please pick one of them at random to answer the question. Provide an answer from them. Then, ask two follow-up questions. Make the first an 'exploration' question, inviting them to expand on their answer in some way. Provide their answer. Make the second a 'challenge' question, pushing back on their responses, perhaps by citing contrary evidence. Provide their answer. Then, pick one of the other students to respond to what they heard from the first student. After that, ask the final student to respond to what they heard from the first student.

The question is, Was Bay correct to keep government officials 'in the loop' in the digital contact tracing system he built?"

ChatGPT's Performance in Higher Education Activities

Prompt engineering appears to be an emerging skill set of value, and one which academics will need to understand themselves. Beyond simply repeating a structured query, users of AI need to understand the capabilities and limitations of the technology. In this section, we review the performance of generative AI in areas associated with higher education including its ability to perform on examinations and its ability to respond to mathematical queries. We also examine one of the critical limitations of current generative AI, the tendency of artificial intelligence to *"hallucinate"* cogent sounding, but false, responses to prompts.

Exam Performance

A question of interest for academics is ChatGPT's performance on a variety of examinations. Open AI used the most recent versions of past exams that were publicly available or purchased 2022-2023 versions of practice exams to evaluate the ChatGPT's examination performance.

Exhibit 8 shows test performance employing GPT-3.5 and GPT-4. Overall, GPT-4's test performance was superior to that of GPT-3.5. Among the 15 AP (Advanced Placement) tests, GPT-4 and GPT-3.5 earned the same score in only six exams, scoring high in four of the exams but performing poorly in the two AP English tests. Except for the GRE Writing score, where both ChatGPT versions scored in the 54th percentile, GPT-4's performance in the Uniform Bar Exam, LSAT, SAT Reading & Writing and Math, and GRE Quantitative and Verbal was better than the GPT-3.5 as evidenced by the estimated percentile reported in Exhibit 8 (GPT-4, 2023).

Exhibit 8. Select Examinations Results Using ChatGPT-4 versus ChatGPT-3.5

Source: Adapted from <https://arxiv.org/pdf/2303.08774v3.pdf> p. 5

Simulated exams	GPT-4		GPT-3.5	
	Score	Estimated Percentile	Score	Estimated Percentile
Uniform Bar Exam	298 / 400	~90th	213 / 400	~10th
LSAT	163	~88th	149	~40th
SAT Evidence-Based Reading & Writing	710 / 800	~93rd	670 / 800	~87th
SAT Math	700 / 800	~89th	590 / 800	~70th
GRE Quantitative	163 / 170	~80th	147 / 170	~70th
GRE Verbal	169 / 170	~99th	154 / 170	~63rd
GRE Writing	4 / 6	~54th	4 / 6	~54th
Medical Knowledge Self-Assessment Program	75%		53%	
AP Art History	5	86th–100th	5	86th–100th
AP Environmental Science	5	91st–100th	5	91st–100th
AP Psychology	5	83rd–100th	5	83rd–100th
AP Biology	5	85th–100th	4	62nd–85th
AP Microeconomics	5	82nd–100th	4	60th–82nd
AP US Government	5	88th–100th	4	77th–88th
AP US History	5	89th–100th	4	74th–89th
AP Statistics	5	85th–100th	3	40th–63rd
AP Macroeconomics	5	84th–100th	2	33rd–48th
AP World History	4	65th–87th	4	65th–87th
AP Physics 2	4	66th–84th	3	30th–66th
AP Chemistry	4	71st–88th	2	22nd–46th
AP Calculus BC	4	43rd–59th	1	0th–7th
AP English Language and Composition	2	14th–44th	2	14th–44th
AP English Literature and Composition	2	8th–22nd	2	8th–22nd

Mathematical Skills

Morgan (2024) investigated how well ChatGPT performed in solving Calculus 1 exam questions used at the University of Houston by uploading the test bank with thousands of questions into both GPT-3.5 and GPT-4.0. GPT-3.5 was only able to accurately respond to 38% of the questions compared to GPT-4.0 responses that were correct for 58% of the questions. The errors were not attributed to the application of formulas or concepts, but rather simple arithmetic errors made by ChatGPT. The findings reported by Morgan (2024) parallel the results for the AP Calculus BC test in Exhibit 8.

Hallucination

Orchard and Tasiemsky (2023) noted that ChatGPT and other similar technologies work by predicting which words would appear, and in which sequence, given the context of the prompt. *“This means that when there is no exact ‘match,’ (the model lacks exact knowledge), it is likely to make it up very confidently which is now known as model ‘hallucinations’”* (pg. 12).

Hallucinations remain one of the more surprising complications of LLM-based AI applications. These fabrications seem to be related to limitations or restrictions in the application which prevent it from providing an accurate answer. Researchers from Vectara investigated the frequency of hallucination in various AI models. The study found that hallucination rates ranged from 3% to 27%, with OpenAI having the lowest hallucination rate and Google’s Palm chat having the highest rate (Hughes 2023; Metz 2023).

Those who rely on ChatGPT without confirming the veracity of the AI’s output do so at their own peril. That appears to be the takeaway from the dismissal of a 2023 U.S. District Court lawsuit (Brodkin 2023). Lawyers for the plaintiff relied on ChatGPT in a legal brief. The brief included some cases, hallucinated by ChatGPT as a basis to counter the defense proposal to dismiss the case. Judge Castiel ultimately dismissed the case, concluding that the attorney’s submission of false information was an act of bad faith. Given the propensity for ChatGPT to hallucinate and the convincing nature of the fabrications, it follows that training students to monitor for hallucinations should improve their ability to detect and counter them.

ChatGPT and Teaching Cases

Terwiesch (2023) asked ChatGPT 3.0 to answer common questions on the MBA operations management course at the University of Pennsylvania's Wharton school. Terwiesch concluded that *"it does an amazing job at basic operations management and process analysis questions including those based on case studies"* (pg. 1). While Terwiesch drew upon commonly used cases, they were deployed as exam questions. The question contained a summary of the case which only included information pertinent for the exam question. In effect, this condensed a large case into an examination word problem. We were intrigued by ChatGPT's ability to answer these condensed questions and wondered how ChatGPT would perform if it, like a student, had to sift through the entirety of a case narrative to identify relevant information.

The research question which led to this paper's creation involved our interest in whether students might use ChatGPT to answer the discussion questions in cases used in our classes. ChatGPT can rapidly produce insightful-sounding responses and can be easily navigated to provide more detail, offer differing perspectives, or suggest innovative recommendations in an answer. Students have already evidenced some comfort in adopting ChatGPT (Duong and Tran 2023) and they are likely to continue to adopt it given the media narrative on ChatGPT's successes and failures. In this case, instructors should be aware of the evolving capabilities of the tools available to their students.

Instructors using teaching cases may be curious, as we are, about how well ChatGPT addresses case questions for at least three reasons. First, students are likely to use ChatGPT to formulate answers to *"out of the classroom"* discussion questions (Duong and Tran 2023). Second, instructors are likely to find ChatGPT is a useful pedagogical partner for developing lesson plans and testing discussion prompts (Weiss 2023). Third, ChatGPT can be deployed during the classroom discussion and used to spark discussions with greater depth and breadth (Mollick & Mollick 2023b).

Methodology

We provided ChatGPT-3.5 and ChatGPT-4 with access to three recently published business cases and the discussion questions associated with each case. Two primary source cases and one secondary source case were evaluated as part of this study. We uploaded the narratives of Bendeck (2022), Bendeck & Voelker (2023), and Anders *et al.* (2024) to the free and paid versions of ChatGPT (OpenAI 2023a). After uploading the narratives, we asked ChatGPT the questions that students were expected to address in each case.

We provided seven of our colleagues with the ChatGPT responses and the instruction manual rubric for the discussion questions. The faculty taught accounting, finance, economics, and management with expertise in international business and entrepreneurship. Two faculty members evaluated the *Istmo* case which focused on capital budgeting decisions (Bendeck 2022). Three faculty members evaluated the All-Occasions T-shirt Company case which focused on evaluating strategy and resources necessary to breakeven for the company to continue operations (Bendeck & Voelker 2023). Three faculty members evaluated the Bitcoin case which focused on the adoption of Bitcoin as legal tender in El Salvador (Anders *et al.* 2024).

We asked our colleagues to evaluate the quality of the ChatGPT responses based on the answer key from the instructor's manuals. Each evaluator was provided with a copy of the case narrative and an Excel workbook. Each case question had its own spreadsheet that contained the following information:

- The question;
- The answer key from the Instructor's Manual;
- The grading scale for the question as it appears in the Instructor's Manual;
- The GPT-3.5 and the GPT-4 responses.

Case 1- Is the Consultant's Analysis Correct? Inversiones Istmo and the Capital Investment Decision

Case 1 Background

The *Inversiones Istmo* case is a primary-sourced case (Bendeck 2022). *Inversiones Istmo*, who owns a sugar mill in Honduras, hired consultants to provide the technical requirements and specification to establish distillery operations. As part of the report, the consultant included a capital budgeting analysis for establishing distillery operations that allowed *Inversiones Istmo* the flexibility to produce both ethanol and extra neutral alcohol (ENA) for use in production of medicines, cosmetics, food, and spirits. The entire production of ENA was to be sold in Honduras. The entire production of ethanol was designed for the European market where premiums were paid for sugarcane-based ethanol. The project was called the global project. Based on the net present value and internal rate of return calculations, the consultants recommended that the global project be undertaken. Upon inspection of the report, Pedro Martinez, the Chairman of the Board of *Inversiones Istmo* and member of the Investment Committee, noticed irregularities in the capital budgeting analysis. He asked his staff to rework the analysis and evaluate different scenarios which included:

- Investigating the worst-case scenarios for the global project:
 - Having the capabilities of producing both products but only producing ethanol through the 20-year life of the project;
 - Having the capabilities of producing both products but only producing ENA through the 20-year life of the project.
- Investigating project alternatives:
 - Investing in the necessary equipment to only produce ENA;
 - Investing in the necessary equipment to only produce ethanol for international sale;
 - Investing in the necessary equipment to only produce ethanol for the domestic market;
 - Investing in the global project and selling 100% of ENA and ethanol domestically over the project's life.

Using an excel workbook, students enter various parameters necessary to calculate the Net Present Values (NPVs) and Internal Rate of Return (IRRs) for Pedro Martinez's various scenarios. Students then used the quantitative analysis to answer Q3 through Q6 presented in Exhibit 9.

Case 1 Evaluation

The teaching case called for students to correct the consultant's errors and omissions in deriving the cash flows and identify the correct cost of capital used for the analysis.

Exhibit 9 presents the summary of the evaluation made by two colleagues who have taught business finance. Refer to Appendix A to review the actual responses for ChatGPT-3.5 and 4. Both evaluators rated GPT-4's ability to identify the exclusions and inclusion needed to correct cash flow estimates as outstanding. Moreover, GPT-4 recognized that the consulting firm used the inappropriate discount rate and correctly recommended that the weighted average cost of capital in the case be used. However, both models were *unable* to provide the correct responses for questions that required quantitative analysis. The mathematical capabilities of ChatGPT were limited. GPT-4's demonstrated an ability to reference tables and exhibits where information was located, an ability not exhibited in the GPT-3.5 responses.

Except in one instance, the evaluators were consistent in their assessment of the response quality by GPT-3.5 and GPT-4. Evaluator 1 rated Q3 as outstanding. The rating was assigned because GPT-4 was able to outline all the steps required to derive the capital budgeting cash flows and identify the weighted average cost of capital as the correct rate to use in NPV and IRR. Overall GPT's responses for *Inversiones Istmo* were considered poor by the evaluators.

Exhibit 9. Evaluation of ChatGPT’s Responses for Is the Consultant’s Analysis Correct?

Source: Evaluators for Is the Consultant’s Analysis Correct?

Questions	Evaluator 1		Evaluator 2	
	GPT-3.5	GPT-4	GPT-3.5	GPT-4
Q1 - What were the principal inconsistencies included in Rodriguez Consulting analysis that need correction? Explain.	Poor	Outstanding	Poor	Outstanding
Q2 - What was omitted from the consulting firm's capital budgeting analysis that should have been considered and included? Explain.	Poor	Outstanding	Poor	Outstanding
Q3 - Assuming that there are no capital constraints, what recommendation would you make to Pedro Martinez?	Poor	Outstanding	Poor	Poor
Q4 - Is the option to be able to produce the Extra Neutral Alcohol and Ethanol products worth the additional investments? Explain.	Poor	Poor	Poor	Poor
Q5 - Would your recommendation change if the Ethanol production is designated for sale domestically? Explain.	Poor	Poor	Poor	Poor
Q6 - What recommendation would you make to Pedro Martinez if capital investment funding is of concern and only one of the stand-alone projects can be undertaken?	Poor	Poor	Poor	Poor

Case 2 - When Events Do Not Turn Out as Expected: The Acquisition of All-Occasion Tees Inc.

Case 2 Background

The All–Occasion Tees (AOT) case is a primary-sourced case (Bendeck & Voelker 2023). AOT was a screen-printing company located in Spartanburg, South Carolina that was acquired in 2016 by C&I Investments, a cut and sew business in Honduras with the goal of providing expedited services to its U.S.-based clients. Based on client feedback, C&I was confident that the \$1.7 million acquisition would be profitable. At the time of the acquisition, C&I had been in advanced stages of discussion with two U.S. sports apparel companies to offer screen-printing and third-party logistics services (3PL) not offered by most small screen printers. The logistics services included inventory management, warehousing, and order fulfillment.

Based on the expected volume of business from the 3PL services, C&I rented a facility with 25,000 square feet of warehouse space needed in Spartanburg. The company used the proceeds from the sale of a previously owned property to help finance the \$1.9 million modification to the space, as well as equipment purchases.

With 3PL, C&I's focus was to meet the quick response (hot market) needs that typically required a 24-hour turnaround window and inventory management flexibility for clients who needed small printing runs in the 36 to 48 garments per run. Garments would still be manufactured to client's custom fit specifications in Honduras and shipped to South Carolina at the client's expense. The garments would be warehoused in the facility until screen-printed and shipped per client instructions.

Due to unexpected events, AOT abandoned the 3PL concept in favor of business-to-business (B2B) full screen-printing service including art design, garment selling and screen-printing services in the South Carolina market. AOT bought the garments to be printed from suppliers in the U.S. This segment of the B2B business was referred to as custom printing. In addition, it provided screen-printing services only to large companies in which the client provided the garments to be printed. This segment was referred to as contract business. The custom segment was a high margin, low volume business, while the contract segment was a low margin, high volume business. AOT's net income was -\$819,399, -\$680,008, -\$550,928, in 2017, 2018, and 2019, respectively.

AOT's financial analysis indicated that moving forward, a 30% custom sales volume was required to turn a profit. The company had a production capacity of 675,000 units per year. Target pricing and cost information is provided in Exhibit 10.

Exhibit 10. Target Pricing and Cost Information

Source: AOT's General Manager Interview

	Contract	Custom
Average Pricing	\$2.70	\$9.80
Average Variable Cost	\$0.90	\$6.00
Fixed Cost	\$1,026,000	

By the beginning of 2020, the questions which remained unanswered included: (1) how far AOT needed to grow sales to reach profitability under the 30% custom sales volume plan, (2) whether AOT could realize the price and cost targets it had established, (3) whether AOT had the appropriate physical and human resources necessary to reach a profitable sales volume, and (4) whether the plan, if realized, could lead to profitability.

Case 2 Evaluation

Students were asked a series of 14 questions. Questions Q1 through Q8 in Exhibit 11 focuses on income statement analysis between 2017 and 2019. Students are asked to:

- Describe the pattern of revenues, net income, and gross profit, as well as changes in direct and indirect costs as a percentage of total revenue;
- Describe the pricing and cost structure for contract sales and custom sales and explain the role that each played in the company's product mix.

Questions Q9 through Q14 in Exhibit 11 asked a series of questions relating to the planned solution for the financial situation that asked students to:

- Calculate the breakeven point and the creation of a pro-forma statement based on the resulting breakeven analysis;
- Address whether the company had sufficient production and selling resources needed to reach the breakeven point;
- Discuss and explain which choice they would pick, growing to 30% custom sales or exiting the industry;
- Discuss alternative strategies that could lead AOT to profitability.

Three management faculty members participated in the evaluation of this case. The evaluators' rating summary for GPT-3.5 and 4 appears on Exhibit 11. Refer to Appendix B to review the actual GPT-3.5 and GPT-4 responses.

In the case of GPT-3.5, the evaluators' assessments were identical in 5 of the 14 (36%) questions. The assessment was different across all evaluators in only one instance (7%). Two evaluator assessments were identical in the remaining 8 (57%) questions, with Evaluator 1 and 3 being the most frequent match pair in 5 of the 8 equations. 57% of the questions received a rating of poor, 36% received an acceptable rating, 7% mixed ratings, and none received an excellent rating. While some of the GPT-3.5 responses had merit, the raters largely agreed that GPT-3.5 did not perform well in its responses to these questions.

Overall GPT-4's responses were rated higher than the responses provided by GPT-3.5. Only two (14.3%) of the questions received a poor rating. The evaluators rated the response to 3 (21.4%) questions as excellent and rated 7 (50%) of the questions as acceptable. No consensus was reached by the three evaluators on two (14.3%) questions. The evaluators' assessments were identical in 4 (29%) of the 14 questions. Two evaluator assessments were identical in the remaining 8 (57%) questions, with Evaluator 1 and 3 being the most frequent match pair in 7 of the 8 questions.

Questions Q9, Q10, and Q12 asked students to calculate the contribution margin per unit, the breakeven point, and the creation of a pro-forma statement, respectively. The three evaluators assigned a rating of poor to the GPT-3.5's responses for Q9, Q10, and Q12. The evaluation of the responses to the same questions produced by GPT-4, resulted in a rating of excellent to the contribution margin calculation (Q9), no rating consensus for the breakeven calculation (Q10), and a poor rating across the board for the pro-forma statement construction (Q12). While GPT-4 provides better answers to questions involving math, the results highlight the inconsistent performance on more complex problems such as construction a *pro forma* statement.

Exhibit 11. Evaluation of ChatGPT’s Responses to When Events do Not Turn Out as Expected?

Source: Evaluators for When Events Do Not Turn Out as Expected

Questions	Evaluator 1		Evaluator 2		Evaluator 3	
	GPT-3.5	GPT-4	GPT-3.5	GPT-4	GPT-3.5	GPT-4
Q1 - Describe the changes in revenue across the three years detailed in the case.	Acceptable	Acceptable	Acceptable	Acceptable	Poor	Acceptable
Q2 - Describe the changes in net income across the three years detailed in the case.	Poor	Acceptable	Acceptable	Excellent	Poor	Acceptable
Q3 - How might a firm’s revenue and net income change in opposite directions (how can you sell less, but lose less... or conversely how could you sell more but earn less?)	Acceptable	Acceptable	Acceptable	Excellent	Acceptable	Acceptable
Q4 - Describe changes in variable (direct) costs across the three years detailed in the case. How does labor, printing materials, and the presence or absence of blanks (custom vs. contract) describe the changes in actual cost and cost as a percentage of revenue?	Poor	Poor	Acceptable	Excellent	Poor	Acceptable
Q5 - What is the gross margin for AOT across the time period of the case?	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Q6 - Describe changes in the fixed (indirect) costs across the three years detailed in the case. What factors would describe the changes in actual cost and cost as a percentage of revenue?	Poor	Acceptable	Acceptable	Excellent	Poor	Acceptable
Q7 - Describe the pricing and cost structure associated with the custom sales business. Explain the role of custom orders in the company product mix.	Acceptable	Acceptable	Excellent	Excellent	Poor	Acceptable
Q8 - Describe the pricing and cost structure associated with the contract sales business. Explain the role of contract orders in the company product mix.	Acceptable	Acceptable	Excellent	Excellent	Acceptable	Excellent
Q9 - Given AOT’s confidence in hitting 30%/70% custom/contract units split and their projected price and cost per	Poor	Excellent	Poor	Excellent	Poor	Excellent

Questions	Evaluator 1		Evaluator 2		Evaluator 3	
	GPT-3.5	GPT-4	GPT-3.5	GPT-4	GPT-3.5	GPT-4
unit, what would be their resulting weighted average price per unit, cost per unit, and contribution margin per unit (see Exhibit 14 of case)?						
Q10 - Presuming \$1,026,000 in annual fixed costs and the weighted average contribution margin per unit (from question 3 above), what would AOT's breakeven be if they achieved these goals?	Poor	Excellent	Poor	Poor	Poor	Acceptable
Q11 - Given your breakeven calculation (question 4), does AOT have the production and selling resources and capabilities to reach this target? Are any resources and capabilities lacking?	Acceptable	Excellent	Acceptable	Acceptable	Poor	Excellent
Q12 - Presuming that AOT can produce and sell 675,000 units using the price and variable cost information from question 3, assuming they already have the appropriate resources to operate at this level, and assuming this production volume carries fixed costs of \$1,026,000 with operating and interest expense accounting for \$240,000 of total fixed costs, produce a pro-forma income statement for revenue through pre-tax income.	Poor	Poor	Poor	Poor	Poor	Poor
Q13 - The firm faces a choice between (a) growing towards full capacity with 30% of custom units sold or (b) exiting the industry. Which do you support and what evidence leads you to that?	Acceptable	Acceptable	Poor	Poor	Poor	Acceptable
Q14 - What else could AOT do to improve their profitability?	Poor	Poor	Acceptable	Excellent	Poor	Poor

Case 3 - Bitcoin in El Salvador: Digital Financial Innovation or President Bukele's Gamble?

Case 3 Background

The Bitcoin in El Salvador case is a secondary-sourced case (Anders *et al.* 2024). In 2021, President Nayib Bukele led El Salvador to be the first country to adopt Bitcoin as legal tender. Through a series of initiatives, he pushed for its widespread adoption in the country. President Bukele believed that the use of Bitcoin would help improve access to the formal economy in a country where more than two-thirds of its citizens did not have bank accounts. Furthermore, it was hoped Bitcoin would decrease the costs of citizens receiving remittances from their family members who lived abroad. He was confident that Bitcoin would attract foreign investment and increase tourism, as well as provide Salvadorans with an appreciating currency. The International Monetary Fund and credit rating agencies, however, saw it differently, immediately downgrading El Salvador's debt and raising its borrowing costs or restraining its access to foreign loans until the policy was reversed. Salvadorans themselves were, at best, skeptical, as they remembered the sharp swings in exchange rates and living standards that occurred before El Salvador adopted the U.S. dollar as its official currency in 2001.

Effective September 7, 2021, Salvadorans were able to transact business either in U.S. Dollars (USD), or in Bitcoin (BTC). Exhibit 12 summarizes the provisions of the Bitcoin Law.

Exhibit 12. Provisions of the Bitcoin Law

Source: Decreto N° 57 Ley de Bitcoin (2021)

Market determined exchange rate between the U.S. dollar (USD) and Bitcoin (BTC).

Acceptance of Bitcoin payments by all goods and service providers with the necessary technical capabilities if requested by the purchaser.

Automatic and instantaneous conversion of Bitcoin into Dollars if so desired by the recipient. The guarantee was backed by a \$150 million governmental trust fund.

Prices for goods and services could be quoted in Bitcoin.
Taxes could be paid with Bitcoin.

No capital gains taxes associated with the sale of Bitcoin.

The infrastructure investment to implement the plan would be funded by the government.

The U.S. Dollar would continue to be the currency of reference for accounting purposes.

To facilitate the use of Bitcoin, the Salvadoran government released the Chivo Wallet, a government sponsored mobile app. To promote its use, the government provided the equivalent of \$30 in Bitcoin to anyone who downloaded the app. The Chivo Wallet was a custodial wallet which meant that users did not hold the private keys to their Bitcoins (Casa Presidencial 2021). To facilitate the usage of Bitcoin, the government established 200 Bitcoin ATMs in El Salvador, as well as 50 Bitcoin ATMs in several cities in the United States to promote the transfer of remittances in Bitcoin (Chivo Bitcoin ATMs 2021). While Salvadorans downloaded the app to use \$30 worth of Bitcoin, continuing use did not materialize (Alvarez *et al.* 2022).

A year after the rollout, only 24.4% of 1,267 individuals surveyed in a public opinion poll indicated that they used Chivo to make purchases or payments. In addition, only 16.5% of the respondents indicated that the Bitcoin initiative was a success. In the same survey 77.1% of the respondents disapproved of the use of public money to buy Bitcoin (Instituto Universitario, 2022). Low Bitcoin usage was also reported by El Salvador's Chamber of Commerce and Industry, whose survey results indicated that 86% of local businesses had not made any sales using Bitcoin, and only 14% had. Meanwhile, 3.6% of local stores indicated that Bitcoin had

contributed to an increase in their sales, while 91.7% reported that the implementation of Bitcoin had no effect on their businesses (McDonald 2022).

Exhibit 13 reports the Bitcoin investments made by El Salvador. As of April 10, 2023, El Salvador's BTC holdings were estimated at 2,546 BTC. This is up from the 2,381 BTC announced after a purchase of 80 BTC in July 2022, and a tweet from President Bukele on November 16, 2022, which stated that El Salvador would purchase 1 BTC per day, beginning the next day. The Bitcoin holding had an approximate market value of \$77 million and an estimated purchase price of \$108 million, representing a 29% loss on the BTC holdings (McDonald 2023).

Exhibit 13. El Salvador's Bitcoin Investment*Source: Adapted from Prashant (2022)*

Purchase Date	Bitcoin Quantity	Cost per Bitcoin	Total invested
September 6, 2021	400	\$46,811	\$18,724,400
September 7, 2021	150	\$46,091	\$6,913,650
September 19, 2021	150	\$42,843	\$6,426,450
October 27, 2021	420	\$60,622	\$25,461,240
November 26, 2021	100	\$54,815	\$5,481,500
December 3, 2021	150	\$48,670	\$7,300,500
December 21, 2021	21	\$49,220	\$1,033,620
January 21, 2022	410	\$36,585	\$15,000,000
May 9, 2022	500	\$30,744	\$15,372,000
June 30, 2022	80	\$19,000	\$1,520,000
November 17, 2022	1 per day and thereafter	Between \$16,687 and \$30,253 as of writing	~\$5,000,000 as of April 10, 2023

Given the fluctuations in the Bitcoin market, the level of public support for the Bitcoin rollout, and the attitude of external investors toward Bitcoin adoption, students are asked to evaluate whether the President's choice to adopt Bitcoin as legal tender was a clever idea? How was it superior - or not - from dollarization?

Case 3 Evaluation

The case has two sets of questions, one designed to be used in an international finance course and another designed for economic courses dealing with money and banking issues.

The international finance questions led students to address:

- The political risk in El Salvador;
- Compare dollarization and Bitcoin adoption;
- The application of Mundell-Fleming Trilemma to Bitcoin adoption;
- The impact of remittances on international financial statistics.

The economics questions led student to:

- Compare and contrast Bitcoin to the U.S. Dollar by applying the concept of medium of exchange, unit of account, and store of value;
- Discuss the impact that Bitcoin adoption has on inflation expectations;
- Evaluate the impact of the adoption of Bitcoin on El Salvador's central bank credibility and its ability to respond to recessions;

- Identify the assumptions that are required to make El Salvador’s adoption of Bitcoin wise; what assumptions are required to make the adoption unwise?
- Discuss what the world would look like if Bitcoin was legal everywhere;
- Debate the four positions:
 - Banning Bitcoin as legal tender;
 - Allow Bitcoin use but not make it legal tender;
 - Allow both Bitcoin and dollars as legal tender;
 - Make Bitcoin the sole legal tender.
- For advanced exploration, are the proposed volcano bonds correctly priced?

Two management faculty members familiar with the international finance topic evaluated the responses to international finance questions. The economics questions were evaluated by one economics faculty member. The evaluators’ rating summary for GPT-3.5 and GPT-4 for the international case questions and the economics case questions are presented in Exhibit 14 and 15, respectively. Refer to Appendix C to review the actual GPT-3.5 and GPT-4 responses.

Evaluators reviewing the international finance answers considered all responses, from both versions, acceptable or outstanding. However, the economics evaluators found ChatGPT-4.0 superior to ChatGPT-3.5. Both evaluators rated 3 out of the 4 (75%) of the questions generated by GPT-4 as outstanding. The evaluator who reviewed the responses to the economics questions considered the responses from GPT-3.5 of better quality by rating 4 of 7 (57.2%) responses as outstanding compared to only 2 of 7 (28.6%) of the responses provided by GPT-4.

Exhibit 14. Evaluation of ChatGPT’s Responses to Bitcoin in El Salvador: Digital Financial Innovation or President Bukele’s Gamble? – International Finance

Source: Evaluators of the International Finance Questions

Questions	Evaluator 1		Evaluator 2	
	GPT-3.5	GPT-4	GPT-3.5	GPT-4
Q1 - What were some of the changes to political risk in El Salvador after President Bukele was elected?	Acceptable	Outstanding	Poor	Outstanding
Q2 - What were the reasons why the government of El Salvador decided to adopt Bitcoin as a legal tender? Compare and contrast Bitcoin’s adoption and dollarization in El Salvador.	Outstanding	Outstanding	Acceptable	Outstanding
Q3 - The Mundell-Fleming Trilemma discusses how countries need to select two of three choices: Fixed exchange rate, Free flow of capital or Independent monetary policy. What choice is the government of El Salvador making by adopting Bitcoin as a legal tender in addition to the U.S. dollar?	Poor	Acceptable	Acceptable	Outstanding
Remittances are classified as secondary income in the Balance of Payments. If remittances can be transferred via cryptocurrency (in this case via Chivo Wallet), what could be the impact on international financial statistics?	Poor	Outstanding	Acceptable	Outstanding

Exhibit 15. Evaluation of ChatGPT's Responses to Bitcoin in El Salvador: Digital Financial Innovation or President Bukele's Gamble? – Economics Questions

Source: Evaluator of the Economics Questions

Questions	GPT-3.5	GPT-4
Q1 - Using the concepts of (1) medium of exchange, (2) unit of account, and (3) store of value, compare and contrast the U.S. dollar with Bitcoin.	Acceptable	Outstanding
Q2 - Most central banks are charged with maintaining price stability and maintaining full employment. How does the adoption of Bitcoin as legal tender further these goals? What are the consequences for inflation expectations?	Outstanding	Acceptable
Q3 - Considering El Salvador's starting point of dollarization, evaluate the effect of President Bukele's actions on central bank credibility and ability to respond to recessions? Summarize the IMF's reaction.	Acceptable	Acceptable
Q4 - What assumptions are required for El Salvador's adoption of Bitcoin to be wise? What assumptions for it to be unwise? Which do you think is the case?	Outstanding	Acceptable
Q5 - Discuss what the world would look like if Bitcoin were legal tender everywhere.	Outstanding	Acceptable
Q6 - Debate the Bitcoin positions 1) Ban Bitcoin in El Salvador, (2) Allow Bitcoin transactions but do not make it legal tender, (3) Preserve the current status quo in which both the US Dollar and Bitcoin are legal tender, and (4) Make Bitcoin the sole legal tender of El Salvador.	Outstanding	Outstanding
Q7 - Beyond asking students about the bond issue features and fund usage, the question for students to explore is: Has El Salvador correctly priced the "volcano" bonds to entice investors to purchase them?	Acceptable	Acceptable

Conclusion

This article detailed the performance quality of ChatGPT-3.5 and ChatGPT-4 on discussion questions associated with three published business teaching case studies. The questions posed to generative AI came from the instructor's manual of the published cases. Responses from the generative AI were evaluated by two to three faculty members per case. The raters used the rubrics provided in each case's instructors manual and these rubrics provided guidance on what type of answer was poor, acceptable/good, or excellent/outstanding.

The primary conclusion is that ChatGPT-3.5 performed better than anticipated and ChatGPT-4 performed well, particularly in Case 2 (When Events Do Not as Turn Out as Expected) and Case 3 (Bitcoin in El Salvador). ChatGPT-3.5 performed poorly on 100% of the items in Case 1 (Is the

Consultant’s Analysis Correct?) and 52% of the items in Case 2. But ChatGPT-3.5 only performed poorly on 38% of the items in Case 3. By contrast, ChatGPT-4 performed poorly on 58% of the items in Case 1, but then only performed poorly on 19% of Case 2 and none of the items on Case 3. See Exhibit 16.

Exhibit 16. Summary of Ratings for ChatGPT-3.5 and ChatGPT-4.0

Source: Created from Ratings Reported in Exhibit 9, 11, 14 and 15

	ChatGPT-3.5			ChatGPT-4.0		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
Poor ratings	12	22	3	7	8	0
Good/Acceptable ratings	0	18	4	0	20	1
Excellent/Outstanding ratings	0	2	1	5	14	7

ChatGPT-4 clearly outperformed its earlier version driven both by improvements in the generative AI itself but also through the ability of ChatGPT-4 to read tables and access the Internet. Both versions performed better on qualitative than on quantitative questions. Quantitative questions, for instance the breakeven questions in Case 2, proved interesting because the generative AI would follow a correct process for the calculation but would draw incorrect data from the case itself.

Making up data was the only observed manifestation of “*hallucination*” in this study. Perhaps because both versions of ChatGPT had been trained with the case narrative, the ChatGPT answers to qualitative questions typically drew appropriate material from the case and used it reasonably when preparing answers. Conclusions presented by the generative AI were ‘*correct*’ for the incorrect calculation. Further, ChatGPT-4 performed better than ChatGPT-3.5 on these questions, which suggests that future iterations of the application may prove excellent in their ability to address such questions.

At the time of this study, both ChatGPT-3.5 and ChatGPT-4 did not read tables very well and, when asked about information which would be found in a table, both versions made up answers. ChatGPT-4, for example, would read the top row of an income statement correctly and

interpret the change in revenue over time correctly. ChatGPT-3.5 had difficulty with the same activity – but both versions clearly described a change in net income over the three years in the AOT case. When asked about information found further down in the income statement, net income for example, both versions simply made-up data.

From Bloom’s taxonomy perspective, both versions of ChatGPT perform better at lower order reasoning than at higher order reasoning. Iowa State University provides a useful guide to the revised version of Bloom’s taxonomy (Iowa State University 2024). Bloom’s taxonomy arranges learning into a hierarchy of thinking from lower order recollection to higher order creation.

- **Remember** – the ability to recall facts, concepts, or procedures.
- **Understand** – the ability to construct meaning from facts, concepts, or procedures.
- **Apply** – the ability to operationalize a procedure or model.
- **Analyze** – the ability to deconstruct a concept into its parts as well as the ability to identify the relationships between parts of a whole.
- **Evaluate** – the ability to make judgments consistent with facts, context, and appropriate frameworks.
- **Create** – The ability to assemble parts into a new, non-derivative, whole.

Tasked to recall or explain concepts, ChatGPT performed quite well. Tasked to apply or analyze, evaluate or create, it performed less well. For the two higher order functions, this may be less a limitation of the AI than it is a restriction in place in its programming – both versions of ChatGPT proved averse to ‘*making a decision,*’ often providing an ineffective ‘*this could be used in many different ways, for example...*’ response when asked to take a position. However, a skilled operator of ChatGPT can use ChatGPT to build arguments to defend a position that the operator takes, even if ChatGPT itself will not commit to a position.

We asked our colleagues a set of follow-up questions after completing their evaluation of ChatGPT’s case responses. Each faculty member was asked three questions. First, what was your overall impression of ChatGPT and its ability to address case questions? Second, how do you compare the quality of the AI responses to those of undergraduate students you have taught? Third, what opportunities or concerns do you perceive following this exercise? We were not

able to gather responses from all evaluators, but the five who responded offered insights into the results from all three cases.

What was your overall impression of ChatGPT's case responses?

- Accounting professor - *"I felt that Chat GPT 3.5 was substantially inferior to Chat GPT 4.0. Chat GPT 4.0 did well on questions that dealt with what factors to consider in a capital budgeting case. However, the analysis only told you what to do on questions where a specific recommendation was required. In those situations, neither Chat GPT 3.5 nor Chat GPT 4.0 generated the after-tax cash flows for any projects with their net present value and internal rate of return. The net present value and internal rates of return reported in the answers to Question 6 are from Exhibit 10 and Exhibit 11. The after-tax cash flows presented in these exhibits were not adjusted for some of the factors in Exhibit 12."*
- Management professor #1 - *"I was underwhelmed. At times, it didn't seem to answer the question directly and sometimes would answer a question that wasn't asked."*
- Management professor #2 - *"The AI is not quite at the level of an A-student yet, and it is prone to "AI hallucinations" (to use the technical term). I was impressed by the improvement between ChatGPT 3.5 and ChatGPT 4.0. A key concern of mine is the rate of progress of AI, as it might eventually catch up in future versions, especially as students may get creative with prompt engineering and ask the AI to "mimic the answer of a typical student."*
- Economics professor - *"The AI responded accurately to the questions asked and seemed to provide spot on answers compared to the control responses. Some of the AI responses though did not expand on the direct points made, which could be a downfall in questions that require responses to have explanations and examples included. Overall, I thought the AI was impressive in its ability to formulate responses."*
- Finance professor - *"ChatGPT 3.5 did not do well on either theoretical or numerical questions in this case analysis. GPT 4 was a little better at some of the questions but could not perform a good numerical analysis. Based on my personal experience with GPT 3.5 and GPT4, to get a good answer the prompt needs to be very detailed, and the*

information fed to it needs to be in small parts. Even with a detailed prompt, there are still limitations.”

How do you compare the quality of responses to those of undergraduate students?

- Accounting professor – *“I would require the students to report the after-tax cash flows for each year as well as the net present value or internal rate of return for the project for the base case. Then, I would ask for some sort of sensitivity analysis. Neither Chat GPT 3.5 nor Chat GPT 4.0 provided this information. For universities that require students to have knowledge of Excel prior to taking the undergraduate core finance course, instructors may require students to submit an Excel spreadsheet to the instructor as part of the assignment. Neither Chat GPT 3.5 nor Chat GPT 4.0 provided an Excel spreadsheet.”*
- Management Professor #1 – *“I would say the AI was middle of the pack. Some undergrads would answer much better while others would be worse.”*
- Management Professor #2 – *“AI used considerably more structure in the response, and always used proper grammar and punctuation.”*
- Economics Professor – *“The AI was more direct with responses than undergraduates I have taught before. I notice that undergraduates tend to meander in their written explanations and at times overexplaining in their answers.”*
- Finance Professor – *“GPT 4 did better than the students on the questions involving concepts and understanding of concepts but did not perform the required calculations that the undergraduate students could have done.”*

What opportunities or concerns do you perceive following this exercise?

- Accounting Professor – *“Students may use AI to generate some general discussion points for a specific capital budgeting assignment that may contain discussion points not specifically related to the case. In the future, AI may be able to generate Excel spreadsheets for problems that have a standard input and output, such as for capital budgeting. In that situation, I would not ask students to prepare an Excel spreadsheet for the assignment. Thus, the students would not get practice of creating an Excel spreadsheet for a specific problem. Instead, I would ask students to try to understand the assumptions underlying the Excel spreadsheet model and to make changes in the model to handle certain modifications in the capital budgeting project.”*
- Management Professor #1 – *“I think the biggest opportunity is to learn how AI might respond to prompts and provide insight to instructors regarding what responses might be common.”*
- Management Professor #2 – *“A concern would be the rate of progress of AI, and AI eventually catching up if we don't change our assignments. One opportunity would be to teach students about prompt engineering, and for us to teach how to write a proper AI prompt. The student still needs to accurately describe the case to an AI with natural language, which is a new type of skill that requires both creativity and critical thinking. Without a good prompt, the AI is more likely to give the wrong answer.”*
- Economics Professor – *“There are many opportunities that can arise with using AI in assignments since that seems to be where the future is heading - teaching students how to use AI and when it is appropriate through assignments that critique answers, similar to this study, would be a good tool to use in the classroom.”*
- Finance Professor – *“The questions after a case typically do not break down the steps needed to answer the question. They assume that the students will know what is the relevant analysis and calculations that need to be performed to answer the question. The current version of GPT 3.5 and 4 is limited in the depth of the answer and typically cannot do multi-step analysis unless specifically prompted to (and everything is broken down into multiple small steps). As GPT versions evolve and students get better at prompt*

engineering, AI abilities will increase and may require adapting the requirements for students as they work on cases, i.e. ChatGPT may be required to be used as a tool for some portions of the analysis and then students can assess critically the GPT answers for accuracy and completeness and analyze further if needed.”

Faculty members face a challenging task addressing generative AI in their class deployments. The technology is both too new for there to be clear guidance on how to use it yet increasing in capability at such a rapid pace that such guidance, if it existed, might be soon obsolete. Indeed, in the time taken to prepare this manuscript, the functionality of both ChatGPT-3.5 and ChatGPT-4 changed in ways that necessitated revisions or replacements of entire passages of early drafts. Collectively this limits the precision of the conclusions which we can identify.

The simplest conclusion is that generative AI has already changed the landscape of education. Students should be presumed to have access to older versions of ChatGPT through its integration into Bing and through the currently free access to ChatGPT-3.5 provided by OpenAI. It follows that some students are likely to utilize ChatGPT in preparation of answers to assignments (Duong and Tran 2023) and our examination suggests that the answers provided will at times be quite good.

Further, students who have access to the most recent versions of the AI are quite likely to have access to excellent responses to questions posed in these types of cases. Additionally, the skill of the student in querying the AI, to recognize hallucinations, and to identify when (and how) to ask the AI follow-up questions will lead to different quality of answers to work from (or turn in for credit!). This suggests that the level of access to generative AI and the student-operator's skillset may influence the student's perceived utility of generative AI.

The facts that generative AI hallucinates and that the skill of the operator in querying the AI can affect the quality of the output suggests potential value in using generative AI to assist in teaching with cases. Instructors can use ChatGPT and provide potential answers produced by

ChatGPT to their students. Such answers could be used to identify hallucinations, to provide extensions to a class discussion, or to task students to evaluate the quality of the generative AI's answer. Authors of future cases might be advised to consider how current versions of the AI can handle their planned discussion questions and provide instructor's manual guidance on how to deploy generative AI while teaching with that case.

The apocryphal proverb, "*may you live in interesting times,*" seems appropriate here. Given its speed of adoption and speed of improvement, generative AI is already poised to be one of the more significant innovations in both business and education. We cannot be certain of how generative AI will transform, only that it will transform.

Appendix A – Is the Consultant’s Analysis Correct? ChatGPT Responses and Rating Rubric

Question 1 - What were the principal inconsistencies included in Rodriquez Consulting analysis that need correction? Explain.			
Rating	Poor - Unable to answer or none of the items identified in the answer key.	Acceptable - Identify one of the items on the answer key	Outstanding - Identify all of the items in the answer key
Answer Key	<ul style="list-style-type: none"> • Interest and principal repayments should have been excluded. • The discount factor of 2% should be replaced with the WACC. The discount rate is substantially below Istmo's WACC of 16.55%. The lower hurdle rate used results in increased NPV. Even if Rodriquez Consulting’s cash flow calculations were done correctly, the use of a discount factor that is below Istmo's WACC would lead to an incorrect acceptance decision. 		
GPT 3.5 Response	<p>I'm sorry, but without specific information or context about the analysis conducted by Rodriquez Consulting, I cannot provide a detailed answer regarding the specific inconsistencies that may need correction. To identify the principal inconsistencies in an analysis, I would need access to the specific analysis or at least a description of the key findings, assumptions, or methodologies used in the analysis. If you can provide more details about the analysis conducted by Rodriquez Consulting, I'll do my best to help identify any potential inconsistencies or areas that may require correction.</p>		
GPT 4 Response	<p>Based on the information provided, there are several inconsistencies and areas of concern in the analysis by Rodriquez Consulting that Pedro Martinez found. Some of these include:</p> <ul style="list-style-type: none"> • Discount Rate: The discount rate used in the initial analysis is only 2%, which is far below the firm's weighted average cost of capital (WACC) of 16.55%. The choice of discount rate significantly impacts the NPV and IRR calculations and should align more closely with the firm's actual cost of capital. • Inflation Rate: The analysis assumes a 2% inflation rate, while the country's inflation has fluctuated between 3% and 6.7% in the past decade. This underestimation can result in skewed projections of future costs, revenues, and profitability. • Valuation Methodology: Pedro noted that the approach used seemed more like a real estate valuation, including items usually excluded in business finance capital budgeting. It's unclear what specific items were of concern, but this indicates that the financial modeling approach was not aligned with the best practices for this kind of investment. • Sensitivity Analysis: The initial sensitivity analysis by the consulting firm seems to be confined to a limited price range. Pedro decided to expand the price sensitivity analysis beyond this, which could affect the project’s estimated viability. 		

	<ul style="list-style-type: none"> • Tax Rate for Ethanol: For the Ethanol project, a tax rate of 0% is used, presumably based on the idea that the revenue would be tax-exempt due to the principle of territorial income. While this could be accurate, it's a point that would need verification, especially when producing for export markets where various tariffs and taxes could apply at the buyer's end. • Cash Flow Estimates: Pedro found some irregularities in the derivation of cash flows, although the details aren't provided. Cash flows are a critical element in the NPV and IRR calculations, and errors here could dramatically change the financial viability of the project. • Depreciation Method: Additional information provided by Pedro suggests using straight-line depreciation over 20 years. However, it's unclear if Rodriquez Consulting accounted for this properly in their calculations. • Net Operating Working Capital and Salvage Value: These were not included in the initial reports but are generally considered essential in a capital budgeting analysis. Pedro provides these values in Exhibit 12, suggesting they should be included in a more thorough analysis. • Loan Terms: The terms of the loan (interest rate, period) are used without much context on how they fit into the broader financial landscape, the firm's debt structure, or whether they are in line with current market conditions. <p>Addressing these inconsistencies would offer a more accurate and comprehensive analysis to inform the decision-making process.</p>
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Question 2 - What was omitted from the consulting firm's capital budgeting analysis that should have been considered and included? Explain.			
Rating	Poor - Identify less than 3 items omitted.	Acceptable – Identify three of the five items omitted	Outstanding - Identify all five items omitted
Answer Key	<ul style="list-style-type: none"> • Given that the project was an expansion of business, NOWC requirements should have been incorporated into the analysis as part of the initial outlay. • Similarly, the recovery of NOWC in the terminal year of the project should have been included. • With the magnitude of the capital expenditures in plant and equipment, depreciation was overlooked in the analysis. Under the country's tax code, the equipment is depreciable on a straight-line basis over a 20-year period and deductible as an expense. • Salvage value of the equipment in the terminal value of the project was not included. • Although a 2% inflation rate was mentioned in the analysis, the inflation adjustment was not made by the consultant. Rodriquez Consulting indicated that their cost estimates were on the high side, above current costs, so they did not explicitly 		

	<p>include inflation in the analysis. Given the pattern of inflation in the country, Pedro Martinez believed it was advisable to include a 2% inflation adjustment per year on project costs.</p>
<p>GPT 3.5 Response</p>	<p>Without information about the specific capital budgeting analysis conducted by Rodriguez Consulting, it is difficult to pinpoint what might have been omitted. However, in a capital budgeting analysis, several factors should typically be considered and included. Here are some common elements that could be relevant:</p> <p>Projected cash flows: The analysis should consider all relevant cash flows associated with the investment project, including initial investment costs, operating cash inflows and outflows, salvage value, and potential tax implications.</p> <p>Time value of money: The time value of money recognizes that a dollar received in the future is worth less than a dollar received today. Therefore, the analysis should incorporate discounted cash flow techniques, such as net present value (NPV) or internal rate of return (IRR), to account for the time value of money.</p> <p>Risk assessment: It's important to consider the risk associated with the investment project. Factors like market conditions, competition, regulatory changes, and other relevant risks should be evaluated and incorporated into the analysis. Techniques like sensitivity analysis or scenario analysis can help assess the impact of varying risk levels on the project's financial viability.</p> <p>Opportunity cost: The analysis should account for the opportunity cost of investing in one project over another. This means considering alternative investment options and comparing their potential returns and risks.</p> <p>Capital structure and financing: The analysis should evaluate the appropriate capital structure and financing options for the project. This involves determining the optimal mix of equity and debt, considering the cost of capital, and assessing the impact of financing decisions on the project's financial metrics.</p> <p>Non-financial factors: While financial metrics are crucial, non-financial factors should also be considered if relevant. These may include environmental impact, social considerations, strategic alignment, or other qualitative aspects that could impact the overall project evaluation.</p> <p>These are general considerations, but to identify specifically what was omitted in Rodriguez Consulting's capital budgeting analysis, it would be necessary to review the analysis or obtain more specific information about the project and the analysis conducted.</p>
<p>GPT 4 Response</p>	<p>Based on the information provided, the consulting firm's capital budgeting analysis appeared to omit several important factors that should typically be included for a more comprehensive and accurate evaluation. These are:</p> <p>1. Weighted Average Cost of Capital (WACC): The WACC of 16.55% was not considered in the discount rate, which can result in a skewed NPV and IRR. Using the company's actual cost of capital is vital for a more accurate financial analysis.</p>

2. **Net Operating Working Capital:** Typically, a certain amount of working capital is needed to maintain operations, especially for projects of this scale. Pedro suggests that it should be 10% of the CAPEX, but this was not included in the original calculations.

3. **Salvage Value:** The estimated salvage value of the equipment after 20 years (15% of CAPEX, according to Pedro) should also be included in the cash flow estimations for a more accurate NPV calculation.

4. **Sensitivity Analysis:** A robust sensitivity analysis, which would account for price fluctuations in the Extra Neutral Alcohol and Ethanol markets, was not provided. Pedro mentions price sensitivity ranges, which should have been included to understand the risks associated with price volatility.

5. **Risk Assessment:** Given the uncertainty due to the COVID-19 pandemic and other market conditions, a risk analysis could offer valuable insights into the project's feasibility and what kinds of contingencies may be necessary.

6. **Depreciation Method:** While Pedro indicates a straight-line method over 20 years for depreciation, it's unclear if this was considered in the original analysis. Accurate accounting for depreciation is important for tax purposes and for accurately calculating net income.

7. **Tax Implications:** For the Ethanol project, a 0% tax rate is assumed, which should be verified. Moreover, the impact of various kinds of taxes, including potential tariffs or export taxes, were not considered.

8. **Impact of Inflation:** Although a 2% inflation rate was assumed, a more detailed assessment of how inflation could impact costs and revenues in the future would provide a fuller picture of the project's financial viability.

9. **Foreign Exchange Risk:** Since this is a global project, there might be currency risks involved, especially if sales or inputs are in different currencies. This is usually an important consideration in global capital budgeting but was not mentioned.

10. **Regulatory and Compliance Costs:** The cost of meeting legal and regulatory requirements, especially in foreign markets, was not discussed. These can have a significant impact on the profitability of a project.

11. **Comparison with Standalone Projects:** Given the pandemic, Pedro also believes that the capital budgeting analysis for individual projects should be presented as standalone entities in case they want to minimize investment. This wasn't included in the original analysis.

Including these omitted elements would create a more robust, realistic, and comprehensive capital budgeting analysis.

Question 3 - Assuming that there are no capital constraints, what recommendation would you make to Pedro Martinez? Explain the reasoning behind the selection of any of the three options available or the rejection of all projects.

<p>Rating</p>	<p>Poor - No project decision made</p>	<p>Acceptable - Explain the reasoning behind the selection of any of the three options available or the rejection of all projects.</p>	<p>Outstanding - Identify the selection of the global project for the flexibility it provides.</p>																																																		
<p>Answer Key</p>	<p>In contrast to the consultant's global project results (Exhibit 2), the results, obtained once the correct methodology is applied, show that all NPVs for the Ethanol scenarios are negative, as well as one of the scenarios for Extra Neutral Alcohol, supporting Pedro's initial negative reaction to the global project.</p> <p>In addition, at \$0.60 per liter for the Ethanol global project, the IRR calculation results in an error "#NUM!" Normally individuals associate this error message with multiple internal rates of return, but in this case, multiple internal rates of return do not exist. The other instance where this error happens is when, at any WACC, the NPV is never positive. At a price of \$0.60, the NPV for the Ethanol global project at 0% is - \$1,111,163 and becomes increasingly negative at higher WACC.</p> <p>The summary tables show the worst-case scenario for the global project profitability assuming that over the life of the project's total production is dedicated to producing only one product as indicated in the respective tables. This would occur if the differential in market pricing between the two product lines is such that one product is always more profitable.</p> <p>Students will tend to choose the stand-alone Ethanol project since the NPV is the highest, dismissing the global project's built-in flexibility of producing two different products based on prevailing market prices. Students will automatically assume that the tax treatment of earnings is the difference. While it is correct that taxation differences are a substantial driver, students should also recognize that the per liter cost of production is lower and the liters available for sale is higher with Ethanol. These points will be reinforced in Question 5. Question 4 elaborates on the value of the global project's inherited flexibility.</p> <table border="1" data-bbox="488 1396 1409 1862"> <thead> <tr> <th colspan="5">100% Production in Extra Neutral Alcohol (US Dollars)</th> </tr> <tr> <th></th> <th colspan="2">Global</th> <th colspan="2">Stand-Alone</th> </tr> <tr> <th>Sales price</th> <th>NPV</th> <th>IRR</th> <th>NPV</th> <th>IRR</th> </tr> </thead> <tbody> <tr> <td>\$0.65</td> <td>(\$3,419,424)</td> <td>9.09%</td> <td>(\$2,415,405)</td> <td>10.50%</td> </tr> <tr> <td>\$0.70</td> <td>\$154,346</td> <td>16.84%</td> <td>\$1,158,366</td> <td>18.70%</td> </tr> <tr> <td>\$0.75</td> <td>\$3,728,117</td> <td>23.18%</td> <td>\$4,732,136</td> <td>25.50%</td> </tr> <tr> <td>\$0.80</td> <td>\$7,301,888</td> <td>28.95%</td> <td>\$8,305,907</td> <td>31.80%</td> </tr> <tr> <td>\$0.85</td> <td>\$10,875,659</td> <td>34.43%</td> <td>\$11,879,678</td> <td>37.80%</td> </tr> <tr> <td>\$0.90</td> <td>\$14,449,429</td> <td>39.75%</td> <td>\$15,453,449</td> <td>43.6%</td> </tr> <tr> <td>\$0.95</td> <td>\$18,023,200</td> <td>44.96%</td> <td>\$19,027,219</td> <td>49.3%</td> </tr> </tbody> </table>			100% Production in Extra Neutral Alcohol (US Dollars)						Global		Stand-Alone		Sales price	NPV	IRR	NPV	IRR	\$0.65	(\$3,419,424)	9.09%	(\$2,415,405)	10.50%	\$0.70	\$154,346	16.84%	\$1,158,366	18.70%	\$0.75	\$3,728,117	23.18%	\$4,732,136	25.50%	\$0.80	\$7,301,888	28.95%	\$8,305,907	31.80%	\$0.85	\$10,875,659	34.43%	\$11,879,678	37.80%	\$0.90	\$14,449,429	39.75%	\$15,453,449	43.6%	\$0.95	\$18,023,200	44.96%	\$19,027,219	49.3%
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100% Production in Ethanol (US Dollars)				
	Global		Stand-Alone	
Sales price	NPV	IRR	NPV	IRR
\$0.60	(\$4,742,589)	#NUM!	(\$3,451,442)	6.30%
\$0.62	(\$2,657,889)	9.70%	(\$1,366,742)	13.30%
\$0.64	(\$573,190)	15.30%	\$717,958	18.60%
\$0.65	\$469,160	17.60%	\$1,760,308	20.90%
\$0.70	\$5,680,909	27.20%	\$6,972,057	31.20%
\$0.75	\$10,892,658	35.60%	\$12,183,806	40.50%
\$0.80	\$16,104,407	43.50%	\$17,395,555	49.20%
\$0.85	\$21,316,156	51.20%	\$22,607,304	57.80%
\$0.90	\$26,527,906	58.70%	\$27,819,053	66.20%
\$0.95	\$31,739,655	66.10%	\$33,030,802	74.50%

GPT 3.5 Response	<p>As an AI language model, I don't have access to the specific details of Pedro Martinez's situation or the context of his decision-making process. However, if we assume that there are no capital constraints, I can provide a general recommendation based on typical considerations in business decision-making. Given the absence of capital constraints, Pedro Martinez should consider the following factors:</p> <p>Potential Return: Evaluate the potential return on investment for each available option. Assess the expected profitability and growth prospects of each alternative.</p> <p>Risk Assessment: Consider the risks associated with each option. Evaluate the likelihood and potential impact of risks such as market fluctuations, competitive factors, regulatory changes, and other relevant risks.</p> <p>Strategic Fit: Assess how well each option aligns with Pedro Martinez's long-term strategic goals and objectives. Consider the impact on market positioning, competitive advantage, and overall business strategy.</p> <p>Market Analysis: Conduct a thorough analysis of the market conditions and trends related to each option. Consider factors such as market size, growth potential, competitive landscape, and customer demand.</p> <p>Operational Considerations: Evaluate the operational requirements and feasibility of each option. Consider factors such as resource allocation, technological requirements, scalability, and potential synergies with existing operations.</p> <p>Flexibility and Adaptability: Assess the flexibility and adaptability of each option in response to changing market conditions or future strategic shifts. Consider the potential for expansion, diversification, or exit strategies.</p>
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	<p>Sustainability and Social Impact: Consider the environmental and social impact of each option. Evaluate factors such as sustainability practices, corporate social responsibility, and the potential for positive community impact.</p> <p>Based on a comprehensive evaluation of these factors, Pedro Martinez should select the option that aligns most closely with his long-term goals, offers the highest potential return, manages risks effectively, and fits well within the broader strategic context. It's important to note that the specific details and circumstances of the available options would greatly influence the final recommendation.</p>
<p>GPT 4 Response</p>	<p>Assuming no capital constraints, several factors need to be considered for a recommendation:</p> <p>Discount Rate: The project's discount rate in the Rodriguez Consulting analysis is 2%, which is considerably lower than the 16.55% Weighted Average Cost of Capital (WACC) given in Exhibit 12. This change in discount rate would significantly impact the NPV and make the project less attractive than initially indicated.</p> <p>Net Operating Working Capital, Depreciation, and Salvage Value: These are key elements that were missing in the original analysis and incorporating them would provide a more realistic estimate of cash flows, and consequently, NPV and IRR.</p> <p>Price Sensitivity: According to Exhibit 12, the price of Ethanol and Extra Neutral Alcohol could fluctuate between \$0.60 to \$0.95 per liter. A sensitivity analysis should be conducted to understand how these fluctuations would affect the project's profitability.</p> <p>Product Diversification: Producing both Ethanol and Extra Neutral Alcohol could be a strategic move to diversify risk. If one product faces decreased demand or increased production costs, the other could potentially make up for the shortfall. However, the additional investment required for this needs to be quantified and assessed against the projected incremental revenues and cash flows.</p> <p>Market Conditions: Given the COVID-19 situation, there may be changes in demand and supply chain logistics, impacting both costs and revenues. A scenario analysis should be conducted to estimate how different COVID-19 related market conditions could affect the project.</p> <p>Recommendation: Given that there are no capital constraints, it would be advisable for Pedro Martinez to:</p> <ul style="list-style-type: none"> • Rework the capital budgeting analysis incorporating all the missing factors like WACC, working capital, depreciation, salvage value, etc. • Conduct sensitivity and scenario analyses to assess the robustness of the project against economic fluctuations and changes in market conditions. • Consider product diversification (both Ethanol and Extra Neutral Alcohol) as a strategic move, provided the additional investment yields a positive incremental NPV.

	<ul style="list-style-type: none"> If the reworked analysis still shows a positive NPV and an IRR greater than the WACC, then the project could be considered financially viable and worth pursuing.
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Question 4 - Is the option to be able to produce the Extra Neutral Alcohol and Ethanol products worth the additional investments? Explain.

Rating	Poor - No project recommendation made.	Acceptable - Identify whether there is support for the global project or not, with the rationale for the choice made.	Outstanding - Identify the selection of the global project for the flexibility it provides.
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Answer Key	<p>If Istmo decides to undertake the Ethanol stand-alone project, it would reduce its capital expenditures by \$1,250,000 but forego the opportunity to take advantage of differential prices in the two product lines that would allow it to maximize FCFs. To illustrate, if in year 5 the sales price per liter of Ethanol is \$0.75 and that of Extra Neutral Alcohol is \$0.95, the company would be foregoing \$542,328 in FCFs. The price differential between the two product lines must be sufficient to compensate for the tax disadvantage of the higher production cost per liter, and the smaller liter capacity associated with Extra Neutral Alcohol production. See table below.</p>		
		Stand-alone Ethanol @ \$0.75 per liter in Year 5; Global Project producing Extra Neutral Alcohol @ \$0.95 per liter in Year 5	Global Project producing Extra Neutral Alcohol @ 0.95 per liter in Year 5
	FCFs	\$4,307,227	\$5,473,561
	PV of FCFs in Year 5	\$2,002,794	\$2,545,122
	Value foregone due to loss of flexibility.		\$542,328

GPT 3.5 Response	<p>To determine whether the option to produce both Ethanol and Extra Neutral Alcohol (ENA) is worth the additional investment, several factors need to be considered:</p> <p>Market Demand: Assess the current and projected market demand for Ethanol and ENA. Determine if there is a sufficient market for both products to justify the additional investment. Consider factors such as customer preferences, industry trends, and regulatory requirements.</p> <p>Profitability: Evaluate the potential profitability of producing both Ethanol and ENA. Analyze the expected selling prices, production costs, and profit margins for each product. Consider factors such as economies of scale, production efficiencies, and pricing dynamics in the market.</p> <p>Competitive Advantage: Assess whether producing both Ethanol and ENA would provide a competitive advantage. Consider factors such as unique product</p>
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	<p>characteristics, differentiation opportunities, and the ability to capture a larger share of the market by offering both products.</p> <p>Operational Efficiency: Evaluate the operational feasibility and efficiency of producing both Ethanol and ENA. Consider factors such as shared infrastructure, production processes, and resource utilization. Determine if the additional investment would result in synergies and cost savings.</p> <p>Risk Management: Assess the risks associated with producing both Ethanol and ENA. Consider factors such as market volatility, regulatory changes, supply chain risks, and potential competition. Evaluate if the diversification of products would mitigate risks or expose the business to additional uncertainties.</p> <p>Long-Term Sustainability: Consider the long-term sustainability of producing both Ethanol and ENA. Evaluate factors such as environmental impact, renewable energy policies, and evolving market trends towards sustainable products. Determine if producing both products aligns with sustainability goals and positions the business for future opportunities.</p> <p>Based on a thorough analysis of these factors, Pedro Martinez can make an informed decision about whether the additional investment to produce both Ethanol and ENA is worthwhile. It would depend on the specific market conditions, profitability outlook, operational considerations, and the overall strategic goals of the business.</p>
<p>GPT 4 Response</p>	<p>The question of whether the option to produce both Ethanol and Extra Neutral Alcohol is worth the additional investment requires a multi-faceted analysis, covering final metrics, risk, and strategic considerations.</p> <p>Financial Aspects: NPV and IRR: Both projects have positive NPV and IRR above the discount rate, signaling a likely profitable venture. However, these metrics are lower than the WACC of 16.55%, which might indicate that the projects are not meeting the required return.</p> <p>Economies of Scope: Producing both products could lead to economies of scope if they share the same production, distribution, or marketing activities, thereby reducing the total cost of production.</p> <p>Cash Flow Timing: Producing both might offer staggered cash flows, offering a risk diversification benefit. Capital Expenditure (CAPEX): Both projects have the same CAPEX needs. However, the additional investment needed for dual production should be considered. This should be weighed against the benefits, and the additional capital costs should be included in the cash flow models to reassess NPV and IRR.</p> <p>Risk Considerations: Market Sensitivity: Diversifying into two products might reduce the business risk if the two markets have different sensitivities to economic cycles.</p>

	<p>Supply Chain and Operational Risks: Producing two types of alcohol may introduce complexity in supply chain management and operations. If not managed well, this could offset any gains from diversification.</p> <p>Regulatory Risks: The regulatory framework for each type of alcohol could differ, affecting production costs and selling prices.</p> <p>Strategic Aspects:</p> <p>Market Presence: Producing both might offer greater market presence and better utilization of distribution channels.</p> <p>Portfolio Diversification: It might be strategically beneficial to diversify the product portfolio to mitigate business risks.</p> <p>Brand Value: If the two types of alcohol appeal to different market segments, producing both could offer brand diversification.</p> <p>Recommendations:</p> <p>Feasibility Study: Conduct a feasibility study for the additional investment needed for dual production.</p> <p>Sensitivity Analysis: Re-run the financial models with revised cash flows that include the additional CAPEX and any expected cost savings or additional revenues.</p> <p>Risk Assessment: Conduct a thorough risk assessment for producing both alcohols.</p> <p>Decision Criteria: Based on the revised analyses, set clear decision criteria. If the project still meets or exceeds these criteria, it might be worth the additional investment.</p> <p>In summary, the decision to produce both would depend on the potential synergies, both financial and strategic, that could be realized, the ability to manage additional complexities, and the overall fit with the company’s longer-term objectives and risk tolerance.</p>
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Question 5 – Would your recommendation change if Istmo decided to sell the entire production of Ethanol domestically without government tax breaks?			
Rating	<p>Poor - No project recommendation made.</p>	<p>Acceptable - Indicate that there is no change in the decision made. Stand-alone Ethanol still dominates, and the global project is still a viable project.</p>	<p>Outstanding - Should provide acceptable answers and identify the factors that come into play that led to the decision.</p>
Answer Key	<p>The spreadsheet file contains two tabs where the tax rate has been adjusted to the domestic rate for Ethanol. The results appear below. There should be no changes in the recommendation. When comparing the summary table for the 100% Extra Neutral Alcohol with the summary table for 100% Ethanol Production Sold Domestically, the Global and Stand-Alone Ethanol have higher NPVs in the price</p>		

range of \$0.65 to \$0.95. The analysis indicates that even with the removal of the tax advantage, the production of Ethanol is still profitable because of the lower production cost per liter and the additional liters of Ethanol produced.

100% Production in Ethanol Sold Domestically (US Dollars)				
	Global		Stand-Alone	
Sales price	NPV	IRR	NPV	IRR
\$0.60	(\$6,088,179)	-0.70%	(\$4,905,028)	2.00%
\$0.62	(\$4,628,889)	5.60%	(\$3,445,738)	7.50%
\$0.64	(\$3,169,599)	9.70%	(\$1,986,449)	11.70%
\$0.65	(\$2,439,954)	11.50%	(\$1,256,804)	13.50%
\$0.70	\$1,208,270	18.80%	\$2,391,421	21.40%
\$0.75	\$4,856,494	25.00%	\$6,039,645	28.30%
\$0.80	\$8,504,719	30.80%	\$9,687,869	34.70%
\$0.85	\$12,152,943	36.30%	\$13,336,094	40.90%
\$0.90	\$15,801,168	41.70%	\$16,984,318	46.90%
\$0.95	\$19,449,392	47.00%	\$20,632,542	52.80%

GPT 3.5 Response

If Istmo decided to sell the entire production of Ethanol domestically without government tax breaks, it would have an impact on the recommendation. Without tax breaks, the profitability and competitiveness of the Ethanol production would likely be affected. Here are a few considerations:

Pricing and Profitability: Selling Ethanol domestically without tax breaks may result in a lower selling price for the product. This could potentially impact the profitability of Ethanol production, as the margins may be reduced. It would be essential to evaluate whether the selling price without tax breaks is sufficient to cover production costs and generate a reasonable profit.

Competitiveness: Ethanol produced without tax breaks may face increased competition from other domestic or international suppliers who enjoy favorable tax incentives. This could potentially make it more challenging for Istmo to capture a significant market share or maintain a competitive advantage. Evaluating the competitiveness of the domestic market and the pricing dynamics becomes crucial in this scenario.

Market Demand: Assess the domestic market demand for Ethanol without considering tax breaks. Determine if there is a sufficient market size and growth potential to support the entire production volume. It is essential to consider factors such as the demand from industries like automotive, energy, or chemical sectors and any government policies promoting the use of Ethanol.

Cost Structure: Evaluate the cost structure of Ethanol production in the absence of tax breaks. Assess whether Istmo can achieve cost efficiencies, economies of scale, or leverage other factors to offset the absence of tax incentives. Analyze the production

	<p>costs, including raw materials, energy, labor, and any potential cost-saving measures.</p> <p>Risk Analysis: Consider the risks associated with selling Ethanol domestically without tax breaks. Evaluate factors such as potential changes in government policies or regulations, market volatility, and the overall stability of the domestic market. Assess if the business can withstand potential risks and uncertainties.</p> <p>Based on these considerations, if Istmo decides to sell the entire production of Ethanol domestically without government tax breaks, the recommendation may lean towards a more cautious approach. It would be crucial to conduct a detailed financial analysis, evaluate the competitiveness of the market, and assess the risk-return profile of the investment. Istmo may also consider exploring alternative revenue streams or diversification strategies to mitigate the potential impact of the absence of tax breaks on Ethanol sales.</p>
<p>GPT 4 Response</p>	<p>If Istmo decided to sell the entire production of Ethanol domestically without government tax breaks, the financial viability of the project could change significantly. Several key factors would need to be revisited:</p> <p>Financial Implications:</p> <p>Tax Rate: In the initial calculation, the tax rate for the Ethanol project was assumed to be 0%. If the project now becomes taxable without government support, this will have an immediate and potentially significant impact on after-tax cash flows, reducing the NPV and IRR of the project.</p> <p>Sales Price: Selling domestically might also affect the sales price. If the domestic market is less competitive, this could be advantageous, but if it's more competitive, this could put downward pressure on sales prices, thereby affecting the revenue and profitability.</p> <p>Cost of Sales: If shipping is usually paid for by the buyer "from port to port," the terms might differ for domestic sales, which could either increase or decrease the net cash flow.</p> <p>Strategic Implications:</p> <p>Market Focus: Selling domestically might change Istmo's strategic market focus and could have implications for future international sales or expansions.</p> <p>Regulatory Environment: The domestic regulatory environment could present different challenges or benefits, such as subsidies or tax incentives for domestic production, which might not have been considered initially.</p> <p>Risk Implications:</p> <p>Market Risk: The domestic market might be more or less volatile than the international market, impacting the project's risk profile.</p> <p>Currency Risk: If initially the revenues were expected in a more stable foreign currency, selling domestically might expose Istmo to domestic currency risk. Given these considerations, it would be crucial to redo the financial analysis, incorporating these changes, and reassess the NPV and IRR against the weighted</p>

	<p>average cost of capital (WACC) and other decision metrics. The risk profile and strategic fit should also be reevaluated.</p> <p>Recommendation: If after recalculating the project still offers an acceptable return compared to the WACC, considering the new tax implications and potential changes in sales price and costs, then it may still be worth pursuing. If, however, the changes render the project nonviable or less attractive, then the recommendation would need to be reevaluated.</p>
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Question 6 - What recommendation would you make to Pedro Martinez if capital investment funding is of concern and only one of the stand-alone projects can be undertaken?			
Rating	Poor - No project recommendation made.	Acceptable - Recommendation is incorrect but provided explanation for choice.	Outstanding - Recommended the Ethanol stand-alone project.
Answer Key	The project selected should be the Stand-Alone Ethanol project because it has the highest NPVs and IRR at comparable price levels.		
GPT 3.5 Response	<p>If capital investment funding is a concern and only one stand-alone project can be undertaken, the recommendation would depend on several factors, including financial viability, market potential, and strategic alignment. Here are some considerations for each project:</p> <p>Ethanol Production Project:</p> <ul style="list-style-type: none"> • Evaluate the financial projections and expected return on investment (ROI) for the Ethanol production project. Consider factors such as production costs, revenue potential, and profitability. • Assess the market demand for Ethanol, both domestically and internationally, taking into account factors such as government policies, industry trends, and competition. • Consider the long-term sustainability and growth potential of the Ethanol market. Analyze factors such as the shift towards renewable energy sources and the potential for increased adoption of Ethanol as an alternative fuel. • Evaluate the potential risks and challenges associated with the Ethanol production project, including market volatility, regulatory changes, and technological advancements. <p>Extra Neutral Alcohol (ENA) Production Project:</p> <ul style="list-style-type: none"> • Assess the financial viability of the ENA production project, including projected costs, revenue potential, and expected ROI. • Evaluate the market demand for ENA, considering factors such as the demand from the beverage industry, pharmaceutical industry, and other potential applications. • Analyze the competitiveness of the ENA market, considering factors such as existing suppliers, market growth potential, and any unique selling propositions of Istmo's ENA production. 		

	<ul style="list-style-type: none"> Consider the potential risks and challenges associated with the ENA production project, such as regulatory compliance, market saturation, and changing consumer preferences. <p>Based on a thorough evaluation of these factors, the recommendation would be to prioritize the project that offers the highest potential for profitability, growth, and alignment with Istmo's long-term strategic goals. This recommendation would involve comparing the financial projections, market potential, and risk profiles of both projects to determine which one presents a stronger business case.</p> <p>It is important to note that without specific financial data and market analysis for each project, it is challenging to provide a definitive recommendation. Therefore, conducting a comprehensive feasibility study, including financial analysis and market research, would be crucial in making an informed decision.</p>
<p>GPT 4 Response</p>	<p>Financial Metrics:</p> <p>NPV (Net Present Value): Both projects have positive NPVs, but the project with Extra Neutral Alcohol (ENA) has a slightly higher NPV of \$13,733,249 as opposed to Ethanol's \$13,447,493. Higher NPV suggests higher incremental value to the firm.</p> <p>IRR (Internal Rate of Return): The ENA project has an IRR of 10%, whereas the Ethanol project has an IRR of 9%. A higher IRR is generally preferable when choosing between projects.</p> <p>WACC (Weighted Average Cost of Capital): With a WACC of 16.55%, both projects fall short in comparison, which generally indicates that neither project would meet the firm's hurdle rate. However, WACC itself can be adjusted based on the project risk relative to the firm's average risk profile, so this shouldn't be a stand-alone decision criterion.</p> <p>Tax Benefits: The Ethanol project initially has a 0% tax rate, which can be beneficial from a cash flow perspective. However, this may not remain the case if the project shifts focus to domestic sales.</p> <p>CAPEX and Cash Flows: Both projects have the same initial CAPEX requirements. Cash flows should also be scrutinized to determine which project is likely to deliver better financial performance over the long term.</p> <p>Strategic Considerations:</p> <p>Market Demand: What is the demand for ENA vs. Ethanol? If one product has a significantly larger market or higher growth prospects, this could tip the scale.</p> <p>Flexibility: Which project offers better operational flexibility? For example, could the Ethanol project be more easily adapted to produce ENA at a later date, or vice versa?</p> <p>Regulatory Environment: Are there regulatory considerations that make one project more favorable than the other?</p> <p>Risk: Which project is riskier, and how well can the firm manage this risk?</p>

Final Recommendation:

Based on just the financial metrics, the ENA project appears slightly more attractive with a higher NPV and IRR. However, strategic considerations could alter this recommendation. Ultimately, the choice between the two would hinge on a balanced consideration of both financial returns and alignment with the company's long-term strategic objectives. Given that capital is a concern, it would be prudent to pick the project that best aligns with the firm's strategic goals while also offering the best financial return relative to risk.

Appendix B – When Events Do Not Turn Out as Expected ChatGPT Responses and Rating Rubric

Question 1 - Describe the changes in revenue across the three years detailed in the case.			
Rating and Answer Key	<p>Poor - Conflate revenue with income.</p> <p>Emphasize the year-to-year changes without noting an overall increase across the period.</p>	<p>Acceptable - Note that revenue has increased 13% from 2017 to 2019.</p> <p>Note that revenue has contracted by 11% from 2018 to 2019.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Note that custom sales have decreased overall as a percentage of sales between 2017 and 2019.</p>
GPT-3.5 Response	<p>1. 2017:</p> <ul style="list-style-type: none"> · Custom Sales: \$705,560 · Contract Sales: \$567,839 · Other Sales: \$35,618 · Total Revenue: \$1,309,017 <p>2. 2018:</p> <ul style="list-style-type: none"> · Custom Sales: \$456,503 · Contract Sales: \$1,182,395 · Other Sales: \$26,292 · Total Revenue: \$1,665,190 <p>3. 2019:</p> <ul style="list-style-type: none"> · Custom Sales: \$548,592 · Contract Sales: \$884,516 · Other Sales: \$47,117 · Total Revenue: \$1,480,226 <p>From these figures, we can observe the following trends:</p> <ul style="list-style-type: none"> · Custom Sales: There was a decline in custom sales from 2017 to 2018, but a slight recovery in 2019. However, the overall trend is not significantly positive, indicating that custom sales remained a challenging area for AOT to generate substantial revenue. · Contract Sales: Contract sales showed significant growth from 2017 to 2018, more than doubling in value. However, there was a decrease in contract sales in 2019 compared to the previous year. · Other Sales: Other sales, which likely include miscellaneous or ancillary revenue streams, remained relatively small compared to custom and contract sales. There was a slight increase in other sales from 2017 to 2019. · Total Revenue: The total revenue for AOT increased from 2017 to 2018, indicating overall growth. However, there was a decline in total revenue in 2019 compared to the previous year. 		

	<p>Overall, the revenue trends suggest that AOT faced challenges in consistently increasing their sales and achieving sustained revenue growth. Custom sales were particularly problematic, while contract sales showed more promise initially but experienced a decline in the later year. These revenue fluctuations likely contributed to the urgency for AOT to develop a new strategy and improve profitability.</p>
GPT-4 Response	<p>Based on the information provided in Exhibit 13 – Income Statements, here's how the revenue for AOT has changed across the three years:</p> <p>2017: Total Revenue = \$1,309,017 2018: Total Revenue = \$1,665,190 2019: Total Revenue = \$1,480,226</p> <p>From 2017 to 2018, the revenue increased from \$1,309,017 to \$1,665,190. This represents an increase of \$356,173 or approximately 27.2%.</p> <p>From 2018 to 2019, the revenue decreased from \$1,665,190 to \$1,480,226. This represents a decrease of \$184,964 or approximately 11.1%.</p> <p>Overall, the revenue increased significantly from 2017 to 2018 but then decreased in 2019, although it remained higher than the 2017 level.</p>

Question 2 - Describe the changes in net income across the three years detailed in the case.			
Rating and Answer Key	<p>Poor - Will presume that the decrease in losses is an outcome of “selling more” when that conclusion had already been rejected in Q1.</p>	<p>Acceptable - Observe that income losses have decreased year to year across the three-year period. Identify that the year over year change (17% improvement from 2017 to 2018 and 19% change from 2018 to 2019) results in a 33% improvement on losses across the three-year window.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also: Recognize that the improvement in losses corresponds with a reduction in sales. This may take the form of a puzzlement, or it may result in a group (or student) voicing a subsequent discussion question (such as question 3).</p>
GPT-3.5 Response	<p>Based on the information provided in the case, the net income for AOT (All-Out Tees) changed as follows over the three-year period:</p> <p>1. 2017: · Net Income: (\$819,399) (Loss)</p> <p>2. 2018: · Net Income: (\$680,008) (Loss)</p> <p>3. 2019: · Net Income: (\$550,923) (Loss)</p>		

	<p>From these figures, we can observe the following trends:</p> <ul style="list-style-type: none"> • Net Loss: AOT incurred net losses in all three years. The losses decreased from 2017 to 2019, indicating some improvement in the financial performance, but the company was still operating at a loss. • Loss Reduction: There was a reduction in net losses from 2017 to 2019, indicating that AOT was taking steps to improve its financial performance. However, the losses were still significant, suggesting ongoing challenges in achieving profitability. <p>These changes in net income reflect the financial struggles faced by AOT during the three-year period. The company's inability to generate positive net income highlights the urgency for AOT to implement a new strategy, increase sales volume, improve pricing, and cost structures, and enhance overall profitability to sustain its operations in the long term.</p>
<p>GPT-4 Response</p>	<p>Based on the information provided in Exhibit 13 – Income Statements, the net income for AOT has changed as follows across the three years:</p> <p>2017: Net Income = \$(819,399) (Loss) 2018: Net Income = \$(680,008) (Loss) 2019: Net Income = \$(550,923) (Loss)</p> <p>From 2017 to 2018, the net income improved from a loss of \$(819,399) to a loss of \$(680,008). This represents an improvement of \$139,391 or approximately 17%.</p> <p>From 2018 to 2019, the net income further improved from a loss of \$(680,008) to a loss of \$(550,923). This represents an improvement of \$129,085 or approximately 19%.</p> <p>Over these three years, AOT has been consistently operating at a loss, but the magnitude of the loss has been decreasing year-over-year.</p>

Question 3 - How might a firm’s revenue and net income change in opposite directions (how can you sell less, but lose less... or conversely how could you sell more but earn less?)		
<p>Rating and Answer Key</p>	<p>Poor - Fail to identify drivers of income which are not revenue. Most answers will involve some variation of “selling more,” even though that is the antithesis of the discussion question.</p>	<p>Acceptable - Identify changes in cost-structure as a possibility. This will involve abstract identification of cost without specifically examining financials for this case.</p> <p>Identify changes in product mix in the abstract. For instance, identifying the role of higher margin sales positively affecting income.</p> <p>Identifying abstractly the role of efficiency, specifically time management, as affecting indirect or fixed costs.</p> <p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Notice that there is a substantial drop in direct costs as a percentage of sales (both year to year and across the period).</p> <p>Notice a substantial decrease in indirect labor (both absolute and as a percentage of sales) across the case. Lead into the next discussion question.</p> <p>Insightful responses will allude to or incorporate elements of subsequent discussion questions (e.g., thinking ahead of the class discussion).</p>
<p>GPT-3.5 Response</p>	<p>A firm's revenue and net income can change in opposite directions due to various factors that affect profitability. Here are two scenarios that explain how this can occur:</p> <p>1. Decreased Sales with Improved Profitability:</p> <ul style="list-style-type: none"> • Cost Reduction: If a company successfully implements cost-cutting measures, such as streamlining operations, negotiating better supplier contracts, or improving efficiency, it can lower its expenses even if sales decline. This cost reduction can offset the decrease in revenue and lead to improved profitability, resulting in a smaller loss or even a positive net income. <p>2. Increased Sales with Decreased Profitability:</p> <ul style="list-style-type: none"> • Price Reduction: If a company lowers its prices to attract more customers or faces competitive pressure to reduce prices, it may experience an increase in sales volume. However, if the decrease in price is not offset by a proportionate reduction in costs or if there are additional costs associated with fulfilling higher sales, the profit margins can shrink, leading to lower net income despite higher revenue. <p>In both cases, the relationship between revenue and net income can be influenced by various factors, such as changes in costs, pricing strategies, economies of scale,</p>	

	<p>operational efficiency, market conditions, and competitive dynamics. It emphasizes the importance of analyzing not only the top-line revenue but also the bottom-line profitability to assess the overall financial health and performance of a company.</p>
<p>GPT-4 Response</p>	<p>Revenue and net income can indeed move in opposite directions due to a variety of factors. Here are some scenarios that illustrate this:</p> <p>Selling Less but Losing Less Cost Reduction: Even if a firm is generating less revenue, it could cut back on variable and fixed costs, improving its net income.</p> <p>High-margin Sales: The firm might be selling fewer products but at a higher margin, thus boosting profitability.</p> <p>Reducing Debt: If a company manages to pay down debt, it will incur fewer interest expenses, thereby improving net income.</p> <p>Focus on Core Business: By shedding unprofitable lines of business or customer segments, the firm may see a drop in revenue but an increase in net income.</p> <p>Efficiency Improvements: The firm may become more efficient in production, thus lowering the cost per unit and improving net income despite lower sales.</p> <p>Selling More but Earning Less Increased Costs: A company might be able to boost sales by increasing marketing spend or cutting prices, but these could lead to an overall decrease in net income.</p> <p>Lower-margin Sales: Selling more of a low-margin product will boost revenue but can reduce net income.</p> <p>Seasonal Factors: Sometimes higher sales occur during a season where costs (like energy costs for heating or cooling, or holiday pay for employees) are also higher.</p> <p>Inventory Costs: If the cost of goods or raw materials increases, then even if sales revenue increases, the profit might decrease.</p> <p>Increased Competition: Sometimes companies have to lower prices to maintain or increase market share, resulting in higher sales but lower profitability.</p> <p>Understanding the relationship between revenue and net income requires more than just a superficial look at these two metrics. A comprehensive analysis of all contributing factors is essential for an accurate understanding.</p>

Question 4 - Describe changes in variable (direct) costs across the three years detailed in the case. How does labor, printing materials, and the presence or absence of blanks (custom vs. contract) describe the changes in actual cost and cost as a percentage of revenue?			
<p>Rating and Answer Key</p>	<p>Poor - Fail to distinguish between direct and indirect costs, emphasizing changes in COGS without thinking through the cost basis.</p> <p>Poorly describe direct costs, for instance, failing to understand that direct costs increase proportionally with sales.</p> <p>Presume that the only way to cut costs is to “go cheap” (e.g., cheap labor, cheap materials, etc.).</p>	<p>Acceptable - Identify a change in labor costs as a percentage of sales (35% to 30% from 2017 to 2019).</p> <p>Identify changes in average wage paid or changes in labor productivity (one or the other) could affect direct labor costs as a percentage of sales. Identify a notable change in the cost of direct materials across the period.</p> <p>Identifying changes in market costs of materials, changes in purchasing patterns (for example buying in bulk) or changes in paying patterns (e.g., fast-paying discounts) might lower the costs of materials.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Observe that direct labor costs increase as a percentage of sales in 2018 while also observing that losses as a percent of sales still decreased.</p> <p>Observe that both wages paid, and productivity affect direct labor costs. May also observe that paying less may lower productivity while paying more may raise it (inferring an optimization even if not specifically articulating it).</p>
<p>GPT-3.5 Response</p>	<p>Based on the information provided in the case, let's examine the changes in variable (direct) costs across the three years and how labor, printing materials, and the presence or absence of blanks (custom vs. contract) contribute to the actual cost and cost as a percentage of revenue.</p> <p>1. Labor Costs:</p> <ul style="list-style-type: none"> · Labor costs include direct labor involved in the production process. In the case, the labor costs are as follows: · 2017: \$459,549 · 2018: \$728,008 · 2019: \$507,165 · Analysis: · Labor costs increased from 2017 to 2018 but decreased in 2019. · In terms of cost as a percentage of revenue, labor costs as a percentage of revenue can be calculated using the formula: (Labor Costs / Total Revenue) * 100. · The percentage of labor costs as a proportion of revenue can provide insights into the efficiency of labor utilization and cost management over the years. <p>2. Printing Materials Costs:</p> <ul style="list-style-type: none"> · Printing materials costs include the direct materials required for the printing 		

	<p>process. In the case, the direct materials costs are as follows:</p> <ul style="list-style-type: none"> · 2017: \$505,204 · 2018: \$345,161 · 2019: \$374,239 <p>• Analysis:</p> <ul style="list-style-type: none"> · Printing materials costs fluctuated over the three years, with a decrease from 2017 to 2018 and a subsequent increase in 2019. · The percentage of printing materials costs as a proportion of revenue can be calculated using the formula: $(\text{Printing Materials Costs} / \text{Total Revenue}) * 100$. · Monitoring the cost of materials in relation to revenue helps assess the impact of material prices and purchasing strategies on overall costs. <p>3. Presence or Absence of Blanks (Custom vs. Contract):</p> <ul style="list-style-type: none"> · Custom Sales: Custom sales involve providing customized products to clients according to their specific requirements. · Contract Sales: Contract sales refer to standardized printing services provided to clients without customization. <p>• Analysis:</p> <ul style="list-style-type: none"> · The presence or absence of blanks (custom vs. contract) affects the cost structure differently. · Custom sales may have higher variable costs per unit due to the need for customization, which can include additional labor and material costs. · Contract sales, on the other hand, may have lower variable costs per unit due to the standardized nature of the printing services. <p>Overall, analyzing the changes in labor costs, printing materials costs, and the presence or absence of blanks (custom vs. contract) provides insights into the variations in actual costs and cost as a percentage of revenue. It helps understand the cost dynamics within the different sales categories and their impact on the overall profitability of AOT.</p>
<p>GPT-4 Response</p>	<p>Based on the case details provided, the variable (direct) costs seem to have undergone some notable changes over the three years:</p> <p>Direct Materials: 2017: \$505,204 (39% of revenue) 2018: \$345,161 (21% of revenue) 2019: \$374,239 (25% of revenue)</p> <p>Direct Labor: 2017: \$459,549 (35% of revenue) 2018: \$728,008 (44% of revenue) 2019: \$507,165 (34% of revenue)</p> <p>Observations on Variable Costs: Direct Materials: There was a significant decrease in direct material costs from 2017 to 2018, both in absolute terms and as a percentage of revenue. It rose slightly in 2019 but remained lower than the 2017 level.</p> <p>Direct Labor: Labor costs spiked in 2018 but reverted closer to the 2017 levels in 2019. As a percentage of revenue, labor costs took a greater share in 2018 but came down in 2019.</p>

Factors Affecting Costs:

Labor: The case indicates that labor market conditions had been tight, and the company believes they could grow their labor force to produce 19,000 items per week. It's possible that the spike in labor costs in 2018 was due to this tight market and perhaps increased overtime or higher wages to attract and retain employees.

Printing Materials: If the company is using different qualities or quantities of materials for custom and contract jobs, this could affect material costs. It's also possible that efficiencies have been gained over time or that the company has switched to lower-cost suppliers.

Presence/Absence of Blanks (Custom vs. Contract): Custom jobs might require special materials or more labor-intensive work, affecting the variable costs. Contract jobs are likely more standardized and could be more cost-efficient to produce, although they were less profitable according to the case.

Percent of Custom vs. Contract: The mix between custom and contract jobs can significantly impact variable costs. Custom jobs in 2019 made up 14.6% of units sold but accounted for 37% of revenue, indicating a much higher cost but also a higher price point.

In summary, the shift in labor and material costs, combined with the ratio of custom to contract work, appears to significantly impact the variable costs for AOT both in actual numbers and as a percentage of revenue.

Question 5 - What is the gross margin for AOT across the time period of the case?			
<p>Rating and Answer Key</p>	<p>Poor - Conflate gross margin with operating or net margin (e.g., discussing costs which do not involve producing the goods). Conflate direct and indirect costs. Focus on changes in dollars without noting changes in percentage. By this point in the discussion, most students should begin incorporating the common-sized percentages into their discussion.</p>	<p>Acceptable - Recognize that the firm is not covering the cost of producing the product at any time over the three-year period. Note a general improvement in gross margin. May inadvertently assume that the firm is “on pace” to cover this gap.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also: Note that the reduction in the negative gross margin reflects the firm’s general improvement in covering the cost of producing the goods. Clearly associate differences between productivity for direct costs and efficient coverage for indirect costs. Recognize that direct costs eat up a substantial percentage of revenue (74% in 2017 and 59% in 2019) suggesting that volume would need to increase significantly at these cost structures to cover COGS. (Excellent answers will lead to break-even discussion)</p>
<p>GPT-3.5 Response</p>	<p>To calculate the gross margin for AOT across the time period of the case, we can use the formula:</p> $\text{Gross Margin} = (\text{Total Revenue} - \text{Cost of Goods Sold}) / \text{Total Revenue} * 100$ <p>Using the provided information from the case, let's calculate the gross margin for each year:</p> <p>Year 2017: Total Revenue: \$1,309,017 Cost of Goods Sold: \$1,846,560 Gross Margin = $(1,309,017 - 1,846,560) / 1,309,017 * 100 = -41\%$</p> <p>Year 2018: Total Revenue: \$1,665,190 Cost of Goods Sold: \$2,104,867 Gross Margin = $(1,665,190 - 2,104,867) / 1,665,190 * 100 = -26\%$</p> <p>Year 2019: Total Revenue: \$1,480,226 Cost of Goods Sold: \$1,758,406 Gross Margin = $(1,480,226 - 1,758,406) / 1,480,226 * 100 = -19\%$</p> <p>Therefore, the gross margin for AOT across the time period of the case was -41% in 2017, -26% in 2018, and -19% in 2019. The negative values indicate that the cost of</p>		

	<p>goods sold exceeded the total revenue, resulting in negative gross margins. This suggests that AOT faced challenges in generating a positive gross profit during this time period.</p>
<p>GPT-4 Response</p>	<p>The Gross Margin for AOT across the time period of the case is presented as follows:</p> <p>Gross Profit and Margin by Year 2017: Gross Profit = -\$537,543, Gross Profit Margin = -41% 2018: Gross Profit = -\$439,676, Gross Profit Margin = -26% 2019: Gross Profit = -\$278,180, Gross Profit Margin = -19%</p> <p>Observations: Negative Gross Margin: Throughout all three years, AOT's gross margin was negative. This indicates that the company was not even able to cover its cost of goods sold (COGS) through its revenues, a serious problem that would make it very difficult to turn a profit.</p> <p>Improvement Over Time: Despite remaining negative, the gross margin has been improving each year, going from -41% in 2017 to -19% in 2019. This suggests that the company may be moving in the right direction, although it still has a long way to go to reach a positive gross margin.</p> <p>Comparison with Industry Averages: According to the RMA Statement Studies (2021), the average profit margin for similar companies is 50%. AOT's gross margin is significantly below this industry average, indicating severe inefficiencies or problems in their business model or execution.</p> <p>The gross margin serves as a basic indicator of a company's profitability and financial health, and the negative values for AOT suggest urgent action is needed to correct course.</p>

Question 6 -Describe changes in the fixed (indirect) costs across the three years detailed in the case. What factors would describe the changes in actual cost and cost as a percentage of revenue?			
<p>Rating and Answer Key</p>	<p>Poor - Not articulate differences between indirect and direct costs. Continue to consider costs in dollars without evaluating costs as percentages.</p>	<p>Acceptable - Note that indirect labor has decreased both in dollars and percentage over the three-year period.</p> <p>Note that indirect manufacturing has increased in both dollars and percentage across the three years.</p> <p>Continue to consider costs in dollars without evaluating costs as percentages.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Note that substantial changes in indirect costs (labor up and manufacturing down) suggest that these so-called, fixed costs are not very fixed. The student may not identify why, but they will note the oddity here.</p>
<p>GPT-3.5 Response</p>	<p>Based on the information provided in the case, let's analyze the changes in fixed (indirect) costs across the three years:</p> <p>Year 2017: Fixed Costs: \$1,026,000 Year 2018: Fixed Costs: \$1,026,000 Year 2019: Fixed Costs: \$1,026,000</p> <p>According to the case, the fixed costs remained constant at \$1,026,000 throughout the three-year period. This suggests that there were no significant changes in the overall indirect costs incurred by AOT during this time.</p> <p>To understand the factors that may influence the changes in actual cost and cost as a percentage of revenue, we need to consider the dynamics of the business and the company's operations. Some possible factors include:</p> <ol style="list-style-type: none"> 1. Economies of scale: As the company's revenue increases, the fixed costs may represent a smaller proportion of the total revenue, resulting in a decrease in cost as a percentage of revenue. 2. Efficiency improvements: If the company implements cost-saving measures or process improvements, it can lower its overall fixed costs and improve the cost as a percentage of revenue. 3. Inflation or cost fluctuations: Changes in the cost of inputs, such as labor or raw materials, can impact the fixed costs. If these costs increase over time, it can lead to a higher cost as a percentage of revenue. 4. Changes in business strategy: If the company introduces new initiatives or expands into different product lines or markets, it may incur additional fixed costs. This can impact the overall fixed costs and cost as a percentage of revenue. 		

	<p>It's important to note that the case does not provide specific information on the factors driving the changes in fixed costs or their percentage in revenue.</p>
<p>GPT-4 Response</p>	<p>Fixed Costs by Year 2017: Fixed Cost = \$1,083,361 2018: Fixed Cost = \$1,176,123 2019: Fixed Cost = \$1,050,058</p> <p>Observations: Increase from 2017 to 2018: Fixed costs increased from \$1,083,361 in 2017 to \$1,176,123 in 2018. This could be due to a number of factors such as the addition of new equipment, increase in rent, or perhaps new salaried employees.</p> <p>Decrease from 2018 to 2019: Fixed costs decreased in 2019 to \$1,050,058. The decline suggests that there might have been some cost-cutting measures, such as laying off staff, reducing overheads, or renegotiating facility rents.</p> <p>Cost as a Percentage of Revenue: In 2017, fixed costs were about 82.7% of total revenue ($\\$1,083,361 / \\$1,309,017$) In 2018, they were about 70.6% of total revenue ($\\$1,176,123 / \\$1,665,190$) In 2019, they were about 70.9% of total revenue ($\\$1,050,058 / \\$1,480,226$)</p> <p>Factors for Change in Costs:</p> <p>Actual Cost: Changes in actual costs could be due to multiple factors such as inflation, strategic investments, or change in scale of operations.</p> <p>Percentage of Revenue: This could be influenced by changes in the revenue itself. For example, a decrease in fixed costs as a percentage of revenue could result from increased sales, even if actual fixed costs remained constant.</p> <p>The changes in fixed costs and their percentage of total revenue can be indicative of the company's scaling operations or cost-saving measures. While the fixed costs in absolute terms have fluctuated over these years, their proportion relative to revenue has somewhat stabilized, suggesting that the company may be aligning its cost structure with its sales performance, though more needs to be done to achieve profitability.</p>

Question 7 - Describe the pricing and cost structure associated with the custom sales business. Explain the role of custom orders in the company product mix.			
Rating and Answer Key	<p>Poor - Have difficulty distinguishing the custom from contract business. This extends beyond use of terms and includes difficulty understanding pricing and quantity differences between the two lines.</p>	<p>Acceptable - Identify a higher selling price, higher cost per unit, and better margins.</p> <p>Identify lower units sold per order and a greater challenge sourcing new order.</p>	<p>Excellent -In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Observe that there is likely more variation in pricing for custom orders than for contracts.</p> <p>Better answers may recognize that some custom orders are inherently more profit-driving than others (setting themselves up well for question 9)</p>
GPT-3.5 Response	<p>In the context of AOT, the custom sales business refers to the sale of customized products tailored to the specific requirements and preferences of individual customers. The pricing and cost structure associated with custom sales can be described as follows:</p> <p>Pricing:</p> <ul style="list-style-type: none"> · The average pricing for custom sales is estimated to be \$9.80 per unit, according to the target figures provided in Exhibit 14. · This higher pricing is justified by the added value and customization offered to customers, which allows AOT to command a premium compared to standardized products. · Customers are willing to pay more for custom orders due to the personalized nature of the products and the ability to meet their unique needs. <p>Cost Structure:</p> <ul style="list-style-type: none"> · The average variable cost associated with custom sales is estimated to be \$6.00 per unit, according to the target figures. · Variable costs represent expenses that directly vary with the production and sales volume, such as direct materials, direct labor, and other manufacturing overhead. · The higher variable costs in custom sales are mainly attributed to the additional labor, materials, and processes required to fulfill the specific customization requests of each customer. <p>Role of Custom Orders:</p> <ul style="list-style-type: none"> · Custom orders play a crucial role in the product mix of AOT, as they are considered the primary driver of profitability and growth. · Francisco and Cesar, the owners of AOT, believe that custom and contract sales need to carry the firm to profitability. · They aim to increase the share of custom sales volume to 30%, with the remaining 		

	<p>sales coming from contract sales and a small portion from promotional sales.</p> <ul style="list-style-type: none"> · Custom orders provide higher profit margins compared to other sales categories, such as contract sales or promotional goods, allowing AOT to generate higher revenues per unit sold. · By focusing on custom orders, AOT can leverage their ability to offer unique and personalized products, which can command higher prices and differentiate them from competitors. · The strategy is to improve per unit margins by raising prices for custom orders and reducing variable costs, ultimately leading to increased profitability for the company. <p>Overall, the custom sales business represents a key component of AOT's product mix, offering higher profitability potential through customized products that cater to the specific needs and preferences of individual customers.</p>
<p>GPT-4 Response</p>	<p>Pricing and Cost Structure for Custom Sales</p> <p>Average Pricing: The average price for custom sales is \$9.80 per unit.</p> <p>Average Variable Cost: The average variable cost for custom sales is \$6.00 per unit.</p> <p>Role of Custom Orders in the Company Product Mix:</p> <p>Higher Margins: Custom sales have a higher price point compared to contract sales, allowing for greater profitability per unit. This is especially vital for a company with AOT's financial profile, which is currently operating at a loss.</p> <p>Diversification: Custom sales offer a different product line that helps diversify the company's revenue streams. This is important for risk mitigation, especially when contract sales are often loss-making.</p> <p>Target for Growth: Francisco and Cesar see custom sales as a potential avenue for growth, aiming to increase its share to 30% of total sales volume. This is based on the understanding that custom orders allow for higher per-unit profitability.</p> <p>Brand Building and Customer Loyalty: Custom orders typically require a closer relationship with the customer, providing opportunities for brand-building and fostering long-term relationships. These are generally more difficult to achieve with contract sales, which are often more transactional and price-sensitive.</p> <p>Limited Scale So Far: Despite the advantages, custom sales haven't scaled significantly yet. They have not sold more than 107,000 custom units in a single year, indicating that the potential for this segment is still largely untapped.</p> <p>Resource Allocation: Custom orders can be more resource-intensive to produce due to their bespoke nature. This means they play a unique role in how production capacity is utilized and can be a factor in decisions around scaling labor and other resources.</p> <p>Pricing Flexibility: Francisco believes that the ability to raise prices in the custom segment is closely tied to the delivery of quality products and building strong client relationships.</p> <p>In summary, custom orders play a multifaceted role in AOT's business strategy. While</p>

	they offer higher margins, their share in the total sales volume needs to grow for the company to turn profitable. Custom orders serve as a high-margin supplement to the bulk volume brought in by contract sales and are viewed as a key component of the turnaround strategy for AOT.
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Question 8 - Describe the pricing and cost structure associated with the contract sales business. Explain the role of contract orders in the company product mix.

GPT-3.5 Response	<p>In the context of AOT, the contract sales business involves providing valued-added services with simple print runs of 1 to 2 colors to large-volume clients. The pricing and cost structure associated with contract sales can be described as follows:</p> <p>Pricing:</p> <ul style="list-style-type: none"> · The average pricing for contract sales is estimated to be \$2.70 per unit, according to the target figures provided in Exhibit 14. · Contract sales typically involve larger volumes and standardized products, which allows for a more cost-efficient production process and, consequently, lower prices compared to custom sales. · While the per-unit price for contract sales is lower than custom sales, the larger volume of contracts can compensate for the lower margins. <p>Cost Structure:</p> <ul style="list-style-type: none"> · The average variable cost associated with contract sales is estimated to be \$0.90 per unit, according to the target figures. · Variable costs in contract sales primarily include direct materials, direct labor, and other manufacturing overhead. · Due to the standardized nature of contract orders and the use of simple print runs with 1 to 2 colors, the variable costs per unit are lower compared to custom orders. · The efficiency gained from producing standardized products in larger volumes allows for cost savings and improved profitability in contract sales. <p>Role of Contract Orders:</p> <ul style="list-style-type: none"> · Contract orders play an important role in the product mix of AOT, complementing the custom sales business. · AOT pursues large-volume contract clients who require simple print runs and value-added services. · The role of contract orders is to provide a consistent stream of revenue and volume to support the overall profitability of the company. · While the profit margins per unit in contract sales may be lower than custom sales, the larger volumes and cost efficiencies enable AOT to generate significant revenues and maintain a stable base of operations. · Contract orders contribute to the overall revenue diversification and help balance the product mix by providing a steady flow of sales alongside the more customized and higher-priced custom orders. · The strategy of AOT involves leveraging the contract sales business to achieve profitability by improving per unit margins through pricing adjustments and cost controls. <p>In summary, contract sales in AOT's product mix involve providing standardized products and value-added services to large-volume clients. The pricing is relatively lower compared to custom sales, but the cost structure benefits from cost</p>
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	<p>efficiencies gained through larger production volumes. Contract orders serve as a consistent revenue stream, supporting the overall profitability of the company and balancing the product mix alongside the custom sales business.</p>
<p>GPT-4 Response</p>	<p>Pricing and Cost Structure for Contract Sales Average Pricing: The average price for contract sales is \$2.70 per unit. Average Variable Cost: The average variable cost for contract sales is \$0.90 per unit.</p> <p>Role of Contract Orders in the Company Product Mix: Volume Driver: Contract sales account for the majority of AOT's sales volume. According to the case, they constituted 43% to 71% of total sales over 2017-2019. This is significant for covering fixed costs, even if the per-unit profitability is low.</p> <p>Lower Margins: These sales generally have lower profit margins compared to custom sales. According to Francisco, AOT lost money on 90% of their contract clients, breaking even only on those who utilized value-added services.</p> <p>Cash Flow: Despite the lower margins, contract sales contribute to cash flow, which is essential for any business, especially one that has been operating at a loss.</p> <p>Utilization of Capacity: Contract sales help in utilizing plant capacity, which is important when the company has high fixed costs. To break even, however, a high percentage of plant capacity needs to be utilized (82% and 90% for 2017 and 2018, respectively).</p> <p>Simpler Orders: The strategy is to target contract clients who require simple print runs of 1 to 2 colors. This simplicity may allow for easier production scaling and potential cost reductions.</p> <p>Pricing Challenges: Since contract clients are often more price-sensitive, raising prices in this segment may be more difficult. Yet, Francisco believes that value-added services could be a way to improve profitability here.</p> <p>Leverage for Supplier Negotiation: The volume from contract sales can provide some leverage when negotiating prices with suppliers, even if the margins are slim.</p> <p>Balancing Custom Sales: Given that AOT is targeting a 30%/70% split between custom and contract sales, contract sales will continue to play a significant role in balancing the product mix and ensuring that the firm has enough volume to cover fixed costs.</p> <p>New Client Acquisition: Contract sales often serve as a 'foot in the door' with clients who may later be interested in more profitable custom options, providing an upselling opportunity.</p> <p>In summary, while contract sales have lower margins, they play a critical role in AOT's overall business model by driving volume, aiding in cash flow, and providing a balance to the more profitable but currently smaller custom sales segment. The challenge is to make this segment profitable or at least break-even to ensure long-term sustainability.</p>

Question 9 - Given AOT's confidence in hitting 30%/70% custom/contract units split and their projected price and cost per unit, what would be their resulting weighted average price per unit, cost per unit, and contribution margin per unit (see Exhibit 14 of case)?

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There is not a rubric for this question. The instructor's manual provides the correct answers for each calculation.

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	Custom (30% weight)	Contract (70% weight)	Weighted Average
Price per unit	$(\$9.80 \cdot .3) = \2.94	$(\$2.7 \cdot .7) = \1.89	\$4.83
Variable cost per unit	$(\$6.00 \cdot .3) = \1.80	$(0.9 \cdot .7) = \$0.63$	\$2.43
Contribution margin per unit	\$1.14	\$1.26	\$2.40

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To calculate the weighted average price per unit, cost per unit, and contribution margin per unit based on AOT's projected 30%/70% custom/contract volume split and the provided target figures from Exhibit 14, we can use the following formula:

Weighted Average Price per Unit = (Custom Sales Volume * Custom Average Pricing) + (Contract Sales Volume * Contract Average Pricing)

Weighted Average Cost per Unit = (Custom Sales Volume * Custom Average Variable Cost) + (Contract Sales Volume * Contract Average Variable Cost)

Contribution Margin per Unit = Weighted Average Price per Unit - Weighted Average Cost per Unit

Let's perform the calculations:

Custom Sales Volume = 0.30 (30% of total sales volume) Contract Sales Volume = 0.70 (70% of total sales volume) Custom Average Pricing = \$9.80 Contract Average Pricing = \$2.70 Custom Average Variable Cost = \$6.00 Contract Average Variable Cost = \$0.90

Weighted Average Price per Unit = $(0.30 * \$9.80) + (0.70 * \$2.70) = \$5.21 + \$1.89 = \$7.10$

Weighted Average Cost per Unit = $(0.30 * \$6.00) + (0.70 * \$0.90) = \$1.80 + \$0.63 = \$2.43$

Contribution Margin per Unit = Weighted Average Price per Unit - Weighted Average Cost per Unit = $\$7.10 - \$2.43 = \$4.67$

Therefore, based on AOT's projected 30%/70% custom/contract volume split and the provided target figures, the resulting weighted average price per unit would be \$7.10, the weighted average cost per unit would be \$2.43, and the contribution margin per unit would be \$4.67.

G P T - 4 R e s p o n s e	Calculation Steps
	Weighted Average Price Per Unit
	$(0.3 \times \$9.80) + (0.7 \times \$2.70)$ $(2.94) + (1.89) = \$4.83$
	Weighted Average Cost Per Unit
	$(0.3 \times \$6.00) + (0.7 \times \$0.90)$ $(1.80) + (0.63) = \$2.43$
	Weighted Average Contribution Margin Per Unit
	Weighted Average Price Per Unit – Weighted Average Cost Per Unit
	$\$4.83 - \$2.43 = \$2.40$
	Results
	Weighted Average Price Per Unit: \$4.83 Weighted Average Cost Per Unit: \$2.43 Weighted Average Contribution Margin Per Unit: \$2.40

These figures provide an estimate of the average pricing, cost, and contribution margin per unit that AOT would experience if they successfully achieve their target of a 30%/70% custom/contract units split. This information would be crucial for Francisco and the AOT team as they assess the financial viability of their new strategy.

Question 10 - Presuming \$1,026,000 in annual fixed costs and the weighted average contribution margin per unit (from question 10 above), what would AOT's breakeven be if they achieved these goals?	
Rating	There is not a rubric for this question. The instructor's manual provides the correct calculations for each item.
Answer Key	$\text{Breakeven}_{\text{Units}} = \frac{\text{Fixed Costs}}{\text{Contribution Margin}}$ $\text{Breakeven}_{\text{Units}} = \$1,026,000 / \$2.40 = 427,500$ <p>Breakeven contract sales volume = $427,500 \times .7 = 229,250$ units Breakeven custom sales volume = $427,500 \times .3 = 128,250$ units</p>
GPT-3.5 Response	<p>To calculate AOT's breakeven point based on the given annual fixed costs of \$1,026,000 and the weighted average contribution margin per unit of \$4.67, we can use the following formula:</p> $\text{Breakeven Point (in units)} = \frac{\text{Fixed Costs}}{\text{Contribution Margin per Unit}}$ <p>Let's perform the calculation:</p> $\text{Breakeven Point (in units)} = \$1,026,000 / \$4.67 \approx 219,863 \text{ units}$ <p>Therefore, if AOT achieves their goals and maintains the projected weighted average</p>

	<p>contribution margin per unit, they would need to sell approximately 219,863 units to reach the breakeven point and cover their fixed costs.</p>
GPT-4 Response	<p>To calculate the breakeven quantity, you can use the formula:</p> <p>Breakeven Quantity=Fixed Costs ÷ Contribution Margin Per Unit</p> <p>Given:</p> <p>Fixed Costs = \$1,026,000 Weighted Average Contribution Margin Per Unit = \$2.40 (from question 9) Breakeven Quantity = 1,026,000 ÷ 2.4</p> <p>Breakeven Quantity = 427,500 units</p> <p>This means that AOT would need to sell 427,500 units annually to cover both their variable and fixed costs if they were to achieve the goals set forth in their strategy. This is under the presumption that they reach their weighted average contribution margin per unit of \$2.40 and have annual fixed costs of \$1,026,000.</p>

<p>Question 11 - Given your breakeven calculation (question 10), does AOT have the production and selling resources and capabilities to reach this target? Are any resources and capabilities lacking?</p>			
Rating and Answer Key	<p>Poor - Conflate production (making the good) with selling the good.</p> <p>Become sidetracked with a discussion of the custom and contract lines of business.</p> <p>Also, exhibit confusion on the custom and contract lines of the business.</p>	<p>Acceptable - Observe that AOT has produced this volume for each year of 2017 through 2019.</p> <p>They also sold nearly double this amount in 2018.</p> <p>Note that the sales force has not approached the custom volume necessary to realize this plan.</p>	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Observe that this is well within the current labor and machinery capacity.</p> <p>Recognize that the current two-person sales force may not be able to reach the volume necessary in a relevant timeframe.</p> <p>AOT may need to either expand their salesforce or extend their window for profitability (which may itself be unsustainable).</p>
GPT-3.5 Response	<p>Based on the information provided in the case, AOT's current production capacity is approximately 13,000 units per week, or around 675,000 units per year. However,</p>		

	<p>they believe they can increase their production capacity to 19,000 units per week, or approximately one million units per year, through a combination of hiring, overtime, and productivity gains.</p> <p>To reach the breakeven point of approximately 219,863 units, AOT's current production capacity appears to be sufficient. They have mentioned that they would not increase labor without an increase in custom sales, and their two salespeople have been successful in adding new custom clients and developing sales from existing clients.</p> <p>However, it's important to note that the case does not provide information on the current sales volume or the growth rate of custom sales. It is crucial for AOT to generate enough custom sales to support the increased production capacity and reach the breakeven point. If the growth in custom sales is not achieved as planned, it may pose a challenge for AOT to utilize their full production capacity and reach the breakeven point.</p> <p>Additionally, the case does not provide information about the company's marketing and sales capabilities, including their ability to attract new customers, build strong relationships, and effectively promote their products. These factors are important for driving sales and reaching the targeted custom sales volume.</p> <p>In summary, while AOT has the potential production capacity to reach the breakeven point, the actual achievement of this target depends on their ability to generate sufficient custom sales volume and effectively utilize their resources and capabilities in production, marketing, and sales.</p>
<p>GPT-4 Response</p>	<p>Based on the case information, AOT has a machine capacity of 43,000 items per week, which translates to about 2,236,000 items per year (assuming 52 weeks of operation). This is well above the breakeven quantity of 427,500 units, indicating that AOT has sufficient machine capacity to meet this target.</p> <p>As for labor, AOT's current labor force can produce about 13,000 units per week, which is approximately 676,000 units per year. The company believes they could grow their labor force to produce 19,000 items per week, or about 988,000 items per year. Again, this is above the breakeven quantity.</p> <p>However, a few challenges and potential limitations must be considered:</p> <p>Sales Volume: To date, they have not sold more than 107,000 custom units in a single year. They would need to significantly ramp up their sales efforts to reach the breakeven point. They have two salespeople, but it's not clear if this is sufficient to meet the increased sales targets.</p> <p>Labor Market Conditions: While they believe they can grow their labor force, labor market conditions are tight. Hiring more skilled workers or increasing hours might be challenging and could increase labor costs.</p> <p>Raw Material Supply: Francisco mentioned having multiple strategic suppliers to mitigate risks. However, a surge in production might strain these relationships and could potentially lead to supply chain issues.</p>

Quality and Timeliness: Increasing production should not come at the expense of product quality or delivery times, as these are key value propositions for their clients.

Cash Flow: The case doesn't provide information on AOT's cash reserves, but given their negative net income in previous years, it's uncertain whether they have the cash flow to support an aggressive growth strategy.

In summary, while AOT seems to have most of the necessary production capabilities to reach the breakeven target, they may face challenges in sales capacity, labor force scalability, supply chain management, and financial stability.

Question 12 - Presuming that AOT can produce and sell 675,000 units using the price and variable cost information from question 9, assuming they already have the appropriate resources to operate at this level, and assuming this production volume carries fixed costs of \$1,026,000 with operating and interest expense accounting for \$240,000 of total fixed costs, produce a pro-forma income statement for revenue through pre-tax income.

Rating There is not a rubric for this item. The instructor's manual provides a properly calculated pro-forma income statement.

Answer Key

		How was this derived
Revenue	\$3,260,250	4.83 * 675,000
Variable COGS	\$1,640,250	VC per unit \$2.43 * 675,000
Fixed COGS	\$768,000	(1,026,000 - 240,000)
Gross Profit	\$852,000	
Operating and Interest Expenses	\$240,000	
Pre-tax Income	\$612,000	

GPT-3.5 Response

Based on the given assumptions and the information provided, here is a pro-forma income statement for AOT with a production and sales volume of 675,000 units:

Pro-Forma Income Statement: Revenue: Custom Sales: 675,000 units * \$9.80/unit = \$6,607,500 Contract Sales: 675,000 units * \$2.70/unit = \$1,822,500 Total Revenue: \$6,607,500 + \$1,822,500 = \$8,430,000

Cost of Goods Sold (COGS): Custom Sales: 675,000 units * \$6.00/unit = \$4,050,000 Contract Sales: 675,000 units * \$0.90/unit = \$607,500 Total COGS: \$4,050,000 + \$607,500 = \$4,657,500

Gross Profit: Total Revenue - Total COGS \$8,430,000 - \$4,657,500 = \$3,772,500

Operating Expenses: Fixed Costs: \$1,026,000 Operating and Interest Expenses: \$240,000 Total Operating Expenses: \$1,026,000 + \$240,000 = \$1,266,000

Operating Income (EBIT): Gross Profit - Total Operating Expenses \$3,772,500 - \$1,266,000 = \$2,506,500

Interest Expense: \$16,743 Other Expenses: \$17,341 Total Expenses: \$16,743 + \$17,341 = \$34,084

	<p>Earnings Before Taxes (EBT): Operating Income - Total Expenses \$2,506,500 - \$34,084 = \$2,472,416</p> <p>Taxes: Assuming a tax rate of 0% (based on the case information) Tax Expense: \$0</p> <p>Net Income: Earnings Before Taxes - Tax Expense \$2,472,416 - \$0 = \$2,472,416</p> <p>Please note that this pro-forma income statement is based on the given assumptions and may not reflect the actual financial performance of AOT. It provides an estimate of the revenue, costs, and profitability at the specified production and sales volume.</p>		
<p>GPT-4 Response</p>	<p>To create a pro-forma income statement, we first need to calculate the weighted average price per unit and the weighted average variable cost per unit based on the 30%/70% custom/contract units split. Then we will multiply these by the production volume of 675,000 units to find total revenue and total variable costs. Finally, we'll subtract total variable costs and fixed costs from total revenue to arrive at operating income and pre-tax income.</p> <p>Weighted Average Price Per Unit = (0.3 * \$9.80) + (0.7 * \$2.70) = \$2.94 + \$1.89 = \$4.83</p> <p>Weighted Average Variable Cost Per Unit = (0.3 * \$6.00) + (0.7 * \$0.90) = \$1.80 + \$0.63 = \$2.43</p> <p>Total Revenue = 675,000 units * \$4.83 per unit = \$3,260,250</p> <p>Total Variable Costs = 675,000 units * \$2.43 per unit = \$1,640,250</p> <p>Gross Margin = \$3,260,250 (Total Revenue) - \$1,640,250 (Total Variable Costs) = \$1,620,000</p> <p>Operating Income (EBIT) = \$1,620,000 (Gross Margin) - \$1,026,000 (Fixed Costs) = \$594,000</p> <p>Earnings Before Taxes (Pre-Tax Income) = \$594,000 (Operating Income) - \$240,000 (Operating and Interest Expense) = \$354,000</p> <p>Pro-Forma Income Statement (Revenue through Pre-Tax Income)</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">Item</td> <td style="width: 20%; text-align: right;">Amount</td> </tr> </table>	Item	Amount
Item	Amount		

Total Revenue	\$3,260,250
Total Variable Costs	(\$1,640,250)
Gross Margin	\$1,620,000
Fixed Costs	(\$1,026,000)
Operating Income (EBIT)	\$594,000
Operating and Interest Expense	(\$240,000)
Earnings Before Taxes	\$354,000

This pro-forma income statement indicates that, assuming AOT can produce and sell 675,000 units with the given pricing and cost structure, they would have a pre-tax income of \$354,000.

Question 13 - The firm faces a choice between (a) growing towards full capacity with 30% of custom units sold or (b) exiting the industry. Which do you support and what evidence leads you to that?

<p>Rating and Answer Key</p>	<p>Poor - Build decisions from feelings and not from the Session 2 activities.</p>	<p>Acceptable - Build a case for (or against) where the evidence considered includes:</p> <ul style="list-style-type: none"> •Production Capabilities •Selling Capabilities •Potential for profitability at (current) full production 	<p>Excellent - In addition to detailing most, if not all, of the points expected in an acceptable answer, excellent answers will also:</p> <p>Offer evidence for and against and consider the anticipated net benefit.</p> <p>Stronger answers inherently recognize that there are challenges to the assumptions of the 30%/70% plan.</p> <p>Observe that time (not a factor offered in the question) to scale up sales should affect this decision.</p> <p>Synthesize the assumptions about costs in question 3 with those about resource availability in question 5. This should lead to concerns about the quality of the pro-forma in question 6. Stated differently, the pro-forma in question 6 can</p>
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		<p>be no better than the assumptions leading into it. If those assumptions are inaccurate (as evaluated in questions 9-11) the pro-forma produced in question 12 is a mathematical expression of an unrealistic future.</p> <p>Ultimately, the decision advanced for question 13 will reflect the student's confidence (or lack thereof) in these assumptions.</p>
<p>GPT-3.5 Response</p>	<p>As an AI language model, I don't have access to real-time data or the ability to provide subjective opinions. The decision to grow towards full capacity with 30% custom sales or exit the industry depends on various factors and requires a comprehensive analysis of AOT's current situation, market conditions, and future prospects.</p> <p>To make an informed decision, the management of AOT should consider the following factors:</p> <ol style="list-style-type: none"> 1. Market Potential: Assess the growth potential and competitiveness of the custom sales market. Evaluate market trends, customer demand, and the company's ability to capture a larger market share. 2. Profitability Analysis: Determine the financial viability and profitability of achieving the target 30% custom sales volume. Consider the breakeven analysis, contribution margin, and potential for generating sustainable profits. 3. Competitive Advantage: Evaluate AOT's unique capabilities, strengths, and competitive advantages in the industry. Assess whether the company can effectively differentiate itself and maintain a competitive position in the market. 4. Resource Availability: Consider the availability and scalability of production and selling resources required to reach the desired sales volume. Assess whether AOT has the necessary infrastructure, workforce, and operational capabilities to handle increased production and sales. 5. Risk Assessment: Evaluate the risks associated with both options. Consider the potential costs, uncertainties, and challenges involved in scaling up the business versus the potential risks and costs of exiting the industry. 6. Strategic Fit: Analyze the alignment of the growth strategy with AOT's long-term goals, vision, and core competencies. Consider whether the growth plan aligns with the company's capabilities and supports its overall strategic direction. 	

	<p>By conducting a thorough analysis of these factors and potentially seeking expert advice or consulting industry professionals, AOT's management can make an informed decision on whether to pursue growth towards full capacity with 30% custom sales or exit the industry.</p>
<p>GPT-4 Response</p>	<p>Choosing between growing towards full capacity with 30% custom units sold or exiting the industry is a critical decision for AOT that should be made based on a holistic view of various aspects of the business. Here are some points to consider:</p> <p>Advantages of Growing Towards Full Capacity:</p> <p>Positive Gross Margins: According to the pro-forma income statement, the company would have a substantial gross margin, which could eventually translate into profitability.</p> <p>Economies of Scale: Reaching higher production levels might reduce per-unit costs, further improving margins.</p> <p>Client Relationship & Quality: Francisco's strategy emphasizes building strong client relationships and delivering quality, which are sustainable competitive advantages.</p> <p>Flexible Sourcing: Multiple suppliers for the same type of raw materials can add a level of safety and price negotiating power.</p> <p>Market Demand: If there is sufficient market demand for the custom and contract sales, this suggests growth is a feasible option.</p> <p>Risks Involved:</p> <p>Capital Expenditure: Reaching full capacity might require further investments in machinery and labor.</p> <p>Market Risk: A sudden change in market demand or increased competition can affect profitability.</p> <p>Operational Risk: Increasing production also means the company needs to maintain the same level of quality to ensure customer satisfaction.</p> <p>Labor Market Conditions: While the company believes they can find more labor, this has yet to be tested.</p> <p>Advantages of Exiting:</p> <p>Mitigate Loss: The company has been operating at a loss; exiting the industry would stop further financial bleeding.</p> <p>Resource Allocation: Resources could potentially be allocated to more profitable ventures or investments.</p> <p>Evidence for Decision:</p> <p>Financial Projections: The pro-forma income statement suggests that the company could turn profitable if it grows according to plan.</p>

Capacity: The company has significant unused capacity that could be used to generate additional revenue.

Strategic Positioning: AOT seems to have good strategies in place for client relationship management, pricing, and supply chain management.

In summary, growing towards full capacity could be a feasible and profitable decision if AOT successfully implements its strategies. The pro-forma income statement is promising, and the company appears to have thought through many of the important strategic and operational aspects. Exiting should be a fallback option if, after a reasonable period, the growth strategy doesn't yield expected results or if there are significant changes in market or operational conditions.

Question 14 - What else could AOT do to improve their profitability?	
Rating	This question does not include a grading rubric. Rather, the instructor's manual provides examples of alternatives considered by the company.
Answer Key	<p>AOT evaluated several alternative strategies before focusing on the 30%/70% plan. For benefit of the class discussion, we enumerate several of those below. If a class identifies one of AOT’s alternatives, the instructor can share information about that alternative. Should the class discussion not manifest (e.g., no ideas are generated), the instructor could use one of AOT’s alternatives as a stimulant for the discussion.</p> <ul style="list-style-type: none"> - 3PL did not work (details are in case) - They rejected on-demand printing on the consumer side because it required a significant investment in specialized equipment. They commissioned a marketing study, examining both B2B and consumer markets. The study concluded that there was demand from both sectors. The on-demand market requires digital printing and AOT lacked this machinery. Additionally, an on-demand model would require greatly increasing on-hand inventory. An on-demand print shop must carry blanks of all likely sizes and colors. - Partnerships with sport apparel companies required a significant capital outlay to obtain necessary equipment. While AOT had the capacity to manage large screen-printing contracts, the truly enormous vendors generate more volume than AOT’s machinery could produce. AOT worked with a sports apparel company for one-off deals, such as a 2021 world series print for the Atlanta Braves. AOT would need to purchase more equipment to meet digital printing commitments expected under the partnership agreements. AOT considered going through the audit process with a sports apparel company, but in the end decided against it due to the size of the investment that would need to be made. - Sub-leasing the warehouse was considered. Pursuing this would require remodeling the warehouse space to meet the needs of potential clients. - Simple contracts – AOT sought to improve the profitability of the contract business through simpler contracts. Simple contracts result in work orders with less variance and use fewer colors, leading to lower variable costs. One simple contract customer was signed, but the ability to increase the number of simple contracts was obstructed by the pandemic which significantly reduced large-order placements. Francisco intended to develop simple contract clients himself, this was not a task for the sales force. It turns out that simple contracts sometimes become complicated. The simple contract customer identified wound up being more complicated than AOT assumed, requesting many changes and adjustments to orders that went well outside of the negotiated contract.
GPT-3.5 Response	<p>To improve profitability, AOT could consider implementing the following strategies:</p> <p>1. Diversify Product Offering: AOT could explore diversifying its product offering beyond promotional goods and custom sales. By expanding into other product categories or offering value-added services, the company can tap into new revenue streams and potentially reach a wider customer base.</p>

	<p>2. Enhance Marketing and Sales Efforts: AOT should focus on strengthening its marketing and sales efforts to increase brand awareness, attract new customers, and retain existing clients. This could involve targeted advertising campaigns, attending industry trade shows and events, leveraging digital marketing channels, and building strong relationships with clients.</p> <p>3. Improve Operational Efficiency: AOT should continuously strive to enhance its operational efficiency to reduce costs and improve productivity. This can involve streamlining production processes, optimizing inventory management, implementing lean manufacturing principles, and investing in technology and automation where applicable.</p> <p>4. Develop Strategic Supplier Relationships: AOT should continue to foster strong relationships with its suppliers to negotiate favorable pricing terms and ensure a stable supply of raw materials. By cultivating strategic partnerships, the company may be able to secure better deals, minimize disruptions in the supply chain, and gain a competitive edge.</p> <p>5. Focus on Customer Satisfaction and Retention: AOT should prioritize delivering high-quality products and exceptional customer service. By consistently meeting or exceeding customer expectations, the company can enhance customer satisfaction, build long-term relationships, and potentially benefit from positive word-of-mouth referrals.</p> <p>6. Implement Cost Control Measures: AOT should closely monitor and control its costs across all aspects of the business. This includes managing direct costs such as materials and labor, as well as indirect costs such as overhead expenses. Regular cost analysis and cost-cutting initiatives can help improve profit margins.</p> <p>7. Explore New Markets and Expansion Opportunities: AOT could explore entering new geographic markets or expanding its operations to reach a larger customer base. This could involve targeting new industries, forming partnerships with complementary businesses, or leveraging e-commerce platforms to expand its reach.</p> <p>8. Continuous Improvement and Innovation: AOT should foster a culture of continuous improvement and innovation within the organization. Encouraging employees to generate ideas, implement process improvements, and explore new technologies can drive efficiency, differentiation, and ultimately improve profitability.</p> <p>It's important for AOT to carefully assess the feasibility and potential impact of each strategy based on market conditions, available resources, and the competitive landscape. A combination of these approaches, tailored to AOT's specific circumstances, can help enhance profitability and ensure long-term sustainability.</p>
<p>GPT-4 Response</p>	<p>Improving profitability involves multiple approaches, from increasing revenue to reducing costs and improving operational efficiencies. Given AOT's situation, here are some strategies they could consider:</p> <p>Increase Revenue:</p> <p>Product Differentiation: Introduce new, value-added services or products that can command</p>

higher margins.

Cross-Selling and Upselling: Utilize existing customer relationships to sell more products or services.

Volume Discounts: Offer discounts to customers who place large orders, which can increase the total volume of sales.

Market Expansion: Extend market reach by geographic expansion or targeting new customer segments.

Seasonal Promotions: Introduce time-limited offers or seasonal promotions to boost sales during off-peak periods.

Reduce Costs:

Supply Chain Optimization: Continue to negotiate better terms with suppliers and consider long-term contracts for essential raw materials to lock in prices.

Automate Processes: Invest in technology to reduce manual tasks, thereby lowering labor costs over time.

Energy Efficiency: Retrofit facilities and equipment to lower energy costs.

Outsourcing: Consider outsourcing non-core activities like HR, payroll, or IT services to cut costs.

Waste Reduction: Implement lean manufacturing techniques to minimize waste in production.

Improve Operational Efficiency:

Just-In-Time Inventory: Implement just-in-time inventory management to reduce holding costs and improve cash flow.

Quality Control: A reduction in defects or returns can improve profitability and customer satisfaction.

Employee Training: Better-trained employees can perform tasks more efficiently and effectively, leading to lower costs and higher customer satisfaction.

Financial Management:

Debt Refinancing: If possible, refinance high-interest debts to lower monthly payments and interest expenses.

Tax Planning: Take advantage of any available tax incentives or deductions to reduce the tax burden.

Working Capital Management: Optimize the use of working capital by maintaining optimal levels of inventory and receivables.

R&D Tax Credits: If applicable, make use of R&D tax credits to offset some of the costs of innovation.

Pricing Strategy:

Dynamic Pricing: Use data analytics to dynamically adjust pricing based on various factors such as demand, time of day, and customer type.

Bundle Pricing: Offer packages of products or services at a discounted rate to increase the perceived value and encourage more sales.

	<p>Customer Loyalty Programs: Introduce a loyalty program to encourage repeat purchases, which generally cost less to generate than new sales. Implementing a mix of these strategies could help AOT turn the corner towards profitability. As always, each option should be carefully analyzed for feasibility, cost, and potential return on investment.</p>
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Appendix C – Bitcoin in El Salvador – Digital Finance Innovation or President Bukele’s Gamble ChatGPT Responses and Rating Rubric

Question 1 - What were some of the changes to political risk in El Salvador after President Bukele was elected?			
Rating	Poor - Response does not address the points made in the acceptable and outstanding responses.	Acceptable - Identify changes in the murder rate and gang violence.	Outstanding – Identify changes in gang violence but also note corruption challenges and authoritarian threats.
Answer Key	<p>Two of the main country risks in El Salvador in the years before Bukele was elected as president were corruption and deadly gang violence. Gang violence led to a high homicide rate in the country. While the homicide rate decreased sharply after President Bukele confronted gangs, it appeared it was partly through government’s negotiations with the MS-13 gang. As far as corruption is concerned, Transparency International rated El Salvador with a transparency score of 34 out of 100 in 2021. Based on the continuing appointments of judges and other officials close to the President, as well as shielding those officials from corruption charges, it did not appear that he reduced corruption despite describing himself as a corruption reformer.</p> <p>El Salvador had history with military dictatorships over the last century, and while President Bukele had a record high approval rating, his ruling style would be considered largely authoritarian. He even referred to himself on Twitter as the coolest dictator. Bukele’s crack on gang violence led to draconian measures such as mass sentencing with no proper criminal investigations, arrested for illegal gathering, thousands jailed, assault on free speech and journalists.</p>		
GPT 3.5 Response	<p>After President Bukele was elected in El Salvador, there were several notable changes to political risk in the country. Here are some of them:</p> <p>Strong Executive Power: President Bukele consolidated power by winning a majority in the Legislative Assembly, which allowed him to enact policies more easily. This concentration of power raised concerns about checks and balances and the potential for authoritarian tendencies.</p> <p>Anti-Corruption Measures: Bukele's administration vowed to tackle corruption, which was a major concern in El Salvador. He established the International Commission Against Impunity in El Salvador (CICIES) to investigate corruption cases and promote transparency. These measures were seen as positive steps to address governance issues but also raised political tensions.</p> <p>Polarization and Political Divisions: Bukele's style of governance and confrontational approach to political opposition led to increased polarization in the country. Critics expressed concerns about democratic norms, the independence of institutions, and the concentration of power in the executive branch.</p>		

	<p>Relations with the United States: President Bukele initially enjoyed a positive relationship with the United States, particularly with the Trump administration. However, his policies and actions have at times strained relations with the Biden administration, particularly regarding concerns about democratic governance, human rights, and the independence of institutions.</p> <p>Bitcoin Adoption: One of the most significant changes was President Bukele's decision to adopt bitcoin as legal tender in El Salvador. This move brought both domestic and international attention to the country and introduced new risks and uncertainties related to the implementation and acceptance of cryptocurrency.</p> <p>Overall, while President Bukele's administration introduced some measures to address corruption and improve governance, there were also concerns raised about democratic norms, political polarization, and the concentration of power. The adoption of bitcoin added an additional layer of political risk and brought both opportunities and challenges for the country.</p>
<p>GPT 4 Response</p>	<p>The election of Nayib Bukele as President of El Salvador marked a significant shift in the country's political landscape. His election came with several implications for political risk in the country:</p> <p>Increased Political Centralization:</p> <p>Concentration of Power: Bukele's popularity allowed him to consolidate significant power, including within the Legislative Assembly. The executive's influence over other branches of government has increased, raising concerns about checks and balances.</p> <p>May 2021 Assembly Actions: One of Bukele's most controversial moves was the ousting of the Attorney General and the judges of the Constitutional Chamber of the Supreme Court. This move was heavily criticized as undermining the rule of law and democratic institutions.</p> <p>Policy Uncertainty:</p> <p>Unpredictable Policy Changes: Bukele has shown a willingness to implement bold and unexpected policies, like adopting Bitcoin as legal tender. While this can lead to rapid reforms, it also increases policy uncertainty.</p> <p>Focus on Populism: His approach to governance has included elements of populism, which can create an unpredictable policy environment, affecting both local and foreign investments.</p> <p>Relations with International Bodies:</p> <p>IMF Relations: Bukele's policies, especially regarding Bitcoin, have been criticized by international organizations like the IMF, which could affect foreign aid and investment.</p> <p>U.S. Relations: Tensions have arisen between El Salvador and the United States, particularly concerning governance and human rights issues. A strained relationship with the U.S. can lead to increased political risk, especially given that the U.S. is a significant source of remittances and aid for El Salvador.</p>

	<p>Economic Risks: Credit Rating Downgrade: Policy decisions like the adoption of Bitcoin have had direct consequences on the country's credit rating, which was downgraded by agencies like Fitch, Moody's, and S&P Global.</p> <p>Debt Levels: Initiatives like Bitcoin City are planned to be funded by Bitcoin bonds, adding another layer of risk related to the country's already complex debt profile.</p> <p>Social Changes: Public Sentiment: While Bukele enjoys high approval ratings, the controversial nature of some of his policies like the adoption of Bitcoin has led to social divisions and protests, potentially destabilizing the political environment further.</p> <p>Law and Order: Though the Bukele administration has been credited with reducing crime rates, any reversion could quickly change public opinion and lead to increased political risk.</p> <p>Media and Freedom of Speech: Press Relations: Bukele has had a contentious relationship with the media, leading to concerns about freedom of speech and an informed electorate, key components of a stable political environment.</p> <p>These changes have collectively contributed to an increased level of political risk in El Salvador under Bukele's presidency. While some of his actions have won him popular support, they've also raised concerns about the rule of law, institutional integrity, and economic stability.</p>
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Question 2 - What were the reasons why the government of El Salvador decided to adopt Bitcoin as a legal tender? Compare and contrast Bitcoin's adoption and dollarization in El Salvador.			
Rating	Poor - Response does not address the points made in the acceptable and outstanding responses.	Acceptable - Identify at least one reason for adoption of the dollar and later for the adoption of Bitcoin mentioned in the case.	Outstanding - Identify at least three reasons for adoption of the dollar and later for the adoption of Bitcoin mentioned in the case and compare the reasons.
Answer Key	<p>There were similarities in the reasons why the U.S. Dollar was adopted as legal tender and why Bitcoin was adopted as a legal tender in El Salvador. The main reasons cited for dollarization were to attract more foreign investment, particularly from the US, lower interest rates (and no currency risk premium) and higher economic growth. The reasons promoted by Bukele's government for the adoption of Bitcoin as a legal tender included (again) trying to achieve higher level of foreign direct investment and economic growth, but also to increase the level of banking participation by giving access to financial services of an exceptionally large number of the Salvadoran population who were not participating before. The idea was to promote the digital cryptocurrency wallet and have a monetary incentive for its use, and in this way</p>		

	<p>incentives the unbanked to use digital finance innovations for the purposes of personal banking, transfers, and payments to businesses. Since a large part of El Salvador’s GDP was from remittances, it could potentially lower transaction costs of the remittances. It could also reduce the reliance on the U.S. Dollar. However, it does not appear that the adoption of Bitcoin as legal tender and the rollout of the Chivo wallet have been successful in convincing the majority of citizen of El Salvador to use Bitcoin or the wallet.</p> <p>The simultaneous use of the U.S. Dollar and Bitcoin as legal tender could pose different types of risks for El Salvador, such as risks to the financial system because of Bitcoin’s possible instability, technological challenges for the citizens using the digital wallets, and security risks (digital theft, money laundering, terrorism financing).</p>
<p>GPT 3.5 Response</p>	<p>The decision to adopt Bitcoin as a legal tender in El Salvador was influenced by several factors. Here are some of the reasons behind the government's decision:</p> <p>Financial Inclusion: A significant portion of the Salvadoran population lacks access to traditional banking services. By adopting Bitcoin, the government aimed to promote financial inclusion and provide a means for the unbanked population to participate in the global economy.</p> <p>Remittances: El Salvador heavily relies on remittances, with a large number of Salvadorans living abroad and sending money back home. Bitcoin's decentralized nature and potential for lower transaction costs could facilitate faster and cheaper cross-border remittances, benefiting both senders and recipients.</p> <p>Economic Development: The government saw the adoption of Bitcoin as a way to attract investment and stimulate economic growth. By positioning El Salvador as a cryptocurrency-friendly nation, they hoped to attract businesses and entrepreneurs from the crypto industry, creating job opportunities and fostering innovation.</p> <p>Independence from the U.S. Dollar: El Salvador has been using the U.S. dollar as its official currency since 2001 when it adopted dollarization. Bitcoin adoption was seen as a way to diversify from the dollar and reduce reliance on a single currency, potentially providing greater monetary independence.</p> <p>Now, let's compare and contrast Bitcoin's adoption and dollarization in El Salvador:</p> <p>Nature of the Currency: Dollarization involves adopting an existing fiat currency, in this case, the U.S. dollar, as the official currency of a country. Bitcoin, on the other hand, is a decentralized digital currency based on blockchain technology.</p> <p>Centralization vs. Decentralization: Dollarization centralizes monetary control with the U.S. Federal Reserve, as the monetary policy decisions are made by the Federal</p>

	<p>Reserve System. Bitcoin, being decentralized, is not controlled by any central authority, and its value is determined by market forces.</p> <p>Stability and Acceptance: The U.S. dollar is a widely accepted and stable currency, with a long history and established reputation. Bitcoin, being a relatively new and volatile currency, faces greater acceptance challenges and price fluctuations.</p> <p>Monetary Policy: With dollarization, El Salvador relinquished control over its monetary policy to the United States. In the case of Bitcoin adoption, while El Salvador can benefit from the potential advantages of using a decentralized digital currency, it also faces uncertainties related to regulatory challenges, price volatility, and the ability to effectively manage monetary policy.</p> <p>Legal Tender: Under dollarization, the U.S. dollar became the sole legal tender in El Salvador. With Bitcoin adoption, while it became a legal tender alongside the U.S. dollar, its acceptance is not mandatory for all transactions, and businesses are required to accept Bitcoin only when offered as payment.</p> <p>In summary, while dollarization and Bitcoin adoption both involve a shift in currency usage, they differ in terms of the nature of the currency, centralization/decentralization, stability, acceptance, and monetary policy implications. Dollarization provides stability and acceptance but relinquishes monetary control, while Bitcoin adoption offers potential benefits such as financial inclusion and innovation but also introduces uncertainties and challenges associated with a decentralized and volatile digital currency.</p>
<p>GPT 4 Response</p>	<p>Reasons for Adopting Bitcoin as Legal Tender in El Salvador:</p> <p>Financial Inclusion: One of the main arguments for adopting Bitcoin was to increase financial inclusion. Roughly 70% of the population in El Salvador does not have access to traditional banking services. Bitcoin was seen as a way to enable more people to participate in the financial system through mobile technology.</p> <p>Remittances: A large percentage of El Salvador's GDP comes from remittances, primarily from the United States. Utilizing Bitcoin for these transactions could lower the costs significantly.</p> <p>Attracting Investment: By becoming the first country to adopt Bitcoin as legal tender, El Salvador hoped to attract crypto entrepreneurs and investments from around the world. The government even offered citizenship to those investing a certain amount in the country.</p>

Economic Diversification: The Bitcoin move was seen as a way to diversify the economy and lessen the country's dependence on the U.S. dollar.

Tourism: A more nebulous goal was to increase tourism by creating a "Bitcoin City" and attracting Bitcoin enthusiasts globally.

Global Recognition: El Salvador is a small country and adopting Bitcoin put it on the global stage, potentially opening doors for other forms of international cooperation or investment.

Innovation: The government portrayed the move as forward-looking and innovative, aligning the country with what it sees as the future of finance.

Comparison with Dollarization:

Control Over Monetary Policy: Dollarization took away El Salvador's ability to control its monetary policy, as it had to depend on the U.S. Federal Reserve's decisions. With Bitcoin, there's also a lack of control but for different reasons—the decentralized nature of the cryptocurrency means no one controls it.

Stability: The U.S. dollar is generally considered a stable currency. Adopting it brought macroeconomic stability to El Salvador at the cost of monetary independence. Bitcoin, however, is highly volatile, which adds an element of economic risk.

Financial Inclusion: Dollarization didn't necessarily improve financial inclusion in El Salvador. In contrast, one of the key arguments for adopting Bitcoin is to bring financial services to the unbanked population through mobile phones.

Inflation: Using the U.S. dollar helped El Salvador control inflation, but it also made exports more expensive and remittances vital. Bitcoin does not have a straightforward impact on inflation but could make remittances cheaper.

Foreign Relations: Dollarization anchored El Salvador's economy to the United States, both economically and geopolitically. Bitcoin's adoption, however, has been met with skepticism from the U.S. and international bodies like the IMF, potentially complicating foreign relations.

Implementation Speed and Public Support: Dollarization had a longer planning and implementation period and was a more broadly understood concept among the populace. Bitcoin adoption happened quickly, and its complexity has led to public confusion and division.

Legal and Regulatory Framework: Adopting the dollar required significant adjustments in the legal and banking systems to accommodate a foreign currency.

Bitcoin adoption has similarly necessitated legislative action but also poses challenges related to financial regulation, tax, and potential for illicit use.

Transparency and Oversight: The U.S. dollar and the systems around it are subject to various forms of governmental oversight. In contrast, Bitcoin’s decentralized and pseudonymous nature makes it harder to track, posing issues related to money laundering, tax evasion, and financial crime.

In summary, while both Bitcoin adoption and dollarization aimed at stabilizing and growing the El Salvadorian economy, they represent fundamentally different approaches with their own unique sets of risks and benefits. Dollarization was a move towards stability and international credibility but came with the loss of monetary policy control. Bitcoin adoption aims for financial inclusion and economic innovation but comes with high volatility and uncertain international implications.

Question 3 - The Mundell-Fleming Trilemma discusses how countries need to select two of the three choices: Fixed exchange rate, Free flow of capital or Independent monetary policy. What choice is the government of El Salvador making by adopting Bitcoin as a legal tender in addition to the U.S. dollar?			
Rating	<p>Poor - Response does not address the points made in the acceptable and outstanding responses.</p>	<p>Acceptable - Mention that with dollarization El Salvador picked two of the three attributes, while with Bitcoin’s adoption the choices are similar, but exchange rate volatility is introduced.</p>	<p>Outstanding - In addition to the response to the Acceptable answer, response discusses the choices for each attribute of the ideal currency under dollarization and under Bitcoin and dollar as legal tenders.</p>
Answer Key	<p>See table below. When El Salvador transitioned to dollarization from a fixed peg, they chose two of the three “attributes of an ideal currency”: fixed exchange rate and free flow of capital. When Bitcoin was approved as a legal tender, in addition to the U.S. dollar, the country is still choosing free flow of capital and focus on foreign investments and financial integration, but now the fixed exchange rate component is not as clear cut. The U.S. dollar would still be used (which adds to stability in trade), but possible volatility and uncertainty for business owners was introduced because of the variability of the exchange rate of U.S. Dollar per Bitcoin. With the introduction of the Bitcoin law, all businesses were required to accept Bitcoin payments and thus were subject to USD – Bitcoin price fluctuations. If prices were set in U.S. Dollars, then the Bitcoin prices of goods would have to be recalculated at the current Bitcoin rate, since there would be no fixed rate.</p>		
		Dollarization	Bitcoin and Dollarization
	Independent monetary policy	<p>The El Salvador’s central bank loses sovereignty over monetary policy but is relying on a stable monetary policy in the United States.</p>	<p>No central bank/no monetary policy tools available when adopting Bitcoin. El Salvador’s central bank still has no sovereignty over monetary policy and is still relying on the U.S. monetary policy.</p>
	Fixed exchange rate	<p>Currency volatility versus the U.S. dollar is removed, which should benefit trade with the United States, greater product, and financial integration. Eliminates currency volatility of remittances.</p>	<p>Currency volatility is introduced because there are two legal tenders and the exchange rate between them is floating.</p>

	Free flow of capital	Encourages capital flows and integration with the United States and opens the country for more foreign direct investment.	Encourages further capital flows from cryptocurrency investors and potentially larger levels of foreign direct investment.
GPT 3.5 Response	<p>By adopting Bitcoin as a legal tender alongside the U.S. dollar, the government of El Salvador is prioritizing the fixed exchange rate and free flow of capital. Let's analyze how this decision aligns with the Mundell-Fleming Trilemma framework:</p> <p>Fixed Exchange Rate: El Salvador's decision to adopt Bitcoin as a legal tender alongside the U.S. dollar indicates a commitment to maintaining a fixed exchange rate. The exchange rate between Bitcoin and the U.S. dollar is determined by market forces, but by accepting Bitcoin as legal tender, the government aims to establish a fixed exchange rate between Bitcoin and the dollar within the country.</p> <p>Free Flow of Capital: The government's adoption of Bitcoin suggests an intention to promote the free flow of capital. By accepting Bitcoin as legal tender, El Salvador allows individuals and businesses to use Bitcoin for transactions, both domestically and potentially across borders. This move facilitates the free movement of capital as it provides an alternative medium of exchange and potentially lowers transaction costs, enabling seamless cross-border transactions in Bitcoin.</p> <p>Independent Monetary Policy: The adoption of Bitcoin as a legal tender poses challenge to El Salvador's ability to maintain an independent monetary policy. Bitcoin is a decentralized digital currency, and its value is determined by global market forces rather than domestic monetary policy decisions. The government's decision to adopt Bitcoin may limit its ability to influence the monetary conditions within the country, as the value of Bitcoin fluctuates independently of El Salvador's economic fundamentals. Considering the Mundell-Fleming Trilemma, El Salvador's decision to adopt Bitcoin as a legal tender alongside the U.S. dollar sacrifices independent monetary policy. By adopting Bitcoin, the country gives up control over its monetary policy regarding Bitcoin and must rely on the decentralized market dynamics of cryptocurrency. However, it maintains a fixed exchange rate with the U.S. dollar and aims to promote the free flow of capital by accepting Bitcoin as a medium of exchange.</p>		

GPT 4 Response	<p>Here's how El Salvador's situation fits into the Mundell-Fleming Trilemma:</p> <p>Fixed Exchange Rate: Since El Salvador is dollarized, it effectively has a fixed exchange rate with the U.S. dollar. Bitcoin, on the other hand, is highly volatile and does not have a fixed exchange rate with any currency. Its adoption makes the overall exchange rate regime of the country a mix of fixed (USD) and floating (BTC).</p> <p>Free Flow of Capital: One of the attractions of adopting Bitcoin is that it facilitates the free flow of capital. It's easy to move Bitcoin across borders without facing the usual restrictions or fees associated with fiat currencies. This is in alignment with a policy promoting the free flow of capital.</p> <p>Independent Monetary Policy: El Salvador doesn't have an independent monetary policy due to its dollarization; it is subject to the monetary policy decisions made by the U.S. Federal Reserve. Adopting Bitcoin doesn't change this situation; in fact, it further diminishes control as Bitcoin is a decentralized currency with no monetary policy.</p> <p>So, by adopting Bitcoin alongside the U.S. dollar, El Salvador is essentially opting for: Free Flow of Capital: Both the U.S. dollar and Bitcoin facilitate this. And it is giving up on:</p> <p>Independent Monetary Policy: It can't influence the monetary policy of either the U.S. dollar or Bitcoin.</p> <p>The country's stance on a fixed exchange rate is more nuanced. It maintains a fixed rate with the U.S. dollar, but the introduction of Bitcoin, which doesn't have a fixed exchange rate, adds a layer of complexity.</p> <p>In summary, by adopting Bitcoin as legal tender alongside the U.S. dollar, El Salvador is essentially choosing the free flow of capital while sacrificing independent monetary policy. The country's stance on a fixed exchange rate becomes more complex due to the dual nature of its adopted currencies.</p>
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Question 4 - Remittances are classified as secondary income in the Balance of Payments. If remittances can be transferred via cryptocurrency (in this case via Chivo Wallet), what could be the impact on international financial statistics?			
Rating	Poor - Response does not address the points made in the acceptable and outstanding responses.	Acceptable - Identify the importance of remittances in El Salvador but recognize that cryptocurrency remittances account for small part of the transfers.	Outstanding - Identify the importance of remittances in El Salvador, evaluate the lack of wide public uptake of transfers via Chivo Wallet and recognize that even though cryptocurrency remittances account for small part of the transfers, the Chivo wallet transactions are recorded in the Balance of Payments as the government tracks them.
Answer Key	<p>Remittances were an especially important part of El Salvador’s economy. In 2020 remittances accounted for over 25% of GDP. In the balance of Payments, remittances should be classified as Secondary Income in the Current Account. Remittances were typically transfers from migrant workers.</p> <p>The adoption of Bitcoin as a legal tender in El Salvador and the Chivo-wallet rollout should have reduced transaction costs for transferring money from migrant workers from the US to their families in El Salvador and thus incentivized transfers via the digital wallet. However, looking at exhibit 11 remittances via cryptocurrency wallets comprised a very small percent (1.6%) of total remittances in 2022. Some of the cited reasons for this reluctance to use the wallet were the preference of many Chivo wallet users to use cash and the trust issues they had with the system and bitcoin. According to the survey cited in the case, one year after the Chivo wallet implementation, the public opinion regarding the adoption of bitcoin was still negative.</p> <p>Hypothetically, lower transaction costs could entice migrants to send a sizable percentage of remittances via crypto wallets and if this is done in an anonymous way, it could evade international financial statistics and distort Current Account balances. However, in the case of El Salvador, the Chivo wallet transfers were tracked by the government and thus recorded in the Current Account in the Balance of Payments.</p>		
GPT 3.5 Response	<p>If remittances are transferred via cryptocurrency, such as through the Chivo Wallet in El Salvador, there could be several potential impacts on international financial statistics, particularly in the context of the Balance of Payments. Here are some considerations:</p> <p>Remittance Reporting: Remittances sent and received in cryptocurrency would need to be accurately identified and reported in international financial statistics. Remittance flows through traditional channels, such as banks or money transfer</p>		

	<p>operators, are usually well-documented and captured in official statistics. However, if a significant portion of remittances starts flowing through cryptocurrency channels, it may require additional efforts to track and measure these transactions accurately.</p> <p>Currency Composition: The currency composition of remittances may change if they are transferred via cryptocurrency. Traditionally, remittances are reported in the currency of the receiving country (e.g., U.S. dollars in the case of El Salvador). However, when remittances are transferred through cryptocurrency, the currency composition could shift, with some portion of remittances being denominated in cryptocurrencies like Bitcoin. This could require adjustments in the reporting and classification of remittance flows in international financial statistics.</p> <p>Cryptocurrency Holdings: The use of cryptocurrency for remittances could affect a country's overall holdings and exposure to cryptocurrencies. As remittances are received and converted into the local currency, the government or central bank may need to decide whether to hold the received cryptocurrency or convert it into another currency. The decisions made in this regard could impact a country's foreign exchange reserves and its exposure to cryptocurrency price volatility.</p> <p>Balance of Payments Imbalances: If remittances via cryptocurrency gain significant popularity, it could potentially affect the overall balance of payments of a country. The inflows and outflows of cryptocurrency associated with remittances would need to be accounted for in the capital and financial account of the balance of payments. This could lead to changes in the overall balance of payments position, which may have implications for a country's economic indicators and policy decisions. It's important to note that the impact on international financial statistics would depend on the scale and significance of remittances via cryptocurrency in a particular country. The precise effects would vary based on factors such as the volume of cryptocurrency remittances, the regulatory framework in place, and the degree of integration of cryptocurrency transactions into the official financial system.</p>
<p>GPT 4 Response</p>	<p>The adoption of cryptocurrencies like Bitcoin for remittance transfers could have several potential impacts on international financial statistics:</p> <p>Reduced Transaction Costs Cryptocurrencies can significantly lower the transaction costs associated with remittances. Traditional remittance channels often involve fees and exchange rate margins that can eat into the amount received. Lower transaction costs could increase the net secondary income in the Balance of Payments for countries like El Salvador, where remittances constitute a significant portion of GDP.</p> <p>Speed of Transactions Blockchain transactions can be confirmed in a matter of minutes, regardless of the day or time, which might make remittances timelier and more reliable. This could result in more frequent remittance transactions, affecting the periodicity and timeliness of related financial statistics.</p> <p>Informal Channels While all formal remittance transactions are accounted for in the Balance of Payments, there may be a significant volume of informal remittances that are not captured. The adoption of cryptocurrencies could blur the lines between formal and</p>

	<p>informal remittance channels. The ease and low cost of cryptocurrency transactions could shift activity from informal to formal channels if the government successfully integrates them into the official financial system.</p> <p>Volatility Cryptocurrencies are highly volatile. This volatility could introduce more noise into international financial statistics, particularly if substantial amounts are sent as remittances and their value fluctuates widely between the time they are sent and the time they are converted to a more stable form of currency.</p> <p>Traceability and Compliance Blockchain transactions are transparent but pseudonymous. This could present challenges for authorities tasked with preventing money laundering, tax evasion, or other illicit financial activities, potentially affecting the accuracy and reliability of financial statistics.</p> <p>Data Capture and Reporting Central banks and financial authorities may need to adjust their data collection and reporting frameworks to accurately capture cryptocurrency transactions in the Balance of Payments and other financial statistics.</p> <p>Exchange Rate and Liquidity Risk Since cryptocurrencies don't have a fixed exchange rate with any fiat currencies, remittances in cryptocurrencies could expose countries to additional exchange rate and liquidity risks, which would need to be accounted for in financial statistics. Overall, the incorporation of cryptocurrencies like Bitcoin in the remittance market could introduce both opportunities and challenges for the compilation and interpretation of international financial statistics.</p>
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Economics Question Set

Question 1 - Using the concepts of (1) medium of exchange, (2) unit of account, and (3) store of value, compare and contrast the U.S. dollar with Bitcoin.			
Rating	<p>Poor - Response does not address the points made in the acceptable and outstanding answers.</p>	<p>Acceptable - List the three functions of money and state whether the dollar and Bitcoin meet the requirements of each function.</p>	<p>Outstanding - List the three functions of money and in detail discuss (give examples) in detail how the dollar and Bitcoin each function.</p>
Answer Key	<p>Medium of exchange: must be widely accepted in exchange for goods and services. The U.S. dollar is accepted for all transactions in the United States and eight other countries that use it as legal tender. In addition, it is frequently accepted in countries where it is not legal tender, but there are many U.S. tourists, such as Mexico and Canada.</p> <p>Since its introduction Bitcoin's acceptance as a medium of exchange has grown significantly. Many companies around the world have declared Bitcoin an acceptable method of payment (e.g., Best Buy, Newegg, Overstock). Furthermore, in El Salvador</p>		

	<p>the Bitcoin law enforces that the financial asset must be accepted. However, in many cases, the direct Bitcoin transactions between buyers and sellers are very costly in time and energy or involve an intermediary who acts as a facilitator exchanging Bitcoin into currency (Yermack, 2013).</p> <p>Unit of Account: a measure to value goods and services. The U.S. dollar is used on posted prices for goods and services in the United States and other countries that use it. For example, catalogs and menus are printed with prices denoted in U.S. dollars, and those prices are stable for the period those documents are in use. Bitcoin’s price, meanwhile, is very volatile, which means that merchants must update the ‘Bitcoin’ prices of their goods and services frequently. Constantly changing prices are confusing and can distort purchasing decisions. For example, in February 2023, Bitcoin traded for \$23,000. Pricing everyday goods in terms of Bitcoin required the use of many decimals, which most people are not used to. For example: a \$1 doughnut would have been 0.000043 BTC. Finally, prices with many digits are more vulnerable to keystroke accounting errors.</p> <p>Store of Value: something used to transfer purchasing power from the present to the future without significant loss of value. The U.S. dollar slowly loses value due to inflation, but in a modest and predictable manner. For example, a U.S. dollar in January 2023 had nearly half (47.7%) of the purchasing power it did in January 1993 (Bureau of Labor Statistics, n.d.). The annual loss of value had not exceeded 10% since 1981. Bitcoin’s volatility does not make it a good store of value. Bitcoin lost more value in 2022 than the U.S. dollar did over the 30-year 1993 to 2023 period. Furthermore, Bitcoins are held in digital wallets, which unlike deposits in the U.S. are not insured by the FDIC, and are subject to security problems, such as theft and hacking attacks.</p>
<p>GPT 3.5 Response</p>	<p>Medium of Exchange: U.S. Dollar: The U.S. dollar is widely accepted as a medium of exchange both domestically and internationally. It is the primary currency for conducting transactions in many countries and is readily accepted in global trade. It has a long history of use as a medium of exchange, which has established trust and confidence in its acceptance.</p> <p>Bitcoin: Bitcoin aims to function as a medium of exchange in digital transactions. While its acceptance has grown in recent years, it is not as widely accepted as the U.S. dollar. Bitcoin transactions rely on a decentralized network and blockchain technology to facilitate peer-to-peer transfers. However, its acceptance as a medium of exchange varies significantly across countries and businesses.</p> <p>Unit of Account: U.S. Dollar: The U.S. dollar is commonly used as a unit of account in economic activities. Prices of goods and services, wages, and financial transactions are often denominated in U.S. dollars. It provides a common framework for measuring and comparing the value of different goods, services, and assets.</p> <p>Bitcoin: Bitcoin has limited use as a unit of account. While some businesses and individuals may denominate prices in Bitcoin, it is not as widespread or standardized as the U.S. dollar. The price of Bitcoin itself is often denominated in U.S. dollars or other fiat currencies, which highlights its reliance on traditional currencies for</p>

	<p>valuation.</p> <p>Store of Value: U.S. Dollar: The U.S. dollar is generally considered a stable store of value, particularly in the short to medium term. It is backed by the confidence and trust of governments and central banks, and its value is maintained through monetary policies and regulation. The U.S. dollar's stability and widespread acceptance make it a preferred choice for preserving wealth and conducting financial transactions.</p> <p>Bitcoin: Bitcoin's store of value characteristics is more volatile and subject to significant price fluctuations. While some individuals and investors see Bitcoin as a store of value or digital gold, its price volatility and speculative nature make it a riskier asset. Bitcoin lacks the backing of a central authority or government, which contributes to its price volatility and limits its stability as a long-term store of value. In summary, the U.S. dollar has a well-established position as a medium of exchange, unit of account, and store of value, with widespread acceptance and stability. Bitcoin, on the other hand, has made strides as a medium of exchange and store of value in some contexts but is not as widely accepted or stable. Its use as a unit of account is limited, with valuation often dependent on traditional fiat currencies.</p>
<p>GPT 4 Response</p>	<p>The U.S. dollar and Bitcoin are both used as forms of money, but they differ significantly in how they serve the three classic functions of money: medium of exchange, unit of account, and store of value.</p> <p>1. Medium of Exchange U.S. Dollar: Widely Accepted: The U.S. dollar is universally accepted in the United States and widely accepted worldwide for international transactions. Stable and Recognized: Most businesses are accustomed to dealing in dollars, and it's considered stable and reliable.</p> <p>Instant Settlements: In domestic settings, the U.S. dollar can provide instant settlements with no additional fees, especially in cash transactions. Regulatory Backing: Backed by legal systems and universally recognized, it's subject to U.S. monetary policy and regulations.</p> <p>Bitcoin: Limited Acceptance: While growing in popularity, Bitcoin is not yet widely accepted for everyday transactions.</p> <p>Irreversible Transactions: Once confirmed, transactions cannot be reversed, reducing the risk of fraud for merchants.</p> <p>Cross-Border: Designed for digital transfer, it can be sent or received anywhere in the world, often with lower fees than traditional money transfer services.</p> <p>Legal and Regulatory Risks: Subject to regulatory scrutiny, and its legal status as a medium of exchange varies by jurisdiction.</p> <p>2. Unit of Account U.S. Dollar:</p>

Stable Value: Generally stable, making it useful for quoting prices or taking measurements of economic value.

Universally Recognized: Prices of goods and services are commonly quoted in dollars, especially in international trade.

Divisible and Fungible: Easily broken down into smaller units like cents, and each unit is interchangeable.

Bitcoin:

Price Volatility: Highly volatile, which makes it less suitable as a stable unit of account for pricing goods and services.

Not Widely Used for Pricing: Few goods and services are priced directly in Bitcoin.

Divisible and Fungible: Highly divisible (up to eight decimal places), but not yet as universally recognized or used for pricing as the dollar.

3. Store of Value

U.S. Dollar:

Inflation Risk: Subject to inflation, which erodes its buying power over time, although generally less volatile than cryptocurrencies.

Backed by Government: Implicitly backed by the U.S. government's ability to tax and regulate.

Physical and Digital: Can be held in both physical (cash) and digital forms (bank accounts).

Bitcoin:

Volatility: Highly volatile, which makes it a risky store of value in the short term.

Not Backed: Not backed by any physical commodity or government but derives value from its scarcity (limited supply) and network effect.

Ownership Control: Can provide more direct control over your own assets without relying on intermediaries like banks.

In summary, while the U.S. dollar offers stability, widespread acceptance, and a reliable unit of account, Bitcoin offers advantages in terms of lower transaction fees for international transfers, irreversible transactions, and control over one's assets. However, Bitcoin's volatility, regulatory uncertainty, and limited acceptance currently inhibit its ability to fully serve as a medium of exchange, unit of account, and store of value to the same extent as the U.S. dollar.

Question 2 - Most central banks are charged with maintaining price stability and maintaining full employment. How does the adoption of bitcoin as legal tender further these goals? What are the consequences for inflation expectations?			
Rating	<p>Poor - Response does not address the points made in the acceptable and outstanding answers.</p>	<p>Acceptable - Students should recognize that monetary policy can be used to impact economic activity (and inflation) by influencing interest rates (through changing the money supply). However, El Salvador had adopted the U.S. dollar as their official currency, which means that they did not have any control over monetary policy but were subject to the actions the U.S. were taking. Adopting Bitcoin did not change El Salvador’s lack of control over the money supply; however, no other country has control over it either.</p>	<p>Outstanding - Students should discuss the monetary policy tools that El Salvador had at its disposal (which were almost none). While there is no ‘direct’ action El Salvador’s central bank can take to influence economic activity, if the valuation of bitcoin increases, tourism and foreign investment improve, El Salvador could experience economic growth, including better employment opportunities. Students should also acknowledge that inflation expectations should be very different under bitcoin.</p>
Answer Key	<ul style="list-style-type: none"> • Bitcoin, as a highly volatile currency / speculative commodity is a terrible option for maintaining price stability. If it appreciates, and if its adoption succeeds in drawing in more remittances and tourism and investment by cryptocurrency backers, it may possibly assist in the employment goals, but similarly a wipeout in BTC would likely drive down consumption and investment and lead to an increase in unemployment, similar to other episodes of debt-deflation. • Regardless, the variability of prices under Bitcoin would be expected to be quite large compared to a traditional currency. We would need investors to demand a large interest-rate risk premium in response. 		

<p>GPT 3.5 Response</p>	<p>The adoption of Bitcoin as legal tender does not directly further the goals of maintaining price stability and full employment typically associated with central banks. Bitcoin operates on a decentralized network and is not governed by a central authority or monetary policy. Therefore, the government's adoption of Bitcoin as legal tender does not give them direct control over monetary policy or the ability to influence economic variables such as inflation or employment.</p> <p>Consequences for inflation expectations: Bitcoin's Volatility: Bitcoin is known for its price volatility, experiencing significant fluctuations in value over short periods. This volatility makes it challenging to predict or stabilize its purchasing power. As a result, using Bitcoin as legal tender could introduce additional uncertainty and risk into the economy, potentially affecting inflation expectations.</p> <p>Limited Monetary Policy Influence: With the adoption of Bitcoin, the government's ability to conduct traditional monetary policy measures, such as adjusting interest rates or controlling money supply, may be constrained. This limitation could make it more difficult to manage inflation expectations and stabilize the economy.</p> <p>Confidence and Expectations: The adoption of Bitcoin as legal tender could impact confidence in the national currency and the government's ability to maintain price stability. If people lose confidence in the local currency due to the adoption of Bitcoin, it may lead to inflationary pressures as individuals seek to convert their local currency holdings into more stable assets like Bitcoin. In such a scenario, inflation expectations could rise as people anticipate further depreciation of the local currency.</p> <p>It's important to note that the consequences for inflation expectations and overall economic stability in the context of Bitcoin adoption are subject to various factors, including the level of acceptance, the degree of integration with the existing financial system, and the government's ability to manage potential risks and uncertainties associated with Bitcoin's volatility.</p>
<p>GPT 4 Response</p>	<p>The adoption of Bitcoin as legal tender in a country like El Salvador has both opportunities and challenges when it comes to the goals traditionally assigned to central banks, such as maintaining price stability and full employment.</p> <p>Potential Benefits Financial Inclusion: One of the reasons cited for Bitcoin adoption in El Salvador is to increase financial inclusion, which can indirectly lead to higher employment. A significant portion of the population in developing countries lacks access to traditional banking. Crypto wallets can serve as a gateway to financial services.</p> <p>Lower Transaction Costs: Remittances make up a significant part of the GDP in some countries. The use of Bitcoin can significantly reduce transaction fees, leaving more money in the hands of the recipients. This could increase disposable income, possibly</p>

leading to a boost in local employment and consumption.

Attracting Investment: The adoption of a forward-looking technology like Bitcoin could attract foreign direct investment and create new job opportunities in tech sectors, contributing to full employment.

Market Dynamics: In a deflationary currency environment, people are less likely to spend frivolously, which could lead to more responsible consumption patterns over time. However, this is a double-edged sword when it comes to employment and economic growth.

Potential Risks and Challenges

Price Volatility: Bitcoin is known for its extreme price volatility, which can be risky for a country's economy and can lead to uncertainty in price stability. This could feed into inflation expectations if people start converting their Bitcoin to U.S. dollars or other more stable assets, driving up demand for those and reducing demand for the local currency or Bitcoin.

Lack of Monetary Policy Tools: Traditional central banks have a range of tools to control inflation and stimulate employment, such as adjusting interest rates or initiating quantitative easing. Adopting Bitcoin as a legal tender takes away some of these levers, as the central bank cannot control its supply.

Asset Bubbles and Financial Stability: Widespread adoption and trading of cryptocurrencies could lead to asset bubbles, the bursting of which can create financial instability and make the tasks of central banks more difficult.

Rapid Capital Flows: Bitcoin's ability to facilitate rapid cross-border money transfers could potentially lead to sudden capital inflows or outflows, affecting the local economy's stability.

Potential for Illicit Use: Lack of regulation can make Bitcoin a tool for money laundering, fraud, and other financial crimes, posing risks to financial stability.

Inflation Expectations

Short-term: The immediate introduction of Bitcoin could create some deflationary pressures due to its limited supply, but this effect might be small and offset by its price volatility.

Long-term: If Bitcoin becomes widely adopted, people might expect future stability in its value, potentially affecting inflation expectations. However, given the highly speculative nature of cryptocurrencies, it's just as likely that people might expect higher inflation in the traditional currency if they view Bitcoin as a safer store of value.

In summary, while Bitcoin offers some opportunities for increasing financial inclusion and reducing transaction costs—factors that can affect employment and price stability—the risks and challenges currently seem to outweigh the benefits when it comes to the traditional goals of central banking.

Question 3 - Considering El Salvador’s starting point of dollarization, evaluate the effect of President Bukele’s actions on central bank credibility and ability to respond to recessions? Summarize the IMF’s reaction.			
Rating	<p>Poor - Response does not address the points made in the acceptable and outstanding answers.</p>	<p>Acceptable - Students should state that the credibility would be hurt and provide two consequences, and that the IMF was disapproving, providing at least two reasons. Students should recognize that El Salvador had given up its use of monetary policy tools when the country adopted the U.S. dollar in 2001.</p>	<p>Outstanding - An outstanding answer should show an awareness that, because of dollarization, El Salvador was extremely limited in its monetary policy tools anyway. Many students will reflexively say it takes away their ability to increase the money supply in a recession, not realizing that was off the table anyway. Further discussion of the impacts of Bitcoin’s volatility and a complete summary of all four IMF concerns are also hallmarks of a full-marks answer.</p>
Answer Key	<ul style="list-style-type: none"> • The effect on El Salvador’s central bank is almost certainly not positive. As El Salvador already uses the U.S. dollar, it is already operating in the refuge of banks with low credibility, but the use of Bitcoin will increase volatility and reduce the effectiveness of the U.S. dollar in maintaining price stability. As the reaction of the IMF suggests, it will cause a loss of confidence from external investors, driving up the risk premium charged for El Salvador to borrow. As far as the direct stabilization tools, most of those were forfeited when El Salvador originally dollarized. • The IMF stated that access to funding would be highly unlikely while bitcoin remained legal tender. The risks it cited include: (1) financial instability from banks and other financial institutions being exposed to massive fluctuations in crypto-asset prices, (2) lack of financial integrity from making it easier to engage in criminal activity, (3) lack of consumer protection from both large swings and value and increased risk of cybercrime and theft, as transactions cannot be reversed, and (4) adverse fiscal consequences from a decline in the price of bitcoin depleting the associated government trust fund. 		
GPT 3.5 Response	<p>President Bukele's actions in adopting Bitcoin as legal tender in El Salvador have raised concerns about the central bank's credibility and its ability to respond to recessions. Here is an evaluation of the effects and a summary of the IMF's reaction:</p> <p>Central Bank Credibility: Dollarization in El Salvador meant that the central bank already had limited control over monetary policy. However, the adoption of Bitcoin as a legal tender further erodes the central bank's credibility in terms of its ability to manage the economy and ensure stability. This move raises questions about the government's commitment to sound economic policies and its respect for central bank independence.</p>		

	<p>Ability to Respond to Recessions: The adoption of Bitcoin does not provide the central bank with an additional tool to respond to recessions or economic downturns. With limited control over monetary policy due to dollarization, the central bank's ability to implement conventional measures like interest rate adjustments or liquidity injections is already restricted. Bitcoin's decentralized nature and the lack of direct control over its value make it an unreliable instrument for countercyclical monetary policy.</p> <p>IMF's Reaction: The International Monetary Fund (IMF) expressed concerns about the adoption of Bitcoin as legal tender in El Salvador. In their statement, the IMF noted that the move raises macroeconomic, financial, and legal issues that require careful analysis. They emphasized the importance of policies that preserve macroeconomic stability and financial integrity, highlighting the need for transparent regulatory frameworks and adherence to international standards. The IMF encouraged El Salvador to work closely with them to assess the implications of the adoption of Bitcoin and develop appropriate policy responses.</p> <p>Overall, the IMF's reaction suggests a cautious approach, emphasizing the importance of maintaining macroeconomic stability, financial integrity, and adherence to international standards. The adoption of Bitcoin as legal tender raises significant challenges for the central bank's credibility and its ability to respond effectively to recessions, given the limited control over monetary policy already imposed by dollarization.</p>
<p>GPT 4 Response</p>	<p>Central Bank Credibility and Ability to Respond to Recessions The choice to adopt Bitcoin as a legal tender alongside the U.S. dollar presents a unique set of challenges for El Salvador, especially in the context of a dollarized economy. Here's how it impacts central bank credibility and responsiveness:</p> <p>Credibility: Adopting a volatile asset like Bitcoin raises questions about the financial acumen of El Salvador's Central Bank. This could undermine the bank's credibility, both domestically and internationally. Lack of credibility can have cascading impacts on investment and financial stability, factors crucial for managing recessions.</p> <p>Monetary Policy: In a dollarized economy, El Salvador already surrendered its ability to issue currency and set interest rates, and therefore its capacity to use monetary policy as a tool to combat recessions was limited. Introducing Bitcoin into the equation did not improve this situation. If anything, it added an extra layer of complexity and risk, making the bank's job even more difficult.</p> <p>Fiscal Policy: While monetary policy options are limited in a dollarized economy, fiscal policy remains a tool to fight economic downturns. However, the adoption of Bitcoin could potentially tie the government's hands fiscally as well. The volatility in Bitcoin prices and its impact on the economy could create an unstable environment for fiscal planning.</p> <p>Loss of Policy Tools: Central Banks usually have a range of tools to counter economic downturns, including interest rate adjustments and quantitative easing. In a dollarized economy, these tools are limited. Bitcoin's adoption may further constrain the available policy options.</p>

IMF's Reaction

As of my last update in September 2021, the International Monetary Fund (IMF) has generally been skeptical about the widespread adoption of cryptocurrencies like Bitcoin for use as legal tender. The IMF worries that such a move could pose risks to macroeconomic stability, financial integrity, and consumer protection. It's reasonable to assume that their reaction to El Salvador's adoption of Bitcoin has not been entirely positive, especially given the complex financial situation the country faces. The IMF is likely concerned that Bitcoin's adoption will compromise El Salvador's economic stability, make it harder to manage its balance of payments, and possibly lead to financial isolation if global financial institutions decide that doing business in El Salvador has become too risky.

In summary, President Bukele's actions to adopt Bitcoin as legal tender in a dollarized economy like El Salvador's add a new layer of complexity and risk that could hamper the Central Bank's credibility and its ability to manage economic downturns effectively. The IMF's likely skeptical stance would reflect these significant concerns.

Question 4 - What assumptions are required for El Salvador's adoption of bitcoin to be wise? What assumptions for it to be unwise? Which do you think is the case?			
Rating	Poor - Response does not address the points made in the acceptable and outstanding answers.	Acceptable - Students should make the connection between the loss of value (decrease in the price of bitcoin) and its resulting negative impact. Students should also note that if the price of Bitcoin had increased, there could have been a positive impact.	Outstanding - Students should contrast the impact of Bitcoin when the price increases and decreases. Students should conclude that adopting Bitcoin as legal tender is a bad idea, based on the functions of money.
Answer Key	<ul style="list-style-type: none"> • As a currency with a fixed supply, Bitcoin stands to increase in value in the long run as it becomes more widely accepted and thus more in demand. If the transaction costs of converting local currencies into Bitcoin also continue to fall, encouraging remittances in Bitcoin both improves efficiency – as less is lost to fees and more reaches El Salvador – and it puts into the hands of Salvadorans an appreciating asset. • Bitcoin could lose its value. Perhaps it is outcompeted by other cryptocurrencies or outlawed in enough of the world to depress demand. It could also encourage enough criminal activity to scare off legal commerce, or criminal activity that steals Bitcoin directly. It could sustain its value but have so much volatility that it creates a series of booms and panics. 		
GPT 3.5 Response	<p>To evaluate whether El Salvador's adoption of Bitcoin as legal tender is wise or unwise, certain assumptions need to be considered. Here are the key assumptions for each scenario:</p> <p>Assumptions for it to be wise:</p> <p>Stable and Reliable Bitcoin Infrastructure: The assumption that Bitcoin's infrastructure is secure, efficient, and reliable is crucial for its adoption to be wise. It requires a robust technological framework, including network stability, transaction speed, scalability, and security measures.</p> <p>Positive Economic Impacts: The assumption that adopting Bitcoin will lead to significant economic benefits is necessary. This includes increased foreign investment, economic growth, financial inclusion, and reduced transaction costs for remittances.</p> <p>Effective Regulation and Legal Framework: Assumptions regarding the government's ability to implement effective regulation and establish a clear legal framework for Bitcoin are important. This includes addressing concerns related to money laundering, fraud, consumer protection, and ensuring compliance with international standards.</p> <p>Assumptions for it to be unwise:</p> <p>Volatility and Risk: The assumption that Bitcoin's extreme price volatility and associated risks will persist can make the adoption unwise. If Bitcoin's value</p>		

	<p>experiences large fluctuations, it can lead to economic instability, uncertainty, and financial losses for individuals and businesses.</p> <p>Limited Adoption and Acceptance: If the adoption of Bitcoin does not gain widespread acceptance within the country or globally, it can limit its usefulness as a legal tender. Limited acceptance may hinder its viability as a medium of exchange and undermine its benefits.</p> <p>Disruption to Monetary Policy: The assumption that adopting Bitcoin will disrupt El Salvador's monetary policy and the country's ability to respond to economic shocks can make it unwise. The loss of control over the currency and monetary policy tools can hamper the central bank's ability to manage inflation, interest rates, and economic stability.</p> <p>Considering the current circumstances, there are valid concerns and uncertainties surrounding El Salvador's adoption of Bitcoin. The extreme volatility of Bitcoin's price and the potential disruption to monetary policy raise doubts about its wisdom. While some benefits such as remittance efficiency and financial inclusion have been touted, the risks and challenges associated with adopting a highly volatile and unregulated cryptocurrency pose significant concerns. The long-term implications of this decision remain uncertain, and further evaluation is necessary to determine its overall wisdom.</p>
<p>GPT 4 Response</p>	<p>El Salvador's decision to adopt Bitcoin as legal tender is a complex and risky undertaking. Whether it turns out to be wise or unwise depends on a multitude of factors, and several assumptions would need to hold true in each scenario.</p> <p>Assumptions for Wisdom</p> <p>Stability in Bitcoin Prices: For the experiment to work smoothly, Bitcoin's infamous price volatility would need to decline significantly, making it a reliable store of value.</p> <p>Increased Investment and Tourism: The adoption of Bitcoin would have to lead to a substantial increase in foreign investment and tourism, as predicted by some proponents.</p> <p>Financial Inclusion: One of the touted benefits is the financial inclusion of rural and unbanked populations. The assumption here is that this segment would be able to access and use Bitcoin easily and safely.</p> <p>Low Transaction Costs: The transaction costs for converting between Bitcoin and other currencies, including the U.S. dollar, would need to remain low.</p> <p>Regulatory Compliance: Global financial entities would have to be comfortable enough with El Salvador's regulatory framework to continue doing business there, despite the introduction of a cryptocurrency.</p> <p>Fiscal and Monetary Responsibility: The government would need to manage its Bitcoin reserves and its financial commitments in a responsible way to avoid credit downgrades and issues with international bodies like the IMF.</p>

	<p>Public Acceptance: There needs to be a wide public acceptance and understanding of how to use Bitcoin.</p> <p>Assumptions for Unwisdom</p> <p>Volatility Remains: If Bitcoin's price continues to be highly volatile, it could wreak havoc on the economy and the country's finances.</p> <p>Regulatory Pushback: If global entities choose to limit their interactions with El Salvador due to perceived risk or non-compliance with international financial regulations, this could isolate the country.</p> <p>Financial Mismanagement: If the government doesn't manage its Bitcoin assets well, it could lead to significant financial loss.</p> <p>Limited Financial Inclusion: If Bitcoin technology remains inaccessible for a large part of the population, then one of the main purported benefits would not materialize.</p> <p>Erosion of Trust: Failing to manage the Bitcoin adoption could erode public and international trust in El Salvador's economic management.</p> <p>Exacerbation of Economic Inequalities: If Bitcoin benefits only a small, tech-savvy portion of the population, it could worsen social inequality.</p> <p>Rise in Illegal Activities: The pseudonymous nature of Bitcoin could facilitate money laundering, tax evasion, and other illegal activities.</p> <p>Which is the Case? It's too early to definitively say whether the adoption of Bitcoin will turn out to be wise or unwise for El Salvador. Given the current data and the inherently volatile nature of cryptocurrencies, the move seems fraught with significant risk, potentially making it an unwise choice. However, the long-term effects, either positive or negative, will take time to fully manifest. Therefore, while it seems like a risky gamble at the moment, the ultimate verdict will depend on how many of the assumptions in either category turn out to be accurate.</p>
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Question 5 - Discuss what the world would look like if bitcoin was legal tender everywhere.			
Rating	Poor - Response does not address the points made in the acceptable and outstanding answers.	Acceptable - Identify the impact on monetary policy and macroeconomic instability	Outstanding - Identify the impact on monetary policy, macroeconomic instability, but also point out at least one of the components from the positive outlook.
Answer Key	<p>As with many hypothetical questions, there is no single correct answer, but there are several elements' students should include in a successful attempt. These are some of the points:</p> <p>Postive Outlook</p>		

	<p>Exchange risk would be eliminated, potentially making it easier for countries with high or volatile exchange rates to conduct international trade. No country or centralized agent would own or control the supply of it, which means that no country could use monetary policy in order to influence economic activity, especially during times of economic slowdown.</p> <p>Some countries could benefit from adopting bitcoin, mainly the ones who experience high inflation, lack of credible financial institutions/system, countries highly dependent on remittances, or countries that try to achieve a less expensive and faster payments system and improve financial inclusion (less developed countries lack financial inclusion for reasons such as literacy and access to financial services).</p> <p>Negative Inequality across the world would increase. People owning bitcoin now, which is a tiny fraction of the population, would become ultra wealthy. While it might seem that the wealth of the world is concentrated in the hands of a few currently, it's not nearly as dire as it would be.</p> <p>Many wealthy individuals (Elon Musk, etc.) have become wealthy by starting successful businesses, which has contributed to economic activity and better standards of living. Most bitcoin owners simply adopted bitcoin early, without creating anything useful. Hence, economic activity would most likely slow down.</p> <p>Most countries would be worse off suffering from macroeconomic instability.</p>
<p>GPT 3.5 Response</p>	<p>Imagining a scenario where Bitcoin is adopted everywhere globally involves speculation and conjecture, as it is highly uncertain and depends on various factors. However, we can explore some potential implications and considerations:</p> <p>Financial Inclusion: Bitcoin's adoption worldwide could potentially promote financial inclusion, especially in areas with limited access to traditional banking services. Bitcoin's decentralized nature allows individuals to participate in the global economy without relying on traditional financial intermediaries.</p> <p>Increased Efficiency: Bitcoin's underlying technology, blockchain, has the potential to streamline financial transactions and reduce inefficiencies associated with traditional payment systems. The adoption of Bitcoin could lead to faster, cheaper, and more secure cross-border transactions, benefiting businesses and individuals alike.</p> <p>Disruption of Existing Financial Systems: Bitcoin's widespread adoption could disrupt traditional financial systems, including banks and intermediaries. This could challenge the current centralized control of monetary systems and potentially shift power to decentralized networks and individuals.</p> <p>Volatility and Price Stability: Bitcoin's current volatility makes it less suitable as a stable medium of exchange. However, if it were to be adopted everywhere, increased liquidity and wider acceptance could potentially lead to greater price stability over time. Price stability is crucial for a currency to be widely accepted and used in day-to-day transactions.</p>

	<p>Regulatory Challenges: The widespread adoption of Bitcoin would likely pose significant regulatory challenges for governments and international bodies. The need to establish consistent regulations, address issues such as money laundering, tax compliance, and consumer protection would become paramount.</p> <p>Economic and Monetary Implications: Bitcoin's adoption everywhere would impact traditional monetary policies and central banks' ability to influence the economy through interest rates, money supply, and other tools. It would require significant adjustments and considerations to maintain macroeconomic stability.</p> <p>Privacy and Security Concerns: Bitcoin's pseudonymous nature raises concerns about privacy and potential misuse for illicit activities. Striking a balance between privacy and regulatory compliance would be a complex challenge in a world fully adopting Bitcoin.</p> <p>Technological Advancements: Widespread adoption of Bitcoin would likely drive further advancements in blockchain technology and its integration into various industries beyond finance. This could revolutionize areas such as supply chain management, voting systems, and more.</p> <p>It's important to note that the above points are speculative and based on assumptions. The adoption of Bitcoin everywhere would require overcoming numerous challenges, including technological, regulatory, economic, and societal hurdles. Additionally, it's worth considering that a world solely dependent on Bitcoin may limit diversity in financial systems and exclude those who are not familiar or comfortable with digital currencies.</p>
<p>GPT 4 Response</p>	<p>If Bitcoin were to become legal tender worldwide, the implications would be far-reaching, affecting various sectors and aspects of life from economics to governance. Here are some areas that would likely see significant change:</p> <p>Economic Impacts</p> <p>Monetary Policy: Central banks would lose some degree of control over monetary policy, as they can't control the supply of Bitcoin. This would limit their ability to manage inflation and employment through monetary means, such as changing interest rates or executing quantitative easing.</p> <p>Financial Markets: With a universal, decentralized currency, we could see greater fluidity in global financial markets. However, the volatility of Bitcoin could introduce new kinds of systemic risk.</p> <p>Banking System: Traditional banking systems could undergo severe disruptions, as Bitcoin's decentralized nature makes many services banks offer, like secure and verified transactions, redundant.</p> <p>Taxation and Regulation: Governments would struggle with taxation and the enforcement of financial laws due to the pseudonymous nature of Bitcoin transactions.</p>

Inequality: Access to digital infrastructure would determine financial inclusion. Those without reliable internet access might find themselves further marginalized.

Capital Flight: Governments would find it harder to enforce capital controls, as Bitcoin can easily be moved across borders without detection.

Social Impacts

Privacy: Bitcoin could increase financial privacy but could also be a boon for illegal transactions and money laundering.

Consumer Behavior: The deflationary nature of Bitcoin might encourage saving overspending, potentially impacting consumer culture and economic activity.

Technological Impacts

Innovation: A worldwide adoption of Bitcoin might spur innovation in blockchain technology and drive the development of decentralized systems.

Energy Usage: The proof-of-work mechanism in Bitcoin consumes significant amounts of energy. Global adoption could exacerbate environmental concerns unless there is a move to more sustainable validation mechanisms.

Political Impacts

Sovereignty: The global adoption of Bitcoin as legal tender would challenge the notion of monetary sovereignty. Countries with weak currencies would be most affected.

Geopolitics: U.S. influence could diminish if the dollar loses its status as the world's primary reserve currency. This could make room for a new kind of "crypto diplomacy."

Governance: The decentralized governance model of Bitcoin might influence political systems and could give rise to decentralized autonomous organizations that exist entirely on blockchain.

Regulation: International bodies may need to step in to provide a framework for how Bitcoin could be regulated on a global scale, leading to a new kind of global financial governance.

In summary, if Bitcoin were to become legal tender everywhere, we'd likely see a seismic shift in how economies operate and governments function. It would raise unprecedented challenges in policymaking, social equity, and governance at all levels.

Question 6 - Debate the Bitcoin positions 1) Ban bitcoin in El Salvador, (2) Allow Bitcoin transactions but do not make it legal tender, (3) Preserve the current status quo in which both the US Dollar and Bitcoin are legal tender, and (4) Make Bitcoin the sole legal tender of El Salvador.			
Rating	Poor - Response does not address the points made in the acceptable and outstanding answers.	Acceptable - At least one of the points in each position are included in the answer	Outstanding - Two or more points in each position are included in the answer.
Answer Key	<p>(1) Ban Bitcoin in El Salvador Students assigned to this position should make arguments focusing on the downsides of Bitcoin: loss of control of monetary policy, high price volatility resulting in unpredictable periods of inflation and deflation, and difficulties in meeting the standard definitions of money (store of value, unit of account). They should go further and argue that other negative aspects of Bitcoin outweigh its benefits enough to fully ban its use. These may include its ability to facilitate crime, the threat it may pose to the stability of traditional financial systems and its potential to form an asset bubble, the lack of consumer protection (transactions are irreversible), and even environmental concerns about the energy-intensive process of mining and verifying transactions. They should similarly make these arguments when rebutting other groups.</p> <p>(2) Allow Bitcoin transactions but do not make it legal tender A lot of this argument is similar to (1), but more nuanced. Students in this group should focus on the threats to financial stability, loss of monetary control, and difficulty of merchants being able to access the technological infrastructure and price goods in Bitcoin, but also argue that Salvadorans should be free to voluntarily participate in the Bitcoin economy. While students in (1) may take a paternalistic view that Salvadorans should be protected from fraud and the risks of speculation, students in this group should not. Students in this group may argue that the ability to detect financial crimes conducted in Bitcoin has improved over time, reducing those costs.</p> <p>(3) Preserve the status quo where both US Dollar and Bitcoin are legal tender. This group, as well as group (4), will likely make the use of many of the arguments President Bukele made that are outlined in the case. Instructors should give extra rewards to students that are able to think outside of those arguments. A good argument for this group is that using both the dollar and Bitcoin in parallel offers “the best of both worlds.” There is the relatively stable U.S. dollar that meets all of the common definitions of money and the currency used by the vast majority of Salvadorans who send remittances. At the same time, the use of Bitcoin provides access to the unbanked, and additional security and privacy. The belief that Bitcoin will rise in value over time means that Salvadorans are being driven into acquiring an appreciating asset.</p> <p>(4) Make Bitcoin the sole legal tender of El Salvador. This group should have a largely mirror image argument to (1). Good arguments for this position would include that bitcoin operates on a decentralized network and is independent from government interference, which reduces the risk of corruption. Bitcoin, in the long run, is presumed to avoid inflation risks because of its fixed supply. There are privacy and security arguments in favor of Bitcoin – the same features that might lead to greater tax evasion and financial crimes can also protect individuals from fraud, identity theft, and unauthorized transactions. Even though</p>		

	<p>transactions are irreversible fraudulent transactions may be less likely to occur in the first place. Because Bitcoin can be used by anyone with an internet connection, it provides access to the unbanked and allows for easy transfer of remittances. Meanwhile, use of the U.S. dollar imposes US monetary policy on El Salvador with all the attendant downsides.</p>
<p>GPT 3.5</p>	<p>Ban Bitcoin in El Salvador: Supporters of this position might argue that banning Bitcoin is necessary to mitigate potential risks associated with its use. Concerns such as price volatility, money laundering, tax evasion, and consumer protection could be cited as reasons for a ban. They might also argue that a ban would allow the government to maintain control over the monetary system and ensure stability.</p> <p>Opponents, on the other hand, might argue that a ban stifles innovation and economic growth. They may believe that instead of outright banning Bitcoin, the government should focus on implementing effective regulations to address the risks associated with its use. They might also highlight the potential benefits of Bitcoin, such as financial inclusion and efficiency, and argue that a ban would hinder progress in these areas.</p> <p>Allow Bitcoin transactions but do not make it legal tender: Supporters of this position may argue that allowing Bitcoin transactions without making it legal tender provides flexibility and choice to individuals while minimizing potential risks. They may advocate for a regulatory framework that ensures transparency, consumer protection, and tax compliance. By allowing transactions, they argue, the government can tap into the potential benefits of Bitcoin without relinquishing control over the monetary system.</p> <p>Opponents might argue that this approach creates uncertainty and confusion regarding the legal status of Bitcoin. They may claim that without official recognition, businesses and individuals may be reluctant to accept Bitcoin, hindering its adoption and potential benefits. They might also raise concerns about the potential challenges in regulating Bitcoin transactions effectively and ensuring compliance.</p> <p>Preserve the current status quo of dual legal tender (U.S. dollar and Bitcoin): Supporters of maintaining the current status quo may argue that it provides a balance between the stability of the U.S. dollar and the potential benefits of Bitcoin. They might highlight the advantages of having options for transactions and emphasize that individuals and businesses can decide which currency to use based on their preferences and circumstances.</p> <p>Opponents might argue that the dual legal tender system creates complexity and challenges in day-to-day transactions, accounting, and financial management. They may claim that it dilutes the effectiveness of monetary policy and complicates macroeconomic management. They might also express concerns about the potential volatility and risks associated with Bitcoin's price fluctuations.</p> <p>Make Bitcoin the sole legal tender of El Salvador: Supporters of making Bitcoin the sole legal tender might argue that it promotes financial innovation, attracts investment, and positions El Salvador as a global leader in the adoption of digital currencies. They might claim that Bitcoin's decentralized</p>

	<p>nature reduces dependency on traditional financial systems and provides individuals with more control over their finances. They may also argue that it fosters economic growth and encourages technological advancements.</p> <p>Opponents might contend that making Bitcoin the sole legal tender is risky due to its volatility and uncertain long-term stability. They might express concerns about the potential impact on the country's monetary policy, central bank credibility, and the ability to respond to economic crises. They may also raise concerns about the exclusion of individuals who are not familiar or comfortable with digital currencies.</p> <p>It's important to note that the positions outlined above represent general arguments and do not encompass all possible perspectives. The actual debate surrounding Bitcoin's adoption in El Salvador involves complex considerations and requires a thorough examination of its potential benefits, risks, and long-term implications.</p>
<p>GPT 4</p>	<p>Position 1: Ban Bitcoin in El Salvador</p> <p>Arguments For: Financial Stability: One of the most important reasons for banning Bitcoin is to maintain financial stability. Cryptocurrencies are volatile and can introduce significant risk to an economy.</p> <p>International Relations: The adoption of Bitcoin as legal tender has raised concerns among international financial institutions like the IMF. Banning it could help maintain good relations and secure vital funding.</p> <p>Regulatory Compliance: Cryptocurrencies often pose challenges to law enforcement agencies because of their anonymous nature. Banning Bitcoin could aid in the fight against money laundering and other illegal activities.</p> <p>Arguments Against: Lost Opportunity: By banning Bitcoin, El Salvador could miss out on the potential benefits such as financial inclusion for the unbanked and attracting investment and tourism.</p> <p>Public Sentiment: There could be backlash from the public and businesses that have adopted or invested in Bitcoin, causing social unrest.</p> <p>Position 2: Allow Bitcoin transactions but do not make it legal tender</p> <p>Arguments For: Reduced Risk: This would allow people to engage in Bitcoin transactions without the government having to take on the associated financial risks.</p> <p>Financial Inclusion: Could still offer more financial tools to people who are unbanked.</p> <p>Attract Investment: Could attract tech-savvy investors and companies to El Salvador without making the country reliant on a volatile asset.</p> <p>Arguments Against: Confusion: Differentiating between currencies that are legal tender and those that are merely allowed could cause confusion.</p> <p>Limited Adoption: If Bitcoin is not legal tender, businesses and people may be less inclined to use it.</p>

Position 3: Preserve the current status quo in which both the U.S. dollar and Bitcoin are legal tender

Arguments For:

Financial Inclusion: One of the biggest potential benefits is providing financial services to the unbanked population of the country.

Dual Benefits: Could potentially harness both the stability of the U.S. dollar and the potential upside of Bitcoin.

Arguments Against:

Volatility: The volatile nature of Bitcoin poses a considerable risk to the country's financial stability.

Confusion: Having two vastly different forms of legal tender could create confusion among residents and investors.

Position 4: Make Bitcoin the sole legal tender of El Salvador

Arguments For:

Full Financial Independence: It could allow El Salvador complete monetary freedom and independence from U.S. monetary policy.

Global Spotlight: Would draw global attention and potentially attract Bitcoin entrepreneurs and investors to the country.

Arguments Against:

Extreme Risk: Making a highly volatile asset the sole legal tender would be an unprecedented economic gamble.

International Relations: This could severely harm relations with international financial institutions and other countries.

Practicality: Given the current technological limitations of Bitcoin such as transaction speed and cost, it might not serve as a practical sole legal tender.

Each of these positions has its pros and cons, and the choice is not straightforward. It would depend on a variety of factors including risk tolerance, economic conditions, and the potential for implementing safeguards against the associated risks.

Question 7 - Beyond asking students about the bond issue features and fund usage, the question for students to explore is: Has El Salvador correctly priced the bonds to entice investors to purchase them?			
Rating	Poor - The response does not address country risk and default risk in the response.	Acceptable - The response addresses country risk and default risk.	Outstanding - Mention of the actual estimate of default and country risk premiums for El Salvador from databases available at NYU.
Answer Key	<p>Kohler (2023) makes this statement: “While a 6.5% interest payment in dollars seemed very attractive trade a year ago when the U.S. was near 0%. This year has been a different story, with central banks scared of rampant inflation, and as a result of the fight against inflation, the Federal Reserve continued to hike interest rates to over 4%. Now that you know that the so-called “risk-free rate” is only 2.5% off El Salvador’s offering, it makes the bitcoin bond far less attractive when you compare the risk versus the reward. The current central bank policies could seriously drown out investor demand for additional yield offshore when they can park their money in U.S. bonds and move in and out of it, as the U.S. bond market is far more liquid.”</p> <p>The question would lead students to explore the default risk and country risk premium for El Salvador. Damondaran (2023) has developed a database that calculates these risk premiums that are updated at least once a year. As of the last data update in January 2023, the default risk premium for El Salvador was 12.24%, with a country risk premium of 17.26%. The implications of the data and the theory, suggest that under the current U.S. interest rate environment there is not a sufficient spread to provide compensation to entice foreign investors to purchase the bonds.</p> <p>The response to this question may vary overtime with changes in the interest rate environment in the United States and as credit agencies revise El Salvador’s credit rating.</p> <p>The details of the bond issue can be found in Kohler (2023) article.</p>		
GPT 3.5 Response	<p>As an AI language model, I don't have real-time data or access to the specifics of El Salvador's volcano bonds. However, I can provide some general insights on pricing bonds to entice investors.</p> <p>Pricing bonds involves determining an appropriate interest rate or yield that aligns with market conditions and investor expectations. Several factors influence bond pricing, such as creditworthiness, market interest rates, maturity, and the bond's specific features.</p> <p>To entice investors, El Salvador would need to consider the following:</p> <p>Risk Assessment: Investors assess the creditworthiness of a bond issuer, including factors like economic stability, political environment, and the ability to honor debt obligations. El Salvador's risk profile, including its fiscal position and stability, would impact the pricing of volcano bonds.</p>		

	<p>Market Conditions: Bond pricing is influenced by prevailing interest rates in the market. Higher market interest rates generally lead to higher bond yields. El Salvador would need to assess market conditions and price the volcano bonds competitively to attract investors.</p> <p>Bond Features: The specific features of the volcano bonds, such as the maturity period, coupon rate, and redemption terms, will affect pricing. Balancing the terms to offer an attractive yield relative to the perceived risk is crucial to enticing investors.</p> <p>Investor Demand: The demand for the volcano bonds plays a role in pricing. El Salvador would need to gauge investor interest and appetite for the bonds to determine the pricing strategy. If there is strong demand, the pricing can be set at a more favorable level.</p> <p>Without specific information on El Salvador's volcano bonds, it is difficult to assess whether they have been correctly priced to entice investors. The pricing strategy should consider market conditions, investor sentiment, and the risk-reward balance. Professional financial institutions and experts typically work on bond issuances to determine appropriate pricing based on these factors.</p>
<p>GPT 4 Response</p>	<p>I don't have up-to-date information beyond September 2021, so I can't provide specific numbers on the pricing of El Salvador's Bitcoin bonds. However, there are several considerations that can be made to assess whether the country has correctly priced the bonds to attract investors.</p> <p>Risk Premium: Given El Salvador's low credit rating and the volatile nature of Bitcoin, the bonds would likely need to offer a substantial risk premium over safer assets to attract investors.</p> <p>Market Conditions: Timing can be crucial. Are investors currently risk-averse, or are they looking for high-return investments? Are interest rates generally rising or falling in global markets?</p> <p>Bond Structure: The terms of the bond—such as the interest rate, the period until maturity, and any additional features like convertibility into Bitcoin—will also influence how attractive it is to investors.</p> <p>Political Risk: Any political instability or policy flip-flops would need to be factored into the bond pricing.</p> <p>Global Sentiment Towards Crypto: The global regulatory environment for cryptocurrencies is a significant factor. Supportive or restrictive measures could dramatically affect investor willingness to purchase such a bond.</p> <p>Currency Risks: Investors will need to consider the currency risks involved in holding a bond related to Bitcoin, especially if they ordinarily deal in another currency.</p> <p>Track Record: Finally, El Salvador's track record of meeting its debt obligations will be crucial. Any history of defaults will necessitate higher returns for investors to consider the bonds a viable investment.</p>

Given these factors, if the bond is priced with a high enough yield to compensate for these risks and uncertainties, it could attract a niche group of investors looking for high returns and willing to bear the associated risks. If not, the offering may struggle to find enough buyers.

For the most current and specific evaluation, one would need to consult financial analysts who have looked closely at the terms of the bond offering and the current market conditions.



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